Covid-19 and Economic Analysis: a Review of the Debate

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Contents

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1) Introduction

This newsletter aims at providing an overview of relevant, covid-19 related economic issues as discussed in the current literature. It therefore draws as much on traditional working papers as on (respected) online publications, blogs, etc.

This issue reviews research linking the evolution of the pandemic to macroeconomic outcomes, with a view to frame in a rigorous context the relevant normative issues. Attention is also devoted to works discussing the most appropriate policy responses, highlighting the role of fiscal and monetary policies.

Many of the proposed policy solutions are quite innovative and out-of-the-box, mirroring the very peculiar features of the current juncture. The newsletter closes with a review of the debate on how to exit from the lockdown, arguably the next big challenge for policymakers.

2) Understanding the economic consequences of Covid-19

As a pure epidemiological shock, the Covid-19 is recognized to be a potential trigger of an economic disruption where aggregate supply and demand kill each other in a self-fulfilling spiral (Galeotti and Surico, 2020). **Merging the epidemiological models with macroeconomic models** revealed that taking into account economic interactions leads to a sharper recession and fewer deaths than in a pure epidemiological model. The reason is that susceptible people severely reduce their consumption and hours worked to lower their own probability of being infected. In doing so, they do not fully internalize the impact of their actions on the overall spread of the infection. Hence, containment measures are necessary (Eichenbaum et al., 2020).

Historical analyses reveal also that after a pandemic the natural real interest rate tends to decrease becoming about 2% lower after 20 years (at its trough) to be reabsorbed in a matter of other 20 years (Jordà et al., 2020). This feature is particularly worrisome if considered that the Covid-19 shock occurred in a context of secular stagnation with the monetary policy already constrained by the proximity to the effective lower bound. In such a context, expectations of lower productivity growth - which in turn translate into a lower natural rate - might lead the system to a stagnation trap (Fornaro and Wolf, 2020).

Guerrieri et al., 2020 **emphasize the importance of multi-sector analyses** to understand how the Covid-19 shock might be what they call a "**Keynesian supply shock**" **where aggregate demand contracts more than the initial supply shock when goods are not too close substitutes across sectors**.[2] Extending the epidemiological-macroeconomic model to multiple sectors, Krueger et al. (2020) stress that the higher the substitutability across sectors the milder the Covid-19 crisis can be, even in the absence of explicit government interventions. Individually rational agents reallocate their consumption to sectors with low risk of infection (depending on the assumed degree of sectoral social interaction in consumption). In the limiting case when goods are perfect substitutes across sectors the epidemiological curve is not just flattened but reversed. However, this stark result might critically hinge upon the assumption not only of frictionless labor market (in particular, immediate reallocation) but also of no infection possibility in the workplace. Barrot et al. (2020) analyze empirically **the sectoral effects of social distancing as a purely labor supply shock** for major European countries (particularly France) taking into account national differences in sectoral composition (input-output tables) and propensity to telework. They find that **value added decreases the most** in **sectors more distant from final demand** ('upstream sectors' such as 'mining', 'technical activities', 'consulting', 'utilities') on top of those **sectors directly impacted by social distancing** (such as 'arts and leisure', 'hotel restaurants'). Hence, 'upstreamness' – the number of nodes between a given sector and the final demand in the production network of a country – seems a key determinant of the harshness of the Covid-19 shock. Six

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[2] As highlighted in the previous newsletter, this happens when the intertemporal elasticity of substitution is sufficiently high and the elasticity of substitution across sectors is not too large. Intuitively, two channels are at play: (i) the shutdown increases the shadow price of the goods in the affected sectors, making total current consumption more expensive; (ii) in presence of imperfect substitutability the unavailability of some sectors' goods does not fully shift spending towards the other sectors. These channels work even in complete markets (incomplete markets would only increase its likelihood). The main message is that a 50% shock that hits all sectors is not the same as a 100% shock that hits half the economy (what the Covid-19 policies actually do).

weeks of social distancing would bring annual GDP down by 5.6% in France and with a range of 4.3-9.2% in other European countries.

As stressed in the previous issue of the present newsletter, the **Covid-19-induced economic uncertainty is huge**. By looking at several uncertainty indicators (e.g., the VIX or the US EPU),[3] Baker et al. 2020 show that the uncertainty is larger than the one associated with (i) the financial crises of 2008-09 and (ii) past epidemics like Ebola and SARS. Furthermore, using stock market measures to calibrate the first- and second-moment aspects of the COVID-19 shock,[4] and feeding them into an estimated empirical model of disaster (first presented in Baker et al. 2019), they find that the **US real GDP falls by 9% in 2020Q2 on a year-on-year basis and reaches a year-on-year contraction of 11% two quarters later. M**ore than half of the projected **output contraction would be caused by** second moments, i.e., **Covid-19-induced uncertainty**, and the output effects of the Covid-19 would persist up to the end of next year.

3) Normative policy analysis: optimizing the health-output trade-off

Authors started asking about the optimal policy to save the most possible lives while minimizing the economic cost in terms of output. It is generally found that the optimal policy entails an immediate lockdown policy followed by a ramp-up of its severity that accelerates at the pace of infection and then slowly fades away accordingly (Eichenbaum et al., 2020). The length of this severe lockdown is estimated to be about 5 weeks (Alvarez et al., 2020). While the optimal policy depends on many factors (including possibility of a vaccine or effective treatment, hospitalization capacity, welfare weights on different categories of individuals) the fall of real GDP in the first year of the epidemic in presence of containment policies tends to be larger than the corresponding fall in a *laissez-faire* equilibrium by a factor of 3. This *laissez-faire* equilibrium is characterized by a GDP fall in the range 5-7%. Some authors note that containment measures end up favoring certain categories of individuals more than others and study optimal policies with different degrees of heterogeneity (Glover et al., 2020, Kaplan, Moll and Violante, 2020). **Caution on this type of analysis is needed** not only because disruption in trade and global-value-chains might add up to those estimates of lost output (Fernando and McKibbin, 2020), Baldwin and Freeman, 2020), but also because empirical analysis based on historical episodes suggest that the cost of not acting might have long-lasting effects (Correia et al, 2020).

Some contend the very existence of a health-output trade-off (see Saraceno, 2020: "There is no Trade-off. Saving Lives is Good for the Economy"). The Economist (2020) depicts the trade-off as an **unavoidable "grim calculus"**. Budish (2020) recommends to incorporate the health policy experts' problem, minimizing the spread of Covid-19 subject to 'keeping society functioning', into an economic maximization problem. Hence, the problem should read: 'Maximize social welfare subject to technological/incentive constraints and the condition that the Covid-19 average transmission rate stays below one ($R<1$)'. Then, his purely speculative approach recommends to think in terms of "production possibility frontier": how much social welfare can be achieved for a given level of disease transmission risk. Kaplan et al. (2020) offer results for this frontier in terms of trade-off between lives (as percentage of initial population) and prosperity of those alive (as aggregate consumption in percentage of the pre-infection level).

Some contributions point to another crucial trade-off, which becomes even more relevant as the exit from the lockdown approaches (on this issue see the last Section), namely the trade-off **between the short-term health consequences of the Covid epidemic and the medium and long term health cost of the lockdown-induced downturn.** Janke et al. (2020) estimate that **a 1% fall in employment leads to a 2% increase in the prevalence of chronic illness**. Banks et al. (2020) review the relevant literature, according to which **the health effects or recessions are particularly severe for children** and those with preexisting poor mental health.

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[3] The daily Vix, which reflects the forward looking volatility implied by options on the S&P 500 index, reached its global peak within last March. The monthly US EPU index, which reflects real-time uncertainty perceived and expressed by journalists, surged from around 100 in January 2020 to almost 400 in March, the highest value on record.

[4] More in details, the first (second) moment is calibrated based on the fall (rise) of the stock market index (stock market volatility) from February 24 to March 31, 2020. These shocks are fed in the model as of 2020:Q2, while setting other contemporaneous shocks and all shocks in previous periods to zero.

At the basis of any calculus of the health-output trade-off there is the question: **'What fraction of consumption everyone is willing to give up to avoid the new mortality risk induced by Covid-19'?** Within a model with a young and an old generation for the United States, Hall et al. (2020) answer that the society would be willing to **trade off roughly ¼ of one year's consumption.**[5] Obviously, containment policies would induce a decrease in both death rates and forgone consumption which however is not taken into account by the authors.[6]

Within the evolving literature on epidemiological macroeconomic models ("SIR macro models"), Jones et al. (2020), adds the possibility for individuals of learning-by-doing in working from home. Compared to the most quoted framework of Eichenbaum et al. (2020), they find that the **optimal social planner's policy flattens the epidemiological curve much more** via a lockdown that requires roughly 40% of the population to work from home almost immediately (as long as a vaccine is not available). The planner also **invest heavily on the learning-by-doing technology** to mitigate future disruptions.

4) Going granular: policy levers to mitigate the economic fallout

4.1) The role of fiscal policies

The growing macro literature mostly agree that discretionary fiscal policies should be an important part of the policy mix deployed to mitigate the COVID19-induced recession. Regardless of the way the shock and its propagation mechanism are modelled – be it a negative shock to the propensity to consume "contact-intensive" services (Faria-e-Castro 2020) or a self-fulfilling prophecy on the productivity growth rate (Fornaro and Wolf 2020) – the existence of ZLB on the policy interest rate limits the effectiveness of monetary policy.

The appropriate fiscal policy tools: targeting effectiveness. As the shock has heterogeneous effects on different sectors and industries as well as on different types of workers **some suggests the necessity of targeted interventions** to protect the most vulnerable. The IMF, in its recent April 2020 Fiscal Monitor, also argues that broad-based fiscal stimulus risk being ineffective until lockdown policies are relaxed. However, **precise targeting requires a lot of information and an increased bureaucratic complexity**; this may hamper the timeliness and overall effectiveness of the intervention. **Second**, if one prefers targeted measures - e.g. decides to protect specific workers and/or some specific sector -**what kind of transfers have the best bang for the buck?**

Recent contributions on how to best target fiscal transfers stress **the need to gather detailed information on** who is more damaged by the crisis. **Bosio and Djankov (2020)** **suggest a data-driven approach relying extensively on** credit bureaus and registries to track the liquidity status of businesses. Three broader empirical exercises shed light on the unequal impact of the crisis on different groups of workers.

Bell et al. (2020) look at a large sample of UK historical earnings data (400 000 workers between 1975 and 2016) and find that **working in a small firm, being male and young implies, in general, a greater exposure to aggregate risk**. Still in the context of the UK economy, but directly in relation to the Covid-19 emergency, Joyce & Xu (2020) examine the data coming from the Quarterly Labor Force Survey to study how specific sector shutdowns affect the employment of men vs. women, young vs. old workers and low- vs. high-earners. The analysis uncovers the exceptional vulnerability of young, female and low-earners, who concentrate disproportionately in the sectors subject to mandatory shutdowns. In a similar fashion, Adams-Prassl et al. (2020) compare UK and US survey data and document that vital sectors as "food preparation", "personal care" and "healthcare support" are associated with tasks that cannot be carried out from home. Moreover, these types of jobs generally feature high physical proximity, no paid sick leave and lower earnings, making the employees particularly exposed to both economic and health risks.

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[5] They assume that (i) only the elderly die, (ii) a year of life is worth three times annual consumption (see Viscusi and Aldy, 2003), and (iii) the death rate associated to Covid-19 is 3.86% for one year, absent any mitigation effort (Ferguson et al., 2020).

[6] In a much more complex analytical framework, Martin and Pindick (2019) estimate that the society would be willing to sacrifice roughly 10% of aggregate consumption, now and throughout the future, to eliminate the threat of a pandemic like a Spanish flu.

Concerning the issue of what are the most appropriate fiscal tools, several papers have analyzed the pros and cons of short-time work schemes, especially following the proposal by the European Commission to launch a **100 billion euros loan programme for member states (SURE) aimed at** promoting them.

The decision to encourage the adoption of short-time work schemes is supported by Giupponi & Landais (2018) in the context of the Italian Cassa Integrazione Guadagni nd, more generally, by Eichengreen (2020). In the same vein, the IMF April 2020 Fiscal Monitor says that "*the main policy goal during the virus containment and mitigation phases is ... to preserve the web of economic relationships between employers and employees, producers and consumers, and lenders and borrowers.*" Indeed, in the current juncture the provision of **short-time work subsidies seem preferable over other forms of insurance (e.g. unemployment benefits)** as they preserve employer-employee matches and avoid the costly processes of separation, vacancy posting, training and job search.

Giupponi & Landais (2020) discuss the practical issues related to the implementation of short-time work subsidies during the Covid-19 crisis. Granting firms some degree of **flexibility on the optimal reduction of hours worked as well as providing timely payments** appear crucial ingredients to minimize the impact of liquidity shortages. However, in order to prevent the risk of moral hazard, **the obligation for firms to retain their workers** should be one of the conditions to receive support. Given the extraordinary circumstances, eligibility to this type of insurance should be extended to temporary workers, and, in general, to the most vulnerable worker categories that are not included in the existing national schemes.

In any event, the recession triggered by the Covid-19 viral outbreak will likely bring about an increase in the unemployment rate, partly due to a **hiring stall**. Merkl & Weber (2020) propose to establish also **a public subsidy for new hires, to be implemented via the postponement of social security contributions** for new employment contracts. Bosio and Djankov (2020) suggest that there are simple – and therefore sometimes overlooked – ways to help ailing firms. In particular, public administrations should speed up payment of their commercial debts (in some states, including Italy, payment times are quite long); second, governments could implement a temporary freeze of bankruptcy procedures.

Government guarantees on business loans have been largely used as a short-term liquidity support by the countries most-hit by the crisis. According to the IMF April 2020 Fiscal Monitor, this instrument can be more efficient than direct government support, as its implementation costs and lags are lower. However, the associated fiscal risks must be transparently identified.

Fiscal policy in the euro area: As **in some countries the fiscal response is constrained** by a lack of fiscal space, most economies agree that **a policy response at the European level** is warranted. **Opinions differ on how best implement** such a response. Some argue that the **existing instruments** (ECB's QE and ESM) are inadequate, and that **innovative tools** should be used, such as helicopter drops or the issuance of "coronabonds".

The discussion has heated up in the wake of the **Euro-group of April 9**. Immediately before that date, two important political proposals have been diffused, favoring a temporary and targeted issuance of Eurobonds, coming from two EU Commissioners (Breton and Gentiloni) and from the French ministry of the economy (Le Maire). The French also proposed to use a solidarity tax to finance the common fiscal effort. In the broader policy debate there have been further papers arguing in favor of European "coronabonds", such as Kirkegaard (2020) or Legrain (2020).

Vandenbroucke et al. (2020) welcome the agreement reached at the Eurogroup level for the institution of the SURE scheme in the EU, as such an instrument can be seen as a first step towards a centralised unemployment insurance arrangement, which would in turn **foster both intertemporal and interregional smoothing and risk-sharing**.

Supporters of a new ESM-based credit line, as Erce et al. (2020) and Probstl (2020), stress that this instrument is already in place (as opposed to coronabonds) and faces less legal problems given the current EU (and national) legislations.

A **balanced approach** is the one pursued by Bénassy-Quéré et al. (2020) who **suggest the EU should launch more than one innovative tools**. Indeed, they point out that there are at least two – conceptually orthogonal - issues at stake: first, countries have been hit differentially by the health shock; second, countries have different fiscal room for manouvre to contrast the recession. Therefore they are in favour both of commonly-issued covid bonds (to address the former problem) and of a new ESM credit line (to address the latter one).

Gros (2020) suggests instead of **exempting severely hit countries from contributing to the EU budget** for the next seven years, i.e. the length of the EU Multiannual Financial Framework (which begins in 2021 and is still under discussion). This would free resources worth about 1% of each country's GDP per year. A less generous but still substantial alternative would be one in which the exemption from contributions is scaled down linearly to zero. In both cases, the lower contributions from "unlucky" countries would be made-up by the other countries.

Switching to a contribution which looks at another currency union, Krugman points out that – differently to what has happened in the EU – **in the USA the balanced-budget rules** constraining the fiscal response of the States **have not been waived/suspended**. This might induce, in a year of cyclically-induced falling revenues and raising expenditure, a pro-cyclical fiscal tightening at the local level, which could undermine the overall fiscal stance.

4.2) The role of banks

The previous newsletter presented the debate about the role of banks in the current race for saving firms and jobs from the impact of the Covid-19 crisis. In the case of firms, the discussion has evolved around debt vs. equity financing for firms. The debate was ignited by some authors arguing that policymakers should consider equity financing through recapitalization from public funds, as supporting firms through new loans would weaken their financial structure (see e.g. Pagano, 2020).

Along these lines, Boot et al. (2020) have proposed the creation of a **European Pandemic Equity Fund (EPEF)** backed by governments, where **firms receive transfers that will pay back through higher corporate taxes conditional on their performance**. This is a way to combine equity-like payment structure, without impinging on ownership structure. The authors highlight that financing firms through loans could be problematic because of i) rising corporate leverage, ii) increasing bank risk exposure, iii) growing sovereign exposures, and iv) emerging cross-country distortions to competition in product and capital markets. They intentionally do not focus on the question of funding of the EPEF, but rather on how to use it.

Their idea is that the EPEF offers payments to firms that carry no direct repayment obligation (although they are not outright transfers). In this way firm leverage (and thus, firm default risk) does not rise. **The risk of a future loss of the initial payment is assumed by the investor**, the EPEF. In the same way, **future profits are also shared** by the EPEF. The financing scheme of the EPEF could differ for large and small-medium firms. For the former, it could offer to take an equity-like claim: cash to the firm in exchange for a fair share of future profits. For the latter, given that entrepreneurs of SMEs tend to dislike external ownership of the firm, the EPEF can offer cash to firms in exchange for a temporary increase in the future corporate profit tax rate post-crisis. In this way the EPEF could reach SMEs, which typically stay away from the capital market in the first place and rely on bank financing instead.

4.3) The role of monetary policy

The previous newsletter overviewed the debate on helicopter drop-type policies, consisting in large monetary transfers from the central bank to households and firms, either direct or *via* the Treasury[7]. From an accounting point of view, there is no difference if the central bank purchases the government bonds in the primary or in the secondary markets[8]. But if the purchases are made in the secondary market, **what would differentiate an helicopter drop measure from a quantitative easing one**?

Differences are not in term of their final goals: both measures aim at stimulating aggregate demand. **The main differences lie in the mechanisms and in the degree of coordination of the actors involved**.

Quantitative easing (QE) aims at influencing aggregate demand primarily by reducing medium and long-term interest rates. To do so, the central bank buys low-risk securities (such as government bonds) with medium and long-term maturities. By making them relatively scarce it is able to increase their price and reduce,

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[7] In this second case, the government would issue bonds to finance the transfers and the central bank would purchase them and credit the account of the Treasury. See for example Bernanke (2003).
[8] See also Barwell, Chadha and Grady (2020).

as a consequence, their returns. **The scarcity channel is therefore a key element of the QE**[9]. The reduction of the returns on the asset purchased is then transmitted to other financial assets and activates other channels that indirectly stimulates households' consumptions and firms' investments[10].

Helicopter drops (HD) aim instead at influencing aggregate demand directly. What matters is not that the purchased securities become relatively scarce, but that the money created by the central bank is transferred by the government to households and firms that effectively use it to increase their consumptions and investments. **Its effectiveness, therefore, rests on one of two (sufficient) conditions**. Either (i) agents perceiving the money injection as permanent (money transfers will not be reversed in the future by an equivalent increase in taxes), or (ii) if such injections will be reversed in the future, they should be targeted to agents with a relatively low discount factor (i.e. who care relatively little about future disbursements, either because of their preferences or because they are currently facing liquidity or borrowing limits).

Given these requirements, **the recent debate has emphasized two ways to implement HD-like policies** starting from existing measures.

The first consists in making QE permanent. Permanent purchases of government bonds can occur either (i) by issuing and purchasing irredeemable government bonds or (ii) by issuing redeemable bonds that the central bank (credibly) commits to repurchase every time that they matures. Many economists have been debating about this possibility in the last weeks. Some suggested just converting the bonds that central banks already purchased in QE programmes into irredeemable bonds[11]; some say that assets purchased in the context of QE programmes will inevitably be repurchased when they will expire[12]; others say that this is still an open option but the central banks at this stage should remain silent about it[13].

The main issue with permanent QE is that it implies a loss of capital for the central bank. While this has no implications in the short term since central banks are not subject to the same rules as private individuals and firms in accounting terms[14], if the capital shortfall is sufficiently large and it is not recovered in the medium to long term, the monetary authority could lose credibility in its ability to maintain price stability. Therefore,

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[9] The theoretical and empirical literature suggests that the effect depends on certain characteristics of the assets, including the maturity and the issuer (see for example Vayanos and Vila (2009) for a theoretical model and D'Amico and King (2012) for empirical evidence). Since some investors have a preference for longer-term low-risk assets issued in their home country, a reduction in the volume of such assets available on the market will lower the yield that investors demand for holding them. For instance, institutional investors such as pension funds might want to hold a fixed amount of ten-year government bonds in their portfolios. In this case, government securities of different residual maturity would not be a perfect substitute; that is, a reduction in the volume of securities of a particular maturity will generate what can be dubbed a 'local scarcity' (the scarcity channel). Imperfect substitutability implies that the elasticity of price to supply is very high. In other words, the greater the price inelasticity of the demand for securities in the maturity segment in which it intervenes, the more effective the central bank's purchases will be in lowering yields. See Grande et al (2019).

[10] For a description of the main channels activated by quantitative easing programmes, see Cova and Ferrero (2015).

[11] Vihriälä (2020), suggests to "convert a fraction of the sovereign debt held by the ECB (or better the European System of Central Banks, or ESCB) into perpetuity with zero coupon. Monetary financing strictly speaking, yes. But how different economically from the continued holdings and rollover of large amounts of the same sovereigns' debt at (close to) zero rates? Relative to trusting the ECB to continue to pursue extremely accommodative policies for undetermined period of time, such a conversion would make debt relief certain".

[12] In an article signed by its editorial board, The Financial Times (2020) claims that "*there is no clear distinction between quantitative easing and monetary financing. Central bankers say asset purchases under QE are temporary, meaning the newly-created money will one day be removed from the economy. But it is hard to bind the hands of their successors, who could one day make them permanent. [...] Recent QE programmes, in fact, look increasingly likely to become permanent*" Financial Times, 6 April 2020, "Printing money is valid response to coronavirus crisis. Quantitative easing programmes may be here for the long term" (https://www.ft.com/content/fd1d35c4-7804-11ea-9840-1b8019d9a987).

[13] Blanchard and Pisani-Ferry, 10 April, 2020, Blanchard and Pisani-Ferry (2020) claim that "*to a first approximation, when interest rates are equal to zero, the purchase of bonds by the central bank in exchange for money – that is, the degree to which public debt is monetised – does not affect public debt dynamics.*" In such a situation "*the eventual impact of central bank purchases of government bonds depends on what will happen in the future when economic activity and inflation are such that the central bank will want to increase interest rates. Monetisation today may affect expectations of what will happen then.*" This would imply that the governments should not exclude to transform a QE in a permanent QE, since "*remaining silent about what will be done in the future may indeed be the best policy today*". "Monetisation: Do not panic" (https://voxeu.org/article/monetisation-do-not-panic).

[14] See for example Buiter (2020), "Central Banks as Fiscal Actors; the Drivers of Monetary and Fiscal Policy Space", forthcoming Cambridge University Press.

if the loss of capital is not replenished in the future, it will increase the risk of price instability; this is in fact the main argument against permanent QE according to opponents of this measure.[15]

This has led to consider **the second possibility**, a **permanent non-inflationary QE with targeted transfers.** The idea is that capital should be replenished in the future with the central bank withholding part of the seigniorage that would otherwise have been transferred to the Treasury. The recent proposal by Galì (2020), for example, suggests a conversion of actual QE programs into permanent QEs, but at the same time he suggests that the central banks and the governments agree on "*a permanent reduction in the transfer of ECB profits to governments in proportion to the effective debt cancellation*". However, since the reduction in revenues for the Government would imply a lower spending capacity and, other things equal, an increase in future taxes (Ricardian equivalence), **for the effectiveness of such a program it would be crucial that** monetary **transfers are targeted to agents with a relatively low discount factor**.

5) How to exit the lockdown?

Most countries have opted to address the dramatic spreading of the virus and the exponential increase in fatalities with stringent forms of lockdown. These suppression measures imply sizable economic costs. As the measure of social distancing deployed helped reducing the contagion, the debate about an exit strategy is mounting. This column briefly reviews the main traits of the proposals put forward.[16]

Most contributions **assume** that the suppression of the virus through a vaccine is unlikely before several months, and the unlocking shall therefore occur with positive risks of contagion/new outbreaks. In this scenario, the challenge is to devise an unlocking strategy that avoids putting the health system under strain (sometimes referred to as the "flatten the curve" approach). For example, by making sure that the patterns of infections under alternative scenarios implies a demand for ICU that is significantly lower than the supply.

The typical exit strategy involves **two steps**: **step 1** involves the strengthening of the health system, largely achieved during the lockdown period. **Step 2** is about deciding how people can progressively go back to work. It is triggered by health autorities as series of health supply markers are met.[17]

Step 1 features a substantive strengthening of the health system both in terms of treating capacity, and of the "test, isolate, and trace" approach recommended by the WHO. More specifically, in step 1 countries should:

   i. Ensure the health care system has the capacity to safely treat both COVID-19 patients and others requiring care. This implies expanding ICU capacity,[18] ensuring sufficient critical-care capacity in hospitals, increase the supply of personal protective equipment, and establish protocols of medical assistance for people isolated at home. As almost all countries are involved in this scaling up effort, the production capacity has been put under strain.[19] Developing provision and logistics capacity will be an essential element to the unlocking strategy.

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[15] See for example Kevin Dowd (2018), "Against Helicopter Money", (https://www.cato.org/cato-journal/winter-2018/against-helicopter-money).

[16] The literature on this matter include scattered contributions by experts on specific aspects of the unlocking, and a few comprehensive "roadmaps", usually targeted to some specific country. These include the US (American Enterprise Institute with John Hopkins University, the Center for American Progress, Harvard University's Safra Center for Ethics,), Germany (IFO), the UK (Globalvision), France (Scientific council and Academy of medicine). See also the FT coverage of the UK and other European cases.

[17] For example, the AEI-John Hopkins University document suggests step2 should start as: (i) hospital bed supply catches up fully with demand; (ii) testing catches up fully with demand; (iii) programs for quarantining new cases and informing their contacts are developed; and (iv) the number of cases declines for 14 consecutive days.

[18] In many countries, the ICU endowment proved insufficient in the critical phases of the epidemics. In the case of Italy, the number of ICUs has been raised from 5.200 to 8.500 and the target is now of 11.000 units. For an assessment of the consequences of Financial Recovery Plans, implemented starting in 2007, on the healthcare systems in some Italian regions, see Aimone Gigio et al (2018).

[19] There are already shortages of reagents and swabs, and the supply of health workers is of curse limited in the short run. In some cases, local partnerships between universities and firms have been used to scale up production. Bottlenecks come also from technology learning, for instance the UK tried to accelerate its own supply of hospital ventilators by pushing

ii. build a **health surveillance** system that allows for early detection of possible outbreaks. The system should be able to **Test, Isolate & Trace** (as per the WHO recommendations).

- When referring to **testing capacity** most exit strategies combine both

    - **diagnostic tests** of genetic material (known as "swabs") which detect currently positive individuals and are therefore key to detect and contain potential new outbreaks (e.g. in the workplace, of within a community)[20]. It is unclear whether tests for positivity could be suitable for recurrent mass-testing of individuals during the unlocking.[21]

    - **serological tests**, which detect antibodies that the immune system produces in response to infection. These will become more and more important to identify people that are (albeit possibly temporarily) immune to the virus and that can be safely put back to work. [22]

- **isolating** positive cases is a key aspect to contain the diffusion of the virus. Within-households contagion represents a major risk of spread and it can contribute to new outbreaks. To tackle this issue, alternative solutions have been suggested (and sometimes implemented) as isolating in hospitals (or temporary facilities) patients with had mild symptoms (e.g. South Korea), or signed agreements with hotels' representatives (as in the case of several Italian regions).

- **tracing** contacts of infected individuals is also an essential part of any exit strategy. Most health agencies have consolidated practices of contact tracing (through interviews, phone calls etc.), but recent innovations in eastern Asian countries (as China, Singapore, Taiwan and South Korea) showed the advantages of using mobile phones (via Bluetooth or geo localization). Despite several privacy concerns, Western countries are already moving in that direction[23].

Step 2: The second step is about deciding how people can progressively go back to work. All contributions **recommend the easing** of current restrictions **should be gradual**, with an eye on the consequences that each step may have on the contagion rate[24]. It should be **flexible,** potentially targeting sub-national areas (states or regions) so to keep into account the local capacity of health system(s) and the different impact of contagion in different areas.

The main concerns in discussing **how** to implement the unlocking are about (i) whether some type of activities and individuals should be prioritized (and which ones) and (ii) the definition of minimal safety requirements to be respected at work, and their communication.

Common recommendations from such discussions include:

i. Allow **low risk activities**, those that imply few interactions in the workplace, to **open first**. Available measures based on the **degree of sociality of occupations** suggest there is large variability across

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companies into production, but without being able to get regulatory approval so far. Similarly, the UK ordered 17.5 million of quick antibody tests that turned out to be ineffective.

[20] The tests for COVID-19 positivity cost about 30 euro and a laboratory of 30 people (a large one) could implement around 2000 such tests per day. In many countries their number has been limited by short-term constraints (e.g. on reagents). In some cases, only a few public labs per region are allowed to carry the tests; in others the reagents for doing the tests have been distributed to several (including private) labs.

[21] This approach was proposed in the case of the US and UK (Paul Romer NYT, or Peto et al, TheLancet), but recently criticized based on their costs and feasibility in the short run.

[22] Serological tests are relatively easy and cheap, and can therefore be implement in large scale. They require small amount of blood (30ml) that could come out from a finger pricker. A single person in a lab could process 5000-7000 tests per week. Preliminary antibody tests in Liguria and Lombardy showed that about 15% of the population is already immune, which is higher than what scientists expected.

[23] The development or adoption of has been planned in in Italy, the UK, and Germany and France. Unlike the East Asian experience, in European countries the usage of the app should be optional, it should not use also facial recognition and CCTV monitoring, and the anonymity of the data should be guaranteed. Cooperation between Apple and Google, that power 3.5bn devices, is going to facilitate the development of such platforms and strengthen privacy protection.

[24] The reference parameter is the so called "reproduction number", or R0, measuring how many susceptible people on average an infected person will transmit the virus. This depends on the number of contacts, on the probability of infection from a single contact, and on the duration of the infection. If R0 >1, the disease will spread; if R0 < 1 it will fade away.

activities, with many service industries (as retail, hotel and restaurant, personal care etc.) being at high risk (see Barbieri et al. 2020, Boeri and Caiumi, 2020). The relevance of complementarities between sectors (e.g. input-output chains, or more simply those between the education system and parents' capability of employability) is sometimes mentioned, but rarely taken into account.

ii. Protect more vulnerable individuals and **free people at lower risk**. Growing evidence suggests **the severity of the virus varies significantly with age** (see e.g. Ferguson et al, 2020, Verity et al 2020.) **and health conditions** as obesity, diabetes, heart diseases (see CDC, 2020). Accordingly, many recommends the unlocking should only concern younger people (e.g. 50-, see Ichino et al) and individuals without pre-existing pathologies. Similarly, existing measures of social distancing should not be attenuated for the old and for people with poor health status.

iii. Strengthen and monitor on **site work protection**. Broad information and binding specifications for the use of protective equipment; availability of such equipment as masks, gloves, thermal scanners at entrance, reorganization of working space to ensure distance across workers.

iv. Finally, because implementing an exit strategy plan step-by-step is highly complex, countries should make sure and requires objective, uniform, convincing communication.

Existing recommendations are mostly targeted to a specific country and rarely take a broader perspective, including considerations on issues of international coordination. These are relevant in particular in highly integrated areas. One relevant concern is the possibility that of outbreaks induced by movement of individuals across areas at different stages of the lockdown (or unlocking). What many of the roadmaps do recommend to consider is the importance of a **fallback strategy**, and to determine the conditions **requiring** to move back from unloking to "slow the spread" mode**.** According to Gottlieb et al. (2020), the trigger to such move would be the existence, in multiple geographic locations around a country, of confirmed cases that cannot be traced back to other known cases.

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