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Costs and Trade-Offs in the Fight against the COVID-19 Pandemic: A Developing Country Perspective

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The world is experiencing the worst pandemic crisis in one hundred years. By mid-April 2020, more than 80 percent of countries around the world had imposed strict containment and mitigation measures to control the spread of the disease. The economic fallout from the pandemic has been immense, with dire consequences for poverty and welfare, particularly in developing countries. This Brief first documents the global economic contraction and its potential impact on developing countries regarding macroeconomic performance, poverty rates, and incomes of the poor and vulnerable. It then argues that the pandemic crisis may hurt low- and middle-income countries disproportionately because most of them lack the resources and capacity to deal with a systemic shock of this nature. Their large informal sectors, limited fiscal space, and poor governance make developing countries particularly vulnerable to the pandemic and the measures to contain it. Next, the Brief reviews recent epidemiological and macroeconomic modelling and evidence on the costs and benefits of different mitigation and suppression strategies. It explores how these cost-benefit considerations vary across countries at different income levels. The Brief argues that, having more limited resources and capabilities but also younger populations, developing countries face different trade-offs in their fight against COVID-19 than advanced countries do. For developing countries, the challenge is preserving lives and avoiding crushed livelihoods. Different trade-offs call for context-specific strategies. For countries with older populations and higher incomes, more radical suppression measures may be optimal; while for poorer, younger countries, more moderate measures may be best. Having different trade-offs, however, provides no grounds for complacency for developing countries. The Brief concludes that the goal of saving lives and livelihoods is possible with economic and public health policies tailored to the reality of developing countries. Since "smart" mitigation strategies (such as shielding the vulnerable and identifying and isolating the infected) pose substantial challenges for implementation, a combination of ingenuity for adaptation, renewed effort by national authorities, and support of the international community is needed. The lockdowns may be easing, but the fight against the pandemic has not been won yet. People and economies will remain vulnerable until a vaccine or treatment are developed. The challenge in the next few months will be to revive the economy while mitigating new waves of infection.

Public Disclosure Authorized

The Economic Contraction

The COVID-19 pandemic has thrown the world into its worst economic crisis since the Great Depression. The adverse shock first originated in the powerhouses of the world economy—China, Europe, and the United States. It has quickly propagated throughout the globe. Because of the pandemic, the world economy in 2020 is projected to grow 6 to 7 percentage points lower than otherwise, with 90 percent of countries experiencing negative growth rates (IMF 2020a). The sharp contraction will affect most aspects of economic activity, including trade and labor. Global trade volume is expected to decline between 13 and 32 percent in 2020 (WTO 2020). Global labor, measured by working hours, is projected to decrease by 10.5 percent in the second quarter of 2020, a decline equivalent to 305 million full-time workers (UN 2020).

For developing countries, the global contraction carries a large adverse external shock. The demand for exports has plummeted, and merchandise exports are expected to decline in 2020 by 8 to 36 percent, depending on the region and projection scenario (WTO 2020). Commodity prices are declining to record lows, with oil and metal prices projected to drop by 40 percent and 13 percent, respectively, in 2020 (World Bank 2020a). International tourism (measured by tourist arrivals and tourism receipts) is expected to decrease by 20 to 30 percent in 2020 (UNWTO 2020). Remittances, an increasingly important source of income in developing countries, may suffer a decline of about 20 percent in 2020 (World Bank 2020b). External finance is drying up, with the largest capital outflow from developing countries ever recorded (more than US$80 billion since the start of the crisis) and spreads on sovereign debt increasing by hundreds of basis points (IMF 2020a).

No less important, the pandemic entails a large domestic shock in developing countries, with direct costs related to morbidity, health care, and uncertainty; and indirect costs related to the containment and mitigation measures imposed to reduce the spread of the disease, such as reduced labor, production capacity, and productivity. The combined external and domestic shocks related to the pandemic will produce an unprecedented systemic contraction in GDP growth in 2020 throughout the developing world, with estimated reductions (relative to expectations prior to the pandemic) of about -5 percentage points (pp) in emerging and developing Asia; -8 pp in emerging and developing Europe; -7 pp in Latin America and the Caribbean; -6 pp in the Middle East and Central Asia; and -5 pp in Sub-Saharan Africa (IMF 2020a; see figure 1).

The International Monetary Fund (IMF), in its April 2020 *World Economic Outlook*, warns of "severe risks of a worse outcome" (IMF 2020a). The growth projections cited above are predicated on the condition that the restrictions imposed to contain the spread of the disease are concentrated over the first half of the year (first quarter for China and second quarter for the rest of the world). However, if the lockdowns are extended by 50 percent longer, with financial conditions becoming tighter and fiscal burdens becoming heavier, world GDP growth in 2020 could drop an additional 3 percentage points. This severe scenario would imply mass unemployment, firm closures, and possibly debt and financial crises. The dislocation implied by such a large contraction would extend well beyond 2020, making the recovery in subsequent years weak and volatile.

The Impact on Poverty

The pandemic crisis is bound to have an impact on poverty. Conservative estimates suggest that the economic contraction will push 48 million to 135 million of people to poverty worldwide, with the estimates depending on the poverty line used (48 million new poor, using the $1.90/day poverty line for all countries; and 135 million new poor, using $1.90/day for low-income, $3.20/day for lower-middle income, and $5.50/day for upper-middle income countries). This will make 2020 the first year since 1998 that the global rate of poverty will increase (Mahler et al. 2020; World Bank 2020c).

If inequality were to rise, the poverty impact of the economic contraction would be much worse. For instance, if the Gini coefficient increases by 2 percent in all countries, the number of poor would rise by 83 million to 200 million people (with the larger estimate allowing for different poverty lines across income groups) (see table 1 and figure 2). If the risks of a worse growth contraction materialize, the numbers of poor could increase by an additional 70 percent.

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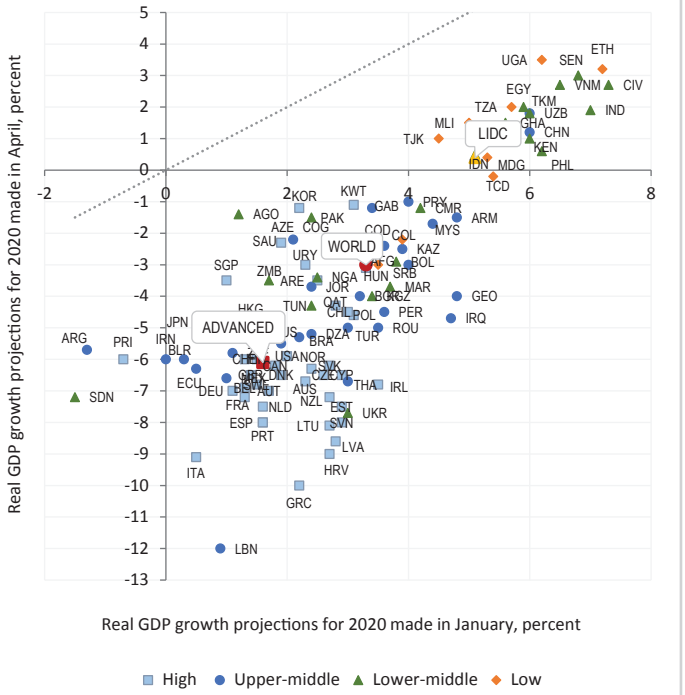
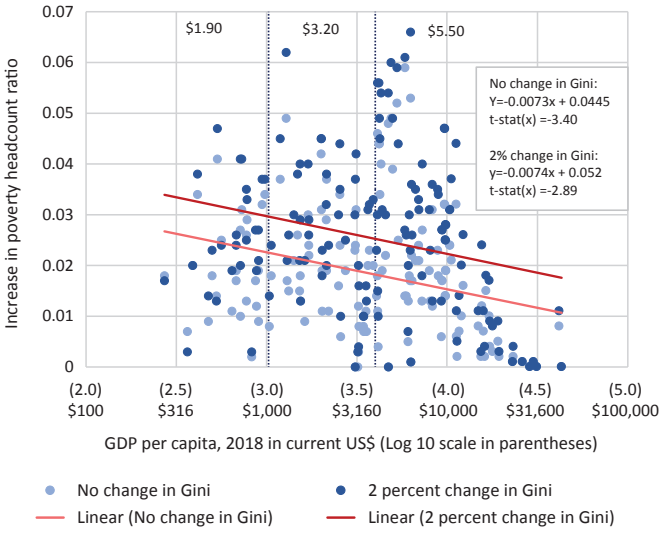
Figure 1. GDP Growth Will Plummet in Almost Every Country in 2020



Source: Prepared by Loayza and Shaharuddin based on data from IMF 2019a, 2020a.
Note: The figure compares GDP growth projections for 2020 made before and after the pandemic struck, in January 2020 and April 2020, respectively. "World" represents the growth rate for the global economy. "Advanced," "EMDE," and "LIDC" represents advanced economies, emerging market, and low-income developing economies, respectively, based on the IMF groupings. Data labels uses the International Organization for Standardization (ISO) country codes. The country income groups follow the World Bank classification based on annual gross national income (GNI) per capita: low-income, less than $1,025; lower-middle-income, $1,025–$3,995; upper-middle-income, $3,995–$12,375; and high-income, more than $12,375. The 45-degree line indicates no changes in the projections of 2020 real GDP growth made in January 2020 and April 2020. Being above (below) the 45-degree line indicates projections improved (worsened) for real GDP growth in 2020. For countries that had no projections made in January 2020, projections from October 2019 are used.

Figure 2. Poverty Will Increase Worldwide because of COVID-19



Source: Prepared by Loayza and Shaharuddin based on data provided by Christoph Lakner and Daniel Gerszon Mahler from PovcalNet (World Bank 2020d); IMF 2020a; and Lakner et al. 2019.
Note: The country income groups follow the World Bank classification based on annual gross national income (GNI) per capita: low-income, less than $1,025; lower-middle-income, $1,025–$3,995; upper-middle-income, $3,995– $12,375; and high-income, more than $12,375. The number of new people in poverty per capita is calculated using different poverty lines based on income groups. Low-income and lower-middle income countries use $1.90/day and $3.20/day, respectively. Upper-middle income and high-income countries use $5.50/day. The vertical lines represent the thresholds.

Not only poverty but also incomes of the poor and vulnerable would be affected, especially if the crisis implies an increase in inequality. If the Gini coefficient increases by 2 percent in all countries, the income growth rate of the bottom 40 percent of the population would drop on average by an *additional* 2.7 percentage points (ranging from about 1 percentage point to 5 percentage points, depending on a country's initial income distribution).

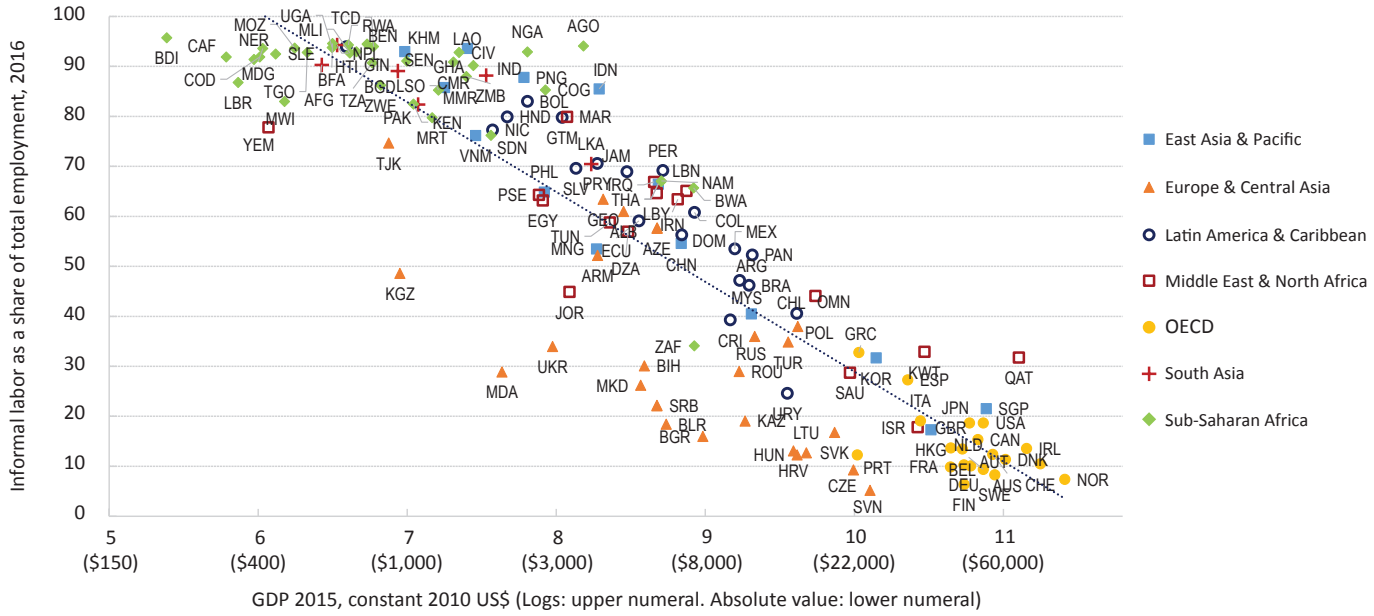
An increase in the Gini coefficient by 2 percent in a *given country* is not unusual during times of crisis (Lakner et al. 2019). The Gini coefficient increased by 6 percent between 1998 and 2002 in Argentina, for instance,

Table 1. Millions of People Will Cross the Line into Poverty because of COVID-19 (Increase in Headcount Poverty)

Million	Scenarios								
	$1.90/day poverty line Percent change in Gini			$3.20/day poverty line Percent change in Gini			$5.50/day poverty line Percent change in Gini		
Income group/region	**0%**	**1%**	**2%**	**0%**	**1%**	**2%**	**0%**	**1%**	**2%**
Income group									
Low-income	12.618	14.423	16.541	9.906	10.262	10.833	5.015	4.717	4.042
Lower-middle-income	29.554	38.695	54.358	77.767	92.545	110.949	67.591	66.381	67.976
Upper-middle-income	5.677	8.106	10.437	14.605	21.737	28.882	44.667	58.154	73.191
High-income	0.246	0.269	0.274	1.238	1.273	1.388	1.821	2.096	2.381
Region									
World	48.095	61.493	81.610	103.516	125.817	152.053	119.094	131.348	147.590
East Asia & Pacific	4.393	5.754	7.960	14.150	19.548	26.061	33.854	42.849	53.555
Europe & Central Asia	0.857	1.144	1.376	2.464	3.052	3.679	6.453	7.642	9.089
Latin America & Caribbean	2.656	4.163	5.422	6.090	8.881	11.437	12.408	16.617	20.322
Middle East & North Africa	2.720	3.300	3.655	6.484	7.720	9.039	10.906	11.803	13.109
North America	0.075	0.075	0.075	0.996	0.996	0.996	0.996	0.996	0.996
South Asia	15.228	20.578	31.669	54.229	65.311	78.473	42.793	40.146	39.977
Sub-Saharan Africa	22.165	26.479	31.453	19.103	20.310	22.369	11.685	11.296	10.542

Source: Prepared by Loayza and Shaharuddin based on data provided by Christoph Lakner and Daniel Gerszon Mahler from PovcalNet (World Bank 2020d); IMF 2020a; and Lakner et al. 2019.
Note: The $1.90/day, $3.20/day, and $5.50/day poverty lines are used for low, lower-middle, and upper-middle income countries, respectively (shaded rows). The size of the growth contractions is equal to the difference in GDP growth projections for 2020 between April 2020 and January 2020.

Figure 3. Labor Informality is Higher in Poorer Countries



Source: Prepared by Loayza and Shaharuddin based on data from ILO 2018; Loayza and Meza-Cuadra 2018.
Note: Data labels use the International Organization for Standardization (ISO) country codes. OECD includes high-income countries that have been members of the Organisation for Economic Co-operation and Development for more than 40 years. Developing countries are grouped in geographic region as presented in the legend.

and rose 4 percent in the single year between 2000 and 2001. On the other hand, a synchronized increase of 2 percent in all countries has never been recorded. It is, however, not an improbable scenario in the current crisis because, first, the adverse shock is both global and extremely large, and, second, the shock is hurting low-income workers who are most affected by strict social distancing measures, particularly informal workers (see the following section). The International Labour Organization (ILO) recently warned that "Some 1.6 billion people employed in the informal economy—or nearly half the global workforce—could see their livelihoods destroyed due to the continued decline in working hours brought on by lockdowns to curb the spread of COVID-19" (UN 2020). According to ILO, in the first month of the crisis, the incomes of informal workers dropped by 60 percent worldwide.

An increase in poverty and a decline in the incomes of the poor and vulnerable have implications beyond monetary well-being. They can lead to a deterioration in education, nutrition, health, and living conditions in general, with long-lasting consequences (Banerjee and Duflo 2011). For example, the number of people at risk of starvation could almost double because of the pandemic crisis, increasing by 130 million people worldwide, according to the World Food Programme (WFP 2020).

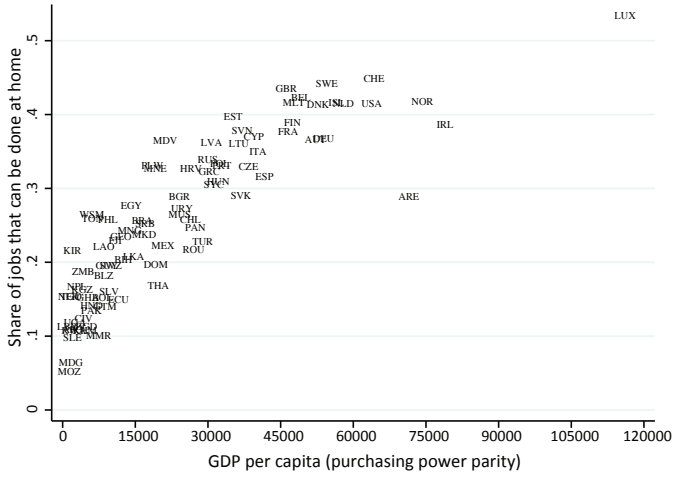
Limited Ability to Cope

The economic crisis brought about by the pandemic may hurt low- and middle-income countries disproportionately because they lack the resources and capacity to deal with large systemic shocks. For a shock of the same magnitude, low- and middle-income countries suffer more than advanced countries do in terms of worsening poverty, inequality, human capital losses, economic disruption, and uncertainty, with scarring consequences that could last for years or decades to come (World Bank 2013). For the pandemic crisis, three structural characteristics make developing countries especially vulnerable to the economic shock large: informal sectors, limited fiscal space, and poor governance (Loayza and Pennings 2020).

Large informal sectors. Informality is rampant in developing countries (Loayza 2018; see figure 3). In the typical developing country, the informal sector employs 70 percent of the labor force, and in some low-income countries this rate can be over 90 percent. Informal workers lack benefits such as unemployment insurance, health insurance, and paid leave. They are highly exposed not only to the health impacts of COVID-19 but also to the containment and mitigation measures to reduce the spread of the disease. Most informal workers, especially the self-employed, depend on daily work to pay for their basic household necessities: if they cannot work even for short periods of time, their family's subsistence is at risk. Moreover, extensive labor informality implies that relief and recovery policies aimed at formal labor (such as increasing unemployment insurance, reducing payroll and income taxes, and extending paid sick leave) have very limited effects. Another relevant issue for the resilience of the economy in the face of containment restrictions is the ability to work from home, which depends on the share of formal employment but also on sectoral concentration and digital connectivity. It is estimated that in advanced countries, about 35 percent to 45 percent of jobs can plausibly be performed at home; in sharp contrast, for developing countries, working from home is possible for only 5 percent to 25 percent of jobs (Dingel and Neiman 2020; Sanchez et al. 2020; see figure 4).

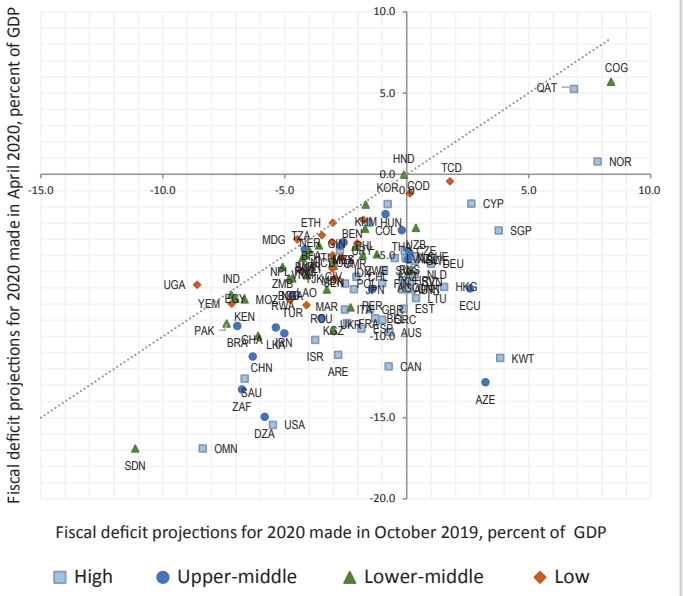
Limited fiscal space. Low- and middle-income countries do not have sufficient "fiscal space," that is, the ability to deploy public funds and resources to counter a large negative shock (Kose, Ohnsorge, and Sugawara 2018). Although developing countries do not have larger

Figure 4. Lower-Income Countries Have Much Lower Shares of Jobs that Can Be Done at Home



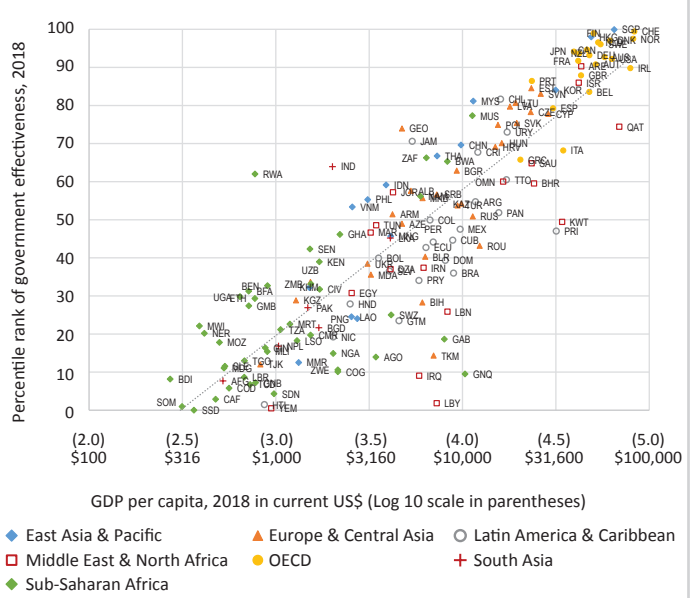
Source: Figure reproduced from Dingel and Neiman 2020.

Figure 5. Fiscal Deficits Are Projected to Increase Sharply in 2020 because of COVID-19



Source: Prepared by Loayza and Shaharuddin based on data from IMF 2019b, 2020b.
Note: Data labels use the International Organization for Standardization (ISO) country codes. The country income groups follow the World Bank classification based on annual gross national income (GNI) per capita: low-income, less than $1,025; lower-middle-income, $1,025–$3,995; upper-middle-income, $3,995–$12,375; and high-income, more than $12,375. The 45-degree line indicates no changes in the projections of fiscal deficit made in October 2019 and April 2020. Being above (below) the 45-degree line indicates projections improved (worsened) for fiscal deficit in 2020.

Figure 6. Government Effectiveness Is Lower in Poorer Countries



Source: Prepared by Loayza and Shaharuddin based on data from World Bank 2020e World Development Indicators and World Bank 2019 Worldwide Governance Indicators.
Note: Government effectiveness reflects perceptions of the quality of public services; the quality of the civil service and the degree of its independence from political pressures; the quality of policy formulation and implementation; and the credibility of the government's commitment to such policies. The estimates are in percentile rank terms. Data labels use the International Organization for Standardization (ISO) country codes. OECD includes countries that have been high-income members of the Organisation for Economic Co-operation and Development (OECD) for more than 40 years. Developing countries are grouped in geographic region as presented in the legend.

public-debt-to-GDP ratios than developed ones, their debt is more subject to exchange rate and maturity risks, their credit rating is lower, and their financial markets are shallower. In addition, a small tax base and less efficient tax administration mean that income support for people whose income is disrupted or sharply curtailed because of the pandemic and countercyclical fiscal policy are harder to implement in developing than developed countries. The global, systemic nature of the shock implies that most countries will be running large deficits. Fiscal revenues are likely to be much lower because of the economic contractions, while fiscal expenditures for efforts to mitigate the effects of the crisis are likely to be much higher. It is estimated that advanced countries will run an average deficit of about 11 percent of GDP in 2020, while developing countries will run an average deficit of 9 percent of GDP, double the previously estimated deficit for 2020 (IMF 2020b; see figure 5). In the uncertain times of COVID-19, as financial markets engage in a "flight to quality," many developing countries will find it much more difficult to cover their fiscal needs, even with some support from the international community (Hausmann 2020).

Poor governance. The quality of governance determines a country's effectiveness to manage shocks and provide assistance (Khemani 2020; World Bank 2013). Most developing countries suffer from corruption, lack of transparency and accountability, low bureaucratic competence, and burdensome regulatory systems (Kaufmann, Kraay, and Mastruzzi 2011; see figure 6). To make matters worse, some countries suffer from fragility, conflict, and violence (Signé 2020). Faced with the challenge of COVID-19, developing country governments may find it hard to implement complicated measures to cope with the crisis. To mitigate the impact of the crisis with economic policies, they may have to rely on straightforward relief and recovery policies, such as providing direct cash transfers and ensuring continuity of public goods and services. To contain the spread of the disease with public health measures, developing country governments may have to adopt strategies that, first, do not require strong state enforcement capacity but rely more on community-level enforcement and household action, and, second, allow for complementary support by nongovernmental organizations, the private sector, and international organizations.

Different Strategies for Different Contexts

A welfare evaluation of different strategies to deal with the pandemic crisis should consider both public health and economic considerations jointly. Success in limiting the fatalities and suffering from the disease depends on, first, taking into account the economic and institutional challenges faced by different countries and, second, considering the incentives that people have to comply with social distancing measures (Chang and Velasco 2020a; World Bank 2020f).

Governments have had difficult choices to make on the best approach for their countries to contain the spread of the disease. Surrounded by uncertainty as to the threat of the virus, some governments chose strict lockdowns. They may have been a necessary first line of defense in some countries. But, can lockdowns be the foundation of a sustainable strategy in developing countries? And, with the benefit of more evidence and time, can governments make better choices?

The Problem with Indiscriminate Lockdowns

Indiscriminate lockdowns are less effective and more costly in developing than in advanced countries (Barnett-Howell and Mobarak 2020a; Brown, Ravallion, and van de Walle 2020; Loayza 2020a; Ravallion 2020). Lockdowns are ineffective in containing the spread of the disease when they are imposed in cities with pervasively overcrowded dwellings and neighborhoods. There, instead of social distancing, the result from a lockdown is social compression as people are forced into crowded living quarters. Lockdowns are counterproductive when they produce massive displacement of people, especially from urban to rural areas, spreading, rather than containing, the contagion of the virus. And lockdowns are unproductive when compliance is low, leading to short-lived containment gains and an increased probability of second or third waves of infection. Low compliance results not only from weak enforcement capability but also from the dire need that poor people have to work and make an income.

In developing countries, lockdowns can be extremely costly in economic and human terms (Basu 2020). They can lead to mass unemployment and business closures. They can put the families of poor and informal workers, especially daily laborers, at the risk of starvation,

crime, and disease. Furthermore, the loss of public and private resources due to lockdowns reduces the ability to provide other vital services in health care, education, and safety. In India and Pakistan, for example, there is early evidence that the lockdowns have led to fewer prenatal visits, more unattended home births, fewer child immunization visits, and lower adherence to cancer and tuberculosis treatments (Livemint 2020; Stop TB Partnership 2020). Most developing-country governments do not have the means to prevent these losses and unintended consequences, especially during a deep recession (Didier et al. 2020; Lakner, Özler, and Van der Weide 2020).

Different Vulnerabilities for Different Demographic Profiles

An important aspect of the COVID-19 disease is that it affects the young and old differently. According to current epidemiological evidence, there is a marked difference in the age profile of vulnerable populations: the infection fatality rate for people over 60 years of age appears to be 5 to 100 times higher than those below the age of 60, with substantially higher fatality rates in older age groups (Verity et al. 2020).

This is relevant for two reasons. First, the population most vulnerable is the least economically active; and, conversely, those most economically active are at considerably lower risk of serious or fatal disease. A blanket constraint of economic activity, therefore, disables those who can work (and practice responsible social distancing) without increasing significantly their exposure to health risks.

Second, developing countries, being at an earlier phase of the demographic transition, have younger populations. The ratio of people over 60 years of age to total population is 1:20 and 1:10 in the typical low-income and middle-income country, respectively. In comparison, this ratio is 1:5 in advanced countries. Therefore, the mortality risk from COVID-19 is significantly lower in low- and middle-income than in advanced countries (Walker et al. 2019).

A qualification is that not only age but also comorbidities determine the severity of COVID-19. On the one hand, low- and lower-middle income countries have a lower prevalence of diseases known to exacerbate symptoms of COVID-19, such as cardiovascular disease, chronic respiratory disease, and diabetes, even controlling for age differences (WHO 2019, 2020b). On the other hand, lower-income countries have a higher prevalence of infectious diseases and, in some cases, higher HIV infections, which weaken immunity if unattended. These two forces might lead to a different risk profile from that observed in China, Europe, and US (Walker et al. 2019), although it is not clear if this will reinforce or not the age-driven mortality differences projected across countries.

The Alternatives to Indiscriminate Lockdowns

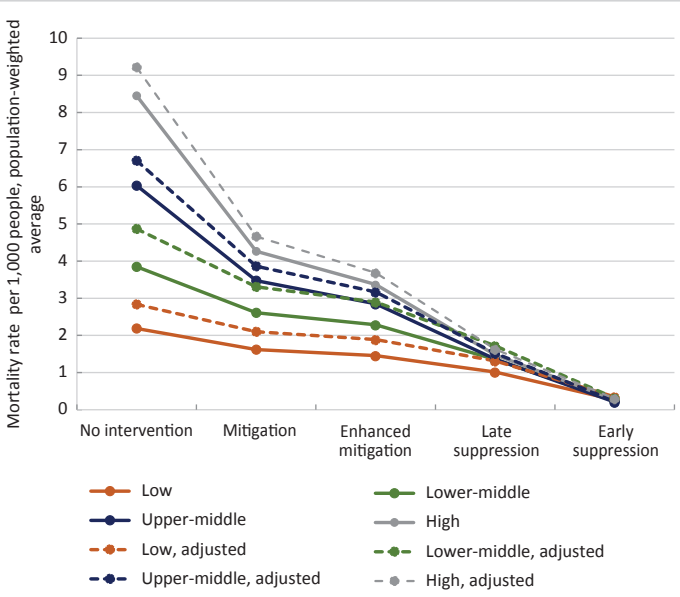
So, are there alternatives to strict and indiscriminate suppression measures? How effective are they in reducing mortality risk across different countries? And, what social and economic losses are involved? This Brief considers two approaches to answer these questions, one from epidemiology and the other from economics.

Insights from Epidemiology

One of the world's top epidemiological teams, the Imperial College COVID-19 Response Team, has studied the results of alternative mitigation and suppression strategies on mortality rates in a worldwide group of countries (Walker et al. 2020). Using a variation of the canonical susceptible-infected-recovered (SIR) model, Walker et al. study the effects of five strategies: (1) unmitigated epidemic; (2) social distancing (reducing interpersonal contact by 45 percent); (3) enhanced social distancing (reducing, in addition, interpersonal contacts of people aged 70+ by 60 percent); (4) late suppression (reducing interpersonal contacts by 75 percent when the number of fatalities exceeds 1.6 per 100,000 people per week); and (5) early suppression (triggered at 0.2 fatalities per 100,000 people per week). In the model, the infection fatality rate varies across age groups and is constant across countries (Verity et al. 2020). Therefore, differences across countries are given by their demographic structures. The findings of Walker et al. for countries at different income levels are presented in figure 7.

The epidemiological projections show that, first, mortality rates are lower for countries at lower income levels; second, mortality rates for all country groups decrease as mitigation and suppression measures become more severe; and, third, the gains in lives saved by more severe

Figure 7. Mitigation and Suppression Strategies Have Different Effects on Mortality Rates in Low-, Middle-, and High-Income Countries



Source: Prepared by Loayza and Kim based on data provided by Patrick GT Walker (Imperial College London COVID-19 Response Team).
Note: Adjusted mortality rates take into consideration that critically ill patients may not receive proper attention due to constraints in health care capacity. We adjust for heterogeneity in health care by using the number of hospital beds as proxy. See Kim and Loayza (2020) for details.

measures decrease with income level. These results are driven by countries' age composition, with younger populations in lower-income countries being less affected by the pandemic and corresponding mitigation and suppression strategies.

Some caveats on these epidemiological projections should be considered when applied to low- and middle-income countries. First, the original projections do not control for the quality of public health care. To partially address this concern, Kim and Loayza 2020 provide a new computation that attempts to adjust for higher mortality of critically ill patients in countries with lower health care capacity (presented in Figure 7 as dashed lines). Second, the projections assume uniform compliance across countries and do not allow for collateral or unintended damage. Stricter and more demanding measures will likely elicit lower compliance (except for short periods of time when repression can be imposed) and, moreover, lead to lives lost from starvation, diminished health care, and, in general, worsened extreme poverty. Low compliance and collateral damage would diminish the containment effect of radical suppression strategies, making them less beneficial than other more moderate strategies (reducing further the slope of the lines for developing countries in figure 7).

Barnett-Howell and Mobarak (2020b) go one step beyond epidemiological projections to estimate the economic loss derived from estimated fatalities in different countries and for different mitigation and suppression strategies. They highlight four findings. First, the loss from inaction to address the disease is enormous for all countries. Second, the loss across all scenarios is higher for better-off countries because of a combination of higher mortality (due to an older population) and higher incomes. Third, all countries benefit from mitigation strategies, but the marginal gains decrease when moving from mitigation to suppression strategies. Fourth, lower-income countries gain less in moving from no intervention to mitigation and still less in moving from mitigation to suppression than higher-income countries do.

The finding that the economic benefits of more strict suppression measures decline with income level is particularly relevant. Barnett-Howell and Mobarak cite three reasons. First, fatality rates in lower-income countries are lower because their populations are younger. Second, delaying infections is less useful in countries with significantly lower health care capacity. Third, the opportunity cost (in terms of, for instance, work and nutrition) of more drastic measures is higher for poorer people. Barnett-Howell and Mobarak conclude, "Simply put, rich

people can more easily meet their basic needs while social distancing, while a poor person may need to prioritize income-generating opportunities to put food on their family's table" (p. 5). (See Kim and Loayza (2020) for a fuller discussion of related methods and results).

Insights from Economic Modelling

The analytical and policy-oriented response to the pandemic from economics has been robust, with an expanding number of high-quality and relevant papers. Box 1 presents a selection of these papers, focusing on recent macroeconomic contributions. They embed variations of the canonical SIR epidemiological model in a macroeconomic setup in order to study the interaction between the dynamics of the pandemic and economic activities such as work and consumption. The models are then calibrated and simulated to jointly derive results on public health outcomes (such as infection and fatality rates) and economic outcomes (such as losses of employment, consumption, and production). Most economic models consider two basic externalities: an infection externality (because people do not fully account for the effect that their actions may have on the infection of others) and a congestion externality (because public health care facilities may be jammed by people needing services at the same time). These externalities create a clear role for government intervention to improve social welfare. To assess the optimality of these interventions, some models formulate an explicit social welfare function that depends on losses derived from fatalities and a decline in economic activity.

In these papers, economic agents have been modelled with increasing degree of complexity and realism. Early models assume that all economic agents are homogeneous in terms of productivity and, importantly, vulnerability to the disease. More recent models allow for economic agents to be heterogeneous regarding sector of economic activity (such as essential and nonessential); productivity (such as whether they can work from home); and demographic structure (such as young, middle-aged, and old).

Public health interventions are also modelled with increasing realism. Early models only allow for governments to impose indiscriminate lockdowns, varying only by length of duration and extent of the population. More recent models allow for governments to discriminate between sectors (allowing for essential activities to continue while restricting a fraction of nonessential activity); introduce differential lockdowns or shielding of vulnerable populations (acknowledging the evidence that the old and comorbid are the most affected by the disease); and conduct testing, tracing, and isolating of cases of infection.

These models introduce political economy aspects in various forms. One is by recognizing the distributional consequences of imposing blanket quarantines that benefit and hurt different groups of society differently: for instance, the old would benefit more from longer, stricter lockdowns than the young would. Another form of introducing political economy considerations is by acknowledging that compliance to mitigation and suppression measures matter for the choice of optimal social distancing: for instance, in low compliance settings, mitigation and suppression measures should be more moderate. A third form is by recognizing the feedback loops between good economic policy and the incentives to comply with regulations: for example, when people expect that the economy will recover and they will have their jobs back, they are more likely to heed temporary shutdowns.

One of the latest models, by Acemoglu et al. (2020), studies the effects of a comprehensive set of policy measures potentially available to policy makers. This study provides some results that can help summarize the lessons from economic models of the pandemic. In their benchmark case, where the only available mitigation measure is a uniform lockdown, the optimal policy prescribes a strict and extended quarantine, resulting in a fatality rate of 1.83 percent of the working-age population and an economic loss of 23.4 percent of GDP. If differential lockdowns across groups are possible, the optimal policy prescribes a targeted shielding of the old (and vulnerable) until a vaccine becomes available and lighter social distancing for the rest of the population, allowing them to work. This targeted policy produces an improvement in both health and economic outcomes, as the fatality rate and the economic loss drop almost to half of those in the benchmark case. Furthermore, if testing, tracing, and isolation of the infected are conducted, in addition to shielding of the old and vulnerable, social losses can be reduced further. For instance, if all symptomatic people are tested and quarantined, fatalities will reduce to one-third and economic loss to one-fourth with respect to the benchmark case. If, in addition, one-third of asymptomatic infected people are identified and quarantined, social losses will be reduced to one-twentieth the losses under indiscriminate lockdowns.

So, what implications can be drawn for developing countries? The most prominent macroeconomic models of the pandemic have been calibrated to advanced economies in North America or Europe. Recalibration and application to various low- and middle-income countries is badly needed. Nevertheless, some qualitative implications can be derived. First, social welfare losses due to the economic contraction are likely to weigh more heavily than those due to fatalities in developing than developed countries. This is because developing countries have younger and poorer populations. Second, compliance with strict measures is bound to be significantly lower in developing countries than in advanced countries. This is because of lower perceived gains from compliance, inadequate government enforcement, lower social trust, and weaker economic policies for relief and recovery. The policy implication is that mitigation and suppression strategies in developing countries should be less strict and lengthy than in advanced countries. Third, since economic losses in countries that are already low-income matter significantly for their welfare, the need for finding cost-effective ways for addressing the pandemic is large and possibly higher than in advanced countries.

A fourth implication has to do with implementation capability. Some of the "smart" mitigation strategies that could render great benefits (such as shielding the vulnerable and identifying and isolating the infected) pose challenges for implementation even in developed countries. Their implementation is likely to be more difficult in developing countries; yet applying "smart" measures is the only sustainable strategy in the absence of a vaccines or treatment. What is needed is a combination of ingenuity for adaptation of "smart" strategies, renewed effort by national authorities, and support of the international community.

The Excruciating Trade-Off between Saving Lives and Saving Livelihoods

What makes managing the COVID-19 crisis so challenging is that if unattended, it could lead to countless numbers of fatalities—yet, if drastic measures to contain the spread of the disease are imposed, it can produce a deep and long recession, resulting in devastated livelihoods, extreme poverty, starvation, disease, and conflict. For developing countries, the trade-off is not just between lives and the economy; rather, it is about preventing deaths from COVID-19 versus avoiding crushed livelihoods and deaths flowing from those crushed livelihoods (Basu 2020).

The trade-off between saving lives and saving livelihoods is excruciating but is also real and unavoidable (Ferreira 2020; Loayza 2020a; Economist 2020a). The analysis and estimations presented in previous sections suggest three conclusions.

1. *Developing countries have limited ability to cope with the pandemic crisis and related trade-offs.* In advanced countries, the lives-versus-livelihoods trade-off can be eased with immense resources. Several developed countries have committed to spend over 10 percent of GDP to alleviate the effect of the pandemic (IMF 2020b). For example, the United States and Denmark will spend, respectively, about US$5,700 and US$7,500 per capita to tackle the crisis. Developing countries, on the other hand, not only face limited (and shrinking) financial resources but are also burdened by precarious health systems, overcrowded cities, informal labor markets, poor governance, and, in some cases, fragility and conflict (Loayza and Pennings 2020). In advanced countries, saving lives can be afforded even at great expense. In developing countries, a single-minded goal of saving lives from the pandemic is unrealistic and can lead to considerable human losses.

2. *Developing countries face different trade-offs than advanced countries.* Given their limited ability to cope with the pandemic, developing countries suffer more from the contraction in economic activity required by strict suppression measures. These measures have a higher negative

Box 1. A Selection of Recent Macroeconomic Models on the COVID-19 Pandemic

Several recent high-quality studies model the interaction between public health and economic outcomes and policies with increasing sophistication and realism. The following summarizes the contributions from a selection of these studies.

Eichenbaum, Rebelo, and Trabandt (2020) extend the canonical susceptible-infected-recovered (SIR) epidemiological model, where transition probabilities across health status are exogenous, to account for the effect that work and consumption may have on such probabilities. By augmenting the SIR model with macroeconomic features, they can estimate fatality rates and income losses jointly and study the effect of public policy health interventions. In the model, all agents are uniform in economic productivity and vulnerability to the disease. People fail to fully internalize that their economic activity can increase the contagion rate. In the presence of this externality, government bodies interested in social welfare in terms of both health and economic outcomes should intervene to restrict economic activity and limit the extent of infection and mortality. In the absence of knowledge on who the infected are, the best policy is to restrict economic activity for a period of time, which reduces the mortality rate by one third. This comes at a large cost, however, as suppression measures make the economic contraction three times worse than it would have been from the health shock alone. Knowledge of who the infected are greatly eases the trade-off. In the limit, when government knows who the sick are and is able to isolate them, the mortality rate is lowered to the minimum and the additional economic loss from "smart" containment is negligible.

Alvarez, Argente, and Lippi (2020) present a model similar to Eichenbaum, Rebelo, and Trabandt (2020), with an infection externality and a health care congestion externality. The government intervenes to eliminate these externalities and optimize a social welfare function that depends on health and economic outcomes. Alvarez, Argente, and Lippi use a simple suppression measure that mandates a certain fraction of the population to stay at home, allows for imperfect efficiency of lockdowns (in reducing contagion), and considers improvement (or not) in health care capacity. In their benchmark model, optimal policy suggests a lockdown of about 60 percent of the population during the first month of the epidemic, gradually reduced to 20 percent in the following three months. Under this lockdown policy, the reduction in GDP is in the order of 8 percent, but the welfare gains derived from reduced mortality with respect to no policy intervention are twice as high. Optimal policy changes with structural conditions, however. If the lockdown is less effective (as would be in developing countries), the optimal severity should be lower and the duration of the lockdown shorter than in the benchmark. If health care capacity is not expected to improve (and a vaccine is far in the future), the duration of optimal lockdown should be reduced to virtually zero. The welfare gain of allowing recovered people to go back to work is on the order of 2 percent of GDP.

The paper by Jones, Philippon, and Venkateswaran (2020) is similar to the previous two papers but introduces home-based work, which is subject to learning-by-doing. The optimal policy in this model is early suppression and interventions to facilitate productivity in home-based work. The disadvantages of this and previous models are that, first, they do not account for the heterogeneity of economic agents (and corresponding distributional effects of blanket suppression measures), and, second, the possibility and benefits of targeted antigen testing and quarantine.

Glover et al. (2020) study the distributional impact of the epidemic and the policies to contain it. Agents vary by age (young and old), economic sector (essential and nonessential), and health status (susceptible, infected, and recovered). The old do not work and are more vulnerable to the disease, while the opposite is true for the young. The old prefer strict and extensive suppression measures, and the young would rather have less radical and shorter measures to mitigate contagion. A utilitarian government selects an intermediate suppression strategy by shutting down a fraction of nonessential economic activity and redistributes income from those who can work to those who do not. Redistribution is costly, however, and the more costly it is, the less intense optimal suppression should be. The model is calibrated to the United States (a country with an older population and less costly redistribution than in developing countries) and suggests closing down 25 percent of nonessential economic activity for about two months and gradually lifting the restriction over coming months reduces mortality rates by half with respect to no mitigation. This suppression strategy is notably less extensive than current lockdowns (by half).

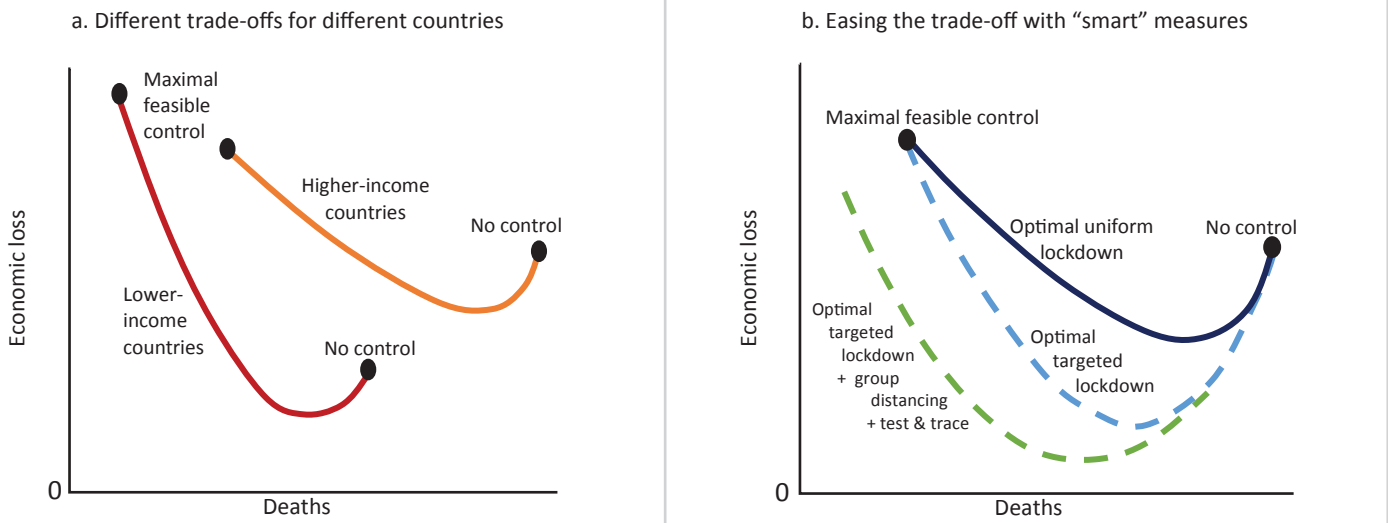
Berger, Herkenhoff, and Mongey (2020) study the introduction of targeted antigen testing and quarantine of potentially infectious people. They compare it with a benchmark where quarantine is gradually ordered for a fraction of the population in the absence of testing. The benchmark is calibrated to the prevalent lockdown in the United States in March 2020. A policy of targeted testing and quarantine allows for noninfectious people to participate in economic activity. Its gains are substantial, as it allows for a reduction in both mortality rates and economic contraction. The model estimates that after one year of targeted testing and quarantine, GDP is 10 percent higher and mortality is cut by half than under the benchmark scenario of indiscriminate shutdowns. (Mortality would increase to the benchmark in subsequent years if treatments and vaccines are not developed).

Acemoglu et al. (2020) study both targeted shielding of the elderly and testing/tracing/isolating of the infected as alternatives to uniform lockdowns. As in previous models, they use an SIR epidemiological model but augment it to include age-specific risks and differential targeted policies. In the model economy, there are three types of agents: the young, middle-aged, and old (65+). Although all agents can be infected, the old have a much higher risk of serious or fatal disease. Acemoglu et al. then study optimal policies (which minimize social loss from fatalities and lack of work) under various conditions. The model is calibrated to the United States, but its qualitative results have general relevance. In the benchmark case, where the only available mitigation measure is a uniform lockdown, the optimal policy prescribes a strict and extended quarantine, resulting in a fatality rate of 1.83 percent of the working-age population and an economic loss of 23.4 percent of GDP. If differential lockdowns across groups are possible, the optimal policy prescribes a targeted shielding of the old until a vaccine becomes available and lighter social distancing for the rest of the population, allowing them to work. This targeted policy produces an improvement in both health and economic outcomes, as the fatality rate is reduced to 1 percent and the economic loss to 12.8 percent of GDP. Furthermore, if testing and tracing are conducted, so that isolation of the infected can be added to shielding of the old, social losses can be reduced further. For instance, if testing/tracing/isolating is conducted for all symptomatic people, the fatality rate will decline to 0.57 percent and the economic loss to 5.9 percent of GDP. If testing is increased so that about one-third of asymptomatic infected people are identified and isolated, the mortality rate will decline to 0.12 percent, the economic loss to 1.2 percent of GDP, and the young and middle-aged will not have to undergo any lockdown.

Finally, Chang and Velasco (2020b) highlight a feature that has not received enough attention: the interconnection between public health and economic policies. The success of suppression measures depends on the degree of compliance by the population. Compliance, in turn, depends on economic incentives: if the population receive transfers to help them cope during the lockdown and, importantly, expect that policies will support the economy in the recovery phase, then they will be more motivated to comply with containment and mitigation measures. This feedback loop creates a role for the government to shape expectations through clear and sensible actions, commitment, and leadership.

Note: This box benefitted from valuable inputs by Roberto Fattal-Jaef, Tatjana Kleineberg, and Rishabh Sinha.

Figure 8. "Smart" Measures Can Ease the Trade-Off between Lives and Livelihoods



Source: Author's illustrations adapted from Acemoglu et al. 2020.
Note: The figures are presented for illustration purposes only. Economic losses are relative to income levels, with larger losses implying higher development setbacks. The downward sloping portion represents the trade-off between economic losses and fatalities; and the upward sloping portion represents the lose-lose situation of more fatalities and higher economic losses.

impact on poverty; associated social ills such as malnutrition, disease, and conflict; and human capital formation of a large fraction of children with limited or no access to online learning (Giannini 2020; UNESCO 2020). Yet, the benefits of these suppression measures in reducing mortality and the corresponding economic loss are lower in developing countries because of both their younger populations and their lower ability to treat critically ill patients. Therefore, the lives-versus-livelihoods trade-off is likely to be different for countries at different levels of development and demographic profiles (for an illustration, see figure 8a). Different trade-offs call for context-specific strategies: for countries with older populations and higher incomes, more radical suppression measures may be optimal; while for poorer, younger countries, more moderate measures may be best.

3. *The terms of the trade-offs can be eased by coordinated economic and public health policies.* Having different trade-offs for developing countries provides no grounds for complacency (Demirgüç-Kunt, Lokshin, and Torre 2020). The goal of preserving lives and livelihoods is possible with a combination of pragmatic and effective economic and public health policies, tailored to the reality of developing countries (Basu 2020; for an illustration, see figure 8b). The success of public health measures to fight the pandemic requires well-designed economic policies. Compliance with social distancing is higher when current economic support is available and the prospects for economic recovery are better; likewise, public health infrastructure can be improved if sufficient revenues are being generated by a well-performing economy.

- *Public health care capacity*. Measures should be urgently undertaken to increase public health care capacity, procuring emergency hospital space, breathing ventilators, medical protective equipment, and testing kits. Given the global rush to acquire medical equipment, developing country governments would need to rely on cost-effective solutions in cooperation with their own private sectors and international aid organizations (WHO 2020a; see also box I.B.5 in World Bank 2020f).

- *Relief and recovery economic policies*. Relief measures should be implemented during the containment period and recovery measures in the aftermath. They should aim to protect the poor and vulnerable (for instance, scaling up both targeted and untargeted cash transfers); provide temporary support to affected businesses (for example, granting wage subsidies and tax reductions); and ensure macroeconomic stability and the continuity of public services. (For a review of economic policies to mitigate the effects of the pandemic, see Didier et al. 2020; Loayza and Pennings 2020, and Özler 2020). Since most low- and middle-income countries lack the fiscal space to conduct sufficient relief and recovery policies, they would need the economic support of the international community. International aid is a global public good to face the pandemic because to be defeated, COVID-19 has to be defeated everywhere (Lakner, Özler, and Van der Weide 2020; Loayza 2020b).

- *Sustainable and cost-effective mitigation*. Although there is much uncertainty regarding the science around COVID-19, including its epidemiology, there is relevant evidence that can help guide sustainable and cost-effective mitigation measures. They are especially relevant where lockdowns are ineffective and excessively costly. They are also important for countries that are considering exit strategies from their lockdowns to prevent a second wave of infection. Some of these measures consist of improving personal and public hygiene; compulsory wearing of face masks and other protective devices in public places; encouraging working from home when possible; restricting mass gatherings; shielding vulnerable groups like the elderly and people with certain preexisting conditions; antibody testing of representative samples to obtain a profile of the extent of infection and recovery in the population; extensive antigen testing, tracing, and isolating cases of infection; and use of information technologies to gather information on social distancing, detection of potential contagion, and compliance with mandated isolation (Basu 2020; De Walque et al. 2020; Loayza 2020a; Maloney and Taskin 2020; The Economist 2020b). Here again, the role of international coordination and cooperation is essential: first, to share technologies and best practices; and second, to prevent waves of infection "imported" from other countries with less effective mitigation measures.

Conclusion

The world is four months into the worst pandemic crisis in one hundred years. By mid-April 2020, more than 80 percent of countries had imposed strong social distancing measures to control the spread of the disease (Hale et al. 2020). The economic fallout has been immense, with dire consequences for poverty and welfare, particularly in developing countries. As the restrictions are gradually eased, the challenge will be to revive the economy while mitigating new waves of infection. Having more limited resources and capabilities but also younger populations, developing countries face different trade-offs in their fight against COVID-19. Sooner rather than later, draconian measures may have to give way to more targeted, self-enforcing, and cost-effective practices to reduce the rate of infection. Only then can a careful and gradual economic recovery begin.

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