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Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?

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ABSTRACT

The COVID-19 crisis is likely to have dramatic consequences for progress on climate change. Imminent fiscal recovery packages could entrench or partly displace the current fossil-fuel-intensive economic system. Here, we survey 231 central bank officials, finance ministry officials, and other economic experts from G20 countries on the relative performance of 25 major fiscal recovery archetypes across four dimensions: speed of implementation, economic multiplier, climate impact potential, and overall desirability. We identify five policies with high potential on both economic multiplier and climate impact metrics: clean physical infrastructure, building efficiency retrofits, investment in education and training, natural capital investment, and clean R&D. In lower- and middle-income countries (LMICs) rural support spending is of particular value while clean R&D is less important. These recommendations are contextualised through analysis of the short-run impacts of COVID-19 on greenhouse gas curtailment and plausible medium-run shifts in the habits and behaviours of humans and institutions.

I. INTRODUCTION

The COVID-19 crisis could mark a turning point in progress on climate change. This year, global greenhouse gas (GHG) emissions will fall by more than in any other year on record. The percentage declines likely in 2020, however, would need to be repeated, year after year, to reach net-zero emissions by 2050. Instead, emissions will rebound once mobility restrictions are lifted and economies recover, unless governments intervene. There are reasons to fear that we will leap from the COVID frying pan into the climate fire.

However, the crisis has also demonstrated that governments can intervene decisively once the scale of an emergency is clear and public support is present. COVID-19 has precipitated a major increase in the role of the state (Helm, 2020). Decisive intervention has begun to stabilise infection rates, prevent health systems being overwhelmed, and save lives.

The climate emergency is like the COVID-19 emergency, just in slow motion and much graver. Both involve market failures, externalities, international cooperation, complex science, questions of system resilience, political leadership, and action that hinges on public support. Decisive state interventions are also required to stabilise the climate, by tipping energy and industrial systems towards newer, cleaner, and ultimately cheaper modes of production that become impossible to outcompete (Acemoglu et al., 2012; Grubb, 2014; Aghion et al., 2016; Farmer et al., 2019).

Will such action be forthcoming? Public support for action on climate change increased to a peak prior to the pandemic; government and corporate action was also gathering momentum. COVID-19 has clearly slowed this momentum, not least in delaying the international conference on climate (COP26) from 2020 to 2021. However, the momentum could find new impetus if, humbled by the ability of 'natural' forces to shock the global economy, humans recalibrate our sense of omnipotence. Furthermore, opinion polls in many countries show that people are noticing the clean air, uncongested roads, the return of birdsong and wildlife, and are asking whether 'normal' was good enough; could we not 'build back better' (Ipsos, 2020)? The shape of COVID-19 fiscal recovery packages put in place in the coming months, once lockdowns are eased, will have a significant impact on whether globally agreed climate goals are met.

This paper identifies stimulus policies that are perceived to deliver large economic multipliers, reasonably quickly, and shift our emissions trajectory towards net zero. The recovery packages can either kill these two birds with one stone – setting the global economy on a pathway towards net-zero emissions – or lock us into a fossil system from which it will be nearly impossible to escape.[1]

In section II, we examine the recent effects of COVID-19 on emissions. In section III, we catalogue over 700 stimulus policies proposed or enacted during and since the Global Financial Crisis (GFC) and develop a set of 25 policy archetypes. We conduct a global survey of over 230 experts, including from financial ministries and central banks, to subjectively assess the economic and climate impact potential of these archetypes. We establish that respondents consider it feasible for policy action to stimulate economic activity and make progress towards net-zero emissions. In section IV, we briefly consider the broader impacts of COVID-19 on trends in individual and corporate behaviour, including

[1] Sustainable recovery packages from governments are *necessary* to address climate change. Without a sustainable recovery, emissions will rise, the private sector will not invest enough in clean technology in a depressed economy, and the Paris goals will be nearly impossible to meet. Given the scale of recovery packages, a sustainable recovery could also be nearly *sufficient* to address climate change. Once the macroeconomy has recovered and the costs of clean technologies are low enough, the private sector would need limited further encouragement. This blending of macroeconomic and microeconomic considerations is atypical of the approach to public economics involving a sequential focus on (i) stabilisation of national income; (ii) economic efficiency; and (iii) fair distribution (Musgrave, 1959) — get the macro right before worrying about micro issues such as carbon prices. However, the macro and micro are inescapably interlinked here, due to the scale and timing of the climate challenge and the pandemic. We are grateful to David Vines for these observations.

towards less travel and more working from home, increased localisation and self-sufficiency, and institutional trends towards scepticism of multilateralism and coordinated global action. We conclude that progress on climate change will depend significantly on policy choices in the coming 6 months; the right choices could drive a long-term downward trend in GHG emissions.

II. EARLY DAYS: THE ECONOMIC SLOWDOWN AND FISCAL RELIEF MEASURES

(i) Decline in economic activity

All G20 nations have implemented restrictions on mobility (IMF, 2020a) such as 'self-isolation' and 'social-distancing' (Wilder-Smith and Freedman, 2020). These restrictions have reduced the spread of the virus (Hou et al., 2020; Koo et al., 2020), but with severe economic consequences. On the supply side, an estimated 81% of the global workforce has been hit by full or partial lockdown measures (del Rio-Chanona et al., 2020; ILO, 2020), with unprecedented job losses and furloughs (ILO, 2020). On the demand side, consumer spending has fallen as it is no longer possible to travel, including to shop for discretionary items, go to restaurants, or for experience-based activities (Chen et al., 2020; Muellbauer 2020; Andersen et al., 2020). Aviation volumes have collapsed, with international airlines projecting a reduction of 503–607 million passengers and losses of US$112–135 billion in the first half of 2020 (UNICAO, 2020). Consumer confidence is falling (OECD, 2020) and job losses and furloughs simply exacerbate spending contractions as workers lose their incomes.

(ii) Decline in fossil fuel use and GHG emissions

These dramatic declines in economic activity have reduced energy demand and the use of fossil fuels, which supply 85% of our energy demands (BP, 2019). The collapse in oil demand has exacerbated market imbalances (Oxford Analytica, 2020a; Oxford Analytica, 2020b), and contributed to Brent crude prices dipping to their lowest level in over two decades.[2]

The fall in fossil fuel use has reduced pollution of various kinds, including GHGs such as carbon dioxide (CO_2) and nitrous oxide (N_2O), as well as aerosols, short-lived gases (Myhre et al., 2013; Jacobson, 2010), and harmful particulate matter. While it is currently impossible to accurately detect CO_2 emissions in the short term at a regional scale (Yang et al., 2019; Artuso et al., 2009), estimates can be pieced together using data on fuel use, and measurements of nitrogen dioxide (NO_2) concentrations (Konovalov et al., 2016), which is emitted alongside CO_2 in industrial and automotive combustion.[3] For instance, it has been estimated that China's shutdown in February resulted in a 25% decline in CO_2 emissions (200 $MtCO_2$) due to lower coal and oil consumption (Myllyvirta, 2020).

Globally, GHG emissions might fall by 8% or 2.6 $GtCO_2$ in 2020 (IEA, 2020a), which is more in absolute terms than in any other year on record (Boden et al., 2017, Le Quéré et al., 2018). By comparison, annual CO_2 emissions fell by an average of 4% during the Second World War (1939–45), 3% during the 1991–92 recession, 1% during the 1980–81 energy crisis, and 1% during the 2009 Global Financial Crisis (Boden et al., 2017). The declines in 2020 are significant relative to major historical wars and epidemics (Pongratz et al., 2011; Boden et al., 2017).

This decline in GHG emissions has been advanced as a 'silver lining' of the COVID-19 crisis (Bandyopadhyay, 2020; Isaifan, 2020; Teale, 2020), but the UN Environment Programme estimates

[2] Demand for electricity (which is supplied by higher proportions of renewable energy) has been less affected than demand for transportation, which is predominantly supplied by liquid fossil fuels (IRU, 2020).

[3] While NO_2 is not itself a GHG, it also contributes to the formation of the potent GHG, ozone, in the atmosphere (Lerdau et al. 2000; Ghazali et al. 2009). As NO_2 has a short atmospheric lifespan (NOAA 2020), it is a useful and measurable descriptor for period-specific economic activity (Cui et al. 2019), for example in illustrating changes over the COVID-19 period at a local and regional scale (Worden et al 2020; EPA 2020).

that global GHG emissions must fall by 7.6% *every year* from 2020 to 2030 to keep temperature increases to less than 1.5°C (UNEP, 2019). Further, every year that GHG emissions are above zero, atmospheric GHG concentrations continue to build, increasing the risk that even incremental increases could trigger feedback loops that result in outsized and permanent damage to the climate (Farmer et al., 2019).

Without decisive government intervention, discussed in the next section, emissions will rebound once the lockdowns end.[4] However, the magnitude of the rebound will depend on the speed of the economic recovery, the nature of rescue spending (keeping businesses and people alive) and recovery spending (reinvigorating the economy once mobility restrictions can be relaxed), the extent of a rebound in consumer demand, and the prescience of certain human and institutional trends discussed in Section 4. Conceivably, in the event of a rapid rebound, pent-up demand could even bring a short-term increase in GHG emissions above the long-term average. A rebound in emissions can already be seen in China, where mobility restrictions are being relaxed and factories are reopening.

More important than the short-run impact on emissions are the impacts on investment in clean technologies such as renewable energy. Falling energy demand means sharp reductions in the growth of installed wind, solar, and battery capacity in 2020, with effects lingering into 2021; solar photovoltaic installations in particular are projected to fall by 48% in Q2 2020, followed by a gradual recovery (Eckhouse and Martin, 2020). These challenges are further compounded by disruptions to global supply chains for key parts, as well as the collapse in oil prices (IEA, 2020b), which increases the allure of fossil-fuel-based consumption in the economic recovery phase, particularly in emerging economies (Fox-Penner, 2020).

(iii) The climate impact of existing rescue packages

Many G20 national governments have already proposed and/or implemented sizeable fiscal rescue measures. These emergency measures are hoped to protect balance sheets, reduce bankruptcies and address immediate human welfare concerns during lockdown periods, including through curtailing the spread of the virus and addressing incremental healthcare costs. In April 2020, all G20 nations (including most EU member states), had signed such fiscal measures into law, earmarking a total of over US$7.3 trillion in spending. We identified over 300 implemented policies of significant magnitude, detailed in full in the Supplementary Materials. Distinguishing between rescue and recovery measures (see Section 3) we find that the vast majority of these policies are of the rescue typology, including significant worker and business compensation schemes which defend livelihoods. Our subjective assessment is that 4% of policies are 'green', with potential to reduce long-run GHG emissions, 4% are 'brown' and likely to increase net GHG emissions beyond the base case, and 92% are 'colourless', meaning that they maintain the status quo.

The priority of the rescue packages has naturally been to increase cash flows to individuals in financial distress and to support those who need to spend on food, shelter, health, electricity, and other basic goods. Multiple nations have already implemented policies hoped to have this effect. For instance, the 2020 United States *CARES Act*, signed into law on 27 March 2020, includes relief provisions to directly support citizens through cash-in-hand programmes (Courtney, 2020). Other countries have implemented schemes to similar effect. The UK's *Coronavirus Job Retention Scheme (*UK Coronavirus Act, 2020*)* allows firms to apply for government assistance to cover up to 80% of furloughed workers' wages, capped at £2,500 monthly.

[4] Reductions in GHG emissions during other economic crises have been transitory. Global CO_2 emissions fell by 1% during the GFC in 2009, but grew by 4.5% in 2010, above the 5-year average increase of 2.4% (Boden et al., 2013). This rebound was attributable to high levels of government investment in fossil fuel dependent economic activities in order to stimulate domestic economies, coupled with low energy prices (Peters et al., 2012).

However, some rescue policies also cover emissions-intensive firms, such as airlines, that face bankruptcy or significantly reduced revenue as a result of COVID-19. Examples include Russian tax breaks for airlines (through the *Anti-crisis Fund*) (Ostapets et al., 2020), AU$715mn of unconditional Australian airline relief (through the *Coronavirus Economic Response Package* (Commonwealth of Australia, 2020), and US$32bn of bailouts (including grants and loans) for US airlines (through the *CARES Act*) (Courtney, 2020). Fossil fuel industries, facing extraordinarily low oil prices (Ngai et al., 2020), are likely to request future tax breaks or bailouts. While there may be good reasons for such support, such bailouts should be conditional on these industries developing a measurable plan of action to transition towards a net-zero emissions future.

Overall, although COVID-19 has reduced GHG emissions in 2020, the overall impact will be driven by investment choices. The emergency rescue packages that are currently being implemented represent life and death decisions made by government officials about people alive today. The imminent recovery packages, soon to be designed and implemented, will reshape the economy for the longer-term, representing life and death decisions about future generations, including through their impact on the climate.

III. THE CLIMATE IMPACT OF FISCAL RECOVERY PACKAGES

While most G20 governments have implemented rescue packages, as of April 2020 no government has fully exited lockdown and introduced significant recovery packages. These recovery packages could be 'brown', reinforcing the links between economic growth and fossil fuels and risking future stranded assets (Pfeiffer et al., 2018), or 'green', decoupling emissions from economic activity.

Several factors are relevant to the design of economic recovery packages: the long-run economic multiplier, contributions to the productive asset base and national wealth, speed of implementation, affordability, simplicity, impact on inequality, and various political considerations. A key objective of any recovery package is to stabilise expectations, restore confidence, and to channel surplus desired saving into productive investment. However, 'business as usual' implies temperature increases over 3^{o}C, implying great future uncertainty, instability and climate damages. An alternative way to restore confidence is to steer investment towards a productive and balanced portfolio of sustainable physical capital, human capital, social capital, intangible capital, and natural capital assets (Zenghelis et al, 2020), consistent with global goals on climate change. Finally, any recovery package, including climate-friendly recovery, is unlikely to be implemented unless it also addresses existing societal and political concerns – such as poverty alleviation, inequality, and social inclusion – which vary from country to country.

(i) Assessing economic and climate impact potential

Studies of fiscal responses during the GFC suggest that the economic success of fiscal stimulus is strongly affected by two attributes: the speed at which the stimulus delivers real-world impact; and the short- and long-run economic multiplier, or return for every dollar of expenditure (Freedman et al., 2009, Coenen et al., 2012, Ramey, 2019). Compared to the GFC, the COVID-19 crisis has had a severe and broad impact; it is not focused on a particular sector (as distinct from 1973–5, 1981–2, 2001, and 2008–9). The rescue packages have had to be rapidly acting. Given the sudden need, limitations on administrative capacities have affected the design of programs and have been a binding constraint. Speed is important but less critical for the recovery packages, where there is greater scope for carefully directing resources towards investments in high productivity assets, with higher economic multipliers, to deliver a capital stock and a labour force suited to the challenges of the future (Hepburn et al, 2020).

What determines the long-run multiplier? High-productivity economies of the future will be those that make the most of artificial intelligence and the technologies of the fourth industrial revolution (Schwab and Davis, 2018) while also protecting and enhancing natural capital, such as ecosystems, biodiverse

habitats, clean air and water, productive soils, and a stable climate. Here, we focus on the climate impact. Co-benefits of climate policies (Karlsson et al., 2020) often include reduced waste and inefficiency, pollution (Dong et al., 2015; Bollen, 2015), congestion (Portugal-Pereira et al., 2013), and food waste (Munesue et al., 2015), and improved health outcomes (Chivian and Bernstein, 2008; Andersen, 2017; Quam et al., 2017), biodiversity (Bryan et al., 2016; Wüstemann et al., 2017) and ecosystem sustainability (Palm et al., 2014); these are vitally important but not the focus of this paper.

(ii) Lessons from previous crises

The COVID-19 crisis is different from the 2009 GFC, but there is nevertheless much to learn. Economic multipliers are near zero when the economy operates near capacity. In contrast, during crises such as the GFC, economic multipliers can be high. Uncertainty, reluctance to invest for the future, and concern about the affordability of spending prompts economic actors to take economically undesirable measures. Businesses may cut investment and shed workers, banks may reign in credit, and consumers may contain spending. Lack of confidence can thereby prove self-fulfilling in delivering a weaker economy through Keynesian 'multiplier' and 'accelerator' effects.

Expansionary policy in a slump can arrest the negative reinforcing feedback resulting from a shortfall in private activity and prevent negative hysteresis effects on future supply, whereby capital is scrapped and labour skills are lost due to underutilisation (DeLong and Summers, 2012). Fiscal injections during such slowdowns have been found to generate multipliers as high as 1.5 to 2 (Auerbach and Gorodnichenko, 2012) or even as high as 2.5 (Blanchard and Leigh, 2013). Three models for the UK, applying estimates only to fiscal injections based on additional borrowing, find that the long-run multiplier lies in a narrow range of 2.5 to 3.0 (IMF, 2014, Abiad et al., 2015, Mourougane et al., 2016). In this case, depending on the nation and the sector, increased tax revenues can go a long way to financing any increases in expenditure.

Within the set of expansionary policies, government spending on investment appears preferable to tax reductions, delivering higher multipliers (Mahfouz et al., 2002). Direct cash transfers to households have also performed well (Gechert and Rannenberg, 2018). So far, financial systems have remained functional and low real interest rates provide the opportunity for targeted investment in productive assets to deliver higher short- and long-run economic multipliers (Freedman et al., 2009).

Of course, no crisis is the same. There are four reasons that COVID-19 spending might have smaller multipliers. First, if the uncertainty in the current crisis is deeper than in previous crises, individuals and firms could engage in more precautionary behaviour, hoarding cash. Second, if fear of COVID-19 means that people choose not to engage in travel and social activities, efforts to stimulate economic activity will be less effective. Third, it may be difficult to target government injections to where there is a high marginal propensity to spend. Fourth, the impact on expectations may be shaped more by emerging health risks than by financial responses (Stiglitz, 2020).

Nevertheless, it is likely that there are lessons to head from the past, including with respect to the impact of such measures on the climate. We therefore undertook a light-touch assessment of 196 stimulatory fiscal recovery policies implemented in response to the GFC, finding that 63 were green, 117 were colourless, and 16 brown. A lesson from the GFC is that green stimulus policies often have advantages over traditional fiscal stimulus. For instance, renewable energy investment is attractive in both the short and the long run. Renewable energy generates more jobs in the short run (higher jobs multiplier), when jobs are scarce in the middle of a recession, which boosts spending and increases short-run GDP multipliers (which are derived from expanding demand). In the long run, renewable energy conveniently requires less labour for operation and maintenance (Blyth et al., 2014). This frees up labour as the economy returns to capacity. The more efficient use of labour and the savings on fuel means that renewables are also able to offer higher long-run multipliers (which are derived from expanding supply).

Green construction projects, such as insulation retrofits or clean energy infrastructure, can similarly deliver higher multipliers. These large construction projects are less susceptible to offshoring to imports (Jacobs, 2012). Clean energy infrastructure is also helpfully very labour intensive in the early stages – one model suggests that every $1m in spending generates 7.49 full-time jobs in renewables infrastructure, 7.72 in energy efficiency, but only 2.65 in fossil fuels (Garrett-Peltier, 2017). In the long run, these public investments offer high returns by driving down costs of the clean energy transition (Henbest, 2020). Harnessing more of these opportunities could result in 'kick starting the green innovation machine' (Acemoglu et al., 2012) and driving an efficient, innovative, and productive economy, with higher spill overs that benefit the wider economy (Aghion et al., 2014).

Speed of implementation is critical for the rescue packages but also valuable for the longer-term recovery packages. Fast-acting climate-friendly policies include residential and commercial energy efficiency retrofits, as well as natural capital spending (afforestation, expanding parkland, enhancing rural ecosystems) (Bowen et al., 2009; Houser et al., 2009). When implemented through existing programs (Houser et al., 2009), energy efficiency retrofits can be the "most obvious option for a shovel-ready, local green investment" (Kamal-Chaoui and Robert, 2009). Natural capital spending is fast-acting because worker training requirements are low, many projects have minimal planning and procurement requirements, and most facets of the work meet social distancing norms. Through their Nationally Determined Contributions (NDCs), many countries have already prepared "shovel-ready" projects, and in most lower- and middle-income countries (LMICs) these NDCs are heavily oriented towards infrastructure.

Investment could also be used for development and early-stage demonstration of key technologies that appear necessary to reach net-zero emissions. Greenhouse gas removal (GGR) technologies, including land-based biological processes and industrial carbon capture and storage (CCS), are one example. GGR technologies are necessary to meet the Paris goals, but barriers exist, and costs remain uncertain; more research, development and deployment could be extremely beneficial (Hepburn et al, 2019)

(iii) Global survey of fiscal recovery policies

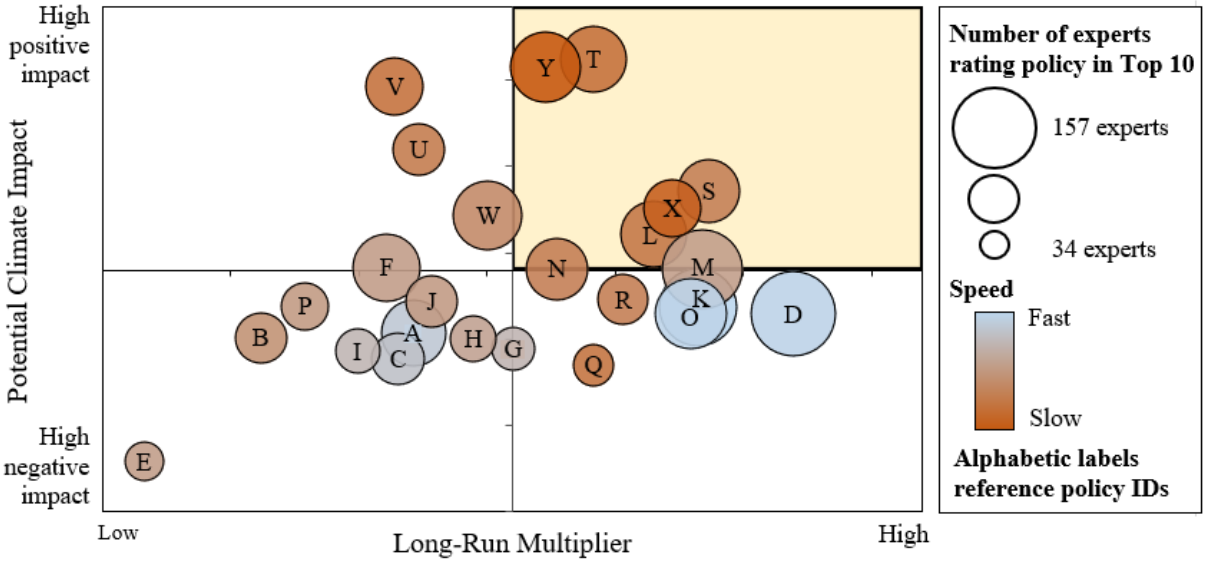
In April 2020, we surveyed 231 finance ministry officials, central bank officials, and other economists, representing 53 countries including all G20 nations, to ascertain their perspectives on COVID-19 fiscal recovery packages. These perspectives are relevant to policy design. A set of 25 policy archetypes – 6 rescue-type policies (A, C, D, I, K, O) and 19 recovery-type policies (Figure 1, details in Appendix 2) – were defined, following a wide cataloguing effort of over 700 significant G20 fiscal stimulus policies proposed or implemented over the period 2008–20. Respondents were systematically identified using a filtering procedure with associated methodology described in Appendix 3. Our 'target group' comprised senior central bank officials (226 contactable officials identified, 43 respondents), senior development bank officials (301 contactable officials identified, 41 respondents), senior members of finance/treasury ministries (147 officials identified, 23 respondents), expert academics (217 experts identified, 71 respondents), and think tank commentators (128 experts identified, 21 respondents).

Respondents were asked to assess, in a relative and subjective manner using sliding responses, each policy archetype on three core metrics; 'speed of implementation' from the time of legislation (scaled from less than a month to more than 3 years), 'long-run economic multiplier' (low to high), and 'climate impact potential' (highly negative to highly positive). A fourth summative metric, 'overall desirability' (strongly opposed to strongly support) was also tested to account for relevant social, political, and personal factors not addressed by the climate and economic metrics. Respondents provided demographic data (6 questions) including country of focus, experience level, and educational training. Respondents were also encouraged to provide any additional comments in a free response question and had the option to leave their name for publication (see Appendix 1). In this way, each respondent answered 106–108 questions, giving a total of 24,703 data points for the survey. Each 'target group' expert received a controlled individual link for personal response as well

as an unrestricted link for sharing with colleagues. Unrestricted respondents formed the 'supplementary group'. Details on sampling groups and survey design are included in Appendix 4.

Policies perceived to be in the desirable upper-right quadrant of Figure 1 (large long-run multiplier and strongly positive impact on climate) included connectivity infrastructure (S), general R&D spending (X), education investment (L), clean energy infrastructure (T), and clean energy R&D spending (Y). Each of these was also often identified as being in the top 10 desired recovery policies of respondents. Other notable policy options included healthcare investment (M) and worker retraining (N). Two archetypes scored highly on potential climate impact but were not recognised for high multiplier or speed of implementation: green spaces and natural infrastructure (V), and energy efficient buildings upgrades including retrofits (U).[5]

Many traditional 'relief type' measures, clumped to the centre right of the figure, including liquidity support for households, start-ups, and SMEs (D), direct provision of basic needs (K), and targeted direct cash transfers (O), predictably out-performed others in terms of speed of implementation and ranked amongst the highest for long-run multiplier. Non-conditional airline bailouts (E) recorded a markedly poor performance on all metrics and featured in fewer experts' top 10s than any other policy.



A	Temporary waiver of interest payments	N	Worker retraining
B	Assisted bankruptcy (super Chapter 11)	O	Targeted direct cash transfers or temporary wage increases
C	Liquidity support for large corporations	P	Rural support policies
D	Liquidity support for households, start-ups and SME's	Q	Traditional transport infrastructure investment
E	Airline bailouts	R	Project-based local infrastructure grants
F	Not for profits, education, research, health inst. bailouts	S	Connectivity infrastructure investment
G	Reduction in VAT and other goods and services taxes	T	Clean energy infrastructure investment
H	Income tax cuts	U	Buildings upgrades (energy efficiency)
I	Business tax deferrals	V	Green spaces and natural infrastructure investment
J	Business tax relief for strategic and structural adj.	W	Disaster preparedness, capacity building
K	Direct provision of basic needs	X	General R&D spending
L	Education investment	Y	Clean R&D spending
M	Healthcare investment		

Figure 1: Target group mean survey results aggregated using relativity-adjusted scores

The clean R&D archetype, when directly compared to general R&D, was perceived to be significantly more desirable overall, and to have greater positive climate impact potential. However, it received a

[5] We found this perception surprising: policies U and V have low worker training requirements and are potentially able to be rapidly deployed.

lower ranking for both speed (25th vs 20th) and multiplier (12th vs 6th), suggesting target group respondents placed a relatively strong weighting on the importance of climate impact.

In the target group, the most desirable recovery-type policies (ordered by mean, starting with the best policy) were healthcare investment (M), disaster preparedness (W), clean R&D spending (Y), not for profit bailouts (F), and clean energy infrastructure investment (T). The worst-performing policies (ordered by mean, starting with the worst policy) were airline bailouts (E), traditional transport infrastructure (Q), income tax cuts (H), reduction in VAT and other goods and services taxes (G), and rural support policies (P).

Figure 2 illustrates notable response variation between sampling groups. After think tanks, finance and treasury ministry officials had the highest overall variation in responses from the target group mean (see Appendix 7). Finance officials reported comparatively low overall desirability for reduction in VAT (G), direct cash transfers (O) and direct provision of basic human needs (K). On climate, officials perceived that the negative climate impacts of unconditional airline bailouts (E) were not as severe as what others reported. Officials also indicated that the multiplier of business tax relief for strategic and structural adjustments (J) was much higher than the indications of other groups, while the speed of implementation of assisted bankruptcy (B) and VAT reductions (G) were much lower. On an overall basis, opinion on the climate impact potential of policies across all groups was the least controversial (lowest variation) whilst speed of implementation was the most controversial (highest variation).

Under the hypothesis that national wealth influences optimal fiscal response strategy, all survey responses were categorically sorted into higher-income countries (HICs) (N = 168) and lower- and middle- income countries (LMICs) (N = 63) under the most recent OECD (2017) definition. As shown in Figure 2, variation in mean responses was sizeable, suggesting that local economic context is a significant driver of policy appropriateness. The greatest variations between HIC and LMIC expert opinion, those of 8 points or higher on the relativity-adjusted 100-point scale (see Appendix 7), were in rankings of overall desirability of targeted rural support policies (P: 13 point difference, LMICs higher than HICs) and clean R&D spending (Y: 8 point difference, HICs higher than LMICs). These policies manifest differently in LMICs to HICs. Whilst rural support policy in a HIC may involve agricultural subsidies to support existing enterprise, in a LMIC it may involve direct creation of jobs through state-owned enterprises. While HIC clean R&D spending can represent investment to becoming a global leader in high-margin future industries, due to a deficit in local highly skilled labour, analogous LMIC spending is unlikely to bring the same multiplier.

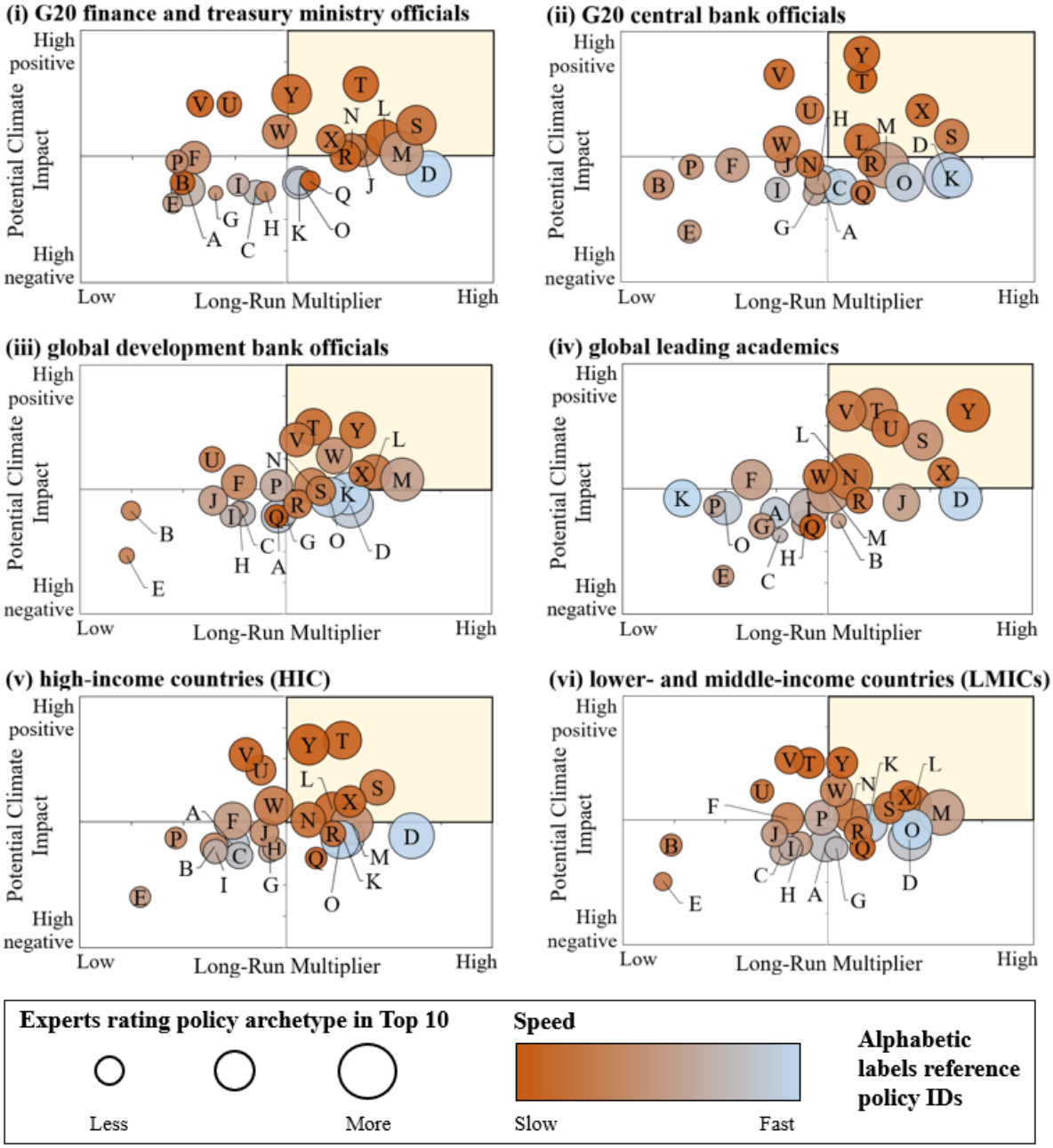


Figure 2: Mean policy response characteristics by sampling group (i to iv) and wealth of focus economy (v to vi)

Our results suggest that, in many cases, experts think that climate-positive policies also offer superior economic characteristics. However, there is the potential that these results are driven by participation and/or response bias related to any number of background factors. For instance, climate change beliefs of respondents could have influenced their responses to economic metrics in either direction. The survey was not framed as focused on climate change and the survey question on climate impact potential came after the questions on economic impact. However, the invitation for the survey was sent by the authors, who have a public track record of research on climate economics. We acknowledge the potential role of bias in our results and suggest that readers interpret them as uncorrected, subjective and relative perspectives.

(iv) Guidelines for policy-makers

Based on our review of the literature, the survey results and our own judgement, we suggest the following three key insights for policy-makers designing COVID-19 recovery packages.

1. **Recovery policies can deliver both economic and climate goals.** Following the "colourless" emergency rescue packages, there are a set of fiscal recovery policy types which offer high economic multipliers and positive climate impact. Combining survey responses with evidence from the literature, five policy types stand apart from the rest:

    — clean physical infrastructure investment in the form of renewable energy assets, storage (including hydrogen), grid modernisation and CCS technology,
    — building efficiency spending for renovations and retrofits including improved insulation, heating, and domestic energy storage systems,
    — investment in education and training to address immediate unemployment from COVID-19 and structural shifts from decarbonisation,
    — natural capital investment for ecosystem resilience and regeneration including restoration of carbon-rich habitats and climate-friendly agriculture, and
    — clean R&D spending.

    In many LMICs, clean R&D spending might be replaced with:

    — rural support scheme spending, particularly that associated with sustainable agriculture, ecosystem regeneration, or accelerating clean energy installations.

    While political and other circumstances related to the national interest may render some climate-negative policies unavoidable, even these policies can be designed to have long-term positive climate outcomes by attaching appropriate conditions. For instance, conditional green bailouts for airlines could require achievement of net-zero emissions by 2050 with intermediate targets set at 5- or 10-year intervals (O'Callaghan and Hepburn, 2020). If airlines are unable to meet these targets, bailout funding would be converted to equity at today's very low stock market spot prices.

2. **Co-benefits can be captured.** As indicated by the survey results, there are non-economic, non-climate attributes of climate-positive policies which increase their overall desirability. For instance, electric vehicle incentives reduce local air pollution, which is especially valuable in dense urban areas. Support for energy efficiency retrofits could be directed towards lower-income households to decrease social and health inequality by shrinking real electricity costs and keeping homes warm in winter. In LMICs, new renewable energy can be used to increase rural electrification and provide support to citizens working to escape the poverty trap (Aklin et al., 2018).

    Policy-makers must proactively act to identify potential co-benefits during the policy design stage and shape implementation criteria to maximise impact. As national priorities and urgent social needs can differ manifestly between countries, the prioritisation of relevant co-benefits is likely to also differ. Governments can shape policy to best meet the needs of their constituency.

3. **Policy design is important.** Poorly designed recovery policy is likely to be ineffective in delivering economic, climate, and social outcomes, regardless of theoretical potential. During the GFC, many governments needlessly wasted the opportunity for significant long-run economic benefits and climate impact.

    Policy timeliness and flexibility will be important characteristics, since it is unclear how long the pandemic will last and whether there will be second or third waves. It also remains unclear

whether the current recession will progress to a deeper depression with possible default cascades (Stiglitz, 2020).

Extreme urgency was appropriate in introducing rescue packages during the lockdown phase. There is probably more time to ensure that the recovery packages prioritise the sorts of investments that deliver productive assets for the future. This will be significantly more likely if policy design processes are fast but also consultative and evidence-based. Success will depend upon the specific social, political, environmental, and financial contexts of actors.

Finally, domestic climate-positive policy development should involve collaboration with and learning from the international community. A Sustainable Recovery Alliance, proposed in a UK government briefing prepared alongside this research paper (Allan et al., 2020), could provide a forum for nations to avoid a race to the bottom, to learn from one another, and to coordinate their recovery packages for greater impact.

(v) Financial factors constraining and enabling government expenditure

The affordability of these potential interventions varies across countries. Government balance sheets and current financial conditions may limit significant expansionary policy in some LMICs. An internationally coordinated response with support from the IMF might address this (Vines et al.,2020), or judicious and stronger use of unconventional monetary policy and other non-fiscal policies might be used to steer expectations and help restore confidence.

Concerns about repaying growing local currency public debt and limited 'fiscal space', though understandable, are overplayed in HICs, notwithstanding rapid increases in government borrowing following the pandemic. Real government bond rates in rich countries are near zero or negative, reflecting limited concerns at present about devaluation or default. The US Federal Reserve maintains a policy rate of 0% (Federal Reserve, 2020), while the Bank of England maintains a rate of 0.1% (Bank of England, 2020) and other central banks maintain similarly low rates.

Concerns about total global debt are also frequently expressed. According to Tiftik et al., (2020), the ratio of global debt to GDP reached an all-time high of 322% towards the end of 2019. More than two-thirds of the debt is in private hands, and dramatic declines in equity valuations and asset values has hit corporate balance sheets, increasing leverage ratios.

However, financial assets are not net wealth, and total global debt is only relevant in that it reflects underlying challenges, such as growing inequality, or in that it creates vulnerabilities from systemic financial interlinkages between entities. For every debtor there is a creditor, and what matters is whether borrowing is used to invest in sustainably productive assets. With rates low and the prospect that borrowing will boost nominal GDP with multipliers greater than one, the cost of servicing debt induced from a large fiscal stimulus is low and, in most cases, sustainable.

Nevertheless, avoiding a downward economic spiral will require careful management (Stiglitz, 2020). The global stock of non-financial corporate debt was at record levels of $13.5tn at the end of 2019 – greater than during the GFC (OECD, 2020). This debt is also of lower quality – credit ratings are lower and maturities are longer – so the possibility of contagion to the banking system cannot be discounted. The UK Office for Budget Responsibility estimates that if lockdown remains in place for 3 months, UK output would plunge an unprecedented 35 per cent in 2020 Q2 (OBR, 2020). JPMorgan forecasts that the US economy will shrink by 9 per cent in the second quarter, relative to the previous quarter, on top of a 1.2 per cent contraction in the first quarter (Domm, 2020). In April, the IMF predicted that advanced economies' GDP will be 6.1% lower than otherwise in 2021, even after a sharp recovery. (IMF 2020a). Such a recovery is far from guaranteed without efforts to restore private-sector confidence.

Recovery packages could exacerbate intergenerational inequities if they are focused on consumption, rather than productive investment delivering sustainable returns for future generations. Public borrowing for the recovery will necessarily be matched by corresponding private-sector net financial surpluses, implying greater claims on future taxpayers will be made by the private sector. The real value of the debt might also be eroded by inflation — if recovery plans do generate growth, inflation may well rise. Sensible responses would include progressive environmental and carbon taxes, in addition to conventional tightening monetary policy.

IV. SOCIAL AND INSTITUTIONAL SHIFTS

COVID-19 has already triggered major shifts in individual behaviours, social practices, beliefs, the role of the government in the economy, and relationships between nations and international institutions. These shifts have occurred on remarkably rapid timescales. Which of these changes will have lasting consequences, and what are the climate implications?

(i) Behavioural change in work and transport practices

The COVID-19 crisis has encouraged a rapid shift to digital and remote working practices in many countries (WHO, 2020) and reduced aviation (UNICAO, 2020) and car transportation (IMF, 2020b). These 'adaptive behaviours' are common to large-scale disasters (Cohen, 2020). There has been rapid learning of how to manage remote work, improvements in technology, and an appreciation of some of the benefits.

As economies reopen, in some instances one may expect return to pre-crisis normal, but in others behaviour will change permanently. One (inevitably speculative) estimate is that up to one-third of the global workforce will sustain remote working practices part-time on a permanent basis (Global Workplace Analytics, 2020). Even the aviation industry anticipates a permanent shift in the nature of travel, with business travel projected to be permanently suppressed (Sorensen, 2020; Boone et al., 2020) and with flight volumes that return to pre-crisis levels at a slower rate than in other recent pandemics (IATA, 2020).

The extent to which behavioural adaptations become embedded post-crisis is affected by policy choices during the recovery period, as well as the extent and severity of lockdown measures. Behavioural interventions have historically been more effective during times of transition (Geels, 2002; Reeves et al., 2020). Post-crisis recovery spending offers an opportunity to embed climate-positive behaviours, by supporting teleworking, high-speed broadband connectivity, and residential energy efficiency.

(ii) Shifting dynamics of global institutions and leadership

COVID-19 has disrupted the global political and economic order, with potential long-term implications for multilateral institutions. The rapid spread of the virus has also led to calls for an 'unprecedented level' of global cooperation (Kokudo and Sugiyama, 2020), yet the pandemic has exposed weaknesses in international partnerships, particularly the World Health Organization (WHO), but impressive strengths in others. The IMF and United Nations Conference on Trade and Development (UNCTAD) have shown leadership in calling for funding to meet both the economic and health challenges, including a new issuance of SDR's, and for debt relief. But the multilateral institutions can only be successful if they receive the support of the member countries, and with the current US government's weak support of multilateralism, cooperative effects are likely not to come up to what is needed The WHO, which holds responsibility for coordinating the global health response to any pandemic, has faced criticism for failing to respond to the crisis with adequate speed and force (Mahase, 2020). International financial institutions such as the World Bank and IMF have also faced criticism of their proposed economic relief programmes (IMF, 2020c, Malpass, 2020) for conditionalities and limited relief to countries where repayment obligations may undermine health

funding (IMF, 2020c, Kentikelenis, 2020, Kickbusch et al., 2020). The Joint Ministerial Committee of the Boards of Governors of the Bank and the Fund (the Development Committee) has, however, underscored the vital financial role of the IMF and the World Bank in responding to COVID-19 (World Bank, 2020). And forums such as the G20 have redoubled their commitment to international cooperation (G20, 2020).

These challenges to international institutions have ramifications for the climate crisis, posing risks and opportunities. With attention focused on COVID-19, climate change negotiations have been delayed. However, the lead up to the postponed COP26 to 2021, hopefully after the peak of COVID-19 crisis, offers an opportunity for countries to collaborate and share knowledge on climate-positive economic recovery packages. Global collaboration and strengthening the mandate and financing of global decision-making bodies is essential, not only to ensure an effective response to the virus, but also to facilitate ongoing collaboration in the climate domain (Stavins et al., 2020, Steele et al., 2014). With widespread international agreement concerning the importance of climate change, a new administration in Washington could also conceivably support an initiative for multilateral assistance for developing countries and emerging markets with climate-friendly policies as a central component.

V. SUMMARY AND CONCLUSIONS

The COVID-19 crisis represents a dramatic shock to the global economy that will affect progress on climate change in multifaceted ways. The biggest driver of the long-term impact on climate is through fiscal recovery packages, along with possible shifts in power within and across national and international institutions. Green fiscal recovery packages can act to decouple economic growth from GHG emissions and reduce existing welfare inequalities that will be exacerbated by the pandemic in the short-term and climate change in the long-term. Short-term reductions in GHG emissions resulting from lockdowns will themselves have minor long-term effects, unless they facilitate deeper and longer-term human, business, and institutional changes. Urgent rescue packages have been necessarily 'colourless' and focused on preserving liquidity, solvency, and livelihoods, but their climate impact is also unlikely to be positive.

In this paper, a survey of officials from finance ministries, central banks, and other leading organisations is combined with a large-scale policy cataloguing effort and review of expansionary fiscal policy literature. We emerge with the recommendation of five policy items (plus one item specific to LMICs) that are well-placed to contribute to achieving economic and climate goals. These are:

- clean physical infrastructure investment,
- building efficiency retrofits,
- investment in education and training to address immediate unemployment from COVID-19 and structural unemployment from decarbonisation,
- natural capital investment for ecosystem resilience and regeneration, and
- clean R&D investment.

For LMICs, rural support spending is another high-value policy item, with clean R&D investment less vital. National governments differ significantly in their economic, social, and environmental priorities, and recovery packages will reflect these priorities, with different consequences for the climate.

Several other insights emerged from the survey. Many climate-positive policies were perceived by our respondents to have high overall desirability; most climate-negative policies had relatively low desirability. This was true even for climate-positive policies that took more time to implement. Long-run multipliers of climate-positive policies were found to be high, reflective of strong return on investment for government spending. Given the uncertainty in the future waves of the pandemic, flexibility and timeliness will also be important considerations. Finally, appropriate policies differ by national context.

As we move from the rescue to the recovery phase of the COVID-19 response, policy-makers have an opportunity to invest in productive assets for the long-term. Such investments can make the most of shifts in human habits and behaviour already under way. In the lead up to COP26, recovery packages are likely to be examined on their climate impact and contributions to the Paris Agreement (UNFCCC, 2015). For many countries, this will be a matter of building on existing NDCs, already framed to facilitate fast-acting investment. Recovery packages that seek synergies between climate and economic goals have better prospects for increasing national wealth, enhancing productive human, social, physical, intangible, and natural capital.

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Will COVID-19 fiscal recovery packages accelerate or retard progress on climate change?

Supplementary Materials

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Contents

APPENDIX 1: LIST OF EXPERTS

The following alphabetised list includes respondents who provided permission for their names to be reproduced in this publication. The list represents 63% (146/231) of total respondents.

Abiad, Abdul
Acconcia, Antonio
Alexander, Sir Danny
Armstrong, Angus
Bardt, Hubertus
Barrow, Lamin
Bartzokas, Anthony
Basile, Raffaella
Bauducco, Sofia
Berger, David
Best, Michael
Bianchi, Francesco
Bjørnskov, Christian
Bobiash, Donald
Boehm, Christoph
Boone, Laurence
Bordo, Michael
Boussaid, Mohamed
Brazys, Samuel
Buti, Marco
Camacho, Edna
Cespedes, Luis Felipe
Chika, Urama Kevin
Colombo, Emilio
Dave, Nanda
de Lemos, Samuel
de Oliveira Segundo, Francisco O.
Di Lorenzo, Paolo
Drobyshevsky, Sergey
Duarte, Angelo
Duryea, Suzanne
Eickmeier, Sandra
Ekins, Paul
Éltető, Andrea
Estrada, Ãngel
Evans, George
Eyquem, Aurélien
Felici, Francesco
Franco, Daniele
Galan, Enrique
Gimet, Celine
Gomme, Paul
Goulard, Sylvie
Guaranys, Marcelo
Gurumurthy, R.
Hevia, Constantino
Honkapohja, Seppo
Hu, Ruiyang
Ibrahim, Musa Jega
Ilzetzki, Ethan
Imai, Katsushi
Jaramillo, Serafin M.
Jayne, Thomas
Kabagambe, Anne
Kahanec, Martin
Kalinowski, Thomas
Kaplan, Ethan
Kavaš, Damjan
Kganyago, Lesetja
Kollmann, Robert
Kreivi, Eila
Kremer, Manfred
Kurlyandskaya, Galina
Landau, Bettina
Lee, Keun
Leiser, Stephanie
Levine, Paul
Levy, Joaquim
Li, Minqi
Li, Rong
Liebreich, Michael
Liepach, Werner
Lim, Jamus
Llewellyn, John
Lucas, Deborah
Mabey, Nick
Mahmood, Shahid
Marchitto, Barbara
Marjut, Falkstedt
Marks, Arnost
Martin, Philippe
McManus, Richard
Minea, Alexandru
Misiani, Antonio
Mitra, Annapurna
Miyazaki, Tomomi
Molterer, Wilhelm
Muthitacharoen, Athiphat
Napoletano, Mauro
Ndung'u, Njuguna
Nenna, Manuela
Niazi, Tariq
Nisticò, Salvatore
Noland, Marcus
O'Donnell, Gus
Ogbu, Osita
Ohe, Kenzo
Özatay, Fatih
Ozkan, Gulcin
Pacini, Henrique
Parigi, Guseppe
Pasha, Farooq
Pastor, Manuel
Pereira, Luis Melim
Petersen, Luba
Piantini, Marco
Pippin, Sonja
Repett, Luca
Revoltella, Debora
Rickman, Dan
Romani, Mattia
Ruggiero, Gian Paolo
Saraceno, Francesco
Sawada, Yasuyuki
Semmler, Willi
Sishi, Edgar
Sorensen, Bent
Sousa, Ricardo
Stein, Betina
Subramaniam, Ramesh
Tambakis, Demosthenes
Taylor, Mark
Temiz, Taskin
Terkper, Seth
Tirelli, Patrizio
Tosun, Mehmet Serkan
Tran, Chung
Treibich, Tania
Trepel, Dominic
Trzeciakiewicz, Dawid
van den Noord, Paul
Veiga, Andre
Verdier, Amélie
Vittorini, Fabio
Watanabe, Shingo
Willems, Tim
Wohlschlegel, Ansgar
Woyecheszen, Sergio
Yasui, Toshiyuki
Yeda, Vivienne
Yoshida, Masanori
Zarazaga, Carlos
Zattler, Juergen Karl
Zhu, Junyi
Zhuang, Juzhong
Zwick, Eric

APPENDIX 2: POLICY ARCHETYPES INCLUDED IN GLOBAL EXPERT SURVEY

25 policy archetypes were developed based on a rigorous cataloguing of over 700 G20 proposed and implemented fiscal stimulus policies covering both the GFC and the COVID-19 response. The policy archetypes were developed from the catalogue solving for the following criteria:

- Archetypes must be relevant to the current COVID-19 fiscal recovery policy landscape
- Archetypes must collectively reflect a prioritisation of fiscal recovery policies over fiscal relief policies (see section III)
- Archetypes must be relevant to multiple geographies (e.g. early superannuation funds release is excluded as a uniquely Australian measure)
- Archetypes must be mutually exclusive
- Archetypes must drive towards being collectively exhaustive
- Merging of policies into a single archetype is permissible when the perceived multiplier-implementation-green potential is highly similar (e.g. investment in road infrastructure and investment in airport infrastructure)

Table A2.1: Full description of policy archetypes as included in survey.

A	**Temporary waiver of interest payments** Holidays on interest payments or other relief on mortgages or commercial loans.	**H**	**Income tax cuts** Reduction in marginal income tax rates, increase in tax-free thresholds or expanded deductions.
B	**Assisted bankruptcy (super Chapter 11)** Government consolidates troubled businesses and resolves all of them in a common procedure, which may involve swapping debt for shares across the board.	**I**	**Business tax deferrals** Deferral of payment of corporate taxes or strengt carry-back provisions in tax loss offsets.
C	**Liquidity support for large corporations** Government support for banks to rapidly provide liquidity to large corporations on terms favourable to the government.	**J**	**Business tax relief for strategic and structural adj.** Tax credits for specific business investments in future-oriented capabilities, swaps to electric vehicle fleets, green R&D, energy efficiency measures, investments in artificial intelligence and robotics.
D	**Liquidity support for households, startups, SMEs** Government support for banks to rapidly provide liquidity to households as well as startups and small/medium sized businesses on terms favourable to the government.	**K**	**Direct provision of basic needs** Direct funds to the immediate local production and distribution of essential goods such as food, health and transport, irrespective of whether these are part of the formal or informal economies.
E	**Airline bailouts** Support for airlines suffering financial stress.	**L**	**Education investment** Injections to fund improved teacher training, in-classroom and digital materials and other education capital for pre-primary, primary & secondary, increased support for tertiary students in high-productivity sectors.
F	**Not for profits, education, research, health inst. bailouts** Support for non-profit institutions suffering financial stress.	**M**	**Healthcare investment** Funding to support targeted increases in public health capital, preventative measures, training health-care professionals and associated infrastructure (hospitals, IT systems for health care).

(continued)

G Reduction in VAT, other goods and services taxes
Reduction in the rate of regressive value-added taxes (VAT) or goods and service taxes (GST) on consumption. E.g. taxation of alcohol.

N Worker retraining
Retraining members of current or soon-to-be displaced workforces with new skills and modern apprenticeships suitable for future industries (complementary to artificial intelligence, robotics, distributed manufacturing, new energy, new food systems).

O Targeted direct cash transfers or temporary wage increases
Direct cash transfers targeted to lower income workers or in the form of a bonus to COVID-19 essential workers. Wage increases for those with government-controlled wages (public sector, minimum wage).

U Buildings upgrades (energy efficiency)
Increase thermal efficiency through improved insulation, improved energy efficiency of appliances, clean heating (heat pumps or heat networks).

P Rural support policies
Support for rural communities such as debt forgiveness for small landholders; employment guarantee schemes (minimum period of employment in state-run entities at minimum wage).

V Green spaces and natural infrastructure investment
Upgrading public parks, green spaces, national parks, tree planting and biodiversity protection, ecological conservation initiatives, ecological system services.

Q Traditional transport infrastructure investment
Spending on traditional infrastructure – road upgrades, airports, ports infrastructure.

W Disaster preparedness, capacity building
Cash spending in preparation for future pandemics, fires, floods, cyclones, other extreme events.

R Project-based local infrastructure grants
Funding for schools, hospitals, social housing and local councils to improve local asset bases.

X General R&D spending
Cash support for technology-agnostic research and development programmes.

S Connectivity infrastructure investment
Clean transport infrastructure and communications infrastructure investment; charging networks for electric vehicles, 5G networks.

Y Clean R&D spending
Cash support for R&D in green technologies, including electrolysis, heat pumps, energy storage, plant genetics, greenhouse gas removal.

T Clean energy infrastructure investment
Increased spending in clean electricity and heat generation and storage; upgraded transmission or hydrogen infrastructure.

APPENDIX 3: SELECTION OF LEADING EXPERTS

Targeting a representative expert perspective on fiscal policy measures, we sampled five categories of experts in fiscal stimulus policy, namely: leading elite academics in the field, G20 senior central bankers, global senior development bankers, G20 finance ministers and senior staff, and leading global policy think tank experts.

A3.1 Academics

Four potential approaches for elite expert selection appear in the literature. The first and most rigorous approach, as used prominently by Drupp et al. (2018), is identification by publication. In this case, elite academics are selected based on the strength and relevance of their research output using stringent filtering rules. See also Howard and Sylvan (2015) who used a working paper version of Drupp et al. (2015) as the basis for their methodology. A second, similarly useful but arguably more biased, approach is identification using peer nomination (Christensen et al., 2018). Here, a broad group of peers nominate experts to a topic area and vote to distinguish those they deem most appropriate for sampling. However, this process is unlikely to be purely meritocratic or representative. Peers are likely to nominate colleagues with whom they have positive personal relationships and/or who have perspectives similar to their own. A third common approach is using conference attendance as an indicator of elite expertise, as in Necker (2014). While this may be an effective means of identifying academics with research interests in a particular field, it is likely to over-index on junior researchers and is not collectively exhaustive. It would also exclude any prominent leaders who were not in attendance at the conference. The final approach is expert selection through personal relationships, as used by Nordhaus (1994). This approach, while simple, time-efficient and in some cases useful for directional understanding, lacks rigour in ensuring complete representation and bias-control.

In this paper, leading academics were selected by virtue of their publications. Using the Scopus engine, we searched for articles containing key terms relating to fiscal policy, including “fiscal stimulus”, “fiscal austerity” and “countercyclical policy”. A complete list of all search terms is included in Table A4.1. The same method was applied using the Google Scholar search engine to supplement the Scopus results. However no additional articles were identified. As the article main text often provides passing comment to themes tangential to the main content, the search was constrained to article abstracts and titles only. Following the approach of Drupp et al. (2018) we limited articles to those published within top economics journals, specifically the 102 ‘A’, ‘AA’, and ‘AAA’ journals identified by Combes and Linnemer (2010). This produced a preliminary valid article count of 162. Subsequently, we manually reviewed each article, using a weak relevancy test to filter out pieces that feature fiscal stimulus terms in their abstract but fail to either discuss these terms in a meaningful way or provide broader commentary that would suggest expertise in the area. In this step we eliminated 32 articles, leaving 130 remaining.

Permitting all named authors of these works and accounting for authors who featured in multiple pieces, we were left with a set of 246 academic experts. Using manual internet search processes, we identified email addresses for 217 academic experts. We failed to identify contact details for 29 who were either deceased or without published details online. 12 of the located email addresses were found to be invalid and generated ‘bounce-backs’ during the send process, yielding an adjusted contact pool of 205. In most cases these bounce-backs were presumably due to recent changes in employment.

The Scopus engine search code used was *ISSN(0033-5533, OR 0002-8282, OR 0022-3808, OR 0012-9682, OR 0034-6527, OR 0304-405X, OR 0304-3932, OR 0034-6535, OR 0022-0531, OR 0022-1082, OR 0304-4076, OR 0013-0133, OR 0741-6261, OR 0047-2727, OR 0022-1996, OR 1542-4766, OR 0014-2921, OR 0734-306X, OR 0020-6598, OR 0899-8256, OR 0893-9454, OR 1537-2707, OR 0167-6296, OR 0304-3878, OR 0022-166X, OR 0022-2879, OR 0022-2186, OR 0165-4101, OR 0094-1190, OR 0095-0696, OR 1381-4338, OR 0165-1889, OR 0167-2681, OR*

0305-750X, OR 1096-6099, OR 0883-7252, OR 0938-2259, OR 0266-4666, OR 8756-6222, OR 1057-9230, OR 0002-9092, OR 0022-1821, OR 0167-7187, OR 0022-0507, OR 0895-3309, OR 0165-1765, OR 0895-5646, OR 0347-0520, OR 0022-1090, OR 0921-8009, OR 0304-4068, OR 0021-9398, OR 1058-6407, OR 0022-0515, OR 0030-7653, OR 0162-1459, OR 2162-2434, OR 0048-5829, OR 0013-0427, OR 0003-0554, OR 0378-4266, OR 0008-4085, OR 0021-9886, OR 1365-1005, OR 0023-7639, OR 0960-6491, OR 0095-2583, OR 0308-5147, OR 0166-0462, OR 0927-5371, OR 0147-5967, OR 0167-6687, OR 0020-7276, OR 0261-5606, OR 0013-0079, OR 0305-9049, OR 0028-0283, OR 0014-4983, OR 0924-6460, OR 0176-1714, OR 0933-1433, OR 0272-7757, OR 0043-1397, OR 0195-6574, OR 2214-8043, OR 0895562X, OR 0034-6586, OR 0922-680X, OR 1042-9573, OR 0747-4938, OR 1573-045X, OR 1468-2702, OR 0927-5940, OR 0038-4038, OR 0378-5920, OR 0019-7939, OR 0007-2303, OR 0167-4870, OR 0013-0117, OR 0928-7655, OR 0022-4367, OR 0003-6846), ABS("fiscal stimulus" OR "fiscal austerity" OR "contracyclical polic"OR "contracyclical fiscal" OR "countercyclical poli*" OR "countercyclical fiscal" OR "contra-cyclical polic*" OR "contra-cyclical fiscal" OR "counter-cyclical poli*" OR "counter-cyclical fiscal" OR "expansionary polic*" OR "fiscal boost" OR "fiscal" AND "economic stimulus" OR "fiscal" AND "policy" AND "global financial crisis" OR "fiscal" AND "policy" AND "global financial crisis" OR "fiscal" AND "Asian Financial Crisis" OR "fiscal" AND "COVID" OR "fiscal" AND "Corona virus")*

Table A3.1: Number of articles retrieved per search term.

Search term	Number of articles
fiscal stimulus	59
fiscal austerity	20
contracyclical polic* OR contra-cyclical polic*	0
contracyclical fiscal OR contra-cyclical fiscal	0
countercyclical poli* OR counter-cyclical poli*	19
countercyclical fiscal OR counter-cyclical fiscal	23
expansionary polic*	25
fiscal boost	0
fiscal AND economic stimulus	1
fiscal AND policy AND global financial crisis	15
fiscal AND Asian Financial Crisis	0
fiscal AND COVID	0
fiscal AND Corona virus	0

A3.2 G20 central bank officials

Senior central bank officials were identified through comprehensive desktop searches of public data for relevant Level 1 - Level 4 employees at all G20 national central banks as well as the European Central Bank. Translation services were used for banks with non-English websites. Employees were primarily identified using corporate organograms, visual hierarchies and organisational charts. 'Relevant' employees were those with job titles that suggested an essential role in setting or advising economic policy. Examples of these included *Head of Economic Analysis Department*, *Head of Research*, *Executive Director* and *Governor*. Support staff were excluded. We observed a range of public openness and website transparency across the set of banks. We were able to locate a minimum of five names for each bank. Email addresses were identified manually through internet research. A total of 484 senior central bank officials were identified with 226 email addresses.

A3.3 G20 finance ministry staff

Senior policymakers in G20 finance and treasury ministries were identified in a similar manner to central bank officials. Manual comprehensive internet searches of public data were used to identify relevant Level 1 - Level 4 employees. Translating services were used for banks with non-English websites. As in central banks, employees were predominantly identified using corporate organograms, visual hierarchies and organisational charts. Again, 'relevant' employees were those with job titles that suggested an essential role in setting or advising economic policy. Examples of these included *Minister of Finance*, *Head of Economic Policy*, *Head of Department of Budget Policy* and *Senior Expert*. The range of public openness and transparency across ministries was even greater than that among central banks. A total of 390 senior finance ministry officials were identified with 147 email addresses.

A3.4 Global development bank officials

Senior development bank officials were selected for the target group based on listing as a Level 1 - Level 4 relevant employee at any prominent multinational development bank or the International Monetary Fund (IMF). Prominent multinational development banks were considered to be the ten major banks by scale of operation as in Faure et al. (2015), as well as the Asian Infrastructure Investment Bank (AIIB), which was established in 2016 and is rapidly raising and distributing funds in a manner to rival the size of others on the 2015 list. Employee titles and email addresses were extracted from publicly available online resources using internet research. Translating services were used for banks with non-English websites. As with central banks and finance ministries, employees were predominantly identified using corporate organograms, visual hierarchies and organisational charts. 'Relevant' employees were those with job titles that suggested an essential role in setting or advising economic policy. Examples of these included *President*, *Director and Vice President of Equitable Growth*, *Director of Finance and Institutions*. Support staff were excluded. A total of 347 senior development bank officials were identified with 301 email addresses.

A3.5 Global think tank experts

A broad-based approach was used to engage leading global experts and commentators at top-tier economic Think Tanks. We combined two preeminent ranking systems with different methodologies to identify a set of 120 'top-tier' economic think tanks. The University of Pennsylvania's *2019 Global Go To Think Tank Index Report (GGTTT)* (McGann 2020) ranked 2019's top 144 domestic economic think tanks in the world (from a much larger list) based on 528 survey responses elicited from a hand-picked panel of experts who reviewed each think tank against 28 criteria. IDEA's *Top 25% Think Tank Ranking for March 2020* (Zimmermann 2020) employed a contrasting strategy to provide a ranking of 55 leading think tanks based on the quantified academic impact of the works put forth by think tank contributors. The top 100 GGTTT think tanks were combined with the top 50 IDEA think tanks to form a total set of 120 top tier think tanks. The existing contact database of the GGTTT was used to identify email addresses for the most senior 2 levels of economics experts at each think tank.

A3.6 Limitations in expert selection methodology

This selection process will inevitably have not identified all relevant experts. Practical feasibility limited the engagement we had with some potential experts, particularly those from non-English G20 nations (e.g. Russia) and some G20 LMICs (e.g. Mexico, South Africa). Inferior information for these locations, largely driven by incomplete or unavailable website listings, meant that we were unable to collate a significant number of expert names and email addresses for some nations. Multilingual research assistants were engaged to source and interpret native language web pages when available.

A potential source of process inefficiency is the likelihood that some emails to target group experts were quarantined by corporate spam filters and either kept from recipients or redirected to junk

folders. Whilst we were unable to determine the percentage of emails that were incorrectly quarantined, spam testing using *mail-tester.com* and *GlockApps* indicated low spam risk. As such we have no reason to believe that a significant number of emails were kept from recipients.

APPENDIX 4: EXPERT GROUPINGS

To differentiate between survey responses, we created 10 identical surveys, one for each sub-group A1, A2, C1, C2, D1, D2, F1, F2, T1 and T2. The target expert group and supplementary expert group each consisted of 5 sub-groups as in the table below. As described in Appendix 3, two survey links were sent to each target expert: a personalised link for self-reporting and a secondary link for sharing with colleagues. In order to ensure no accidental contamination of the target group, these links were designed so that they could only be opened from the mailbox associated with the email address of the specific target group recipient. We developed additional country-specific comparison groups (LIC, MIC, HIC, LMIC, G20, NG20) based on respondent answers to the question, *What national economy do you spend most of your time working on?*.

Table A4.1: Full list of expert groupings and associated ID codes.

Group ID code	Group Description	Form
A1	Expert academics - systematically identified	self-contained
A2	Expert academics - referrals	self-contained
A3	Expert academics - combined set	A1 + A2
C1	Central bank officials - systematically identified	self-contained
C2	Central bank officials - referrals	self-contained
C3	Central bank officials - combined set	C1 + C2
D1	Development bank officials - systematically identified	self-contained
D2	Development bank officials - referrals	self-contained
D3	Development bank officials - combined set	D1 + D2
F1	Finance ministry officials - systematically identified	self-contained
F2	Finance ministry officials - referrals	self-contained
F3	Finance ministry officials - combined set	F1 + F2
T1	Think tank experts - systematically identified	self-contained
T2	Think tank experts - referrals	self-contained
T3	Think tank experts - combined set	T1 + T2
Z1	Target group - all systematically identified experts	A1 + C1 + D1 + F1 + T1
Z2	Supplementary group - all referred experts	A2 + C2 + D1 + F2 + T2
Z3	Total group - all experts	Z1 + Z2
Z1-exA	Target group ex. expert academics	Z1 - A1
Z1-exC	Target group ex. central bank officials	Z1 - C1
Z1-exD	Target group ex. development bank officials	Z1 - D1
Z1-exF	Target group ex. finance ministry officials	Z1 - F1
Z1-exT	Target group ex. think tank experts	Z1 - T1
HIC	Experts focused on high-income countries	self-contained
MIC	Experts focused on middle-income countries	self-contained
LIC	Experts focused on low-income countries	self-contained
LMIC	Experts focused on low- and middle-income countries	MIC + LIC
G20	Experts focused on G20 countries	self-contained
NG20	Experts focused on non-G20 countries	self-contained

APPENDIX 5: SURVEY DESIGN

A5.1 Text of first email

Send date: 15 April 2020

Subject: Urgent COVID-19 request for assistance

Text: Dear <name>**,**

You have been identified as an expert in fiscal policy based on your status as an expert in economics/finance. Our objective is to elicit your assessment and recommendations on fiscal recovery policies in response to COVID-19 to help guide significant government spending, by G20 and other national governments. The output of the survey is intended to be published in a commissioned paper by the *Oxford Review of Economic Policy*.

We would be most grateful if you could find the time to immediately complete the short survey included here: <individual **survey link>** Note that this is best completed on a desktop computer or laptop (not mobile phone).

In the interest of collecting a sample from a broader range of experts, we welcome responses from any of your contacts (or their contacts) who you regard as leaders in fiscal economics or policy. **Please do share the following link with any such individuals:** <general **survey link for group>** (your own link above is unique and will expire if not accessed from your email account).

Your individual response will be held in the strictest confidence. If you wish to be acknowledged and thanked for contributing your expertise to this effort, you will be given the option of including your name at the end of the survey.

Many thanks for your time and cooperation,

Professor Cameron Hepburn, Director of the Smith School | University of Oxford
Professor Joseph Stiglitz, Nobel Laureate | Columbia University
Professor Lord Nicholas Stern, Former President of the Royal Economic Society | London School of Economics
Dimitri Zenghelis | University of Cambridge

A5.2 Text of first follow-up email

Send date: 16th of April 2020

Subject: Urgent COVID-19 request for assistance

Text: Dear <name>,

This email is sent on behalf of Prof. Joseph Stiglitz, Prof. Lord Nicholas Stern, Dimitri Zenghelis and Prof. Cameron Hepburn.

We notice that you have not yet responded to the *urgent survey request* we sent to you on Tuesday. **The survey will be closing tomorrow**. You have been *individually identified* as a part of a **very small group of experts in fiscal policy**. Your response to the survey is vital and will aid in effectively and efficiently guiding trillions of dollars in eminent G20 government spending in response to COVID-19.

We would be most grateful if you could find the time to immediately complete the very short survey included here: <individual **survey link>**

In the interest of collecting a sample from a broader range of experts, we welcome responses from any of your contacts (or their contacts) who you regard as leaders in fiscal economics or policy. Please do share the following link with any such individuals: <general **survey link for group>** (your own link is unique and will expire if not accessed from your email account).

Your individual response will be held in the strictest confidence.

Many thanks for your time and cooperation,

Cameron Hepburn, Director of the Smith School | University of Oxford
Professor Joseph Stiglitz, Nobel Laureate | Columbia University
Professor Lord Nicholas Stern, Former President of the Royal Economic Society | London School of Economics
Dimitri Zenghelis | University of Cambridge

A5.3 Text of second follow-up email

Send date: 17th of April 2020

Subject: Final reminder: Urgent COVID-19 request for assistance

Text: Dear <name>,

This is a final request to action the survey sent to you on Tuesday. **The survey will close tonight (11.59pm GMT).** You were *individually identified as a part of a small group* and as such, your response to this survey is important. The results of this survey will be helpful in guiding government spending in response to COVID-19.

We would be most grateful if you could find the time to complete the very short survey included here: <individual **survey link>**

In the interest of collecting a sample from a broader range of experts, we welcome responses from any of your contacts (or their contacts) who you regard as leaders in fiscal economics or policy. Please do share the following link with any such individuals: <general **survey link for group>** (your own link is unique and will expire if not accessed from your email account).

Your individual response will be held in the strictest confidence.

Many thanks for your time and cooperation,

Professor Cameron Hepburn, Director of the Smith School | University of Oxford
Professor Joseph Stiglitz, Nobel Laureate | Columbia University
Professor Lord Nicholas Stern, Former President of the Royal Economic Society | London School of Economics
Dimitri Zenghelis | University of Cambridge

A5.4 Survey text

Respondents were asked to rate each policy type according to four metrics: speed of impact, long-run economic multiplier, climate impact potential and overall desirability. To provide opportunity for

introduction of additional policy archetypes excluded from the core set of 25, a free response question was also included. Additionally, respondents were asked to provide demographic data in the form of 6 drop-down responses. Collected demographic information included addressing country of research/work focus, country of domicile, educational background, length of time working in the broad fields of economics and/or policy, highest level of educational attainment and gender. A final question allowed participants to provide their name for inclusion as a listed expert in the published paper.

The full survey text was as follows:

Page 1: Welcome

This policy survey aims to assess possible fiscal recovery responses to the COVID-19 crisis. Expected completion time is 15 minutes or less.

Imagine that you are asked by your national government to rate a number of potential fiscal policies against four criteria:

1. Speed of implementation: time for policy to achieve half of its total impact.
2. Economic multiplier: multiplier effect of the policy, from low to high.
3. Potential climate impact: implications of this policy for Paris 2015 net-zero targets.
4. Overall desirability: on balance, should this policy be implemented by your government?

For additional information about any policy, hover over the underlined title. For example, hover your mouse over the following (functionality may be limited on some mobile devices): Direct Cash Payments to Consumers. [Cash transfers to consumers in the forms of direct bank transfers or mailed cheques. E.g. direct transfer of $1,200 to US citizens through the CARES Act in 2020.]

Your response will help assess the possible long-term impact of COVID-19 on the economy and the climate.

Responses will be kept in the strictest confidence.

CUREC Ethics Approval: SOGE 1A2020-44

Demographic Data

a. What national economy do you spend most of your time working on? [Drop-down menu; all UN member states plus, Kosovo, the Palestinian Territories, Malta and Taiwan]

b. What is the category of your current place of work? [Radio bubble options; University, Central Bank, Ministry of Finance, Development Bank, Think Tank, Other - Please specify (with free entry box)]

Privacy

I consent to having my information collected and shared. View Privacy Policy. [Check box question]

Page 2: Speed of implementation

Please estimate how quickly you would expect each policy to achieve **half** of its total impact in your country of focus from its date of legislation.

Question mechanics

- Type: 25 slider response questions, one for each policy archetype (see *Appendix 2)*
- Left-hand scale label: slow (3+ years)

- Middle scale label: none
- Right-hand scale label: fast (less than one month)
- Scale: 100-point slider
- Default starting value: 50

Page 3: Economic multiplier

Please estimate the relative size of the long-run economic multiplier of each policy. A low multiplier (e.g. 0) implies a net loss. A high multiplier implies an increase in output that is a number of times greater than expenditure.

Question mechanics
- Type: 25 slider response questions, one for each policy archetype (see *Appendix 2)*
- Left-hand scale label: very low (stimulus completely crowds-out private activity)
- Middle scale label: none
- Right-hand scale label: very high (stimulus crowds-in significant additional private activity)
- Scale: 100-point slider
- Default starting value: 50

Page 4: Climate impact potential

Please subjectively estimate the relative potential impact of each policy on reducing greenhouse gas emissions if enacted in your country of focus.

Question mechanics
- Type: 25 slider response questions, one for each policy archetype (see *Appendix 2)*
- Left-hand scale label: Extremely negative impact
- Middle scale label: none
- Right-hand scale label: Extremely positive impact
- Scale: 100-point slider, -50 to 50
- Default starting value: 0

Page 5: Overall desirability

What is your overall opinion on the implementation of each policy as a recovery package item in your country over the coming 12-month period?

Question mechanics
- Type: 25 slider response questions, one for each policy archetype (see *Appendix 2)*
- Left-hand scale label: Strongly opposed
- Middle scale label: Agnostic
- Right-hand scale label: Strongly support
- Scale: 100-point slider, -50 to 50
- Default starting value: 0

Page 6: Additional input

a. What other fiscal policy approaches should governments be considering? How would you rate these for speed of implementation, economic multiplier and potential to impact the climate? [Free response]
b. Where do you live? [Drop-down menu; all UN member states plus Kosovo, the Palestinian Territories, Malta and Taiwan]
c. In total, how many years have you worked in the broad fields of economics and/or policy? [Drop-down menu; integer numbers between 1 and 50, as well as 0-1]

d. What is your highest level of educational attainment? [Drop-down menu; High school, Bachelor degree, Masters by Coursework, Masters by Research, PhD]
e. To which gender identity do you most identify? [Radio bubble options; Female, Male, Not listed (with free entry box), Prefer not to answer]
f. Please enter your name if you would like to be included in the list of experts that are acknowledged in the published paper; your individual answers will remain anonymous. [Free response]

Page 7: Thank you!

Thank you for taking our survey. Your response is very important to us.

Privacy Policy

Fiscal Recovery Options: Global Survey Privacy Policy

Summary
This privacy notice specifically refers to our use of data collected through the *2020 Fiscal Recovery Options: Global Survey*. There are 2 types of information collected by the survey.

1. Anonymised survey data: This consists almost entirely of answers to slider and multiple-choice questions, none of which contain personally identifiable data. One question provides free-text options for written answers. We ask participants not to use these fields to provide any personal information
2. Optional name: Individuals can optionally provide their name if they wish to be acknowledged in the published paper. These names will be reprinted publicly.

Purpose of processing
The anonymised survey data will be used to gain insight into the preferences and opinions of participants. These insights will be used to inform ongoing research into optimal COVID-19 fiscal recovery pathways.

If you choose to provide us with your name, we will acknowledge you as a contributing expert in the published paper. Your name will not be shared for other purposes.

Lawful basis for processing
By opting in to provide your name, you are providing consent to our processing of your personal data for the purpose specified.

Who we share data with
The data is stored by our survey service supplier, SurveyGizmo. This information is stored in the EU.

Retention period and criteria
Anonymised survey data will be kept for the purposes of analysing the data for an indeterminate amount of time (until we no longer need it).

Rights
The GDPR provides certain rights that individuals may exercise in respect of their own personal data. If you would like to exercise any of the rights in the GDPR, in respect of personal data you have submitted, please contact the Data Protection Officer using the contact details below. Please note that there may be some circumstances in which your request cannot be complied with – for instance if we have a legal obligation to keep data, or to process it in a particular way. All requests to exercise GDPR rights will be handled on a case by case basis.

Identity and contact details of controller and representative
The Oxford COVID-19 Stimulus Research Team (led by Professor Cameron Hepburn) is the controller of your personal data. This means that it is the Research Team which decides how and why your personal data is processed. Cameron can be contacted at cameron.hepburn@smithschool.ox.ac.uk.

Contact details of the Oxford University Information Compliance Team
The University of Oxford staffs its own Compliance Team separate from the Research Team. They can be contacted at information.compliance@admin.ox.ac.uk.

Right to lodge a complaint
If you are dissatisfied with the way we are managing your personal data, please let us know in the first instance by writing to Cameron Hepburn (cameron.hepburn@smithschool.ox.ac.uk). If you remain dissatisfied, you are entitled to raise your concerns with the University of Oxford Compliance Team (information.compliance@admin.ox.ac.uk).

APPENDIX 6: DESCRIPTIVE STATISTICS OF SURVEY RESPONDENTS

Table A6.1: Summary of survey response distribution.

Respondents who fully completed survey (all compulsory questions)[6]	231
Slider question responses	23,100
Qualitative 'free answer' question responses	71
Drop-down menu responses	1,386
Names recorded	146
Respondents who partially completed survey (excluded from analysis)	45
Total Number of Respondents (complete and partial)	276

Figure A6.1: Geographic coverage of respondents by *country of focus*. Dark green indicates at least one respondent. Full responses only.

[6] All slider questions were compulsory. All drop-down responses were compulsory. The free-form response question *What other fiscal policy approaches should governments be considering?*, and personal identification question *Please enter your name if you would like to be included in the list of experts*, were both optional.

APPENDIX 7: SURVEY RESULTS

Survey results were exported from the host platform, *SurveyGizmo*, and aggregated for statistical analysis on a continuous relativity-adjusted zero-mean, zero-sum basis to account for response relativity biases.

Respondents rated each policy item in a relative and subjective manner using 100-point sliding scales. The point value of each response was not visible to respondents, rather it was used to compute, for each respondent, the relative performance of policy archetypes. Respondents were not homogenous in their use of the sliding scales; some employed the full 100-point range whilst others constrained their responses to within a tight range (e.g. ± 20 from the centre value). Each respondent's scores were re-based or 'relativity-adjusted' for each of the four sliding response questions so that in all cases the 25 archetypes were collectively zero-mean, zero-sum.

We achieved an overall survey response rate of 19.7% for the target group. This reflected 19.9% for central bank officials, 13.6% for development bank officials, 15.6% for finance officials, 32.7% for academics and 16.4% for think tanks. By comparison, with our response rate of 32.7%, previous surveys of expert academic economists have achieved equivalent response rates of 33% (Howard and Sylvan, 2015), 30% (Drupp et al., 2018), 17% (Necker, 2014), and 7% (Enders and Hoover, 2006). Given the accelerated timeline of our survey – 4 days rather than a typical response windows of 3-4 weeks, a 32.7% academic response rate is high. Surveys of finance officials and central bank executives are rare in the academic literature. No comparable study was identified outside of a select group of opaque corporate surveys (Barontini and Holden, 2019). This subset did not provide data on response rates. Given the high academic response rate, we have no reason to presume that response rates for other target groups were unacceptably low.

Table A7.1 shows that, of the 25 policy archetypes, on a relativity-adjusted basis, five feature in the top quartile of target group scores for more than one core criteria; D, K and O for speed and economic multiplier, S and X for economic multiplier and climate, but no policies for both speed and climate. Four policies feature in the bottom quartile across two or more metrics; B, E, I and Q.

Categorical comparisons took the mean responses of each expert group (A1, C1, D1, F1, T1, HIC and LMIC in Appendix 4) and compared these to the mean responses of the target group (see tables A7.2 – A7.5 below). To ensure mutual exclusivity between comparison groups, expert group participants were removed from the target group to create 'adjusted target groups' as in Appendix 4 (Z1-exA, Z1-exC, Z1-exD, Z1-exF, Z1-exT). Adjusted target groups were not needed for HIC/LMIC comparisons as these groups are already mutually exclusive. The mean variation between groups was calculated by averaging the absolute value of the mean expert group scores minus the mean adjusted target group score for each of the 25 policy archetypes, as in Equation 1.

$$\frac{\sum_{n=1}^{25} |\overline{expert\ group\ score} - \overline{adjusted\ target\ group\ score}|}{25} \quad (1)$$

Table A7.1: Performance of target group relativity-adjusted policy archetypes. Expressed in the form: relativity adjusted score (ranking).

ID	Policy archetype titles	Speed	Multiplier	Green	Overall
A	Temporary waiver of interest payments	21.5 (4)	-4.1 (18)	-7.3 (18)	4.6 (8)
B	Assisted bankruptcy (super Chapter 11)	-3.3 (14)	-10.1 (24)	-7.9 (19)	-3.8 (16)
C	Liquidity support for large corporations	18.1 (5)	-4.7 (20)	-10.4 (23)	-7 (20)
D	Liquidity support for households and SME's	26.7 (3)	10.9 (1)	-5 (17)	17.7 (1)
E	Airline bailouts	2.2 (10)	-14.5 (25)	-22.4 (25)	-17.1 (25)
F	NFP, education, research, health inst. Bailouts	1.7 (11)	-4.9 (21)	0.3 (10)	5.6 (7)
G	Reduction in VAT and other goods & services taxes	12.3 (7)	-0.4 (13)	-9.2 (21)	-9.9 (22)
H	Income tax cuts	3.8 (8)	-1.5 (15)	-7.9 (20)	-10.3 (23)
I	Business tax deferrals	13.1 (6)	-6.2 (22)	-9.5 (22)	-7 (19)
J	Business tax relief for strategic and structural adj.	0.8 (12)	-3.3 (16)	-3.5 (13)	-3.3 (15)
K	Direct provision of basic needs	28 (1)	6.7 (4)	-4.1 (14)	10.7 (3)
L	Education capital investment	-14.9 (21)	5.4 (7)	4.2 (8)	3.9 (10)
M	Healthcare capital investment	2.2 (9)	7.7 (3)	0.2 (11)	12.1 (2)
N	Worker retraining	-11.4 (17)	2.1 (11)	0.3 (9)	2.6 (12)
O	Targeted direct cash transfers or temp. wage rises	26.8 (2)	6.5 (5)	-4.8 (16)	8.1 (4)
P	Rural support policies	0.6 (13)	-8 (23)	-4.1 (15)	-7.3 (21)
Q	Traditional transport infrastructure	-16.4 (22)	3.2 (10)	-11.1 (24)	-12.2 (24)
R	Project-based local infrastructure grants	-11.9 (18)	4.4 (8)	-3.3 (12)	-5.7 (18)
S	Clean connectivity infrastructure	-10.9 (16)	8.1 (2)	9 (5)	2.8 (11)
T	Clean energy infrastructure investment	-18 (24)	3.7 (9)	24.5 (1)	3.9 (9)
U	Buildings upgrades	-13.5 (19)	-3.7 (17)	14.1 (4)	-4.2 (17)
V	Green spaces and natural infrastructure	-17.6 (23)	-4.4 (19)	21.4 (3)	0.3 (14)
W	Disaster preparedness	-6.5 (15)	-0.9 (14)	6 (7)	7.1 (5)
X	General R&D spending	-14.8 (20)	6.5 (6)	7.1 (6)	2.4 (13)
Y	Clean R&D spending	-18.5 (25)	1.6 (12)	23.3 (2)	6.1 (6)

Table A7.2: Mean **speed of implementation** responses by expert group. Figures are expert group average minus adjusted target group average. For HICs/LMICs figures are a subtraction of LMIC group averages from HIC group averages. For all columns, a positive (negative) number indicates that the expert group believes the policy to be faster (slower) than what others believe.

	Policy archetypes	**Academics**	**Finance officials**	**Central bank officials**	**Development bank officials**	**Think tank experts**	**HICs - LMICs**
A	Temporary waiver of interest payments	-1.6	-6.0	11.0	-0.6	-8.4	3.6
B	Assisted bankruptcy (super Chapter 11)	8.6	-15.5	1.5	-7.2	5.7	5.8
C	Liquidity support for large corporations	-8.2	1.5	13.6	-4.2	1.1	4.9
D	Liquidity support for households and SME's	3.1	5.4	-0.6	-6.9	-0.3	6.2
E	Airline bailouts	-0.7	7.8	-0.9	-12.8	17.0	11.8
F	NFP, education, research, health inst. Bailouts	4.9	-0.3	4.7	-9.7	-3.2	9.4
G	Reduction in VAT and other goods & services taxes	0.6	-11.1	-1.3	5.3	3.7	-8.4
H	Income tax cuts	-2.2	-3.6	-2.2	3.8	6.6	-3.2
I	Business tax deferrals	-3.7	1.4	6.6	-2.6	0.2	0.2
J	Business tax relief for strategic and structural adj.	-1.9	-1.1	0.3	3.0	0.2	-5.6
K	Direct provision of basic needs	6.4	-4.4	-0.9	-1.5	-6.4	2.6
L	Education capital investment	-0.2	-0.5	-1.4	4.1	-3.5	0.8
M	Healthcare capital investment	-6.8	5.7	1.1	3.5	2.3	-4.4
N	Worker retraining	1.4	6.7	-7.6	4.1	-4.1	-2.9
O	Targeted direct cash transfers or temp. wage rises	4.2	-2.0	-3.7	-2.6	3.3	-1.8
P	Rural support policies	-4.0	2.3	-1.7	9.7	-6.5	-13.9
Q	Traditional transport infrastructure	3.8	-1.7	1.8	-8.1	3.3	1.3
R	Project-based local infrastructure grants	-1.0	-2.7	-1.1	-1.5	9.9	-1.9
S	Clean connectivity infrastructure	-1.6	1.2	0.2	-0.7	3.5	0.8
T	Clean energy infrastructure investment	2.2	3.0	-6.8	2.3	-0.4	2.4
U	Buildings upgrades	-1.4	-1.8	-0.6	4.5	-1.4	0.2
V	Green spaces and natural infrastructure	2.5	0.5	-1.9	7.0	-15.4	-1.3
W	Disaster preparedness	-2.4	3.5	-7.3	7.1	3.0	-3.7
X	General R&D spending	-3.4	6.2	-1.5	0.5	3.5	-1.2
Y	Clean R&D spending	1.1	5.7	-1.0	3.7	-13.6	-1.9

Table A7.3: Mean **long-run economic multiplier** responses by expert group. Figures are expert group average minus adjusted target group average. For HICs/LMICs figures are a subtraction of LMIC group averages from HIC group averages. For all columns, a positive (negative) number indicates that the expert group believes the policy to be faster (slower) than what others believe.

	Policy archetypes	**Academics**	**Finance officials**	**Central bank officials**	**Development bank officials**	**Think tank experts**	**HICs - LMICs**
A	Temporary waiver of interest payments	0.1	-6.6	0.3	3.9	-0.4	-5.9
B	Assisted bankruptcy (super Chapter 11)	6.7	-0.4	-7.9	-6.6	9.9	8.9
C	Liquidity support for large corporations	-5.1	1.6	3.6	0.4	3.6	-1.0
D	Liquidity support for households and SME's	3.2	3.1	-3.0	-5.9	4.4	2.8
E	Airline bailouts	-3.5	3.7	-0.8	-1.4	8.3	2.7
F	NFP, education, research, health inst. Bailouts	5.5	-4.6	-8.1	0.4	5.3	-1.0
G	Reduction in VAT and other goods & services taxes	4.0	-7.9	-2.2	0.0	2.8	-4.1
H	Income tax cuts	2.0	-0.7	0.0	-3.8	2.4	1.9
I	Business tax deferrals	-4.1	1.5	2.6	0.9	2.0	-2.8
J	Business tax relief for strategic and structural adj.	-6.5	11.9	2.4	-4.9	7.1	3.4
K	Direct provision of basic needs	4.8	-6.9	4.2	-1.5	-9.1	0.7
L	Education capital investment	-2.7	4.4	0.1	3.9	-5.1	-3.5
M	Healthcare capital investment	-1.9	4.2	0.2	4.9	-8.6	-4.5
N	Worker retraining	-0.4	5.1	-4.1	0.9	1.2	-0.1
O	Targeted direct cash transfers or temp. wage rises	6.2	-6.5	-2.5	-3.4	2.4	-4.3
P	Rural support policies	-1.0	-2.9	-5.6	9.0	0.0	-9.6
Q	Traditional transport infrastructure	-0.2	-1.1	1.3	-5.1	8.3	-0.7
R	Project-based local infrastructure grants	-1.1	1.5	0.4	-4.0	7.3	1.7
S	Clean connectivity infrastructure	-6.3	5.5	8.5	-5.4	3.5	2.4
T	Clean energy infrastructure investment	-1.3	4.5	2.2	-0.6	-4.6	7.4
U	Buildings upgrades	0.8	-2.2	5.1	-4.4	-1.0	3.8
V	Green spaces and natural infrastructure	-0.5	-4.3	-1.0	7.1	-4.7	0.8
W	Disaster preparedness	-1.5	0.2	-5.9	7.1	1.6	-1.5
X	General R&D spending	-2.5	-2.2	6.0	1.4	-4.6	-0.1
Y	Clean R&D spending	5.3	-1.0	4.4	7.1	-8.1	2.4

Table A7.4: Mean **climate impact potential** responses by expert group. Figures are expert group average minus adjusted target group average. For HICs/LMICs figures are a subtraction of LMIC group averages from HIC group averages. For all columns, a positive (negative) number indicates that the expert group believes the policy to be faster (slower) than what others believe.

	Policy archetypes	**Academics**	**Finance officials**	**Central bank officials**	**Development bank officials**	**Think tank experts**	**HICs - LMICs**
A	Temporary waiver of interest payments	2.3	-3.5	0.5	-1.7	0.2	0.9
B	Assisted bankruptcy (super Chapter 11)	0.3	-0.5	0.3	1.2	-2.7	0.0
C	Liquidity support for large corporations	-1.6	-1.3	1.1	3.1	-2.0	-0.7
D	Liquidity support for households and SME's	2.0	-0.6	-1.0	0.0	-2.4	1.5
E	Airline bailouts	-5.9	8.1	0.7	1.1	2.5	-3.8
F	NFP, education, research, health inst. Bailouts	0.9	-0.8	-3.8	2.5	1.2	-0.7
G	Reduction in VAT and other goods & services taxes	2.6	-2.9	-1.8	1.0	-1.7	-0.2
H	Income tax cuts	0.2	-3.7	1.6	1.8	-2.3	-0.7
I	Business tax deferrals	-1.5	0.4	1.1	1.0	-0.4	-0.4
J	Business tax relief for strategic and structural adj.	-5.4	6.0	2.2	0.0	2.7	1.0
K	Direct provision of basic needs	1.3	-4.7	-2.1	3.6	-0.5	-2.6
L	Education capital investment	-3.9	1.7	1.5	1.8	2.0	-1.9
M	Healthcare capital investment	-0.3	0.9	-3.3	3.9	-1.2	-2.7
N	Worker retraining	0.3	2.7	-3.4	1.3	0.4	-0.6
O	Targeted direct cash transfers or temp. wage rises	2.6	-3.6	-4.5	3.2	0.1	-1.7
P	Rural support policies	-7.5	2.8	0.3	6.8	2.9	-6.0
Q	Traditional transport infrastructure	-0.9	3.4	-1.4	3.0	-4.3	-3.2
R	Project-based local infrastructure grants	-1.9	3.9	1.4	-1.6	0.6	0.0
S	Clean connectivity infrastructure	13.4	0.7	-4.1	-12.1	-4.9	6.5
T	Clean energy infrastructure investment	0.9	-1.8	0.2	-5.5	9.0	7.4
U	Buildings upgrades	3.6	2.8	0.4	-5.4	-3.1	7.1
V	Green spaces and natural infrastructure	-2.3	-5.1	6.3	-6.7	11.5	1.5
W	Disaster preparedness	-0.5	1.6	-3.6	5.7	-3.9	-4.9
X	General R&D spending	-0.2	-1.9	4.6	-2.5	-1.4	-1.7
Y	Clean R&D spending	1.6	-4.4	7.0	-5.5	-2.1	5.9

Table A7.5: Mean **overall desirability** responses by expert group. Figures are expert group average minus adjusted target group average. For HICs/LMICs figures are a subtraction of LMIC group averages from HIC group averages. For all columns, a positive (negative) number indicates that the expert group believes the policy to be faster (slower) than what others believe.

	Policy archetypes	**Academics**	**Finance officials**	**Central bank officials**	**Development bank officials**	**Think tank experts**	**HICs - LMICs**
A	Temporary waiver of interest payments	1.2	0.1	1.1	0.5	-5.8	-4.5
B	Assisted bankruptcy (super Chapter 11)	5.6	2.4	-3.7	-5.0	-1.0	5.7
C	Liquidity support for large corporations	-8.6	2.7	12.6	0.2	-5.0	-0.9
D	Liquidity support for households and SME's	0.5	-0.4	2.6	-1.9	-2.1	-0.1
E	Airline bailouts	-4.7	3.7	2.1	-0.8	4.9	-0.2
F	NFP, education, research, health inst. Bailouts	4.9	-4.2	-1.7	-2.6	0.1	3.7
G	Reduction in VAT and other goods & services taxes	7.5	-13.1	-4.4	-1.2	5.9	-2.8
H	Income tax cuts	2.1	0.9	1.9	-1.8	-6.5	-4.4
I	Business tax deferrals	-2.9	6.7	2.8	1.7	-8.1	-3.7
J	Business tax relief for strategic and structural adj.	-4.0	5.2	1.3	1.4	-0.8	2.4
K	Direct provision of basic needs	5.7	-11.3	-1.4	2.1	-2.6	-0.2
L	Education capital investment	-1.2	0.0	2.1	-1.3	1.3	0.7
M	Healthcare capital investment	-3.7	1.2	1.4	-2.3	9.1	-0.9
N	Worker retraining	0.1	2.4	-3.3	2.4	-1.0	-0.6
O	Targeted direct cash transfers or temp. wage rises	4.0	-13.4	-3.2	3.8	4.1	-5.6
P	Rural support policies	-6.2	-4.5	-0.6	10.6	2.6	-12.7
Q	Traditional transport infrastructure	-0.3	4.0	-0.4	-1.0	-1.3	-3.9
R	Project-based local infrastructure grants	-2.0	7.8	-3.4	-0.6	3.4	-0.9
S	Clean connectivity infrastructure	-1.2	8.7	1.9	-7.7	3.6	1.6
T	Clean energy infrastructure investment	1.2	1.0	-5.7	3.9	-0.6	6.1
U	Buildings upgrades	1.4	2.0	-1.8	0.0	-2.2	5.5
V	Green spaces and natural infrastructure	-0.9	-2.2	-3.4	6.5	-0.7	1.3
W	Disaster preparedness	0.4	-2.7	-0.3	-0.3	2.9	3.3
X	General R&D spending	-0.8	0.8	4.2	-5.2	2.7	2.6
Y	Clean R&D spending	1.8	2.0	-0.8	-1.3	-3.0	8.4

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