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When to release the lockdown: A wellbeing framework for analysing costs and benefits

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When to release the lockdown

A wellbeing framework for analysing costs and benefits

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Abstract: In choosing when to end the lockdown, policy-makers have to balance the impact of the decision upon incomes, unemployment, mental health, public confidence and many other factors, as well as (of course) upon the number of deaths from COVID-19. To facilitate the decision it is helpful to forecast each factor using a single metric. We use as our metric the number of Wellbeing-Years resulting from each date of ending the lockdown. This new metric makes it possible to compare the impact of each factor in a way that is relevant to all public policy decisions.

Keywords: COVID-19, Wellbeing Economics, Cost-Benefit Analysis, Health Policy

JEL: D6; D61; H12; I31

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SUMMARY

The time to release the lockdown is when the net benefits of doing so become positive.

1. The net benefits include many items, some positive and some negative, and their size varies over time.

On the **positive** side, releasing the lockdown

(1) increases people's incomes now and in the future.
(2) reduces unemployment now and in the future.
(3) improves mental health, suicide, domestic violence, addiction, and loneliness.
(4) maintains confidence in the government.
(5) restores schooling.

As time progresses, the positive effects will increase in magnitude.

On the **negative** side, releasing the lockdown

(1) increases the final number of deaths from the virus (as well as from other conditions which may get undertreated if health services become overstretched with COVID-19 patients).
(2) increases road-deaths, commuting, CO_2 emissions, and air pollution.

2. To compare the different effects requires a common metric. We propose as a metric the number of Wellbeing Years (WELLBYs). This metric is analogous to the QALY metric which has been successfully used in the NHS for 20 years. It should now be extended to all fields of public policy.

3. In this paper we show how the WELLBY metric can provide a framework for evaluating the net benefits of releasing the lockdown in the UK month-by-month, applying the WELLBY metric to each type of effect. The net benefits rise steadily as the lockdown proceeds, since the positive items increase in magnitude. To conduct the analysis requires making many assumptions that are subject to great uncertainty. The figures that we present in the following table are purely illustrative and each reader is free to make other assumptions.

Net benefits of releasing the UK lockdown on the stated date rather than one month later (in WELLBYs, 10k)

	May 1	June 1	July 1	August 1
Benefits				
Income (increase)	48	66	86	103
Unemployment (reduction)	79	82	84	86
Mental health (improvement)	20	23	26	30
Confidence in government	9	13	22	32
Schooling (more)	5	5	3	0
Costs				
COVID-19 deaths (more)	-158	-158	-158	-158
Road deaths (more)	-5	-5	-5	-5
Commuting (more)	-10	-10	-10	-10
CO_2 emissions (more)	-7	-7	-7	-7
Air quality (worse)	-8	-8	-8	-8
Net benefits	**-27**	**1**	**33**	**63**

1. The framework: measuring effects in Wellbeing-Years

It is politicians who have to decide when to release the lockdown, and in what way. In doing so, they have to balance many considerations (as with any decision). Often the different considerations appear incommensurable so that only the roughest of judgements can be made. For example, in the case of COVID-19, one has to compare the economic benefits of releasing the lockdown with the social and psychological benefits, and then compare the total of these with the increase in deaths that would result from an early exit. How can this be done more systematically?

Fortunately, a new methodology exists which enables us to do just this.[1] It involves two steps. The first comes from the new science of "wellbeing" which enables us to evaluate all changes in human experience in terms of a single metric: their impact on individuals' satisfaction with their lives. The UK's official statistics now include the answers to a standard question on life satisfaction on a scale of 0-10 (0 not at all satisfied; 10 completely satisfied). This question has been asked by social scientists for at least half a century and there are therefore now well-established estimates of how different factors affect life-satisfaction.[2] So we can make a serious attempt to evaluate how different policies on lockdown would affect the overall quality of life of the population.

But, second, these estimates have to be combined with the impact of lockdown on the loss of life. Fortunately, for the last 20 years the NHS has used a well-accepted method of combining the effects on the quality of life with effects on the length of life. In this method the overall effect of any treatment is evaluated in terms of its impact on the number of Quality-Adjusted Life-Years (or QALYs). In this method the quality of a life-year is evaluated on a scale of 0-1 (0 meaning not worth living; 1 meaning full health). So one year of healthy life counts as one QALY, whereas one year lived in depression counts as only 0.8 QALYs.

In this paper we adopt the same procedure for comparing changes in the quality of life with changes in its length. But as already explained, we measure the quality of life by "wellbeing". Thus all effects are measured in terms of Wellbeing-Years or WELLBYs for short. The advantage of this procedure is that we can include in the quality of life a much greater range of effects than are usually included in the measurement of QALYs. As average wellbeing in the UK is approximately 7.5 measured on a scale of 0-10[3], we count the loss of one year's life as 7.5 WELLBYs lost.[4]

The value of this analysis is that it allows experts and politicians to apply their own judgements, modifying the assumptions we have used in order to come up with an answer to the key question of when to end the lockdown. Our assumptions imply that it would be best to end it around mid-June. But politicians might make different tradeoffs and come up with a different result. The key point is to use a framework like this to ensure consistency and transparency to ensure the public understand why a particular timing is chosen. We would encourage others to build on this work adding in factors that we have omitted or simply altering our assumptions.

The purpose of this paper is to show how this methodology can provide a framework for evaluating the overall net benefits of ending the lockdown at different dates. For each month we examine the net benefits of ending the lockdown at the beginning of the month compared with the beginning of the following month. Clearly the lockdown should end as soon as the net benefits of ending the lockdown turn positive.

But what do we mean by releasing the lockdown?

2. Releasing the lockdown

There are clearly very many ways of releasing the lockdown and a gradual exit is surely likely. But our aim in this paper is more to illustrate a method of analysis than to arrive at a specific recommendation. We therefore take a crude definition of the "end" of lockdown. It means that all normal commercial life is permitted and schools are re-opened, while physical distancing (2 metres) continues to be required as far as possible, and the elderly and vulnerable continue to self-isolate.

Once lockdown ends, the key issue is how to prevent a second wave of the disease, requiring a second lockdown. Until a vaccine is available, the key method is testing for the disease and tracing for contacts who would then be quarantined. (Testing for immunity would also help but would matter less once everyone is allowed to go back to work). Unfortunately, sufficient testing and tracing is only possible once (i) the rate of infection is already low enough and (ii) the capacity for testing and tracing is high enough. This consideration is reflected in our estimates of how many people die from ending the lockdown at different dates.

In what follows we compare the effects of ending the UK lockdown on 1 May, 1 June, 1 July, 1 August, and 1 September.

3. Measuring the effects of releasing the lockdown in the UK

None of the effects are easy to measure. But any judgement between alternative policies is always based upon implicit guesses about

(i)   the effects of the decision on the **level** of each outcome, and
(ii)   the relative **importance** of each outcome.

In what follows we assign explicit numbers to each of these elements – taking the different outcomes one by one.

(1)   Income

Clearly the lockdown has huge **impact** on different peoples' incomes. For example, for those employed in March and now on paid leave, 80% of their earnings are currently protected (to a maximum of £2,500 a month). The self-employed will receive 80% of their average profits in the previous three years. Clearly corporate profits are being severely hit but the largest part of the fall in income will fall on taxpayers. It is, however, extremely difficult to forecast these different components separately, so we simply focus on the loss of GDP.[5] When weighing the economy against the loss of life, we do not wish to exaggerate the losses to the economy and therefore make fairly conservative estimates of these.[6]

We assume that income during the present phase of the lockdown is 28% down on 2019 (see Appendix 1), and we assume that this level of output will continue as long as the lockdown persists. But after the lockdown ends, the pace of recovery will be slower the longer the lockdown has gone on and the more businesses have had to close. Specifically, we assume that if the lockdown ended on 1 May, output would recover to its 2019 level within one year (in a linear trend). By contrast, if the lockdown lasted to 1 September (i.e. just over 5 months), we assume output would not recover to its 2019 level for two years. (For dates in between we interpolate[7]).

Using these assumptions, we can calculate the total loss of income which would occur from 1 May onwards for each date of leaving the lockdown. Table 1 shows this loss expressed as a proportion of annual income in 2019.

Table 1. Total loss of income from 1 May 2020 onwards for each date of leaving
(as % of annual income in 2019)

Leave on	% of income
1 May	14.0
1 June	17.7
1 July	22.8
1 August	29.4
1 September	37.3

For each date of leaving the loss is greater than for leaving one month earlier, and these differences are what matter when we compare one date of leaving with another. These differences are shown in Table 2.

Table 2. Gain in income from leaving at the date shown rather
than one month later (as % of annual income in 2019)

Leave on	% of income
1 May	3.7
1 June	5.1
1 July	6.6
1 August	7.9

The next issue is how to **value** these gains in output from ending the lockdown earlier. There have been literally thousands of studies of the relation between wellbeing and income. They yield broadly similar results, which imply that a 1% gain in income increases wellbeing (measured 0-10) by around 0.002 points.[8] As we discuss in Appendix 1, this implies that to save one year of life we should be willing to spend much more than the NICE cut-off of £25,000 - and indeed much more than is allowed for in most cost-benefit analyses.[9] Using our standard valuations of income we can immediately reach the last stage of the argument. In Table 3 we take the percentage differences in annual income from Table 2 and we multiply them by the coefficient of 0.002 times the UK population of 65 million.

Table 3. Gain in WELLBYs due to income gains from leaving at the date shown
rather than one month later

Leave on	WELBYs (10k)
1 May	48
1 June	66
1 July	86
1 August	103

It is these figures that enter our final evaluation in Table 4, and figures like them for each other effect.

(2)   ***Unemployment***

As serious as the fall in output caused by the lockdown is so is the rise in unemployment. The two are less closely related than in a normal business cycle. For the biggest part of the fall in output is due to the furlough (paid leave) of workers who stop producing but retain their jobs.[10] The biggest group of newly unemployed people are self-employed workers who are prohibited from working. Many of these will go out of business and they will be joined by former employees whose employers go bust or lay them off. For most of them it will be a struggle to get back into work.

Unemployment will have risen from 1.2 million early in the year to 3.4 million by 1 May—a 10% rate of unemployment.[11] This does not include workers on paid leave. We assume that, as long as the lockdown lasts, unemployment will rise by 0.1 million each month. But as soon as lockdown is lifted, it starts to fall until it returns to its original level of 1.2 million. The rate of fall is roughly the same whenever this fall begins. As explained in Appendix 3, the number of extra months of unemployment caused by continuing the COVID-19 lockdown through May is therefore 0.3 million years, rising slightly in each subsequent month.

Unemployment matters not only because of the income loss (which has already been covered) but also because of the impact on self-esteem and self-worth as well as the loss of social ties. In typical studies the psychic cost of being unemployed for one year is 0.7 WELLBYs. At the same time, higher unemployment generates widespread fear. It has a hugely unsettling effect on the employed, and on a typical estimate the effect of one person's unemployment for a year when aggregated across the rest of the community is 2.1 WELLBYs.[12] Table 4 at the end of our paper shows the effect of applying these values to the forecast level of unemployment with a benefit of leaving on 1 May (rather than a month later) of 790,000 WELLBYs.

(3)   ***Mental Health***

Self-isolation is a huge problem for many people. It is desperately lonely for many of those on their own, while for those in overcrowded dwellings it can generate intolerable tension. There is clear evidence of increased domestic violence.[13] For many children, being cooped up is especially dangerous. On top of all this, economic uncertainty causes increased anxiety to millions. It appears inevitable that continued lockdown will increase mental illness, both among adults and children. The scale of this is not easy to forecast.

There are altogether some 12 million adults and 1 million children in the UK who suffer from diagnosable mental illnesses. These include mainly depression and anxiety disorders like PTSD, OCD, panic attacks, phobias and ADHD but they also include in smaller numbers schizophrenia, personality disorder and drug and alcohol dependence. On average NICE classify these 13 million people as experiencing only 0.8 QALYs per year of life rather than 1.0 QALY for those who are well. The loss through illness is thus 0.2 QALYs per person per year. We assume that, as long as the lockdown lasts, the loss to these people is increased by 10 % in May rising to 15% in August. The cost of the first extra month of lockdown is therefore 26,000 QALYs or 195,000 WELLBYs.

(4)   ***Confidence in Government***

The mental health of the people is one thing but something quite different is their morale – in particular their faith in the government or their anger against it. This is well measured by the question "Do you approve or disapprove of the Government's record to date". The figure in Appendix shows the answer to this question. Approval of the government was very low during the Brexit deadlock in the Summer of 2019 (with approval ratings as low as 10%). It then recovered and stabilized around 30% in

the months before lockdown. But once lockdown occurred on March 23, government approval soared to 52%. This is probably because demonstrating leadership and providing clear guidance are welcomed in times of uncertainty. Indeed, Fetzer et al (2020) show how the UK lockdown directly reduced worries and improved the perception of government response. However, as was observed in other crisis situations in recent history, this spike in government approval will probably erode as the lockdown proceeds even if the policy seems to be working. Frustration and social unrest are likely to rise at an increasing rate. In fact, approval ratings have already started to erode gradually (see Appendix 4). For our analyses, we assume that as the lockdown proceeds confidence in government drops at an increasing rate by 4 % points in May, 6% in June, 10% in July, and 15% in August. Once lockdown ends, we assume that confidence in government returns to its original level.

Trust in government is an important factor affecting the wellbeing of nations. Following Macchia and Plagnol (2018), we run a regression analysis of life evaluation on confidence in national institutions in the UK and Europe using the Gallup World Poll, 2009-2020. We use the survey item "In 'your country' do you have confidence in each of the following, or not? How about the national government?" The answer is a binary yes or no response. The analysis shows that a 10% fall in government confidence produces a reduction of 0.052 points in life evaluation (which runs on a scale from 0 to 10). See the Appendix for details. Spread over 50 million adults, a 10% reduction in government confidence for one month would amount to about 220,000 WELLBYs. Table 4 shows the corresponding effects in terms of WELLBYs spread by month in line with our expected trajectory.

(5) Schooling

The final benefit from ending the lockdown is the re-opening of schools. School closure damages the education of children. The degree of damage varies hugely, depending significantly on the extent of distance learning. Education matters both for the increased productivity that results from it and for the social and emotional training that occurs in school. The nation spends about £7 billion a month on schools in each month of the school year.[14] If we assume that the present value of benefits equals double the costs but that half these benefits still accrue during lockdown, the benefits gained from opening the schools a month earlier are £7 billion. This equals approximately 4% of monthly GDP which raises average wellbeing across the population by 0.008 points for one month. Spread across 65 million people this is a gain of 52,000 WELBYs.

This concludes the main benefits of ending the lockdown. We turn now to the costs of doing so. The first is the increased number of COVID-19 deaths.

(6) COVID-19 Deaths

If the lockdown ends on 1 May in the manner described earlier, the UK would experience some 150,000 deaths from COVID-19, mostly in a second wave occurring before a regime of testing and tracing can be put in place.[15] By contrast if the lockdown ends 1 September and there is a robust regime of testing and tracing (as was observed in South Korea[16]), the number of subsequent deaths will be at most 5,000.

How many deaths would occur at intermediate dates of ending the lockdown? It is difficult to be sure and the neutral assumption is that the number would decline in a straight line from 150,000 to 5,000. So each extra month of lockdown saves some 35,000 lives.

We then assume that those who die would on average have lived another six years.[17] Thus each extra month of lockdown saves 1,575,000 WELLBYs.[18]

These are deaths from COVID-19. However, it is quite possible that extending the lockdown would increase the number of non-COVID-19 deaths. In the week ending 10 April there were some 2,300 "non-COVID-19" deaths in excess of the number expected based upon previous years' experience. Most of them died outside hospital. A&E departments have experienced a sharp decrease in attendance. However, it is difficult to say whether this was due to lockdown ("stay at home") or whether it was because of the risk of exposure from leaving home (which would be even worse if the lockdown were ended). We therefore ignore this factor.

We end with a variety of beneficial side-effects of the lockdown which would be lost if it were ended. Their cumulative impact on the lockdown decision would be small.

(7)   Road Deaths

We assume a 73% reduction in road deaths (Cabinet Office, 2020)[19] with 43 years of life saved (calculated as average life expectancy minus median age, cf. ONS, 2016,[20] 2019[21]) for each person not killed. This yields a gain of about 47,000 WELLBYs for each extra month of the lockdown.

(8)   Commuting

We assume that roughly 10 million people spend one hour less commuting per day. Since having a daily commute of one hour reduces life satisfaction by 0.12 points,[22] the decrease in commuting generates in total a saving of 100,000 WELLBYs each month, assuming that there are on average 22 work days per month on which people commute to work.

(9)   CO$_2$ Emissions

We assume that CO_2 emissions are reduced by just over a half due to reduced travel and production, that is, by about 19 million tonnes (BEIS, 2020)[23]. If we value this at $60 (roughly £50) per tonne, this reduction is worth about £950 million or 0.5% of monthly GDP. This increases average wellbeing across the population by 0.001 points for one month. Spread over 65 million people, this is an increase of roughly 7,000 WELLBYs each month.

(10)   Air Quality

For similar reasons, air quality improves. We assume that about 23% of the population or roughly 15 million people move from bad to good air quality (British Heart Foundation, 2020)[24]. This raises wellbeing by about 0.06 points for each person affected (Rehdanz and Maddison, 2008)[25]. When spread over 65 million people, this saves about 76,000 WELLBYs each month.

(11)   Other factors and limitations

This analysis is not without its limitations. Many aspects are still missing and some variables are difficult to forecast. For example, recorded crime has fallen[26] but it is difficult to anticipate how it might evolve as the lockdown proceeds. Furthermore, we have insufficient data on volunteering which can be expressed in many different ways. For example, while some volunteering can be expected to go down because of movement restrictions, we have seen an increase in other forms of volunteering. It is also very difficult to forecast time use changes (except for commuting). For example, the impact of changes in physical activity or exercise may go either way.

Another set of limitations is that our estimates are not accompanied by statistical confidence intervals and sensitivity analyses and therefore need to be seen as rough valuations of the costs and benefits of the lockdown in terms of wellbeing metrics. For example, if people who died of COVID-19 would otherwise have lived on average for 5 years rather than 6 (as we assume), then the net benefits in Table 4 (bottom row) would need to be increased by 35 * 10k WELLBYs. Moreover, we tabulate

average effects at population level but the COVID-19 virus and the lockdown policy impact different parts of the population in very different ways.[27] Disaggregating the data will reveal myriad ways in how the lockdown policy is experienced.

4. Results

In Table 4 we aggregate the effects of future policy upon all the outcomes that we have considered. To do this, we have expressed all effects in units of Wellbeing-Year or WELLBYs, using the evidence of wellbeing science to value each outcome. Most of the effects are upon the quality of life. But there is also the key effect upon the length of life, where, as explained, we value one year of healthy life at 7.5 WELLBYs. There are clearly major uncertainties about each of our estimates – both the forecasts of the outcome and the impact of the outcomes upon wellbeing. But judgement is a matter of balancing one effect against another, and this becomes easier as we try to assign magnitudes to each effect. This quantitative framework is the main contribution of this paper. The numbers in Table 4 are purely illustrative.

As shown in Appendix 5, we are witnessing important changes in how people experience the quality of their lives throughout this period. Such measures of wellbeing can capture the complexity of the situation in a single set of metrics that can then be usefully applied to informing evidence-based policy that is more holistic in nature. We invite other researchers to develop and refine this model and we recommend that policy-makers adopt this approach in reaching their decision on when to end the lockdown.

Table 4. Net benefits of releasing the UK lockdown on the stated date rather than one month later (in WELLBYs, 10k)

	May 1	June 1	July 1	August 1
Benefits				
Income (increase)	48	66	86	103
Unemployment (reduction)	79	82	84	86
Mental health (improvement)	20	23	26	30
Confidence in government	9	13	22	32
Schooling (more)	5	5	3	0
Costs				
COVID-19 deaths (more)	-158	-158	-158	-158
Road deaths (more)	-5	-5	-5	-5
Commuting (more)	-10	-10	-10	-10
CO_2 emissions (more)	-7	-7	-7	-7
Air quality (worse)	-8	-8	-8	-8
Net benefits	**-27**	**1**	**33**	**63**

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[1] A wellbeing framework based on Wellbeing-Years or Happiness-Years is discussed in, for example, O'Donnell et al. (2014, pp. 74-77), Clark et al. (2018, chapter 15), and in great detail in Frijters and Krekel (2020).
[2] eg Clark et al (2018).
[3] See ONS (2019).

[4] See Dolan (2011). Some would argue that 7.5 is excessive. For there is some evidence that a life satisfaction of 2 is considered not worth living (Peasgood et al., 2018) in which case a year of life is worth less than 7.5 WELLBYs. But we do not assume this because we wish to give adequate weight to the cost of death.

[5] The lockdown, of course, provided time for increased "home production" such as DIY which are not included in GDP.

[6] The OBR's forecast of 14 April is even more optimistic. They assume that if the lockdown ends on 1 July output reverts to normal in Q4. (OBR corona virus reference scenario 14 April 2020). By contrast the OBR assume a current drop of 35% in Q2 compared with our 28%, which is explained in Appendix 1.

[7] We assume that the delay rises at an increasing rate, thus 1 June 1.1 year; 1 July 1.3 years; 1 August 1.6 years. We also assume that the date at which output returns to "normal" has no effect on the course of "super-normal" output.

[8] As examples, see Clark et al (2018) Table 16.2; De Neve et al (2018). The paper by Stevenson and Wolfers (2008) has slightly higher estimates but these come from regressions with no other covariates. Moreover, if most people's incomes fall, the sense of common suffering may blunt the loss in wellbeing from an income loss (see Clark et al 2008).

[7] eg Thunstrom et al (2020).

[10] See https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/conditionsanddiseases/bulletins/coronavirustheukeconomyandsocietyfasterindicators/16april2020

[11] See forecast for Q2 by The Office for Budget Responsibility (2020). They also give a forecast path for the decline of unemployment conditional on lockdown ending on 1 July. We ignore comparison effects which might reduce the pain of widespread unemployment, because these are small.

[12] See Clark et al (2018) Table 16.2 We also include an allowance of 0.1 for scarring effects that are assumed to last for one year after the end of the unemployment spell (see Clark et al., 2001).

[13] See https://www.refuge.org.uk/refuge-response-to-home-secretary-announcement-of-support-for-domestic-abuse-victims/

[14] See Paul Bolton (2019) Education Spending in the UK.

[15] Based on advice from Professor Neil Ferguson.

[16] Normile, D. (March 17, 2020). Coronavirus cases have dropped sharply in South Korea. What's the secret to its success? *Science*. Available at: https://www.sciencemag.org/news/2020/03/coronavirus-cases-have-dropped-sharply-south-korea-whats-secret-its-success

[17] To estimate the average remaining life expectancy of those who die of COVID-19 we proceed as follows. First, we calculate the average remaining life expectancy of people of each age (see ONS Life Tables). Then, we calculate what percentage of those who die of COVID-19 are of each age (see ONS Deaths Involving COVID-19) and use these weights to compute what the average remaining life expectancy would have been from those who died of COVID-19. The resulting number is 11.3 years. However, those who die of COVID-19 have on average substantially lower life expectancy than the average for their age group due to prior co-morbidities. We assume that their life expectancy is approximately half of that 11.3 estimate and use a figure of 6 years. This is a similar to the one used by Dolan and Jenkins (2020).

[18] We do not include any economic benefits from avoiding a 2nd wave of deaths if the lockdown is lifted since it would be politically difficult to impose a 2nd lockdown.

[19] Source: Department for Transport. Statistical data set: Modal comparisons (TSGB01). Available at: https://www.gov.uk/government/statistical-data-sets/tsgb01-modal-comparisons

[20] Source: Office for National Statistics. Overview of the UK population: February 2016. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/overviewoftheukpopulation/february2016

[21] Source: Office for National Statistics. National life tables, UK: 2016 to 2018.

[22] See Oguz, S. (2014)

[23] Source: Department for Business, Energy & Industrial Strategy. Final UK greenhouse gas emissions national statistics: 1990 to 2018.

[24] Source: Blake, I. (February 4, 2020). Government must go further and faster on air pollution. British Heart Foundation.

[25] See Rehdanz, K., and Maddison, D. (2008)

[26] See e.g. https://www.telegraph.co.uk/politics/2020/04/07/violent-crime-falls-40-per-cent-coronavirus-lockdown/

[27] See e.g. Oswald and Powdthavee (2020) and Adams-Prassl et al (2020)

References

Adams-Prassl, A., Boneva, T., Golin, M. and Rauh C. (2020) Inequality in the Impact of the Coronavirus Shock: Evidence from Real Time Surveys. *Mimeo.*

Blake, I. (February 4, 2020). Government must go further and faster on air pollution. *British Heart Foundation*.https://www.bhf.org.uk/what-we-do/news-from-the-bhf/news-archive/2020/february/government-must-go-further-and-faster-on-air-pollution

Bolton, P. (2019) Education Spending in the UK. https://commonslibrary.parliament.uk/research-briefings/sn01078/

Clark, A.E., Flèche, S., Layard, R., Powdthavee, N., and Ward, G. (2018). *The Origins of Happiness: The Science of Well-Being over the Life-Course*. Princeton NJ: Princeton University Press.

Clark, A.E., Frijters, P., and Shields, M. (2008). Relative Income, Happiness and Utility: An Explanation for the Easterlin Paradox and Other Puzzles. *Journal of Economic Literature,* 46, 95-144.

Clark, A.E., Georgellis, Y., and Sanfey, P. (2001). Scarring: the Psychological Impact of Past Unemployment. *Economica,* 68, 221-241.

De Neve, J.-E., Ward, G., De Keulenaer, F., Van Landeghem, B., Kavetsos, G., and Norton, M. I. (2018). The Asymmetric Experience of Positive and Negative Economic Growth: Global Evidence Using Subjective Well-Being Data. *The Review of Economics and Statistics*, 100(2), 362–375.

Department for Transport. Statistical data set: Modal comparisons (TSGB01). Available at: https://www.gov.uk/government/statistical-data-sets/tsgb01-modal-comparisons

Department for Business, Energy & Industrial Strategy. Final UK greenhouse gas emissions national statistics: 1990 to 2018. Available at: https://www.gov.uk/government/statistics/final-uk-greenhouse-gas-emissions-national-statistics-1990-to-2018

Dolan, P. (2011) Using happiness to value health. Office of Health Economics.

Dolan, P., and Jenkins, P. (2020). Estimating the monetary value of the deaths prevented from the UK Covid-19 lockdown – and the value of "flattening the curve". *Mimeo*.

Ferguson, N.M., Laydon, D., Nedjati-Gilani, G., Imai, N., Ainslie, K., Baguelin, M., … et al. (2020). Report 9: Impact of non-pharmaceutical interventions (NPIs) to reduce COVID-19 mortality and healthcare demand. Imperial College COVID-19 Response Team. Available at: https://www.imperial.ac.uk/media/imperial-college/medicine/sph/ide/gida-fellowships/Imperial-College-COVID19-NPI-modelling-16-03-2020.pdf

Fetzer, T., Witte, M., Hensel, L., Jachimowicz, J., Haushofer, J., Ivchenko, A., … Yoeli, E. (2020). Global Behaviors and Perceptions in the COVID-19-19 Pandemic. Retrieved from psyarxiv.com/3kfmh

Frijters, P., and Krekel, C. (2020). Handbook for Wellbeing Policy-Making: History, Theory, Measurement, Implementation, and Examples. Mimeo.

HM Treasury (2020) The Green Book: appraisal and evaluation in central government. Available here: https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

Macchia, L., and Plagnol, A. C. (2018). Life Satisfaction and Confidence in National Institutions: Evidence from South America. *Applied Research Quality Life*, **14**, 721–736.

Normile, D. (March 17, 2020). Coronavirus cases have dropped sharply in South Korea. What's the secret to its success? *Science*. Available at: https://www.sciencemag.org/news/2020/03/coronavirus-cases-have-dropped-sharply-south-korea-whats-secret-its-success

O'Donnell, G., Deaton, A., Durand, M., Halpern, D., and R. Layard (2014) Wellbeing and Policy. Legatum Institute.

Office for Budget Responsibility (April 14, 2020). Commentary on the OBR coronavirus reference scenario.

Office for National Statistics. Personal and economic well-being in the UK: August 2019 https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/bulletins/personalandeconomicwellbeingintheuk/august2019

Office for National Statistics. Overview of the UK population: February 2016. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/articles/overviewoftheukpopulation/february2016

Office for National Statistics. National life tables, UK: 2016 to 2018. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/lifeexpectancies/bulletins/nationallifetablesunitedkingdom/2016to2018

Office for National Statistics. Deaths involving COVID-19, England and Wales: deaths occurring in March 2020. Available at: https://www.ons.gov.uk/peoplepopulationandcommunity/birthsdeathsandmarriages/deaths/bulletins/deathsinvolvingcovid19englandandwales/deathsoccurringinmarch2020

Oguz, S. (2014) Commuting and Personal Well-being, 2014. *Office for National Statistics*.

Oswald, A.J. and Powdthavee, N. (2020) The Case for Releasing the Young from Lockdown: A Briefing Paper for Policymakers. *IZA DP* No. 13113

Peasgood, T., Mukuria, C., Karimi, M., & J. Brazier (2018). Eliciting preference weights for life satisfaction: A feasibility study. *Mimeo.*

Rehdanz, K., and Maddison, D. (2008). Local environmental quality and life-satisfaction in Germany. *Ecological Economics*, 64(4), 787–797.

Stevenson, B., and Wolfers, J. (2008). Economic Growth and Happiness: Reassessing the Easterlin Paradox. *Brookings Papers on Economic Activity*, spring, pp. 1–87

Thunstrom, L., Newbold, S.C., Finnoff, D., Ashworth, M., and J.F. Shogren (2020) The benefits and costs of flattening the curve for COVID-19. (April 14, 2020). Forthcoming *Journal of Benefit-Cost Analysis*. Available at SSRN: https://ssrn.com/abstract=3561934

APPENDICES

13

1. GDP cost of lockdown
2. The monetary value of Life-Years
3. Unemployment
4. Confidence in government
5. Trends in life satisfaction and happiness before and after the lockdown on March 23

1. GDP cost of lockdown

- UK GDP in 2019 was £2.2 trillion or just under £6.1 billion per day.
- The policies introduced by the UK Government on 23 March have, from surveys, clearly had a dramatic impact on production and spending decisions in the economy.
- For the second quarter, many external economists are forecasting double-digit falls in UK GDP, after a more modest fall in the first.
- At this stage of the data cycle, the uncertainty around any quantification of these GDP effects is still enormous.

Output-Based Estimates

- One way of gauging these effects is by looking at how much disruption there will be to the production decisions of various sectors – in other words, looking at the output side of the National Accounts.
- The Centre for Economics and Business Research (CEBR) recently did this, on a sector by sector basis (summarised below).
- Taking into account the sectors' share of value-added, the sectors contributing most to the hit to output are manufacturing, wholesale and retail trade, and construction.
- All in all, the CEBR arrive at a loss of just less than a third of GDP. This is equivalent to a loss of around £1.7 billion for each day the social distancing policies are in place.
- (NB: This is a scaled-down estimate of the CEBR's because we have used actual rather than working days, the former which seems more appropriate.)

Expenditure-Based Estimates

- Another way to scale the GDP hit is by looking at the expenditure side of the National Accounts.
- For consumers, you can classify spending four ways: social consumption; delayable consumption; work-related consumption; and consumption of staples. These represent, respectively, 11%, 14%, 5% and 32% of GDP.
- We would expect the first category to be hardest hit by the social distancing measures, with large hits to the second and third too.
- There could be some small partial offset from higher spending on staple items, as recent supermarket data suggest.
- Assume that social consumption is reduced by 100% and delayable and work-related consumption are each reduced by 90%, with a 5% offset from higher spending on essentials during the period of lockdown.
- As we know the import penetration of these different types of consumption, we can measure the effect on GDP of each category.
- Exploiting that information translates into a GDP hit of almost 20%, or £1.2 billion per day, from lower spending by households.
- In addition, we would expect companies to delay their capital spending for the duration of the social distancing policies (at least).
- If we assume investment net of depreciation is zero, such that the capital stock is flat, that is equivalent to business investment being around £55 million per day lower.

So, whether looked at from the production or expenditure side of the economy, we might expect a hit to GDP of between around £1.3-1.7 billion per day. In this paper we use the higher estimate which is 28% of GDP.

Full Findings

Sector	GVA per day before lockdown, £m	Estimated GVA per day after lockdown, £m	GVA per day loss due to lockdown, £m	Percentage remaining	Percentage lost
Agriculture, forestry and fishing	58	50	8	86%	14%
Mining and quarrying	51	20	31	40%	60%
Manufacturing	785	247	538	31%	69%
Electricity, gas, steam and air conditioning supply	110	99	11	90%	10%
Water supply, sewerage, waste management and remediation activities	100	100	0	100%	0%
Construction	473	237	237	50%	50%
Wholesale and retail trade; repair of motor vehicles and motorcycles	816	345	471	42%	58%
Transport and storage	322	196	126	61%	39%
Accommodation and food service activities	217	46	172	21%	79%
Information and communication	533	494	38	93%	7%
Financial and insurance activities	563	462	102	82%	18%
Real estate activities	1,060	852	207	80%	20%
Professional, scientific and technical activities	591	534	58	90%	10%
Administrative and support service activities	403	325	79	81%	19%
Public administration and defence; compulsory social security	380	380	0	100%	0%
Education	456	246	210	54%	46%
Human health and social work activities	590	604	-15	102%	-2%
Arts, entertainment and recreation	129	25	105	19%	81%
Other service activities	129	87	42	67%	33%
Activities of households and employers	22	4	17	20%	80%
Total	7,787	5,351	2,436		
Percentage	100%	68.7%	31.3%		

Select sub-sectors	GVA per day before lockdown, £m	Estimated GVA per day after lockdown, £m	GVA per day loss due to lockdown, £m	Percentage remaining	Percentage lost
Food and drink retail trade	121	147	-26	122%	-22%
Other retail trade	283	128	156	45%	55%
Food takeaway	42	46	-4	109%	-9%

2. The monetary value of Life-Years

Suppose that we use NICE's £25,000 per QALY and we accept the estimate of Ferguson et al (2020, page 16) that no general lockdown (as opposed to mitigation) would have produced 250,000 more deaths. Suppose, too, that these people would otherwise have lived 6 more years. This implies a loss of under £40b or under 2% of one year's GDP. Since the lockdown costs hugely more than that, we should never have done it—if we accept the figure of £25,000 per QALY or even £60,000 per QALY as is commonly advocated[2]. By contrast, the public supported and still support the lockdown. This implies that the NICE cut-off is too low relative to the public's valuation of life-years.

The NICE cut-off is also inconsistent with what we know about the impact of income on human welfare. Research shows that, when a person has 1% more income their wellbeing is 0.002 points higher. So an extra £1 of income produces 0.2/Y additional WELLBYs where Y is the person's annual income. Furthermore, since average life satisfaction is 7.5, an extra year of life produces 7.5 more WELLBYs. To value these we ask the following question: what is the amount of money £x that when £x/N is taken from each of N people their total WELLBYs fall by 7.5? That £x is the maximum amount of money that society should be willing to pay for securing one extra year of life. It is given by

$$(x/N)*(0.2/Y)*N = 7.5$$

since (0.2/Y) is the extra wellbeing per £1 and N people are affected. Thus,

$$x = 7.5Y/0.2$$

If Y = £20,000, x = £750,000. That is the cost per QALY implicit in this paper. However, it does not mean that, when public expenditure is constrained, it would be right for the NHS to use this figure, since there are many other competing forms of cost-effective public expenditure.

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[2] See HM Treasury Green Book. Whereas the £25,000 reflects the finance available to the NHS. The £60,000 reflects an unconstrained valuation.

3. Unemployment

We assume a level of unemployment on May 1st of 3.4 million, in line with the OBR predictions (Office for Budget Responsibility, 2020). The "natural" level of unemployment is taken to be 1.2 million, corresponding to the number of unemployed in the UK at the end of 2019: lockdown is then associated with a rise in unemployment of 2.2 million. Every additional month of lockdown is assumed to add 0.1 million to this figure.

Excess COVID-19 unemployment is then 2.2 million in May, and rises 0.1 million each month to 2.6 million in September.

There are two elements to the unemployment cost of extending the lockdown for a month: i) the cost of keeping the stock of the excess unemployed out of work one additional month, and ii) what subsequently happens as a result of the extra 100k people unemployed each month.

For i), the WELLBY cost of a stock N of excess unemployed who remain out of work one additional month is (N/12)*2.8. For extending the lockdown from May to June, the excess unemployment figure is 2.2 million, then 2.3 million for extension from June to July, and so on. Analogous calculations are made for each additional month of extension.

For ii), the additional 0.1 million unemployed each month generate subsequently 0.1 million additional years of unemployment. This results in an additional cost of 100k*2.8 WELLBYs.

The total WELLBY cost of unemployment due to delay is thus as follows (in million WELLBYs).

	Unemployment (Millions)	Excess COVID Unemployment (Millions)	Cost of keeping excess stock unemployed one month more (=(stock/12)*2.8)	Cost of extra 100k unemployed for one year (=0.1*2.8)	Total Cost
May	3.4	2.2	0.51	0.28	0.79
June	3.5	2.3	0.54	0.28	0.82
July	3.6	2.4	0.56	0.28	0.84
August	3.7	2.5	0.58	0.28	0.86

It is interesting to compare our forecast path of unemployment for an exit date of 1 July with the equivalent forecast by the OBR (2020). They turn out to be almost identical.

4. Confidence in government

Trend in UK government approval rating before and after the lockdown on March 23d (YouGov)
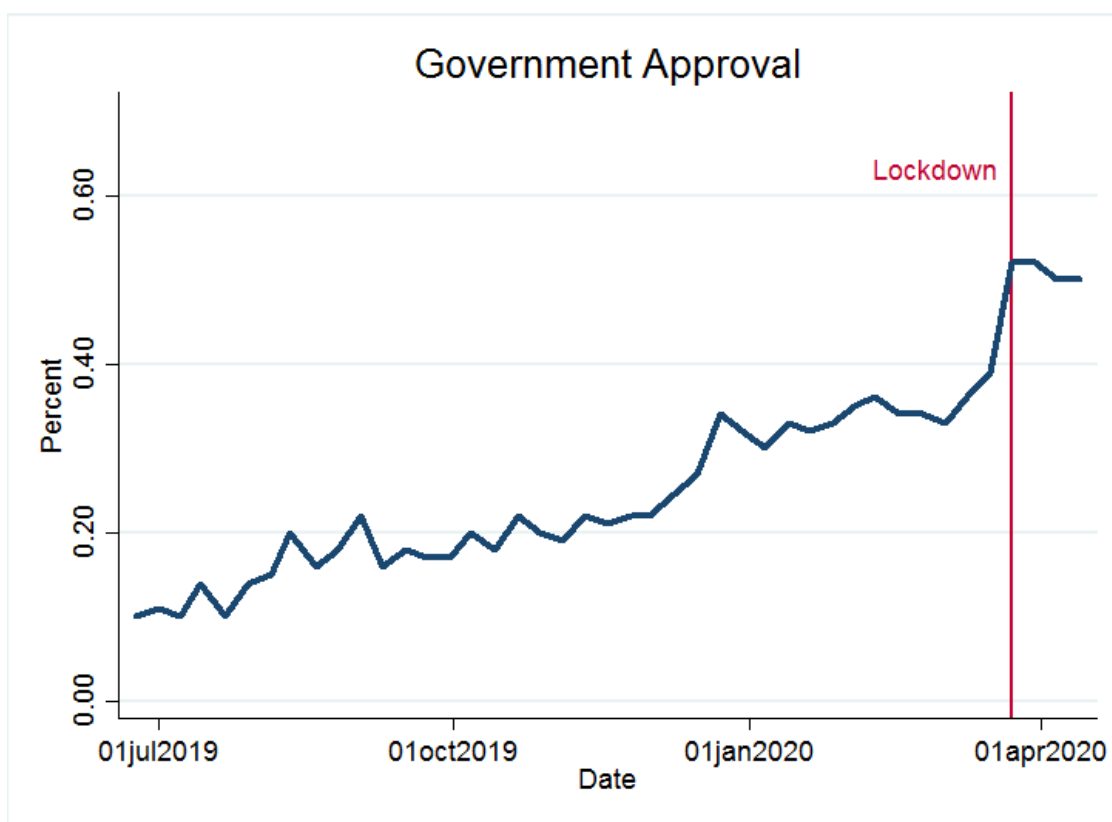
Regression of life evaluation on confidence in government in the UK and Europe, Gallup World Poll, 2009-2020.

	Dependent variable: Life evaluation (0-10)	
	UK	Europe
	(1)	(2)
Confidence in government (0, 1)	**0.520*****	0.454***
	(0.033)	(0.008)
Constant	5.880***	6.102***
	(0.187)	(0.050)
Observations	11,219	206,798
R^2	0.081	0.241
Adjusted R^2	0.079	0.240
Residual Std. Error	1.687 (df = 11191)	1.640 (df = 206748)
F Statistic	36.767*** (df = 27; 11191)	1,336.388*** (df = 49; 206748)

Notes: * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Models show unstandardized regression coefficients with standard errors in parentheses. Model 1 includes year fixed effects only and model 2 includes country-year fixed effects. Model 2 includes the following countries: Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Iceland, Israel, Italy, Latvia, Lithuania, Luxembourg, Malta, Moldova, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland. The dependent variable represents Cantril's Ladder of Life (0-10). All models include gender, age, age squared, level of education, marital and employment status, number of children under 15 in the household and log of personal income as controls.

5. **Trends in happiness[3] and life satisfaction[4] before/after the UK lockdown on March 23, 2020 (sources: YouGov and UCL COVID-19 Social Study)**
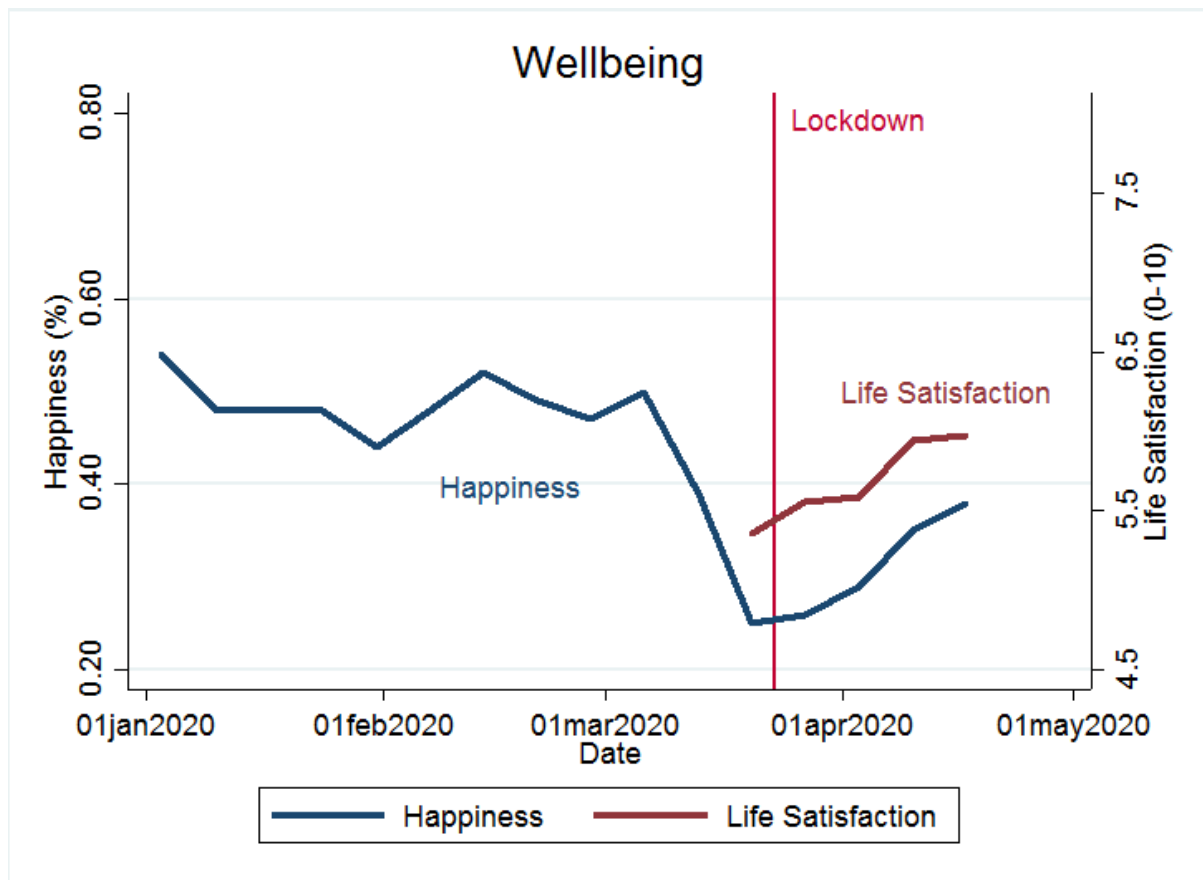
[3] The happiness item is derived from the YouGov weekly survey of a representative sample of about 2,000 UK residents. It represents the percentage of survey participants indicating "Happy" to the following question: "Broadly speaking, which of the following best describe your mood and/or how you have felt in the past week."

[4] The life satisfaction item is obtained from the UCL COVID-19 Social Study. The weekly survey asks "Overall, in the past week, how satisfied have you been with your life?" where 0 represents "not at all" and 10 represents "completely". The UCL COVID-19 Social Study is a large panel study of the psychological and social experiences of over 75,000 adults (aged 18+) in the UK during the COVID-19 pandemic. The study commenced on 21st March 2020 and involves online weekly data collection from participants for the duration of the COVID-19 pandemic in the UK. The study is not random and therefore is not representative of the UK population. But it does contain a well-stratified sample that was recruited using three primary approaches. First, snowballing was used, including promoting the study through existing networks and mailing lists (including large databases of adults who had previously consented to be involved in health research across the UK), print and digital media coverage, and social media. Second, more targeted recruitment was undertaken focusing on (i) individuals from a low-income background, (ii) individuals with no or few educational qualifications, and (iii) individuals who were unemployed. Third, the study was promoted via partnerships with third sector organisations to vulnerable groups, including adults with pre-existing mental health conditions, older adults, carers, and people experiencing domestic violence or abuse. The study was approved by the UCL Research Ethics Committee [12467/005] and all participants gave informed consent.

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