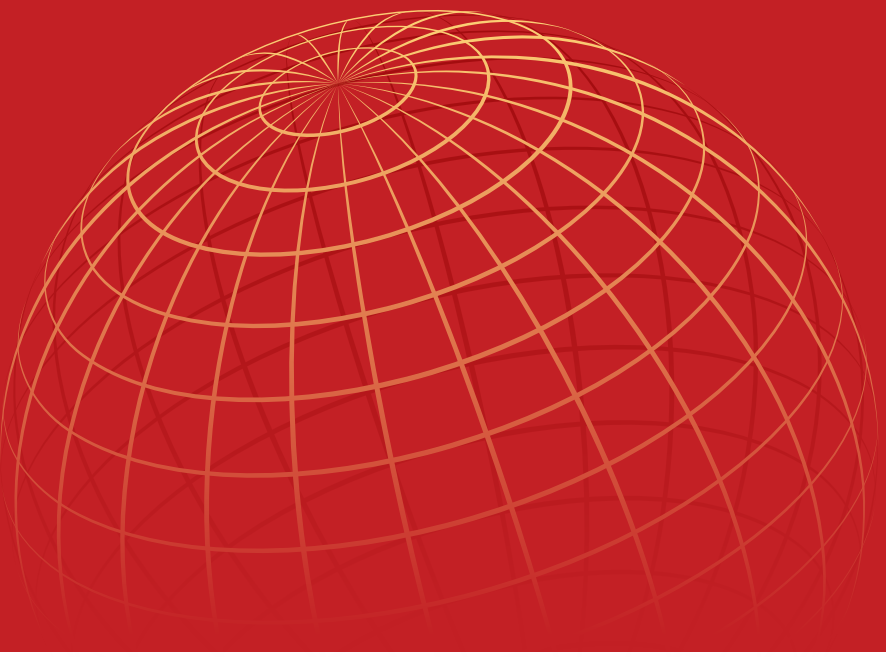


CHAPTER 3

Lasting Scars of the COVID-19 Pandemic

The COVID-19 pandemic has struck a devastating blow to an already-fragile global economy. Lockdowns and other restrictions needed to address the public health crisis, together with spontaneous reductions in economic activity by many consumers and producers, constitute an unprecedented combination of adverse shocks that is causing deep recessions in many advanced economies and emerging market and developing economies (EMDEs). Those EMDEs that have weak health systems; those that rely heavily on global trade, tourism, or remittances from abroad; and those that depend on commodity exports will be particularly hard-hit. Beyond its short-term impact, deep recessions triggered by the pandemic are likely to leave lasting scars through multiple channels, including lower investment; erosion of the human capital of the unemployed; and a retreat from global trade and supply linkages. These effects may well lower potential growth and labor productivity in the longer term. Immediate policy measures should support health care systems and moderate the short-term impact of the pandemic on activity and employment. In addition, a comprehensive reform drive is needed to reduce the adverse impact of the pandemic on long-term growth prospects by improving governance and business environments, and expanding investment in education and public health.

Introduction

On March 11, the World Health Organization declared COVID-19 a pandemic—the first such declaration since the swine flu in 2009. As infections and deaths soared, governments around the world have taken unprecedented measures—including lockdowns and quarantines, school and business closures, and travel restrictions—to stem the spread of the pandemic. These measures, together with the spontaneous reactions of consumers, workers and businesses, have caused severe disruptions to activity in many sectors and a sharp global economic downturn. This has been accompanied by record capital outflows from emerging market and developing economies (EMDEs), a collapse in global trade, and a plunge in oil demand.

This chapter takes stock of the consequences of the pandemic for the global economy. Specifically, it addresses the following questions:

- How has the pandemic evolved?
- Through which channels does the pandemic affect the global economy?
- What is the short-term growth impact of the pandemic?
- What are the likely long-term growth implications of the pandemic?

Contributions. This chapter makes several contributions to a rapidly growing literature on the macroeconomic effects of the pandemic. First, while extensive analysis of the effects on advanced economies is widely available, work on the pandemic's impact on EMDEs has thus far been very limited. This chapter provides the first comprehensive overview of the effects of the pandemic on EMDEs, highlighting the features that make these economies more vulnerable than advanced economies. Second, while much recent analysis has been devoted to the short-term implications, with forecasts for this year and next, this chapter also analyses the long-term macroeconomic effects of the pandemic. Third, the chapter presents, for the first time, a systematic synthesis of the copious literature developed over the past few decades on the macroeconomic effects of past disease outbreaks, including epidemics and pandemics.

Main findings. The chapter reports several novel findings.

- *Evolution of the pandemic:* While outbreaks in most advanced economies appear to be abating, the pandemic is rapidly spreading across EMDEs, including low-income countries (LICs), where health care systems have very limited capacity.

Note: This chapter was produced by a team led by M. Ayhan Kose and Franziska Ohnsorge and including Carlos Arteta, Alistair Dieppe, Justin-Damien Guenette, Alain Kabundi, Sergiy Kasyanenko, Sinem Kilic Celik, Gene Kindberg-Hanlon, Patrick Kirby, Hideaki Matsuoka, Yoki Okawa, Cedric Okou, M. Rudi Steinbach, Dana Vorisek, and Shu Yu. Research assistance was provided by Hrisyana Doytchinova, Maria Hazel Macadangdang, Vasiliki Papagianni, and Heqing Zhao.

- *Severe short-term impact.* The pandemic, the widespread restrictions put in place to stem it, and the spontaneous reactions of many consumers and producers have already caused a deep global recession. Along with the public health crisis, EMDEs are facing tighter financing conditions, plunging oil and other commodity prices, sharp declines in remittances, and collapsing international trade.

- *Magnifying short-term weakness.* Many EMDEs entered this global recession less well-prepared, and with larger vulnerabilities, than when they were hit by the last global recession in 2009. EMDEs that are most vulnerable to the impact of the pandemic include those that have weak health systems, that rely heavily on global trade or tourism, that are vulnerable to financial disruptions, and that depend on oil and other commodity exports. The recession will prolong a decade of disappointing growth for EMDEs.

- *Persistent damage in the long run.* COVID-19 and the resulting recessions engulfing vast swaths of the developing world will leave lasting scars, eroding productivity and potential output for extended periods. The long-term damage will be particularly severe in economies that suffer financial crises, and in energy exporters because of plunging oil prices. In the average EMDE, over a five-year horizon, a recession combined with a financial crisis could lower potential output by almost 8 percent while, in the average EMDE energy exporter, a recession combined with an oil price plunge could lower potential output by 11 percent. The pandemic is expected to exacerbate the weakness in productivity growth and private investment that were features of the past decade.

- *Aggravating long-term challenges.* Recessions associated with the pandemic will likely have an even larger impact on long-term growth prospects because of pre-existing vulnerabilities, fading demographic dividends and structural bottlenecks, and permanent changes in behavior patterns, including consumption habits, and human capital formation. In most years during the past decade, EMDE growth fell short of its long-term average. This was reflected in repeated downgrades to long-term growth projections for EMDEs. The pandemic is expected to exacerbate the multi-decade trend slowdown in potential output growth and productivity growth.

- *Policies.* While the immediate priorities of policymakers are to address the health crisis and moderate the short-term economic losses, the likely long-term consequences of the pandemic highlight the need to forcefully undertake comprehensive reform programs to improve the fundamental drivers of economic growth.

Spread of the pandemic

Outbreak. As of May 22, more than 5.2 million cases of COVID-19 have been confirmed globally, alongside about 340,000 deaths attributed to the disease. Although the number of confirmed cases represents just 0.07 percent of the global population, cases continue to rise rapidly in most countries, including in EMDEs (Figure 3.1). Reported cases may be significantly lower than the number actually infected, given the sparseness of testing in some countries (Bendavid et al. 2020; Hortaçsu, Liu, and Schwieg 2020; Barro, Ursúa, and Weng 2020).

Comparison with previous pandemics. The COVID-19 pandemic is the latest in a long series of epidemics and pandemics during the twentieth and twenty-first centuries. These have included Ebola in West Africa (2014-15), MERS in the Middle East (2012), swine flu (2009-10), SARS in East Asia (2002-03), Hong Kong flu (1968-69), Asian flu (1957-58) and Spanish flu (1918-19). Preliminary estimates suggest that COVID-19 may be considerably more infectious than many of these diseases, but not among the most deadly for those infected (Figure 3.1).

Influenza pandemics during the past century are estimated to have infected around one-quarter to one-half of the global population, although these estimates are highly uncertain (Annex 3.1; Van

Kherkove et al. 2013). Previous coronavirus outbreaks, SARS and MERS, are estimated to have been significantly less contagious than COVID-19; they resulted in approximately 8,000 and 2,500 worldwide cases, respectively (Wilder-Smith, Chiew, and Lee 2020). In some historical episodes, prophylactic measures were taken to reduce the spread of the diseases, but on a much smaller scale than the measures implemented to counter COVID-19.[1]

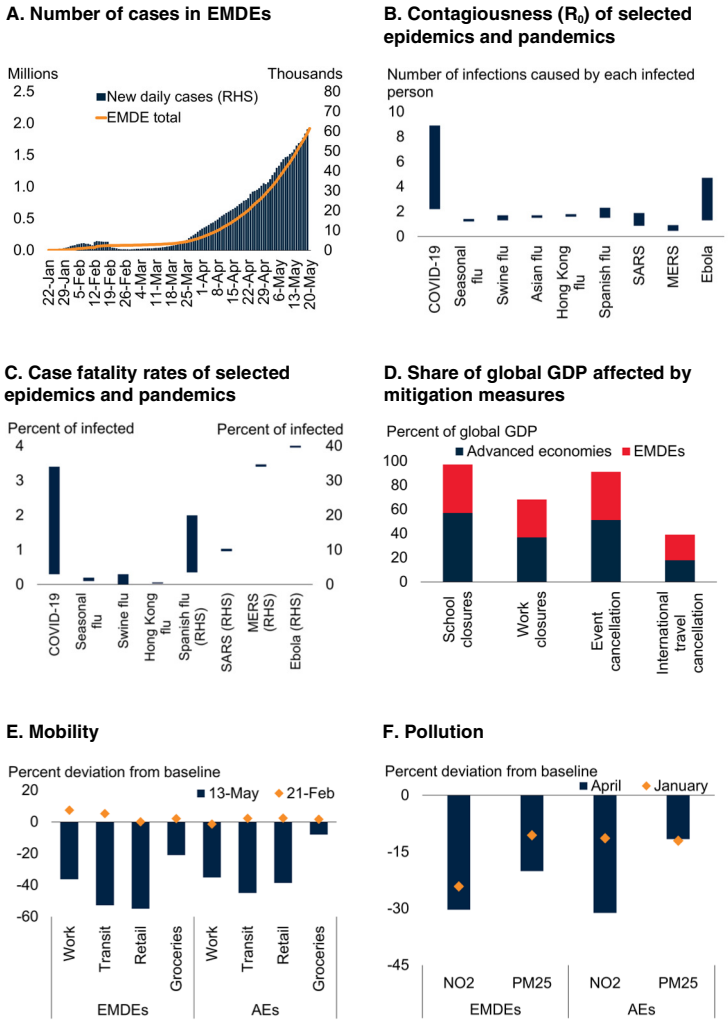
Estimates of COVID-19 fatality rates are currently in flux, in part due to uncertainties over the true number of cases: they have ranged from 0.3 to 3.4 percent, with many of the higher estimates likely to have been biased upwards due to shortfalls in testing and the presence of unrecorded asymptomatic cases (Rajgor et al. 2020). This range is lower than estimates of fatalities resulting from the Spanish flu, which is estimated to have killed 50-100 million people during 1918-19, with case fatality rates of 3.5-20.0 percent (Johnson and Meuller 2002; Spreeuwenberg et al. 2018). The range of estimates of COVID-19 case fatality rates is closer to estimates for the Asian and Hong Kong flus. These pandemics are estimated to have had case fatality rates of approximately 0.01 percent (Li et al. 2008; Wang and Nguyen Thi 2013).

Mitigation measures. Restrictions and voluntary actions taken to stem the pandemic, including social distancing, have helped to lower the infection rate and thus to delay, and lower, the peak number of infections (Eichenbaum, Rebeloz, and Traband 2020; Ferguson et al. 2020). A key part of the policy response to COVID-19 has been the implementation of restrictions on people's movements and economic activity of unprecedented scope and scale, beginning in China and extending to most countries (Figure 3.1). By end-April, nearly 150 countries had closed schools and mandated cancellation of events, and more than 80 had closed all workplaces. Travel restrictions were widespread.

[1] During the Spanish flu, for example, only 6 percent of cities in the United States declared general business closures, while 82 percent of U.S. states issued statewide stay-at-home orders in 2020 (Hatchett, Mecher, and Lipsitch 2007).

FIGURE 3.1 The COVID-19 pandemic and mitigation measures

The global number of infections has been growing rapidly. Many countries, accounting for almost all of global GDP, have put in place mitigation policies that restrict school, work, public gatherings and events, and travel. Reflecting a near-halt to much of economic activity, indicators of mobility as well as air pollution have declined.



Source: Air Quality Open Data Platform; Biggerstaff et al. (2014); Centers for Disease Control and Prevention; Cobos et al. (2016); Coburn et al. (2009); Dawood et al. (2012); Google's *Mobility Tracker;* Johns Hopkins University Coronavirus Resource Center; Johnson and Mueller (2002); University of Oxford COVID-19 Government Response Tracker; Raigor et al. (2020); Sanche et al. (2020); Taubenberger (2006); UN *World Population Prospects*; Van Kerkhove et al. (2013); WHO Ebola Response Team (2016); World Bank, World Development Indicators; Yi et al. (2020).

A. Seven-day rolling average of daily new cases. Sample includes 154 EMDE. Last observation is May 20, 2020.

B.C. Range of estimates from the literature.

C. Confirmed cases are estimated number of those with symptoms for seasonal flu, swine flu, and Hong Kong flu; confirmed cases for SARS, MERS, and Ebola; and total infections for Spanish flu.

D. Figure shows share of GDP accounted for by economies with restrictions. Restrictions are counted if required (i.e., not only recommended) and, for school and work closures, if applied across all levels and sectors, respectively. Travel restrictions are counted if they entail a ban on arrivals from all regions or a total border closure. Data is for April 1, 2020. Sample includes 125 EMDEs and 34 AEs.

E.F. GDP-weighted averages (at 2010 prices and market exchange rates).

E. Based on data from Google's Mobility Tracker. Weekly averages for weeks ending May 13 and February 15.

F. Baseline is defined as daily average for same month in 2015-19. NO_2 = nitrogen dioxide; PM2.5 = particulate matter with diameter less than 2.5 micrometers. Based on daily data from Air Quality Open Data Platform. GDP-weighted monthly averages for January and April.

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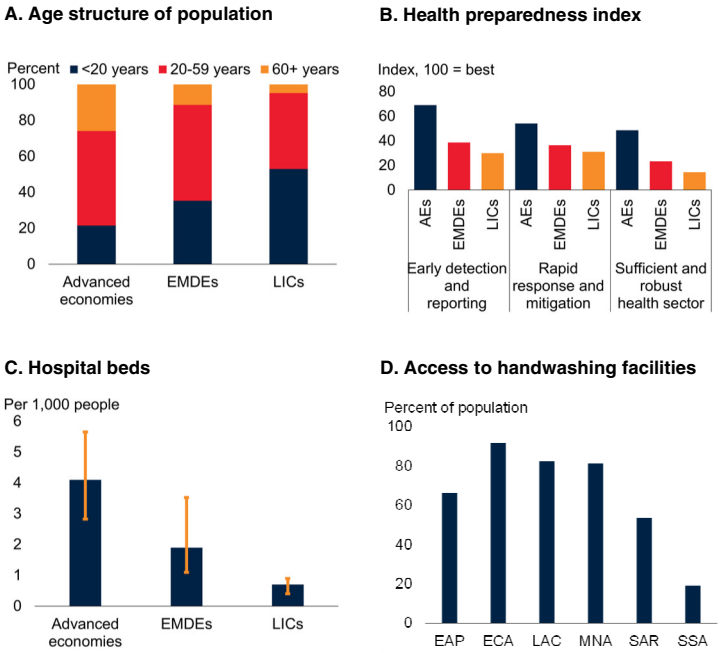
FIGURE 3.2 Health vulnerabilities in EMDEs

EMDEs, with generally younger populations, might be better placed to limit fatalities from COVID-19 than advanced economies. However, EMDEs also tend to have poorer clinical care, are less prepared to manage health crises, and their populations have less access to safe water and sanitation.



Source: Johns Hopkins University and Nuclear Threat Initiative, Global Health Security Index; UN *World Population Statistics*; World Bank, World Development Indicators.
A. Population-weighted averages. Data for 2020. Sample includes 37 advanced economies and 143 EMDEs, of which 29 are LICs.
B. "Early detection and reporting" reflects countries' capacity for detecting and reporting epidemics of potential international concern; "Rapid response and mitigation" reflects their ability to respond to and mitigate the spread of an epidemic; and "Sufficient and robust health sector" reflects the capacity of health sectors to treat the sick and protect health workers. Data reflects 2019. Sample includes 31 LICs, 123 EMDEs, and 35 advanced economies. EMDEs exclude LICs.
C. Bars denote medians. Whiskers indicate first and third quartile ranges. Data for 2015 or closest available year (earliest 2010). Sample includes 36 advanced economies and 155 EMDEs, of which 31 are LICs.
D. Bars denote medians. EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, SSA = Sub-Saharan Africa. Data for 2017 or closest available year (earliest 2015). Sample includes 154 EMDEs.
Click here to download data and charts.

EMDE-specific considerations. One feature of COVID-19 is that its lethality has been highest among the elderly (CDC 2020). This may help lower the case fatality rate in EMDEs, including LICs, which typically have younger populations. The proportion of the population older than 60 years is 11 percent, on average, in EMDEs, and only 5 percent in LICs (as well as in Sub-Saharan Africa more broadly), compared with 26 percent in advanced economies (Figure 3.2). However, EMDEs generally are less prepared for epidemics and have poorer public health and medical care systems than advanced economies, making the likelihood of recovery from COVID-19 lower should medical attention be needed. The median LIC, for instance, has less than one hospital bed per 1,000 people—compared to more than four in the median advanced economy. Finally, a higher proportion of the population of EMDEs live in informal, crowded housing conditions where access to clean water and sanitation services is limited, making the hygiene and physical distancing measures needed to contain the virus impractical or impossible (Corburn et al. 2020).

The economics of the pandemic: Shocks and spillovers

COVID-19 is the most adverse peacetime shock to the global economy in a century. Demand for goods and services has been severely curtailed, while at the same time supply has fallen sharply, as the number of people working has declined and the cost of doing business has risen. The shock has caused unprecedented disruptions to global trade, travel, and tourism; stress in global financial markets; and sharp declines in commodity prices.

Demand shortfalls. While the measures taken by governments, consumers, and firms to reduce social interaction have been critical to slow the spread of the virus, they have entailed significant disruptions to economic activity. A substantial share of private consumption requiring social interaction was lost in the first half of the year. Reduced consumption of goods and services has been one of the main drivers of lost output in a range of model-based estimates of the effects of pandemics (Annex 3.1). Investment has also been curtailed, not only by difficulties in maintaining production and construction but also by sharply weaker growth prospects, rising financing costs, eroding confidence, and increased uncertainty.

Supply disruptions. Air travel, schools and universities, restaurants, theaters, sports venues, and other facilities servicing masses of people have been largely closed down. Labor supply has declined, because of restrictions on movement and human interaction, illness of workers and family members, and school closures (Keogh-Brown et al. 2010; Kilbourne 2004). Workers able to work at

home have in many countries been encouraged or instructed to do so, but fewer jobs can be undertaken remotely in EMDEs than in advanced economies, partly because of more limited internet connectivity (ILO 2020). In some advanced economies, such restrictions as quarantine requirements on the entry of temporary foreign workers have been threatening agricultural production. Delays in input deliveries and limited access to financing, which have been exacerbated by the increased reliance on global value chains, have been causing operational challenges for firms. Over the longer term, workplace closures and quarantines can limit the diffusion of new technologies and knowledge, with lasting damage to productivity.

Global spillovers to EMDEs. These adverse demand and supply shocks have resulted in cross-border spillovers to EMDEs through multiple channels—real channels, including disruptions in global trade, supply chains, travel, and tourism; and financial channels, including sharp declines in remittance flows and large capital outflows amid a flight to safety in March. Commodity prices have been depressed by the sharp decline in demand and, with oil the most affected. These cross-border spillovers have been amplified by plunging confidence and rising uncertainty.

Initial impact: Economic activity, financial and commodity markets

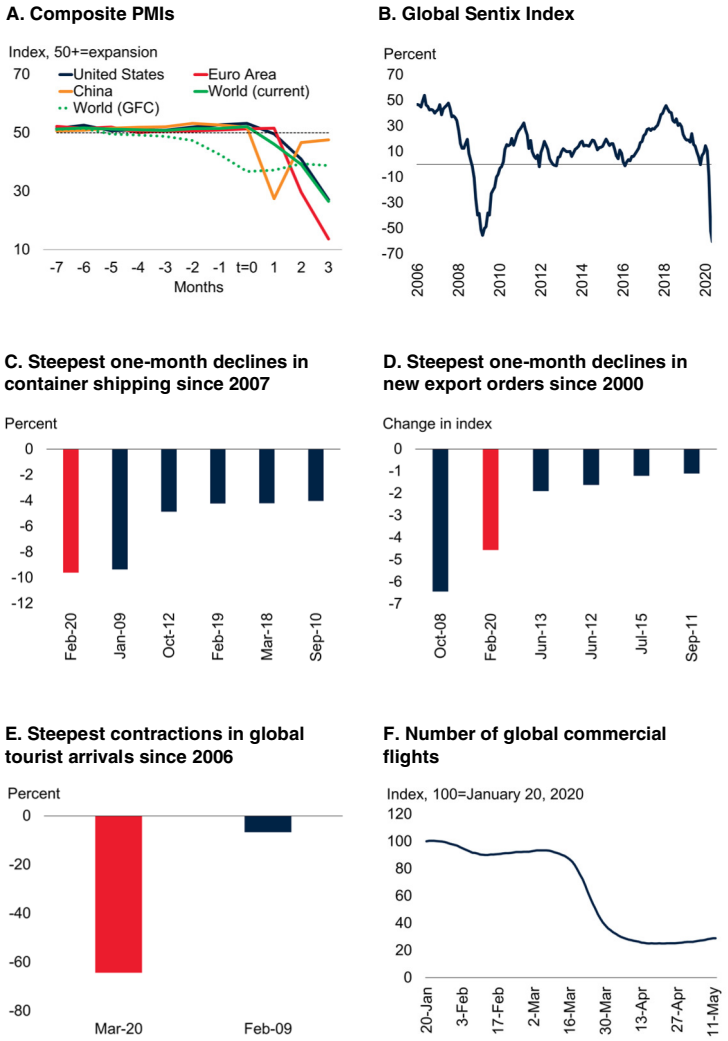
Consistent with the gravity of the shocks and spillovers discussed above, recent data point to substantial disruptions in global activity and trade, a sharp tightening of financial conditions, and a severe decline in commodity prices (Chapter 1).

Global activity and trade

Data released in the first half of 2020 point to a severe global recession. The global composite PMI—a gauge of worldwide manufacturing and services activity—sank deep into contractionary territory to a record low of 26.5 in April (Figure 3.3). Along with the implied sharp drop in output, global trade has also contracted significantly. The new export orders PMI stood at 35.3

FIGURE 3.3 Indicators of economic activity and international trade

The recent decline in global economic activity is one of the steepest and deepest on record. Purchasing managers' indexes have fallen sharply in major economies and global sentiment has plunged. Global trade indicators, such as container shipping and the new export order component of PMI, experienced historically large falls in February. Air traffic volumes have fallen to a fraction of early 2020 values.



Source: flightradar.com; Haver Analytics; Institute of Shipping Economics and Logistics; J.P. Morgan; Sentix GMBH; World Bank.

A. PMI = Purchasing managers' index. GFC = global financial crisis. PMI readings above (below) 50 indicate expansion (contraction) in economic activity. For World (GFC), t=0 at November 2008, the lowest value over the period 2007-2009. For all other data, t=0 at January 2020. Last observations are April 2020 for the Euro Area and March 2020 for China, the United States, and the world. Percent balance of sentiment on the current economic situation. Last observation is April 2020.

B. Figure shows percent balance of sentiment on the current economic situation. Last observation is May 2020.

C-E. Consecutive months not shown.

C. Data only available from 2007. Figure only considers dates that are at least six months apart.

D. Data only available from 2010. Figure only considers changes that are accompanied by declines below the threshold of 50, which indicates a contraction, and dates that are at least six months apart.

E. Year-on-year growth. Monthly data only available from January 2005. Sample includes 22 advanced economies and 29 EMDEs.

F. Figure shows a 7-day moving average. Commercial flights include commercial passenger flights, cargo flights, charter flights, and some business jet flights. Last observation is May 12, 2020.

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in April, deep in recessionary terrain. Its 11-point fall from March was the steepest on record and considerably steeper than at the onset of the global financial crisis, during the Euro Area crisis (2010-13), or during the recent period of trade tensions (2018-19).

With international travel restricted and internal travel discouraged in most countries, global tourism and travel have been severely curtailed. So far this year, tourist arrivals declined by nearly 100 percent among reporting countries. Globally, the number of commercial flights is down about 70 percent since the beginning of the year.

Disruptions to production and international transport have increased the risk that critical inputs will be unavailable, potentially leading to cascading production shortfalls in global value chains. Manufacturers' stocks of purchases have fallen, while suppliers' delivery times have lengthened. Industries reliant on "just-in-time" inputs from global value chains and lean inventories have been particularly affected. In the automobile sector, a collapse in demand, combined with production and delivery challenges, has led to a precipitous plunge in sales worldwide.

Global financial conditions

Global equity markets fell sharply as the pandemic spread across the world. Within a week of reaching an all-time high in mid-February, the S&P 500 index in the United States experienced its fastest decline since October 1987, and stock markets in other major economies experienced declines of similar magnitude. The VIX volatility index more than quadrupled in March before settling at about double its February value in mid-May.

Flight to safety resulted in a sharp tightening of EMDE financing conditions (Chapter 1). Net portfolio outflows from EMDEs during each of the last three weeks of March were the three largest on record (Figure 3.4).

More recently, global risk sentiment improved in May amid large-scale liquidity injections by major central banks and a gradual relaxation of lockdown measures in some countries. Capital outflows from EMDEs have subsided and equity market valuations have retraced a share of their earlier losses. Nonetheless, financial conditions remain fragile for many EMDEs. Remittance inflows to EMDEs are expected to collapse in 2020 across EMDE regions (World Bank 2020b). Foreign aid flows may also shrink in 2020 as donors focus on supporting their own economies (UNCTAD 2020).

Commodity markets

As a result of the sharp decline of global commodity demand, the prices of most commodities have fallen steeply, particularly those used in the transport industry. Benchmark oil prices have been most affected, with the European Brent spot price plunging by 85 percent between late January—when the first human-to-human transmissions of the virus were announced—and its trough in late-April and the WTI price briefly trading at negative levels, before a gradual recovery in May. The decline in oil prices in March was the largest one-month price plunge on record (Figure 3.4; Chapter 4). The restrictions implemented to control the outbreak have resulted in sharp declines in travel and transport—which account for two-thirds of oil consumption—and in other energy-using economic activities. Oil demand is expected to fall by about 20 percent in the year to the second quarter of 2020 and an unprecedented decline of 9 percent is projected for the year as a whole.

Industrial metals prices declined by 24 percent between late January and late April—more than one-quarter as much as they did at the peak of the global financial crisis. With some exceptions, agricultural commodity prices have experienced only minor declines since January, reflecting their less direct relationship with economic activity (World Bank 2020a). While stocks-to-use ratios of most grains are at near-record highs, concerns about food security as a result of the pandemic have grown as countries have announced export bans (for example, Russia for wheat, Vietnam for rice) or "excess" buying (for example, Philippines for rice, Egypt and Saudi Arabia for wheat). Although most of these announcements have thus far not resulted in policy action, such action could

result in localized food price spikes despite ample global supply (Voegele 2020). Disruptions to supply chains have already affected the exports from some EMDEs of perishable products such as flowers, fruits, and vegetables.

Short-term growth impact

The global economy was confronted by the pandemic when it was on a weak footing. Since the 2009 global recession, growth in all country groups had fallen short of pre-crisis and long-term averages in most years. And, in 2019, the global economy delivered its weakest growth performance in the past decade.

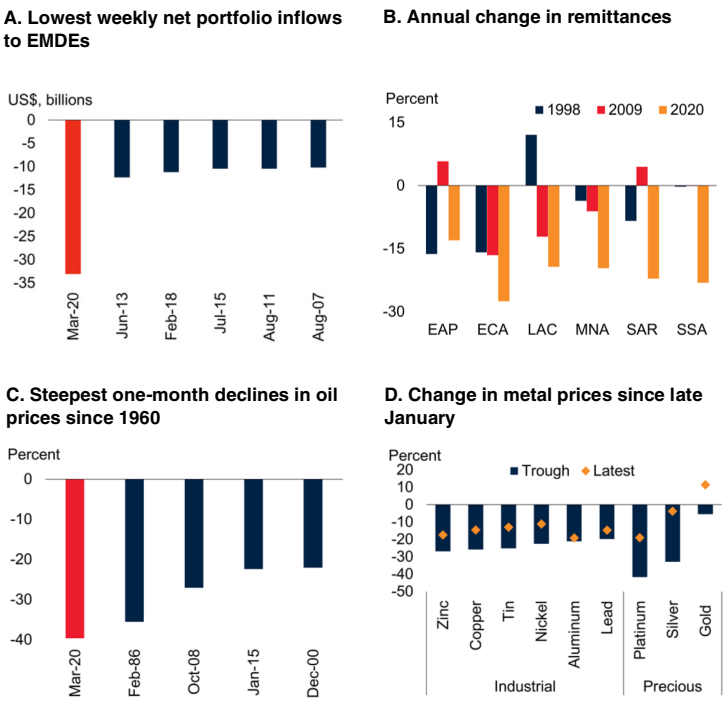
The global economy is now experiencing a deep recession. Its severity and duration will depend on a wide range of factors, including the intensity and duration of restrictions to stem the pandemic, global spillovers from developments in major economies, the ability of policymakers to prevent financial market stress and protect firms and households hurt by the recession, the behavior of the virus, and the success of medical and other scientific advances to contain it.

Previous studies have analyzed the roles of some of these factors in driving short-term growth outcomes, through multiple channels, in the context of the Spanish flu or a hypothetical pandemic influenza. They have found initial GDP losses in the range of 1-8 percent (Annex 3.1).[2] However, these studies do not take into account the effects of restrictions of the kind used to stem the current pandemic, which reflect their unprecedented nature. Taking them into account would be likely to increase estimates of short-term economic losses substantially (Eichenbaum, Rebelo, and Trabandt 2020).

Although subject to considerable uncertainty, studies that do take account of containment measures, as well as other channels for the pandemic's economic impact, have found that EMDEs could suffer output losses of 3-8 percent in the short term, in line with simulations in previous studies of the effects of severe pandemics (IMF 2020; World Bank 2020c). Some studies report that containment measures significantly increase the economic costs of COVID-19.[3] Restrictions on retail, travel, and other service industries could reduce output by 25 percent in

FIGURE 3.4 Financial and commodity market conditions

Net portfolio outflows from EMDEs were the largest on record in March. Across all EMDE regions, remittances in 2020 are expected to suffer larger declines than during the global financial crisis or the Asian financial crisis. Most commodity prices have fallen since January, with oil prices in March experiencing their largest one-month fall since at least 1960. Base metals prices have also declined amid weak industrial demand, while a sharp fall in platinum prices reflects the use of the metal in the automobile industry. In contrast, gold prices have risen on heightened uncertainty and safe-haven demand.



Source: Bloomberg; Dealogic; Institute of International Finance; World Bank.
A.C. Consecutive months or weeks not shown.
A. One-week sum of net daily purchases of EMDE stocks and bonds by non-residents (published by International Institute for Finance) for 20 EMDEs. Data available from 2005. Chart only considers dates that are at least six weeks apart.
B. Data exclude China. Figure for 2020 is a forecast. Orange bar for ECA is for 1999 – after the Russian financial crisis. EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, SSA = Sub-Saharan Africa.
D. Trough shows largest fall in prices relative to January 20th. Latest shows the change in price between January 20, 2020 and May 20, 2020.
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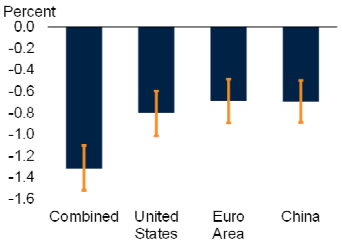
[2] See Barro, Ursúa, and Weng 2020; Burns, van der Mensbrugge, and Timmer 2006; McKibbin and Sidorenko 2006; and Verikios et al. 2011.

[3] For example, in a stylized model for the United States, consumption falls by 22 percent under "optimal" containment measures, compared to just 7 percent if only the effect on labor supply owing to illness and mortality and consumer behavior is considered (Eichenbaum, Rebelo, and Trabandt 2020).

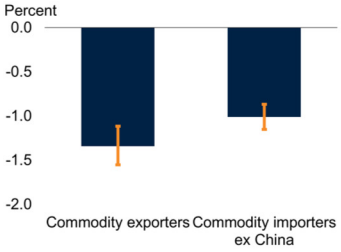
FIGURE 3.5 EMDE growth response to growth slowdown in major economies

A steep growth slowdown in advanced economies and China is expected in 2020, which will generate considerable adverse spillovers for other EMDEs, especially the ones most open to global trade, including commodity exporters, and with less resilient policy frameworks.

A. Response of EMDE growth (excluding China) to a 1 percentage point growth slowdown in the United States, Euro Area, and China



B. EMDE growth response, by commodity exporter status



Source: World Bank.
A. "Combined" stands for GDP-weighted average (at 2010 market exchange rates and prices) of GDP growth in the United States, China, and the Euro Area. Figure shows impulse response of growth in EMDEs excluding China after one year to a 1 percentage point growth slowdown in the United States or China or in all three of these economies simultaneously. Estimates are based on the methodology discussed in Annex 3.2, replacing the "Combined" aggregate with the United States, the Euro Area, and China (in this order).
B. Response of GDP-weighted average (at 2010 market exchange rates and prices) real GDP of groups of EMDEs to a 1 percentage point decline in GDP-weighted average real GDP of United States, Euro Area and China as proxy for global growth, based on impulse responses from the structural vector autoregression described in Annex 3.2. Blue bars show median estimates, yellow whiskers show 16-84 percent confidence intervals. Commodity exporter status as defined in Table 1.2.
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OECD economies during the enforcement period (OECD 2020a).

Spillovers

EMDEs face a perfect storm of both domestic shocks (health crises, restrictions to promote social distancing) and external shocks (plunging trade, collapsing tourism, capital outflows, falling commodity prices). Most immediately, the domestic shocks may well be more disruptive to economic activity than the external shocks. However, the external shocks are likely to also leave a damaging legacy beyond the control of EMDEs. The growth slowdown in the world's major economies, uncertainties about economic policy, and financial market volatility are also expected to weigh heavily on short-term output and investment growth in EMDEs.

The uncertainties surrounding economic policies in the major advanced economies alone would already weigh on investment. Both in the United States and in the Euro Area, economic policy uncertainty is currently at record highs. In the past, such uncertainty significantly lowered EMDE investment. For example, a doubling of the U.S. or Euro Area economic policy uncertainty index (approximately the rise thus far in 2020) has been associated with 6 percentage point weaker investment growth in EMDEs and in EMDEs in Europe and Central Asia, respectively, over the following year (World Bank 2017a).

More broadly, the world's three largest economies—the United States, the Euro Area, and China—are expected to experience sharp economic downturns. It is not expected that any of these three economies will return to pre-pandemic output levels in the short term, before the end of 2021. Since, together, these economies account for almost half of global GDP, this implies important adverse spillovers to EMDEs. A 1 percentage point growth slowdown in the United States or the Euro Area alone has been estimated to lower growth in EMDEs (excluding China) by 0.8 and 0.7 percentage point, respectively, in the following year (Annex 3.2; Figure 3.5). A similarly-sized growth slowdown in China alone could lower growth in other EMDEs by 0.7 percentage point in the following year and, because China accounts for a large part of global commodity demand, would set back growth in commodity-exporting EMDEs by considerably more (Huidrom et al. 2020; Ahmed et al. 2019). Were growth in all three major economies to slow simultaneously by 1 percentage point, growth in EMDEs other than China would be 1.3 percentage points lower in the following year.

The impact of a slowdown in all three major economies would likely be more pronounced in EMDEs that are more open to global trade, finance and commodity markets (Figure 3.5).[4] For example, over the course of one year, growth would slow one-third more in commodity-exporting EMDEs than in commodity-importing

[4] These estimates are based on a Bayesian vector autoregression (Annex 3.2).

ones if growth in the three largest economies slowed by 1 percentage point.

Vulnerabilities: Magnifying the short-term impact

The impact on individual EMDEs will depend on country-specific factors, including vulnerabilities to external and domestic stresses and the ability to provide income support or policy stimulus. These vulnerabilities generally refer to conditions that increase the likelihood or severity of economic or financial stress when downside risks materialize.

Evolution of vulnerabilities

During the last global recession, in 2009, many EMDEs were able to implement large-scale countercyclical fiscal and monetary policies. They were in a position to stimulate activity because they could draw on sizable fiscal and monetary policy buffers accumulated during the pre-recession period of strong growth: government debt had fallen, current account and fiscal deficits had narrowed, and inflation had moderated.

These EMDEs had more resilient economies and, with more forceful stimulus, experienced milder growth slowdowns (Ruch 2019a).

Today, the average EMDE is less well placed to respond to a global downturn than before the 2009 global recession. EMDEs are more vulnerable to external shocks, in part because of larger debt, the trend weakening of demand for commodities, and slower underlying domestic growth. Softening external demand and trade disputes among major economies have also chipped away at an important engine of growth. At the same time, weaker fiscal positions make it more difficult for these economies to support activity with expansionary fiscal policy.

The evolution of vulnerabilities over time is captured in an index that aggregates 20 commonly used vulnerability indicators, grouped into five broader categories of economic vulnerabilities: financial, fiscal, trade, tourism, and poverty (Annex 3.3; Figure 3.6). Both for commodity-importing and commodity-exporting EMDEs, financial and fiscal vulnerabilities have grown since 2007, with particularly large deteriorations in fiscal vulnerabilities in commodity-importing EMDEs. In contrast, commodity-importing EMDEs have scaled back their openness, and corresponding vulnerability, to global trade and tourism since 2007. However, island states that rely heavily on tourism have seen a small increase in their exposure to this sector since 2007. With regard to poverty, commodity exporters continue to have sizable vulnerable population groups, with limited savings and recourse to finance and typically reliant on informal sector activity. While these vulnerable groups tend to be smaller in commodity-importing EMDEs, they have not shrunk there since 2007.[5]

Vulnerable EMDEs

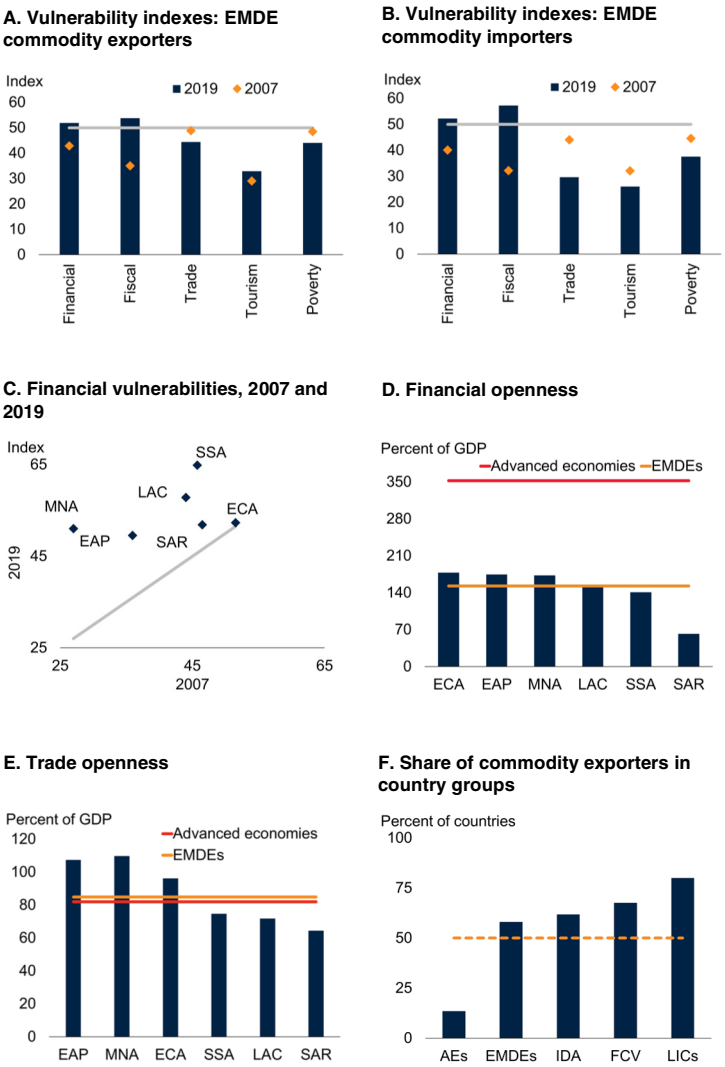
The large capital outflows and steep increases in borrowing costs that have occurred since the beginning of the pandemic are hurting most severely those economies that have large financing requirements; falling commodity prices are hurting the economies that rely most heavily on resource sectors for export and fiscal revenues; and the collapse of foreign demand is hurting most the economies that are most open to trade and tourism. Countries with weak public health and medical care systems, high levels of informal economic activity, and vulnerabilities to food insecurity may face the most disruptive macroeconomic, social and poverty impacts.

Weak public health and medical care systems. EMDEs with weak public health infrastructure and limited capacity to treat the sick will tend to experience higher mortality rates and larger labor supply disruptions as a result of the pandemic. Low- and lower-middle-income economies tend to suffer particularly large economic losses from epidemics as a result of lower-quality health care and poorer population health (Fan, Jamison, and Summers 2018; McKibbin and Sidorenko 2006). COVID-19 mortality is greatly higher among populations with pre-existing chronic health problems. Many EMDEs have limited medical

[5] In the average LIC, 48 percent of the population is poor and another 26 percent is near-poor, compared with 13 percent of the population in each category in other EMDEs (World Bank 2020e).

FIGURE 3.6 EMDE vulnerabilities

Financial and fiscal vulnerabilities have increased in all regions since 2007. Some EMDEs are particularly open to trade, exposing them to spillovers from steep recessions in major economies, or are heavily reliant on commodity exports, exposing them to falling commodity prices.



Source: IMF International Financial Statistics, *World Economic Outlook*; Kose et al. (2017); UN *World Population Prospects*; World Bank World Development Indicators.

A.-C. Unweighted averages for EMDEs and EMDE regions. Vulnerability indexes are defined in Annex 3.3. An index above 50 means that, on average, the indicators score worse than the median in a sample of up to 197 countries for 1960-2019.

A.B. Grey lines denote 1980-99 averages.

C. Data points above the 45-degree line indicate greater vulnerabilities in 2019 compared to 2007.

D.E. Unweighted averages across groups. EAP = East Asia and Pacific, ECA = Europe and Central Asia, LAC = Latin America and the Caribbean, MNA = Middle East and North Africa, SAR = South Asia, SSA = Sub-Saharan Africa. Data for 2018.

D. Financial openness defined as the sum of international assets and liabilities in percent of GDP. Sample includes 25 advanced economies (excluding financial centers, such as Cyprus, Ireland, Malta, Singapore, Switzerland, and the United Kingdom) and 80 EMDEs with population over 2.5 million people (excluding offshore centers).

E. Trade openness is defined as the sum of exports and imports of goods and nonfactor services in percent of GDP.

F. Commodity exporters as defined in Table 1.2. AEs = advanced economies, EMDEs = emerging and developing economies, IDA = International Development Association countries, FCV = fragile and conflict-affected countries, LICs = low-income countries.

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care capacity, which even before the outbreak suffered from lack of public funding and underinsured populations. The median LIC has less than one hospital bed per 1,000 people, and the median EMDE just under two, compared with more than four per 1,000 people in the median advanced economy.

Economic structure. Economies that rely heavily on certain sectors are more vulnerable to the adverse macroeconomic effects of the pandemic (Figure 3.6).

- *Service sector dependence.* Demand contractions in sectors that rely heavily on social interactions, such as the travel, accommodation, and restaurant industries, were key drivers of output losses in the SARS and MERS epidemics (Joo et al. 2019; Keogh-Brown and Smith 2008). Many small EMDEs that are heavily reliant on tourism will see a sudden stop in a major source of income and foreign exchange earnings because of travel restrictions, while mitigation measures last.

- *Openness to trade.* EMDEs highly open to international trade or deeply integrated into global supply chains will be hit hard by the collapse in global trade. In several East Asian countries, for example, foreign inputs account for 50 percent or more of domestic exports, making them highly vulnerable to supply chain disruptions.

- *Dependence on commodity exports.* Almost two-thirds of EMDEs are commodity exporters. Because of the decline in prices and demand this year, these economies are experiencing severe contractionary forces. When the pandemic erupted, many commodity exporters already had more limited fiscal buffers to counter a commodity price shock than they had just before the 2009 global recession, as a result of the 2014-16 commodity price plunge (Stocker et al. 2018). Their fiscal balances turned from (cyclically adjusted) surpluses of almost 1 percent of GDP in 2007 to deficits of a similar magnitude in 2018 (Ruch 2019a). The revenue losses stemming from this year's commodity price declines will further

constrain commodity exporters' ability to support their economies with income support or fiscal stimulus.

- *Reliance on labor-intensive sectors.* Many LICs have large shares of labor-intensive production, which require working in close proximity, than higher-income countries. This type of production may suffer large disruptions as a result of social-distancing efforts or missed work due to illness (Smith and Keogh-Brown 2013).

Financial vulnerabilities. EMDEs with large financing needs (including wide current account or fiscal deficits) or large debt burdens are particularly vulnerable to a sharp increase in borrowing cost or more limited access to financing. Between 2007 and 2019, government debt in EMDEs increased by about 11 percentage points of GDP, on average, to reach 55 percent of GDP. Over this period, debt ratios rose in three-quarters of EMDEs and by more than 20 percentage points of GDP in one-third of them. In LICs, following a steep fall between 2000 and 2010, government debt increased to 67 percent of GDP in 2018 (Kose et al. 2020). In EMDEs, fiscal surpluses of more than 2 percent of GDP in 2007, on average, had turned into deficits of 1 percent of GDP by 2019; near-balanced current accounts in 2007 had become sizable deficits (Figure 3.7).

Financial vulnerabilities not only constrain EMDEs' ability to support their economies with monetary and fiscal stimulus; they can also reduce the effectiveness of fiscal stimulus (Huidrom et al. 2019). In addition, the health of public sector balance sheets is an important determinant of the costs of credit for banks and non-financial corporations since they are linked to the sovereign credit rating. In times of stress, sovereign-bank financial linkages can amplify shocks (World Bank 2018). Banks hold sovereign debt to manage their balance sheets and to fulfill regulatory requirements. Losses on these holdings can disrupt financial intermediation. Over the past decade, bank exposures to sovereign debt have increased in EMDEs relative to both GDP and total bank assets (World Bank 2018).

FIGURE 3.7 Fiscal and external positions of EMDEs

The global expansion before the global recession of 2009 helped EMDEs improve their fiscal and external positions. Since 2007, however, fiscal and current account deficits have widened, government debt has risen, and international reserves have declined.

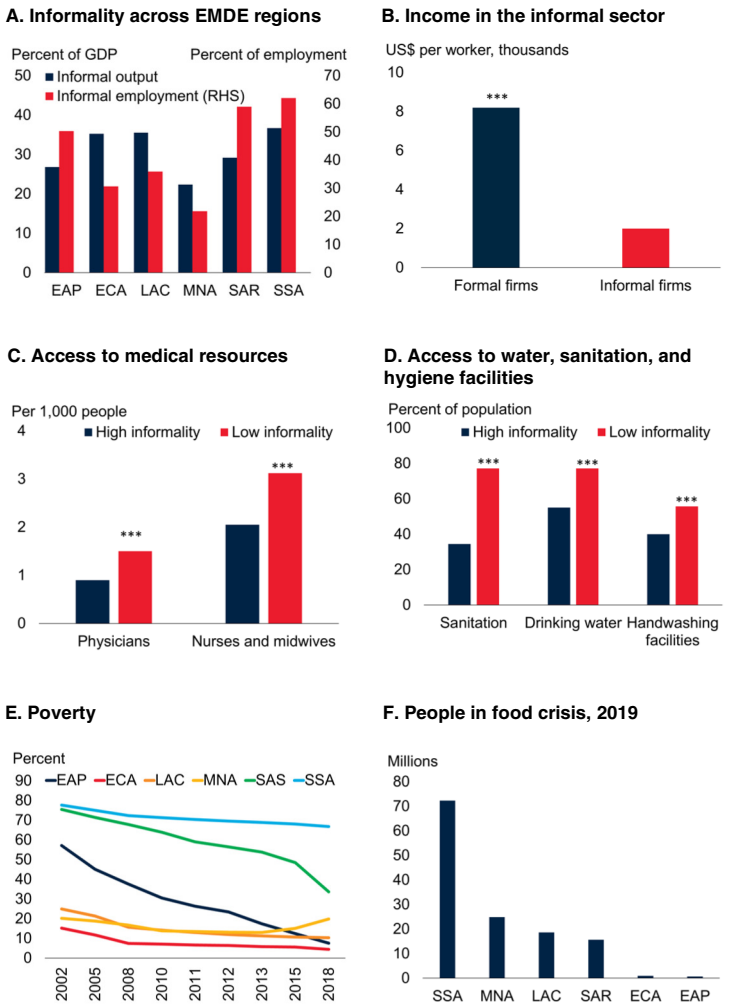
Source: IMF International Financial Statistics, *World Economic Outlook*; Kose et al. (2017); World Bank.
Note: Bars denote unweighted averages. Orange whiskers denote interquartile ranges. Green lines denote 1990-99 averages.
A. Based on data for 149 EMDEs.
B. Based on data for up to 150 EMDEs.
C. Based on data for up to 154 EMDEs.
D. Based on data for up to 130 EMDEs.
Click here to download data and charts.

Informality. The informal sector, on average, accounts for about a third of official GDP and about 70 percent of total employment in EMDEs (World Bank 2019b; Figure 3.8). Pervasive informality is associated with widespread poverty, lack of access to sanitation, lack of access to financial and medical resources, and poor social safety nets—all factors likely to amplify the health and economic impacts of the pandemic.

Poverty. In EMDEs with large numbers of extremely poor or near-poor, populations may not be able to comply with restrictions on economic activity unless the restrictions are suitably designed (Chang and Velasco 2020). The poorest often live in crowded conditions that make social distancing extremely challenging or impossible (Sánchez-

FIGURE 3.8 Informality, poverty, and food insecurity

Informality is widespread in many EMDEs. It is associated with lower incomes and higher incidence of poverty, less access to medical treatment, and poorer sanitation. Even before the pandemic spread to EMDEs, several economies were struggling with the challenges of extreme poverty and food crisis.



Source: Amin, Ohnsorge, and Okou (2019); Elgin et al. (forthcoming); Global Surgery and Social Change (PGSSC) at Harvard Medical School; Haver Analytics; IMF Government Financial Statistics; PovCalNet; WFP (2020); WHO/UNICEF Joint Monitoring Programme (JMP) for Water Supply, Sanitation, and Hygiene; World Bank (Enterprise Survey World Development Indicators); World Bank (2019).
A. Mean of informal output (DGE-based estimates) and employment estimate (share of self-employment) in each region during 2010-16.
A E. EAP = East Asia Pacific, ECA = Europe and Central Asia, MNA = Middle East and North Africa, SAR = South Asia, SSA = Sub-Saharan Africa.
B. *** indicates the group differences between formal and informal firms are not zero at 10 percent significance level.
C.-D. Bars are group means calculated for EMDEs with "high informality" (i.e., the highest one-third DGE-based informal output measure) and those with "low informality" (i.e., the highest one-third DGE -based informal output measure) over the period 2010-16. *** indicates the group differences are not zero at 10 percent significance level.
E. Regional aggregates use a poverty line of $3.20 per day in 2011 purchasing power parity terms.
F. Bars show peak number of people in IPC/CH phase 3 food crisis or worse. "Food crisis" is defined as having food consumption gaps that are reflected by high or above-usual acute malnutrition or being marginally able to meet minimum food needs but only by depleting essential livelihood assets or through crisis-coping strategies. Sample includes 55 EMDEs.
Click here to download data and charts.

Páramo 2020). For example, 70 percent of city dwellers in SSA live in crowded slums where handwashing facilities are sparse and communal and where sanitation is weak (World Bank 2019c). Among the most vulnerable groups are women, which tend to be overrepresented in the informal sector and in services jobs that cannot easily move online (Freund and Hamel 2020). Women employed in the tourism industry and as small-scale farmers are particularly hard-hit (Freund 2020, Freund and Hamel 2020).

Food insecurity. Among the poor, income losses, lack of savings, lack of access to finance, and breakdowns in local agricultural supply chains may all threaten food insecurity. Although global food markets were well supplied at the start of the pandemic, availability of some foods has recently been strained by restrictions on the movement of workers and reductions in air freight capacity (FAO et al. 2020; Pangestu 2020). Restrictions on food exports could further amplify food insecurity (Figure 3.8). In parts of Africa, this could be compounded by the locust infestation currently underway.

Globally, acute hunger could double in 2020, to affect more than 260 million people (WFP 2020). In addition to being a serious health risk, insufficient food supply has the potential to trigger social unrest and conflict, with adverse economic outcomes (Hendrix and Brinkman 2013; Koren and Bagozzi 2016). Food insecurity could also generate significant migration pressure (FAO et al. 2018; Sadiddin et al. 2019).

Long-term growth effects

Prior to the pandemic, the global economy already faced prospects of slower long-term growth, with long-term (ten-year-ahead) growth forecasts having been repeatedly revised down for all country groups since the global recession of 2009. This, in part, reflected a recognition of slowing potential growth in EMDEs, particularly China, over the past decade and reaching into the next decade (Kilic Celik, Kose, and Ohnsorge 2020; World Bank 2018).

In addition to its devastating short-term health and macroeconomic effects, the pandemic may

have significant long-term effects. The substantial economic dislocations, deep output contractions across large numbers of countries, and heightened and wide-ranging uncertainties that have arisen from the pandemic may dampen human and physical capital accumulation. Supply chains and working arrangements in many industries may go through costly reconfigurations. There may also be long-lasting shifts in consumer behavior, including in the composition of spending. Households may also opt for increased precautionary saving in view of heightened uncertainty about employment and income prospects. Both consumer spending and business investment may suffer from sustained declines in confidence. Depressed capital spending would be particularly damaging to long-term growth prospects in EMDEs, coming on the heels of several years of weak investment (World Bank 2019a).

There is little research on the medium- or long-term effects of disease outbreaks on output (McKibbin and Fernando 2020). However, it is well-known that other major adverse economic shocks, such as financial or currency crises, have been associated with persistently negative effects on growth. This suggests that the current pandemic may also leave lasting scars on the global economy by lowering potential output and productivity.

Implications for potential output

Sources of long-term effects. Severe recessions have been associated with highly persistent losses in output in both advanced economies and EMDEs (Box 3.1).[6] These effects arise from various interlinked factors. Low levels of capacity utilization discourage investment and lead to a legacy of obsolete capacity; expectations of weak growth also discourage investment and become self-fulfilling; protracted unemployment causes losses of human capital and reduces job-search activity. All these forces will tend to lower long-run as well as short-run labor productivity.[7]

The current pandemic may be particularly damaging to long-term growth prospects because the disruptions caused by the measures to contain the pandemic call into question the viability of global supply chains that have been a foundation of growth over the past two decades. Productive firms may be disproportionally affected by the disruptions because they are more likely to export, are embedded in complex value chains and employ workers with firm-specific skills (Didier et al. 2020).

The current global recession has occurred with a severity that is unmatched in eight decades and has been accompanied by sharply tighter financing conditions and a record oil price collapse. These two key features of the current global recession—the higher likelihood of financial crisis and a severe terms-of-trade shock to energy exporters—increase the risk of lasting damage to potential output in many EMDEs.

- *Recessions and financial crises.* The lasting damage of recessions has been more severe when they have been accompanied by financial crises.[8] A range of channels drive this outcome. Financial crises increase liquidity demand and tighten credit conditions more broadly—including for productivity-enhancing technologies embodied in new investment and for research and development spending; they curtail access to bank lending for creative firms; they leave a legacy of obsolete capacity; they trigger self-fulfilling expectations of weak growth; and

[6] For estimates of the impact of contractions on actual output levels, see Ball (2014); Blanchard, Cerutti, and Summers (2015); Cerra and Saxena (2008, 2017); and Martin, Munyan, and Wilson (2015). For estimates of the impact on actual output growth, see Candelon, Carare, and Miao (2016). For estimates of the impact on potential output growth, see Haltmeier (2012) and World Bank (2018).

[7] For technology absorption, see Anzoategui et al. (2016); for the legacy of obsolete capacity, see Nguyen and Qian (2014); for self-fulfilling expectations of weak growth prospects, see Caballero and Simsek (2017); and for human capital loss and reduced job search activity among the long-term unemployed, see Ball (2009); Blanchard and Summers (1987); Hall (2014); Lindbeck (1995); Lockwood (1991); and Reifschneider, Wascher, and Wilcox (2015).

[8] Claessens, Kose, and Terrones (2009 and 2012); Furceri and Mourougane (2012); Mourougane (2017); Queralto (2019); and Reinhart and Rogoff (2014) estimate lasting losses from financial crises and Ball (2014) and Hall (2014) the lasting losses from the global financial crisis. Candelon, Carare, and Miao (2016) and Cerra and Saxena (2008) find longer-lasting losses from banking, debt, or equity market crises than from currency, inflation, or political crises.

BOX 3.1 How do deep recessions affect potential output in EMDEs?

The global economy is currently in the midst of one of the deepest recessions in living memory, which is hitting emerging market and developing economies (EMDEs) hard. Historically, recessions accompanied by financial crises or, in energy exporters, by oil price collapses tend to generate particularly deep and lasting damage to potential output, especially in countries that enter the recession with larger vulnerabilities. The average EMDE is now more vulnerable to financial stress than before the 2007-09 global financial crisis, and the average energy-exporting EMDE remains as dependent on energy exports as before the last oil price collapse in 2014. Under these circumstances, the recessions associated with the COVID-19 are likely to have a severely adverse and lasting impact on potential output. Pro-active monetary and fiscal policies, and structural reforms, could moderate this damage.

Introduction

A deep global recession is underway, of a severity that is unmatched in decades. The world economy is expected to start recovering once the pandemic recedes and restrictions on economic activity are lifted.

However, historically, the setbacks to investment and potential output (the level of output an economy can sustain at full capacity and employment) caused by deep recessions have been long-lasting.[1] Beyond the immediate health crisis, two key features of the current global recession increase the risk of lasting damage to potential output in EMDEs. First, even if financial markets appear to have stabilized for now, tight financial conditions and record-high debt increase the probability of prolonged balance sheet repair or even outright financial crises. Second, oil prices have suffered a record collapse. Today's average EMDE is more vulnerable to financial market stress than before the 2007-09 global financial crisis, with higher government and corporate debt, and wider fiscal deficits. And energy exporters remain as dependent on energy exports as before the last oil price plunge in 2014 (Figure 3.1.1).

Against this backdrop, this box explores the likely impact of COVID-19 on potential output by addressing the question: How do recessions, crises and oil price plunges interact to generate long-term implications for potential growth?

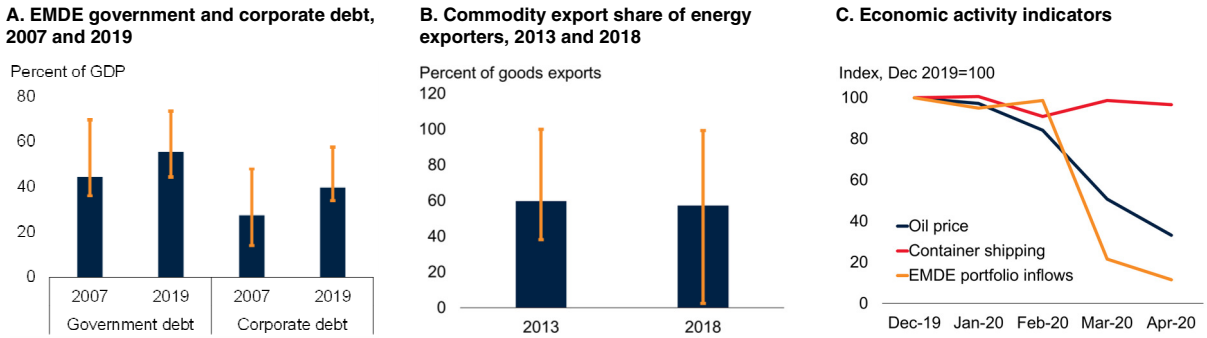
The box builds on earlier work that found that deep recessions lower potential output levels four to five years

Note: This box was prepared by Sinem Kilic Celik, Cedric Okou, and Franziska Ohnsorge, with research assistance from Hrisyana Doytchinova.

[1] Potential output is estimated using a production function approach (Kilic Celik, Kose, and Ohnsorge 2020; World Bank 2018).

FIGURE 3.1.1 EMDE vulnerabilities to financial stress and oil price plunges

Today's average EMDE is more vulnerable to financial market stress, with higher debt and wider fiscal deficits, than before the global financial crisis. Today's average energy-exporting EMDE is as dependent on commodity exports as before the last oil price plunge.

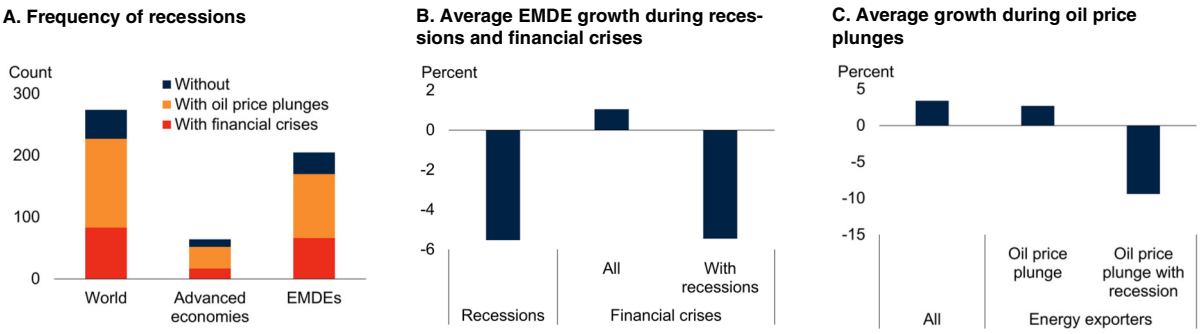


Source: Institute of International Finance; Institute of Shipping Economics and Logistics; International Monetary Fund; World Bank, World Integrated Trade Solution; World Bank.
A.B. Bars show unweighted averages. Whiskers show interquartile range. Based on data for up to 150 EMDEs (A) and up to 27 energy-exporting EMDEs (B).
C. Net portfolio inflows to EMDEs, based on data for 20 economies. EMDE = emerging market and developing economies.
Click here to download data and charts.

BOX 3.1 How do deep recessions affect potential output in EMDEs? *(continued)*

FIGURE 3.1.2 Growth: Recessions, crises, and oil price plunges

In EMDEs, three-quarters of recessions have been accompanied by financial crises or oil price plunges. These tend to be associated with particularly steep output contractions.



Source: World Bank.
Note: Based on a sample of 32 advanced economies and 91 emerging market and developing economies (EMDEs) with available data for potential growth for 1982-2018 (Annex 3.4). Recessions are years with negative growth; in the case of consecutive years with negative growth, the year of output trough is selected. Financial crises are banking, currency, or debt crises, as defined as in Laeven and Valencia (2018). Oil price plunges occurred in 1986, 1990-91, 1998, 2001, 2008, and 2014-15.
B. Unweighted average for EMDE regression sample. Difference between the bars are illustrative and not statistically significant because of wide heterogeneity.
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after the event (World Bank 2018). It extends this work by analyzing the extent to which the long-term impact of recessions differs when they are accompanied by financial crises or oil price plunges.

Impact of recessions with crises and oil price plunges

The COVID-19 pandemic presents a public health crisis. The direct impact of sickness and mortality, and the associated restrictions to stem the pandemic, alone would constitute a major global economic shock. In addition, many EMDEs are facing exceptionally severe economic pressures from financial and oil markets. The 2020 global recession will be extraordinarily deep and prolonged (Chapter 1). To shed light on its implications over a longer time horizon, this section presents evidence on the long-term output cost of severe recessions and how they interact with financial crises and oil price plunges.

Data and methodology. The medium-term impact of recessions on potential output is estimated using a local projections model (Annex 3.4). Recessions are defined as years of negative output growth (see Huidrom, Kose, and Ohnsorge 2016). Financial crises include banking, currency, or debt crises defined as in Laeven and Valencia (2018). Years with oil price plunges are those in which the average of the Brent, Dubai and West Texas Intermediate oil prices plunged by 30 percent or more over a six-month period (1986, 1990-91, 1998, 2001, 2008, and 2014-15).

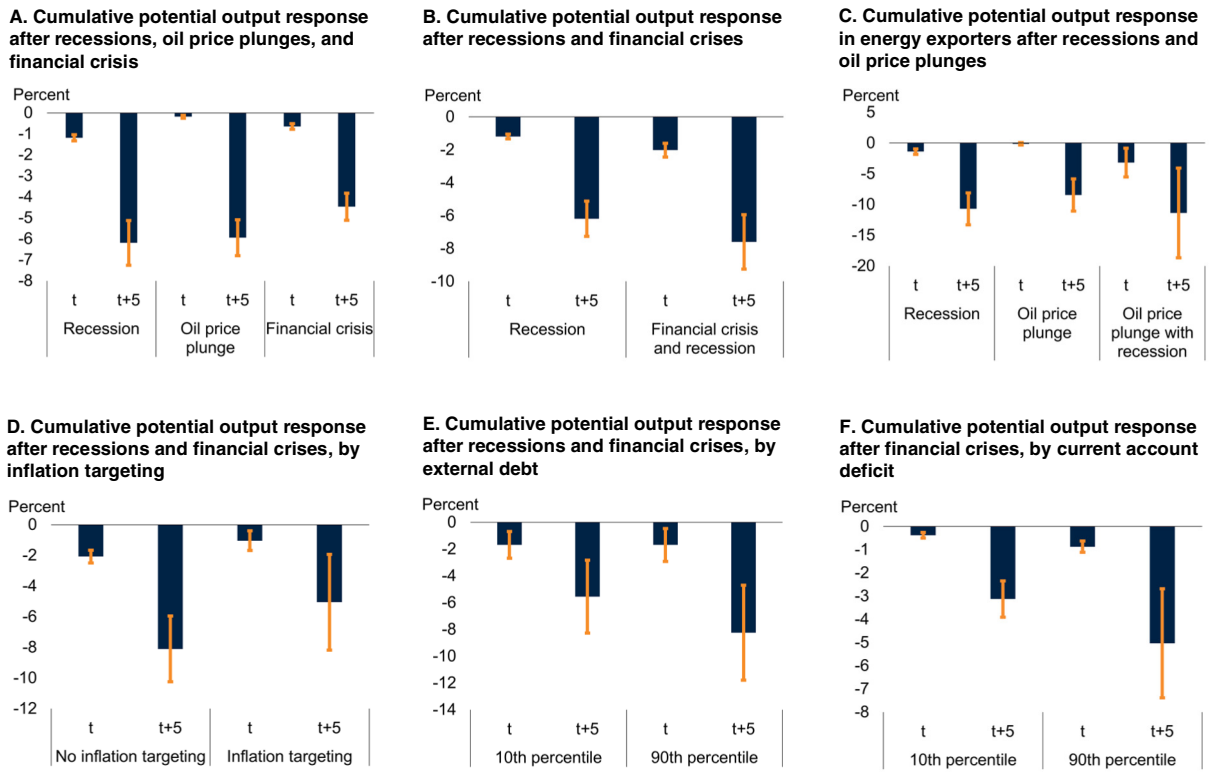
Short-term output losses. In the average year of recession, output declined by more than 3 percent in advanced economies and more than 5 percent in EMDEs. On their own, neither financial crises nor oil price plunges were associated with recessions (Figure 3.1.2). However, when they did accompany recessions, financial crises or oil price plunges were associated with steep output losses.

- *Financial crises.* On average, economies still grew by almost 1 percent in the year of financial crisis and the following year. More than one-half of these events were currency crises, which tend to be associated with milder output losses (Cerra and Saxena 2008; Candelon, Carare, and Miao 2016). Financial crises that did accompany recessions (about 24 percent of financial crises in the sample) were associated with output contractions of more than 5 percent.
- *Oil price plunges.* Oil price plunges were, on average, accompanied by more than 3 percent growth in the same year. Energy-exporting EMDEs historically have had large fiscal buffers, which have allowed them to provide substantial policy support to their domestic economies: their growth averaged more than 2

BOX 3.1 How do deep recessions affect potential output in EMDEs? *(continued)*

FIGURE 3.1.3 Potential output in EMDEs: Recessions, crises, and oil price plunges

Recessions in EMDEs, especially those associated with financial crises or (for energy exporters) oil price plunges, lowered potential output over the medium-term. Potential output losses were lower when countries entered these events with lower external debt or current account deficits, and with an inflation-targeting monetary policy framework.



Source: Ha, Kose, and Ohnsorge (2019); World Bank.

Notes: Data and methodology are detailed in Annex 3.4. Charts show impulse responses for 75 EMDEs from a local projections model. Dependent variable is cumulative slowdown in potential output after a recession, financial crisis, or oil price plunge event. Year t is the year of the event. Bars show coefficient estimates; vertical lines show 90 percent confidence bands.

E. 10th percentile of external debt in EMDEs is 27 percent of GDP; 90th percentile of external debt in EMDEs in 73 percent of GDP.

F. 10th percentile of current account deficit in EMDEs is 1 percent of GDP; 90th percentile of current account deficit in EMDEs is 10 percent of GDP.

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percent in the year of the plunge (Stocker et al. 2018). In cases when oil price plunges were accompanied by recessions (17 percent of recessions in energy-exporting EMDEs), the output contractions in energy exporters were especially deep (about 10 percent).

Medium-term potential output losses. In line with earlier findings, recessions left a legacy of lower potential output for four to five years after their onset. Five years after the average recession, potential output were about 6 percent below baseline in EMDEs (Figure 3.1.3).

Financial crises and oil price plunges alone—including those which were not associated with outright recessions—also tended to be associated with lower potential output over the medium term. Five years after a financial crisis, potential output in EMDEs was about 4 percent below the baseline. Five years after an oil price plunge, potential output in energy-exporting EMDEs was about 8 percent below the baseline.

Recessions that were accompanied by financial crises caused larger long-term potential output losses in EMDEs than recessions without financial crises. Five years after a recession-cum-crisis, potential output in EMDEs remained almost 8 percent below baseline—more than the 6 percent potential output loss following the average recession.

BOX 3.1 How do deep recessions affect potential output in EMDEs? *(continued)*

In energy-exporting EMDEs, oil price plunges that were accompanied by recessions were associated with particularly severe and lasting potential output losses. On average five years after such plunges-cum-recessions, potential output in energy exporting EMDEs remained 11 percent below the baseline.

Effect of policy regimes. Long-term potential output losses are somewhat more modest for countries that enter the recession with fewer vulnerabilities. For example, estimated potential output losses five years after a combined recession and financial crisis were lower in countries that entered the recession with external debt in the bottom decile of the sample than in those that entered it in the top decile of the sample. Similarly, EMDEs with inflation-targeting monetary policy regimes suffered about one-half the potential output losses in recessions and financial crises than countries with other monetary policy regimes. EMDEs that entered financial crises with narrower current account deficits witnessed lower potential output losses after five years.

Conclusions

The immediate policy priority is to address the COVID-19 health crisis. Policies also need to take into account the lasting economic damage from the deep recession triggered by the health crisis. Evidence presented in this box points to two broad sets of priorities to improve growth prospects.

First, since financial crises cause longer-lasting and more severe output losses, EMDEs need to avoid sliding into a financial crisis. Macroprudential policies as well as monetary and fiscal policy support and international assistance are critical to ensure the maintenance of confidence, the stability of lending institutions, and normal flows of credit to households and firms.

Second, oil price plunges cause particularly lasting output losses in energy exporters when they are accompanied by outright output contractions—as will be the case for energy-exporting EMDEs in 2020 (Chapter 1). Once the current crisis subsides, efforts to diversify these economies can help reduce their vulnerability to oil price shocks (Chapter 4). Such measures include ensuring appropriate trade policies that promote diverse exports, infrastructure investment to enable private sector competition, competition regulation to avoid market concentration, and support for innovation through research and development (Ruch 2019b). They also include reforms to establish institutional frameworks for sustainable fiscal and monetary policies. These would help to buffer external shocks and macroeconomic volatility in the short run, and to provide a growth-friendly environment for the long run.

they cause long-term unemployment that leads to human capital loss and reduced job-search activity.[9]

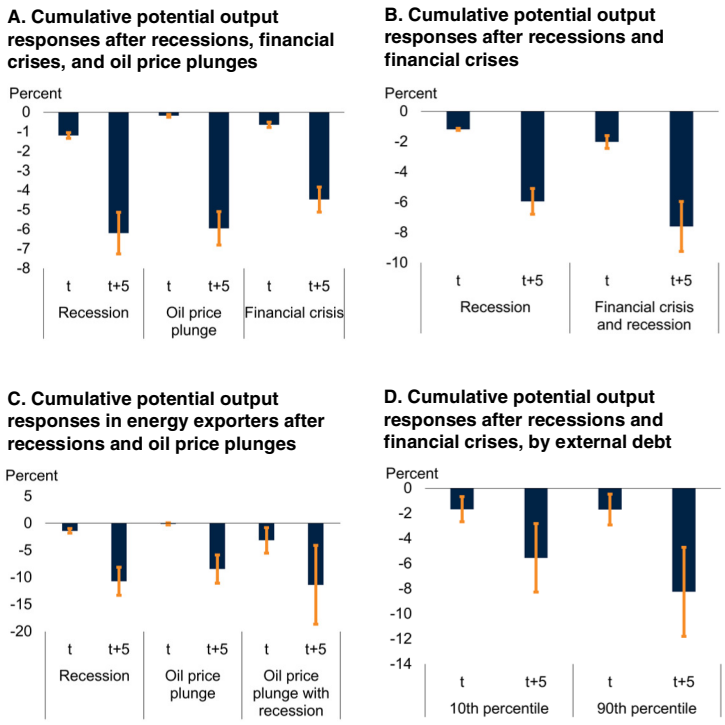
- *Oil price plunges and recessions.* Steep drops in the price of oil have a direct negative impact in oil-exporting economies that magnifies the depth and duration of a recession. They also weigh on global growth in the short-term (Chapter 4). Once the global economic recovery gains momentum, however, the overall effect of lower oil prices, while they are sustained, on global growth may be positive, through increased real incomes, lower inflation and interest rates, and the expansion of energy-intensive activities.

Estimates of potential output impacts. Empirically, recessions were associated with large and lasting potential output losses in EMDEs, especially when accompanied by financial crises. Five years after a recession, EMDE potential output was about 6 percent below baseline and five years after recessions with financial crises, EMDE potential output was about 8 percent below baseline (Box 3.1; Figure 3.9). For energy-exporting EMDEs, recessions accompanied by oil price plunges were particularly damaging: on average, five years after such episodes, potential output in energy exporters was about 11 percent below baseline. These potential output losses were somewhat smaller when economies entered recessions and financial crises with lesser

[9] For loss of access to bank lending for creative firms, see Queralto (2019); for lower labor productivity after financial crises, see Oulton and Sebastia-Barriel (2017); and for lower productivity-enhancing investment, see De Ridder (2016) or, specifically, for R&D spending, see Fatás (2000).

FIGURE 3.9 EMDE potential output and recessions

Recessions have tended to lower potential output in EMDEs over a five-year horizon. Recessions associated with financial crises have tended to reduce potential output by more than those without such crises. Oil price plunges have also significantly lowered potential output in EMDEs over the long term but by less than recessions or financial crises—except for EMDE energy exporters when oil price plunges have been accompanied by recessions.



Source: Ha, Kose, and Ohnsorge (2019); World Bank.

Note: Data and methodology are detailed in Box 3.1 and Annex 3.4. Charts show impulse responses for 75 EMDEs from local projections model. Year t is the year of the event. Dependent variable is defined as cumulative slowdown in potential output after a recession event. Bars show coefficient estimates; vertical lines show 90 percent confidence bands.

D. 10th percentile of external debt in EMDEs is 27 percent of GDP; 90th percentile of external debt in EMDEs is 73 percent of GDP.

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vulnerabilities (e.g., lower external debt, narrower current account deficits) or with more resilient monetary frameworks (e.g., inflation targeting).

Implications for productivity

Productivity growth is the primary source of lasting growth in per capita incomes and living standards, which in turn is the main driver of poverty reduction. The current pandemic is the latest in a string of epidemics and pandemics in the twentieth and twenty-first century (Box 3.2). Pandemics are one of the rarest forms of natural disasters, which also include climate disasters or extreme weather events (such as storms, floods, droughts, and periods of extreme temperature) and geological disasters (such as volcanic eruptions). Evidence from different types of more common natural disasters suggests lasting productivity losses.

Since 2000, there have been several large-scale disease outbreaks, including SARS (2002-03), swine flu (2009-10), MERS (2012-13), Ebola (2014-15), and Zika (2016). These affected over 115 EMDEs and advanced economies. Climate disasters occurred twice as often as all other types of natural disasters combined, accounting for around 70 percent of all natural disasters in 2000-19, but on average they lasted only half as long as epidemics.

Estimates of productivity impacts. Major epidemics have had persistent adverse effects on productivity in the afflicted countries, although without the global reach of the COVID-19 pandemic (Box 3.2). For example, major epidemics that have occurred since 2000—such as SARS, MERS, Ebola and Zika—are estimated to have been associated with 6 percent lower labor productivity in the affected countries after five years (Figure 3.10). This largely reflects a significant erosion in capital deepening: investment was, on average, about 11 percent lower five years after these events, amid heightened risk aversion and uncertainty. The greater global spread and death toll of COVID-19 than these previous epidemics suggest it could have even more costly long-term consequences for productivity.

Unique nature of the pandemic: Magnifying the long-term impact

The deep recessions associated with the current pandemic are likely to leave more permanent economic scars than typical recessions because of lasting effects of the pandemic and related mitigation policies on the behavior of households and firms—effects that will be exacerbated in many countries by pre-existing vulnerabilities (Figure 3.11). The key longer-term dangers to growth include the following:

- *Weak confidence.* Persistently weak confidence could result in a buildup of precautionary savings by households and also more cautious spending by firms, markedly reducing

BOX 3.2 How do disasters affect productivity?

Epidemics that occurred since 2000 are estimated to have lowered labor productivity by a cumulative 6 percent after five years, mainly through their adverse impact on investment and the labor force. In contrast, severe climate events tend to be of shorter duration and reduce labor productivity mainly through weakened total factor productivity. Severe disasters have disproportionately deeper negative effects on productivity partly because they have been more likely to trigger financial stress. Given its global nature, COVID-19 may lead to sizable adverse cross-border spillovers and weaken global value chains, which will further damage productivity. The immediate policy focus is to address the health crisis but policymakers also need to introduce reforms to rekindle productivity growth once the health crisis abates.

Introduction

Prior to the emergence of COVID-19, there were already concerns about the prospects for long-term productivity growth in emerging market and developing economies (EMDEs) and the achievement of development goals, especially the reduction of poverty. COVID-19 has put these goals in even greater jeopardy (World Bank 2020e). In less than half a year since its start, COVID-19 already ranks as a major disaster (Figure 3.2.1). Since pandemics are rare events, this box sheds light on the effects of COVID-19 on labor productivity by examining severe disasters (including epidemics, climate disasters, and wars) since 1960.

Natural disasters (such as biological, climate, and geophysical events), and wars have caused significant economic damage.[1] Past severe disasters (more than 100 deaths per million people) are relevant for gauging the likely effects of COVID-19 on labor productivity and understanding the channels through which disasters may affect the economy. The box examines three questions:

- What are the main channels through which severe disasters affect productivity?
- What are the frequency and extent of severe disasters?
- What are the likely implications of severe disasters for productivity?

Channels through which severe disasters affect productivity

Severe disasters, such as pandemics, epidemics, severe climate disasters, and wars, can affect productivity and long-term growth through supply- and demand-side channels.

Disasters can impact supply through:

- *Depleted labor force and human capital.* Major disasters can disrupt the functioning of labor markets by making it difficult for workers to get to their places of employment or (in the case of infectious diseases) work in close physical proximity with each other, or by causing widespread sickness, injuries and fatalities that directly reduce the labor supply (Field 2019; Ksoll, Macchiavello, and Morjaria 2010; and Mueller 2013). These disruptions undermine the productivity of those remaining in the workforce owing to the loss of complementary skills. Unexpected adverse events that affect large geographic areas have been shown to have lasting consequences on human capital formation (health, education and nutrition outcomes) regardless of the income group.[2]
- *Destruction and misallocation of physical capital.* Severe climate and geophysical disasters tend to reduce and degrade the capital stock, and can lead to a misallocation of capital which can weigh on productivity (Hallegatte and Vogt-Schilb 2019). Disasters more generally can hold back growth-enhancing investment—including by damaging the outlook for activity and profitability, increasing uncertainty, triggering capital flight, and tightening credit conditions (Collier 1999; Hutchinson and Margo 2006). By magnifying economic uncertainty, disasters can also cause a misallocation of investment (Claessens et al. 1997; Claessens and Kose 2017, 2018).
- *Disruption of supply chains and innovation.* Major disasters can damage global value chains.[3] They also

Note: This box was prepared by Alistair Dieppe, Sinem Kilic Celik, and Cedric Okou, with research assistance from Yi Li, Kaltrina Temaj, and Xinyue Wang.

[1] Natural disasters include climate (floods, cyclones), biological (epidemics, insect infestation), and geophysical disasters (earthquakes, volcanoes), and follow EM-DAT definitions.

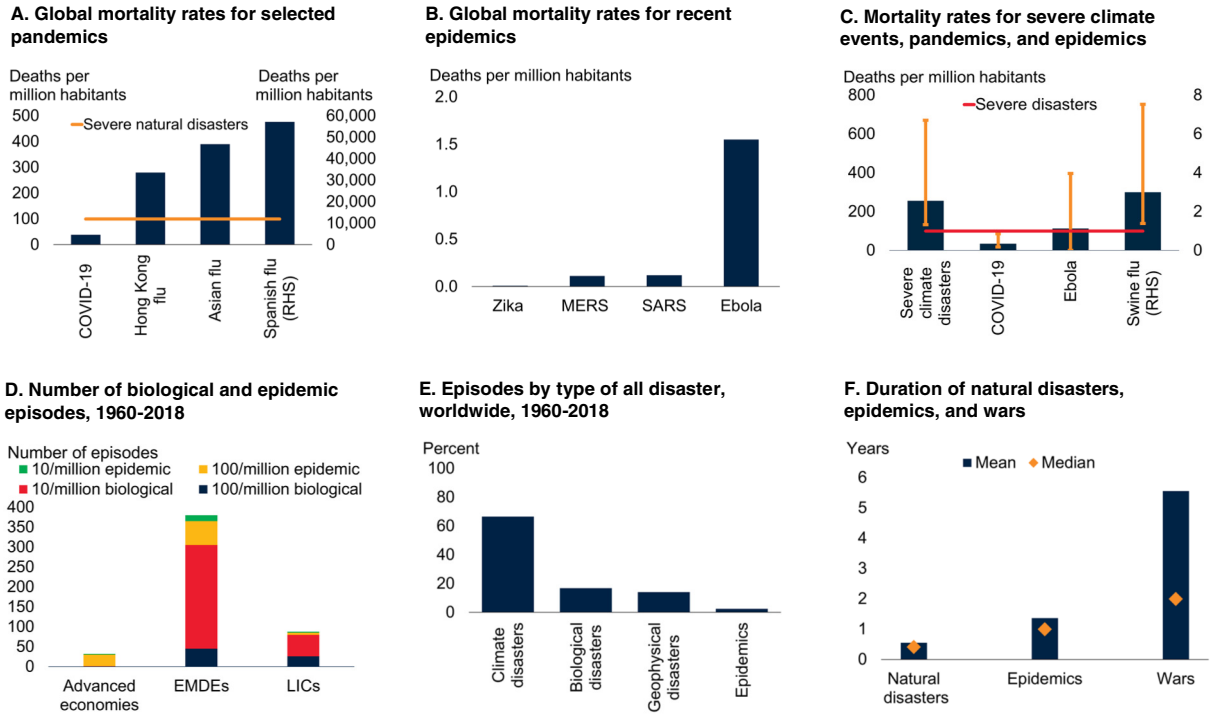
[2] See Acevedo et al. (2018), IMF (2017), and Thomas and López (2015). Biological epidemics can also disproportionally affect low-skilled workers and raise inequality (Furceri et al. 2020).

[3] See Collier (1999), Reynaerts and Vanschoonbeek (2018), and Rodrik (1999).

BOX 3.2 How do disasters affect productivity? *(continued)*

FIGURE 3.2.1 Severity, frequency, and duration of pandemics, epidemics, and climate disasters

In less than half a year, COVID-19 already ranks as a major disaster. In the most severely affected countries, its impact may be as large as those from a severe climate disaster, which typically results in mortality rates of over 100 per million of the population. Climate disasters were the most frequent type of natural disaster in 1960-2018, accounting for nearly 70 percent of all disasters. Epidemics and wars are much rarer although their duration is longer. About 20 percent of biological disasters that have affected EMDEs and LICs have been severe and resulted in death ratios of over 100 per million (0.01 percent) of the population.



Source: Centers for Disease Control and Prevention; Correlates of War; EM-DAT; Johns Hopkins University; OurWorldInData.org; Peace Research Institute Oslo; United Nations; World Bank; World Health Organization.

A.-C. Cumulative deaths per million habitants worldwide. Last observation of death toll for COVID-19 is May 14, 2020. Severe climate disasters are defined as events that led to at least 100 deaths per million population.

C. Blue bars indicate the medians of mortality rates across affected countries. The bottom (top) of the yellow line represents the 1st (3rd) quintile. Red marker indicates 100 deaths per million habitants.

D.-F. Natural disasters include climate (floods, cyclones), biological (epidemics, insect infestation), and geophysical (earthquakes, volcanoes) disasters, and follow EM-DAT definitions. Wars are identified using the World Bank's Correlates of War database. The sample includes 170 economies: 35 advanced economies and 135 EMDEs, of which 27 are low-income countries.

E. Biological disasters include epidemics.

F. The five pandemics and epidemics considered are SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16) .

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undermine the incentives to invest in R&D and new technologies, including by triggering wide-scale institutional dysfunction, weakening property rights, and increasing costs of doing business. Capital outflows tend to be associated with drops in inward foreign direct investment, which can be an important source of technology transfer. Containment efforts during biological events—such as workplace closures and quarantines—can further limit the diffusion of technologies.

Disasters can also impact demand through:

- *Lower business investment.* Short-term projections of demand and economic activity tend to be scaled back and business uncertainty to increase sharply following

BOX 3.2 How do disasters affect productivity? *(continued)*

major disasters, while financial conditions tighten, including in response to increased risk aversion. These typically cause a sharp drop in investment demand. A more prolonged disaster, even at the same magnitude, results in higher uncertainty. This causes firms to delay or deter investments and thereby compounding the negative economic effects of disasters (Bloom 2014; Baker, Bloom, and Terry 2019; and Bloom et al. 2018). The more severe the disaster, the larger the uncertainty (Ludvigson, Ma, and Ng 2020). Model-based estimates by Baker et al. (2020) suggest that increased uncertainty accounts for half of the output loss in the United States in early 2020.

- *Weaker consumer demand.* Job losses, reduced income, increased cost of debt service, higher uncertainty, the forced closure of marketing outlets, and, in the case of diseases, fear of infection, all tend to cause consumers to reduce their spending on goods and services and to increase saving rates. Furthermore, effects on consumer behavior could be long-lasting—for example, a pandemic could cause households to reduce their demand, over an extended period, for travel, tourism, eating out, entertainment, and other activities involving human interaction, and to increase their saving in the absence of close substitutes.

Frequency and short-term effects of disasters

This section briefly reviews the experience of severe disasters over the past 60 years for insights into the main channels through which they impact productivity. Pandemics, epidemics and wars are rare events although they last longer than other types of disasters. Biological disasters and geophysical disasters are more common. Climate disasters (such as storms, floods, droughts, and periods of extreme temperature) occur more often but typically last for less than six months. All these events are associated with weaker productivity over long time spans.

Pandemics. The Spanish flu (1918-19) has an unusually high death toll and mortality rate, killing between 20-100 million people globally. Other, more recent, pandemics had far lower mortality rates. They included the Hong Kong flu (1968-69) and the Asian flu (1957-58), with nearly 300 and 400 deaths per million, respectively. This was followed by swine flu (2009-10), with 11 deaths per million globally (Figure 3.2.1). COVID-19 is the most severe pandemic since the Hong Kong flu, despite the unprecedented mitigation efforts that have been implemented.

Epidemics since the 2000s. During 2000-18, the world experienced SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16). The increased frequency of epidemics increases the likelihood that pandemics will break out. Since 1960, there have been more than 250 episodes of biological disasters with losses of life of over 10 per million population in the countries affected. LICs have been disproportionally affected by these types of disasters, whereas advanced economies were not affected. The frequency of biological episodes has been increasing over time, but they have mostly been contained in size and severity.

Frequent climate disasters. Climate disasters accounted for around 70 percent of natural disasters during 1960-2018, occurring twice as often as other types of natural disasters combined (Figure 3.2.1). However, the frequency of severe climate disasters—defined as causing losses of life exceeding 100 people per million—has stabilized since 2000, perhaps reflecting better mitigation policies in some countries as they have confronted climate change (Figure 3.2.2). Furthermore, climate disasters tend to be short-lived compared to epidemics which on average last twice as long.

Wars. Apart from their direct toll on human life and welfare, wars also have major adverse effects on output and productivity (Abadie and Gardeazabal 2003; Cerra and Saxena 2008). The frequency of wars has dropped over 2000-18, although a typical LIC was twice as likely to experience a conflict as a typical EMDE.[4] The destruction, disruption, and diversion effects of wars can cause sharp reductions in the labor force and physical capital, and also dampen productive investment and innovation.[5]

Damaging severe disasters. Compared to unaffected countries, severe biological disasters are associated with 9 percent lower median labor productivity and 8 percent lower total factor productivity (TFP) three years after the shock (Figure 3.2.2). Severe natural disasters (including climate and biological disasters) also correlate with weaker labor productivity and TFP compared to countries not suffering such disasters. In EMDEs, three years into a

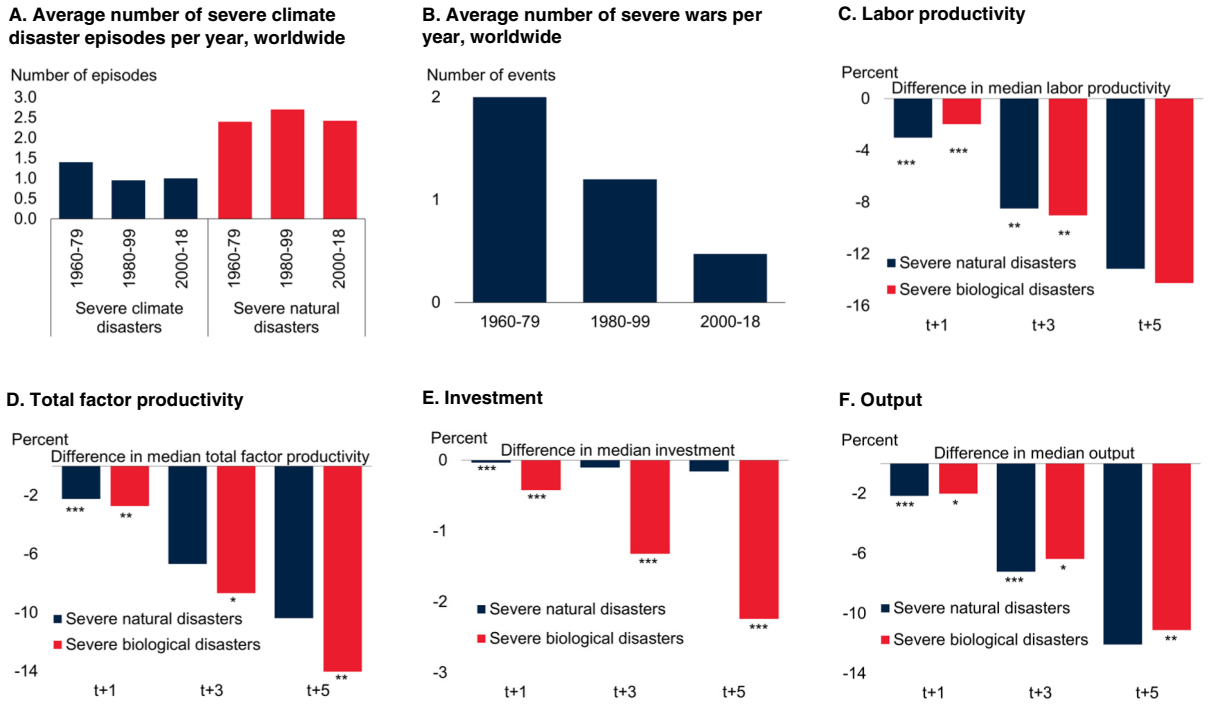
[4] The definition and data for wars are from the Correlates of War database (Singer and Small 1994). The dataset was updated after 2007 using the Peace Research Institute Oslo (PRIO) data (Pettersson, Högbladh, and Öberg 2019). In the database, wars are defined as conflicts with at least 1,000 battle-related deaths.

[5] See Becker and Mauro (2006); Collier (1999); Easterly et al. (1993); Field (2008); Raddatz (2007); and Rodrik(1999).

BOX 3.2 How do disasters affect productivity? *(continued)*

FIGURE 3.2.2 Disasters and productivity

The frequency of the most severe climate disasters stabilized after 2000. In EMDEs, severe natural disasters, especially severe biological disasters, are associated with lower labor productivity. Severe biological disasters are also correlated with lower investment, possibly reflecting a sizable increase in uncertainty that holds off new spending.



Source: EM-DAT; World Bank.

A. B. Natural disasters include climate (floods, cyclones), biological (epidemics, insect infestation), and geophysical (earthquakes, volcanoes) disasters, and follow EM-DAT definitions. Wars include intra-state and external (extra-state and inter-state) wars. Severe climate or natural disasters and severe wars are defined as events that led to at least 100 deaths per million population. The sample includes 170 economies: 35 advanced economies and 135 EMDEs, of which 27 are low-income countries.

C-F. Bars show the difference between the median growth of macroeconomic indicators in EMDEs with and without severe biological disasters (red) and severe natural disasters (blue; including climate, biological, geophysical disasters). A Fisher's test is used to test if medians in two subsamples (with and without disasters) are equal. Severe natural disasters are defined as those that lead to at least 100 deaths per million population. The four biological disasters considered are SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16). Swine flu (2009), which coincided with the 2008-09 global financial crisis, is excluded to limit possible confounding effects. ***, ** and * indicates 1, 5, and 10 percent significance levels.

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severe natural disaster episode median labor productivity was around 8 percent lower in the countries affected, and TFP was 7 percent lower than in countries unaffected whereas investment remained virtually unchanged, which could reflect large-scale reconstruction investment offsetting other negative effects.

Long-term effects of severe disasters

To help draw inferences on the possible effects of COVID-19, this section examines the extent different types of disasters such as epidemics, climate disasters, and wars have lasting negative effects on labor productivity. Epidemics are particularly damaging to productivity, lowering it by between 6 percent and 15 percent (if accompanied with recessions) after five years. Climate disasters weaken productivity by between 4 to 8 percent. Wars also affect productivity for a sustained period.

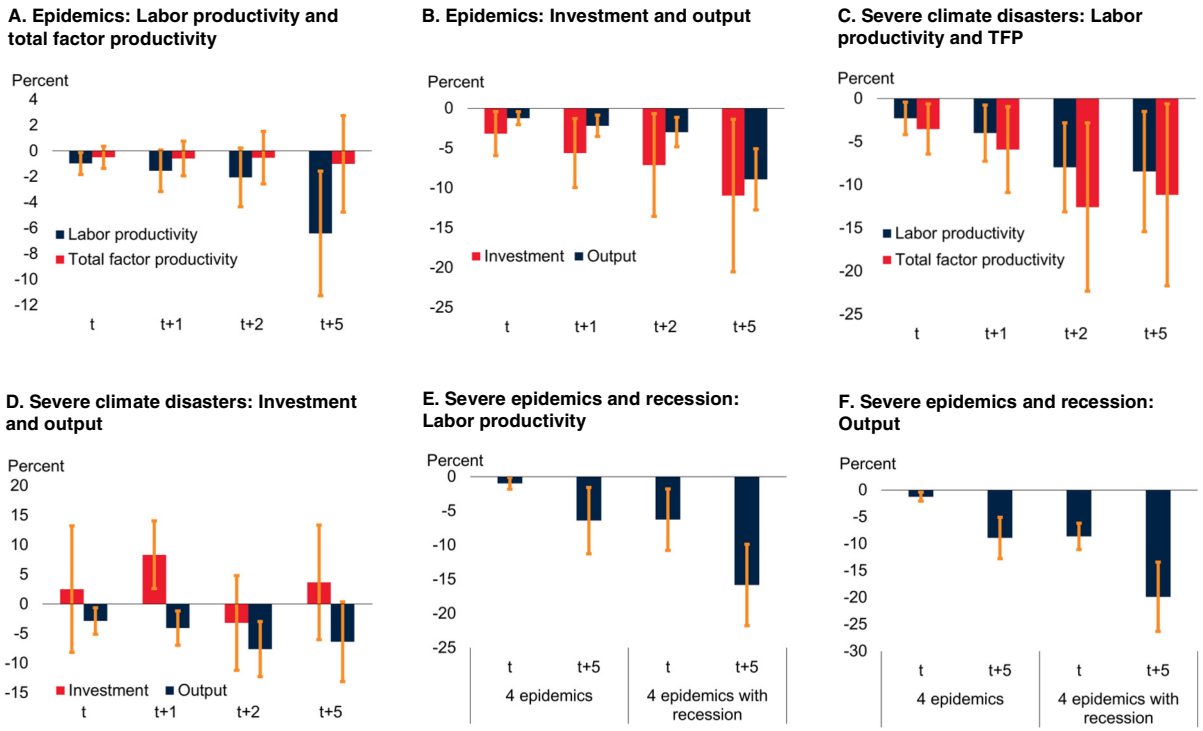
Methodology. The local projection method (LPM) is used to provide a reduced-form estimate of the response of labor productivity to adverse events over various horizons, and to identify key transmission channels through output, investment, and TFP (Jordà, 2005; Jordà, Schularick, and Taylor, 2013).

Adverse effects of epidemics. Results suggest that four epidemics since 2000 (SARS, MERS, Ebola, and Zika)

BOX 3.2 How do disasters affect productivity? *(continued)*

FIGURE 3.2.3 Impact of disasters

Disasters have resulted in considerable losses in output and labor productivity in EMDEs. Severe disasters have larger effects. SARS, MERS, Ebola, and Zika left lasting scars on labor productivity with declines of around 6 percent and larger effects on investment, whereas estimates suggest that total factor productivity hardly declined. The impact of swine flu too was probably large, but impossible to assess because the epidemic overlapped with the 2008-09 global financial crisis. Climate disaster has also led to significant productivity losses, although public and private investment have tended to increase in the short term, reflecting the shorter duration of the shock and reconstruction.



Source: EM-DAT; World Bank.
Note: Orange lines display the range of the estimates with 90 percentile significance.
A.B. Bars show the estimated impacts of the four most severe biological epidemics on output, labor productivity, total factor productivity, and investment levels relative to non-affected economies. The four epidemics considered are SARS (2002-03), MERS (2012), Ebola (2014-15), Zika (2015-16). Swine flu (2009), which coincided with the 2008-09 global financial crisis, is excluded to limit possible confounding effects. The sample includes 116 economies: 30 advanced economies, and 86 EMDEs.
C.D. Bars represents impulse responses of various economic variables to a severe adverse climate event. Severe climate disasters are defined as those that resulted in at least 100 in 1 million population death tolls. The sample includes 116 economies: 30 advanced economies and 86 EMDEs.
E.F. Bars show the estimated impacts of the four most severe biological disasters on labor productivity and output. Orange lines display the range of the estimates with 90 percentile significance. The four epidemics considered are SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16). Swine flu (2009-10), which coincided with the 2008-09 global financial crisis, is excluded to limit possible confounding effects.
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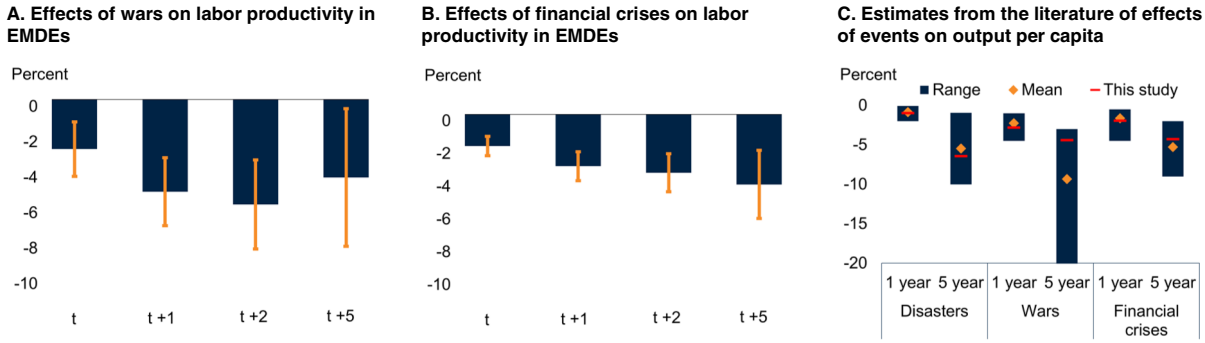
had significant and persistent negative effects on productivity (swine flu is excluded since it coincided with the global financial crisis).[6] These estimates indicate that epidemics led, on average, to a contemporaneous loss of productivity equal to about 1 percent (Figure 3.2.3). After five years, such disasters lowered labor productivity by a

[6] Jordà, Singh, and Taylor (2020) consider major pandemics and find long lasting effects on output. Barro and Ursúa (2008) report that the macroeconomic impact of the Great Influenza Pandemic of 1918 is substantial. Sustained low levels of demand, and excess capacity during disasters, including pandemics, can have persistent effects on productivity (Dieppe, Francis, and Kindberg-Hanlon, forthcoming). Ma, Rogers, and Zhou (2020) focused on the same set of epidemics in 210 countries and found that real GDP in EMDEs is around 2 percent lower, on average, in the first year, and 4 percent lower, on average, after five years. This suggests some uncertainty around the long-run effects.

BOX 3.2 How do disasters affect productivity? *(continued)*

FIGURE 3.2.4 Impact of wars and financial crises on productivity

Wars tend to leave large and persistent productivity losses. Many disasters have been associated with financial crises, which often result in large and persistent losses in labor productivity.



Source: Correlates of War (COW); EM-DAT; Laeven and Valencia (2018); Peace Research Institute Oslo (PRIO); World Bank
Note: Wars include intra-state and external (extra-state and inter-state) wars (COW and PRIO). Financial crisis episodes include banking crisis, currency crisis, and sovereign debt crisis (Laeven and Valencia 2018). Natural disasters include climate, biological, and geophysical disasters (EM-DAT). EMDEs=emerging market and developing economies (including low-income countries), The sample includes 170 economies: 35 advanced economies and 135 EMDEs, of which 27 are low-income countries.
A.B. Blue bars indicate the average impact of the event for each group and orange lines represent the 90 percent significance range.
C. The range of estimates is from the literature.
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cumulative amount of about 6 percent. Over the same horizon, investment declined by nearly 11 percent reflecting heightened uncertainty and risk aversion.

Losses associated with severe climate disasters. In EMDEs, severe disasters (greater than 100 deaths per million) have resulted in considerable losses in output, labor productivity, and total factor productivity. The LPM estimates for climate disasters indicate that labor productivity was lower by 8 percent after five years (Figure 3.2.3, Fomby, Ikeda, and Loayza; 2013). The estimates show that lower labor productivity is mainly accounted for by weaker total factor productivity rather than reduced investment. Possibly because after a severe disaster, firms delay or cancel investment in R&D, which impedes the creation, transfer, and adoption of new technologies and hinders global value chains. On the other hand, reconstruction spending offsets to some extent the negative impact on other capital spending.

The literature finds severe disasters have disproportionately larger economic impacts due to non-linear effects on labor force participation and human capital, particularly amongst younger workers (Cavallo et al. 2013; Hallegatte and Przyluski 2010; Loayza et al. 2012). Furthermore, the cumulative loss of productivity tends to be larger if the disaster lasts for a more extended period—as is the case with biological disasters—or if reconstruction efforts are delayed (Cerra and Saxena 2008; Sawada 2007).[7] Twelve out of around 360 recessions (excluding the 2009 global financial crisis) were associated with severe disasters; 38 were associated with epidemics. In the case of the four major epidemics, the effects associated with recessions are significantly larger on productivity (Figure 3.2.3).[8]

Scarring effects of wars. This is due to the destruction of human and physical capital and reduced total factor productivity. In EMDEs, wars (including internal and external wars) have been especially damaging as they lowered labor productivity by about 4.5 percent after five years (Figure 3.2.4).

[7] The pace of reconstruction may be slowed by financial, physical, and transaction constraints (Hallegatte and Rentschler 2018).

[8] Severe disasters can widen inequalities and exacerbate political tensions in affected countries. Besley and Persson (2011) estimated, for a sample of 97 countries in the period 1950-2005, that severe natural disasters increased the probability of wars by about 4 percentage points. Biological epidemics can also disproportionally affect low-skilled workers and raise inequality (Furceri et al. 2020).

BOX 3.2 How do disasters affect productivity? *(continued)*

Conclusions

The COVID-19 pandemic raises questions about its effects on productivity. Pandemics and epidemics are rare events in comparison to climate disasters and wars, but they have had adverse and persistent effects on productivity. Adverse impacts on productivity increase more than proportionately with the severity and duration of these types of disasters. Severe disasters were lowered labor productivity by 6 percent over the subsequent five years.

The COVID-19 pandemic may have a significantly worse impact on productivity than most previous disasters for three reasons:

- *Global reach.* The COVID-19 pandemic appears to have considerably broader reach—in terms of numbers of both countries and people affected—than other disasters since 1960 (Hassan et al. 2020). The increased integration of the global economy, through trade and financial linkages will amplify the adverse impact of COVID-19.

- *Contagion prevention and physical distancing.* As long as strict social distancing is required, some activities will not be viable. In the hospitality sector, where close socialization is part of the product, the capital stock will become obsolete. Even in less directly affected sectors, severe capacity under-utilization lowers TFP while restrictions to stem the spread of the pandemic remain in place. Disruptions to employment, schooling and other education while restrictions remain in place—or, in the event of severe income losses, even once restrictions are lifted—will also lower human capital and labor productivity (World Bank 2020d).

- *Compounding financial stress.* Financial crises tend to result in especially protracted labor productivity losses (Figure 3.2.4, World Bank 2020f).[9] Larger disasters are more likely to cause a cascade of business and household bankruptcies and hence a systemic financial crisis. Whilst only a few disasters have been associated with financial crises, governments and private sectors entered the COVID-19 pandemic with already-stretched debt burdens (Kose et al. 2020). These have since increased further and heighten risk of a financial crisis should financial conditions tighten further (Ludvigson, Ma, and Ng 2020).

Mitigating factors. In some dimensions, disasters can accelerate productivity-enhancing changes. They can encourage investment in new and more technologically advanced capital and to train more highly skilled workers (Bloom 2014). Moreover, destruction of old capital may lead to new opportunities for green growth with environmentally friendly new investment, especially if it is induced by structural reforms (Strand and Toman 2010). The mitigation measures of COVID-19, including social distancing, may encourage investment in more efficient business practices, including robotics and other digital technologies such as artificial intelligence.[10]

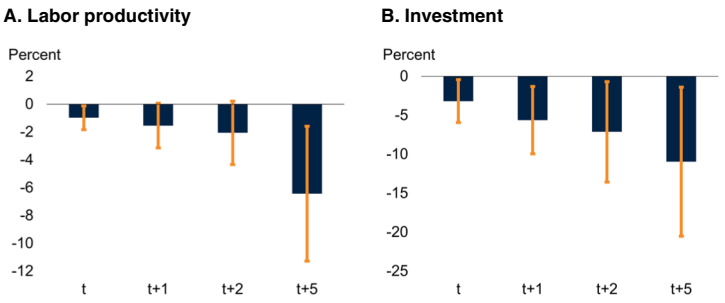
Structural reforms. The negative outlook ahead means that, after addressing the immediate health crisis, countries need to make productivity-enhancing reforms a priority. These include facilitating investment in human and physical capital, as well as in research and development; encouraging reallocation of resources toward more productive sectors; fostering technology adoption and innovation; and promoting a growth-friendly macro-economic and institutional environment (World Bank 2020f). In addition, raising the quality and effectiveness of governance and improving the business climate can encourage a faster rebound from disasters. Governments that improved labor and product market flexibility, strengthened legal systems and property rights, fostered effective competition, and addressed inequality set the foundations for more effective adjustment to adverse events (Anbarci, Escaleras, and Register 2005).

[9] See Benson and Clay (2004); Blanchard, Cerutti, and Summers (2015); Celiku and Kraay (2017); and Cerra and Saxena (2008, 2017). During 1990-2018, the number of financial crises—sovereign debt, banking, and currency—nearly doubled compared to 1960-1989. Over the past three decades, labor productivity growth halved in advanced economies and slowed, albeit less markedly, in EMDEs.

[10] See Hallward-Driemeier and Nayyar (2017); Hsiang (2010); Skidmore and Toya (2002); and Strobl (2011).The accompanying job losses are likely to be lower-skilled and less productive (Lazear, Shaw, and Stanton 2013). To the extent vulnerable groups are particularly exposed to economic losses from disasters, policies to protect these groups are needed (OECD 2020b).

FIGURE 3.10 Productivity and epidemics

Since 2000, severe biological disasters (including SARS, MERS, Ebola, and Zika) have left large and lasting scars on affected economies. On average, after five years, they lowered labor productivity by about 6 percent and investment by about 10 percent.



Source: World Bank.
Note: Bars show the estimated impacts of SARS (2002-03), MERS (2012), Ebola (2014-15), and Zika (2015-16). Orange lines display the range of the estimates with 90 percentile significance. Swine flu (2009-10), which coincided with the 2008-09 global financial crisis, is excluded to limit possible confounding effects. The sample includes 116 economies: 30 advanced economies and 86 EMDEs.
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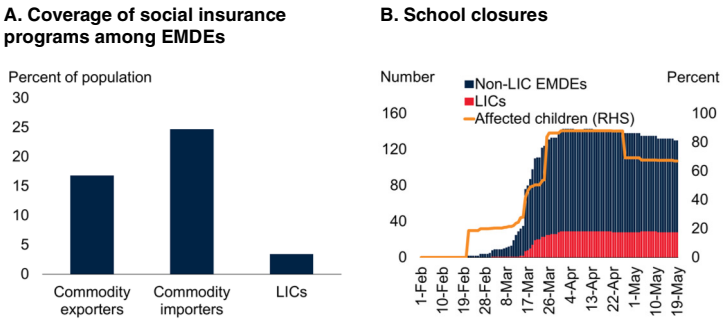
FIGURE 3.11 Factors aggravating long-term costs

The ability of safety nets to cushion income losses varies considerably across EMDEs, and tends to be less in LICs, highlighting the potential for severe welfare losses among the poorest. Prolonged school closures in EMDEs could have lasting implications for human capital accumulation.



Source: UNESCO; World Bank, World Development Indicators; World Bank.
Note. LICs = low-income countries.
A. Aggregates calculated using population weights for the latest available year of data for each country. Sample includes 106 EMDEs, of which 60 are commodity exporters, 46 are commodity importers, and 21 are LICs. Coverage of social insurance programs shows share of population participating in programs that provide old-age contributory pensions (including survivor benefits and disability) and social security and health insurance benefits (including occupational injury benefits, paid sick leave, maternity leave, and other social insurance).
B. Number of countries that have either recommended or required school closings as part of measures to contain the domestic spread of COVID-19. Last observation is May 19, 2020.
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aggregate demand and supply (Bhandari, Borovicka, and Ho 2019; Ilut and Schneider 2014).

- *Changing consumption patterns.* There could be long-lasting changes in consumption patterns motivated by the aim of lowering infection risks (Smith et al. 2014).
- *Erosion of human capital.* The learning disruptions associated with widespread school and university closures, as well as income losses, may cause lasting setbacks to human capital accumulation (UNESCO 2020; Wang et al. 2020).[10]
- *Possible mis-steps in macroeconomic policy management.* Governments in many countries have taken fiscal and monetary policy action on unprecedented scales in response to the pandemic to support demand and activity. Great care will need to be taken when withdrawing this support, as multiple objectives will need to be served, including sustaining the recovery of output and employment, ensuring the sustainability of public debt, maintaining price stability, promoting long-term growth, and ensuring social cohesion.

Conclusion

The COVID-19 pandemic has already taken an exceedingly heavy human toll and ravaged the global economy. Both advanced economies and EMDEs are experiencing an unprecedented combination of public health crises; sharp increases in borrowing costs, especially in EMDEs; a collapse in global trade, travel, and tourism; and a plunge in commodity prices. These shocks have already led to sharp contractions in many economies.

The pandemic is expected to have severe adverse effects on both short- and long-term economic growth. In the short term, the global economy has already begun to experience a deep recession. Many EMDEs will suffer particularly deep downturns because of their substantial vulnerabilities. In the long term, the pandemic

[10] For example, evidence from the Ebola epidemic in West Africa in 2014 suggests that school closures were associated with higher dropout rates and wider gender gaps in educational attainment (UNDP 2015). Large declines in household income are also associated with increased school dropout rates in EMDEs (Glick, Sahn, and Walker 2016).

will weigh on potential output and productivity, especially if financial crises erupt and oil prices remain depressed for an extended period. The pandemic and the accompanying recessions will likely prolong and deepen the multi-decade trend decline in long-term growth prospects.

The exceptional severity of the pandemic and economic collapse raises concerns about the risk of "super-hysteresis": not only a permanent loss of output *levels* but a permanent slowdown in potential output *growth* (Ball 2014). The pandemic could alter the very structures upon which the growth of recent decades was built, since it could cause prolonged damage to global supply chains, global trade and financial flows, and global collaboration.

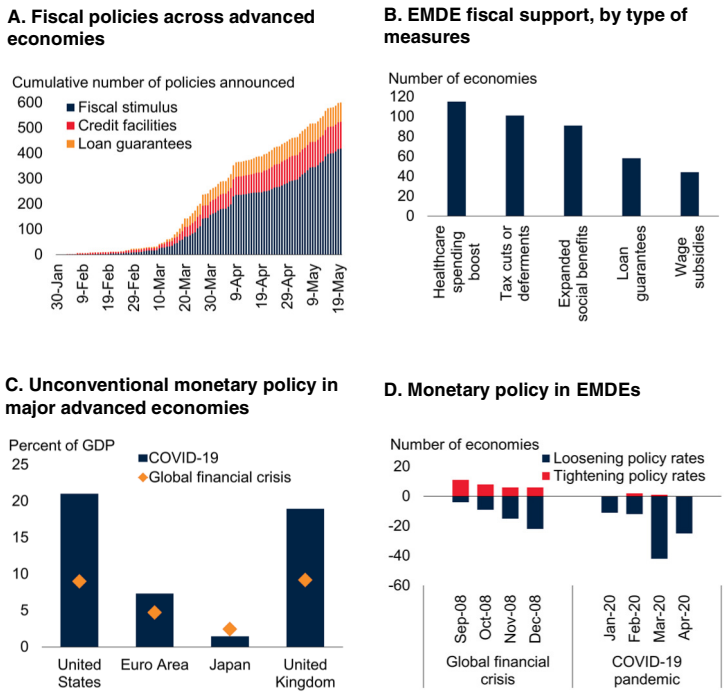
The evolving response to the pandemic has included an extensive menu of policies to dampen the effects of the health crisis, including the short-term economic losses. Many countries have instituted stringent measures to stem the pandemic, including full lockdowns. They have restricted international and domestic travel, closed schools and non-essential businesses, and discouraged work performed other than at home. They have banned, or advised their citizens to avoid, large gatherings. As countries cautiously feel their way toward a gradual reopening of their economies, they face the challenge of rebuilding a healthy economy while at the same time guarding against the threat of a renewed outbreak of the pandemic.

To support their economies through the shutdowns, policymakers have implemented relief programs of an unprecedented scale (Chapter 1; Figure 3.12). The immediate fiscal policy response has included support for health care systems, expanded social benefit programs, and measures to help firms and households. EMDE monetary authorities across the world have eased monetary conditions to support activity and provided emergency liquidity support to stabilize financial markets.

Beyond these short-term policies to confront the current health and economic crisis, the likely long-term implications of the COVID-19 pandemic also highlight the need to lay the foundation for stronger long-term growth. The implication is that for policymakers to be able to fund health systems and support domestic demand through the eventual recovery, they need to credibly undertake comprehensive reform programs to improve institutions and frameworks that can ensure an eventual return to robust growth while setting the stage for stronger long-term prospects. This will require credible fiscal frameworks that ensure that fiscal sustainability will be restored; it will also demand credible monetary policy frameworks that ensure that monetary policy will safeguard low inflation and financial stability. In addition, it will require stronger governance and business environments, and expanding investment in education and public health.

FIGURE 3.12 Fiscal and monetary policy responses

Many countries have implemented unprecedented and wide-ranging fiscal support in the wake of the COVID-19 outbreak, while many central banks have moved quickly to provide accommodation, in many cases beyond levels seen during the global financial crisis.



Source: Bank for International Settlements; Bloomberg; European Central Bank; Haver Analytics; World Bank; Yale Program on Financial Stability.

A. Sample comprises 27 advanced economies and the Euro Area. Last observation is May 20, 2020.

B. Total of measures either planned or under consideration. Contains 147 EMDEs. Last updated May 17, 2020.

C. "COVID-19" reflects recently announced asset purchases and are expressed as a share of 2019 nominal GDP. "Global financial crisis" asset purchases reflect the increase in central bank balance sheets between August 2008 and December 2009 as a share of 2008 nominal GDP.

D. Sample consists of 26 EMDEs.

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As the world emerges from the pandemic, it will also be critical to strengthen the mechanisms for preventing and responding to epidemics before the next one strikes. Less than 5 percent of countries entered this pandemic scoring in the highest tier for their ability to respond to and mitigate the spread of an epidemic (Johns Hopkins University and NTI 2019). Improving these capabilities will require international policy cooperation and coordination, especially given the global reach of such disasters.

ANNEX 3.1 The macroeconomic effects of pandemics and epidemics: A literature review

A growing literature has examined the economic losses from historical and simulated pandemics, taking account of a range of channels, including labor force disruption; a collapse in consumption, trade, and travel; and amplification through confidence and financial market disruptions. These studies have found initial GDP losses that fall in a range of 1-8 percent. However, these estimates generally do not account for containment measures of the scale used during the COVID-19 pandemic, which could significantly increase the economic costs. Other major economic shocks, such as financial or currency crises, have been associated with persistently negative effects on growth, suggesting that there may be long-term scarring effects from COVID-19.

Introduction

SARS-CoV-2 (COVID-19) is the latest in a long series of global disease outbreaks. In just the past century, the world has experienced four influenza pandemics: H1N1 in 1918-19 (Spanish flu), H2N2 in 1957-58 (Asian flu), H3N2 in 1968-69 (Hong Kong flu), and H1N1 in 2009-10 (swine flu). HIV/AIDS, which appeared in the early 1980s, was also eventually classified as a pandemic. In addition, the world has suffered from numerous other disease outbreaks, such as SARS-Cov (Severe Acute Respiratory Syndrome, or SARS) in 2002-03, MERS-Cov (Middle East Respiratory Syndrome, or MERS) in 2012, Ebola in 2014-15 and again in 2018-20, the Zika virus in 2015-16, as well as endemic diseases such as cholera and yellow fever (Table A.3.1.1).

Past pandemics, especially the Spanish flu, have imposed a heavy toll in terms of human lives. The number of fatalities from COVID-19 is rising strongly, and is likely to rise considerably more (Figure A.3.1.1; Atkeson 2020; Ferguson et al. 2020).

Pandemics and epidemics also have significant economic impacts. Even a relatively mild pandemic, in terms of the number of deaths, can generate substantial global output losses in the short term. This annex reviews the relevant literature, addressing the following questions:

- What are the channels through which the global economy is disrupted by pandemics and epidemics?
- What were the economic costs associated with previous pandemics and what do model-based simulations suggest about the costs of pandemics of different severity?
- What are the expected economic costs of COVID-19, based on existing studies?

Channels of economic impact

The macroeconomic impacts of disease outbreaks (epidemics or pandemics) stem from effects on aggregate demand and aggregate supply. Demand-side channels capture the effects on consumption, investment, trade, and travel, while supply channels capture workforce and supply-chain disruptions and the rising costs of doing business.[1]

Demand channels

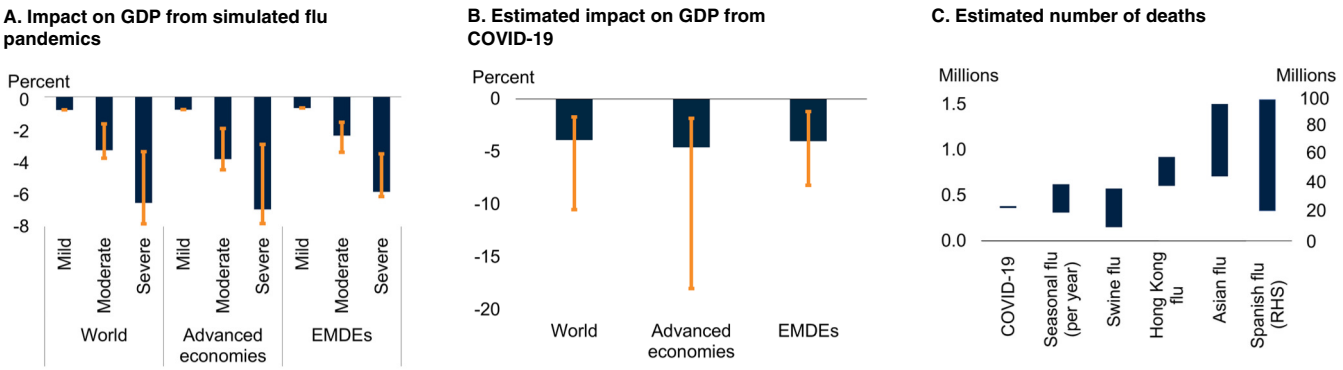
Avoidance, fear, and uncertainty. Infectious disease outbreaks can have a substantial impact on demand as governments, consumers, and firms

Note: This annex was prepared by Gene Kindberg-Hanlon, Yoki Okawa, and Dana Vorisek.

[1] In addition, the supply-side effects can trigger large falls in income which are then magnified by credit constraints and firm failures, reducing demand (Guerrieri et al. 2020).

FIGURE A.3.1.1 Economic impact of pandemics

Model simulations of pandemics of varying severities find that output can be reduced by 2-8 percent in moderate to severe scenarios. The models account for a range of channels affecting the economy, such as work absenteeism, reduced consumption, credit constraints, and financial volatility, but generally do not consider aggressive measures of the sort widely used to contain the COVID-19 pandemic. For this reason, the economic impact of COVID-19 tend to be larger in simulated severe scenarios in recent studies.



Source: Cobos et al. (2016); Dawood et al. (2012); Simonsen (1999); Spreeuwenberg, Kroneman, and Paget (2018); WHO (2018); World Bank.

A. Blue bars show the median of reported GDP shrinkage. Orange lines represent the range of the median estimates of influenza pandemics on first-year (peak impact in all cases) GDP growth from models in McKibbin and Sidorenko (2006); Burns, Mensbrugghe, Timmer (2006); Verikios et al. (2011); and McKibbin and Fernando (2020). In "mild" scenarios, the mortality rate is 2.2 per 10,000 population. In "moderate" scenarios, the mortality rate is 20-50 per 10,000 population. In "severe" scenarios, the mortality rate is 90-110 per 100,000 people.

B. Blue bars show the median reported GDP shrinkage. Orange line represents the range of the simulated impacts of COVID-19 on first-year GDP growth from Baker et al. (2020b); Breisinger et al. (2020); IMF (2020); McKibbin and Fernando (2020); and World Bank (2020b). Baseline estimates from IMF (2020) are changes in forecasts in April 2020 from January 2020. Baker et al. (2020b) and Breisinger et al. (2020) are estimates for only the United States and Egypt, respectively.

C. Number of cumulative daily infections from first day when infections exceeded 100. Data for COVID-19 is as of May 22, 2020.

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take actions to limit contagion. In some cases, this effect may be magnified by uncertainty. SARS, for example, triggered a substantial reduction in travel, consumption, services exports (including tourism), and even investment, despite causing just 800 deaths. Consumer spending patterns have shifted dramatically during the COVID-19 pandemic. In the United States, the magnitude of changes in spending has been linked to both the severity of local outbreaks, which creates heightened avoidance of contagion risk, and to controls imposed at the city and state level, which halt many normal activities (Baker, Farrokhina et al. 2020). Heightened uncertainty may also be reflected in financial market stress. The market volatility from COVID-19 has been severe. Risk spreads on borrowing costs have widened sharply. Many EMDEs have experienced capital flight. Previous infectious disease outbreaks have had qualitatively similar effects on financial markets (Ma, Rogers, and Zhou 2020).

Supply channels

Labor force effects. Illness and preventive measures to reduce contagion during infectious disease outbreaks reduce available labor supply and labor productivity in the short run, while loss of schooling and job experience, as well as mortality, can have persistent effects. In past pandemics, illness and absences to care for family members reduced labor supply more than mortality (Kilbourne 2004; McKibbin and Sidorenko 2006).[2]

Business closures and supply chain disruptions. Business costs are likely to increase during a pandemic as measures are taken to protect employees and the general population, and closures can exact an even greater toll. Empirical assessments of disease outbreaks have found that high-exposure service sectors, such as travel, accommodation, and food services, are hardest hit during pandemics, even when few restrictions or closures were imposed (Joo et al. 2019; Siu and Wong 2004). Manufacturing can be deeply affected by supply chain disruptions. In some CGE-based estimates of the economic costs of pandemics, rising business costs in affected sectors

[2] In addition, over the long term, the loss of human capital due to fatalities during the outbreak can result in long-term output losses (Fan, Jamison, and Summers 2018).

TABLE A.3.1.1 Estimated mortality and infection rates of pandemics during the past century

	Spanish flu	Asian flu	Hong Kong flu	Swine flu	COVID-19
Period	1918-19	1957-58	1968-69	2009-10	2020
Deaths (% of global population)	1.0-5.7	0.03-0.05	0.02-0.03	0.001-0.004	0.004
Infections (% of global population)	28	42-55	30-57	24	0.07

Source: Cobos et al. (2016); Johnson and Mueller (2002); Johns Hopkins University Coronavirus Resource Center; Simonsen (1999); Taubenberger and Morens (2006).
Note: COVID-19 infections and deaths are as of May 22, 2020.

are responsible for the majority of economic losses (Lee and McKibbin 2003; McKibbin and Sidorenko 2006).

Amplifying and dampening factors

Several factors affect the magnitude of economic losses from disease outbreaks.

Demographic profiles. Large-scale infectious disease outbreaks tend to strike some age segments more than others. For example, the case fatality rate during the Spanish flu was highest for young adults, while during the Asian flu, school-aged children and young adults experienced the largest elevation in mortality relative to the baseline (Gagnon et al. 2013; Viboud et al. 2016). Early experience with COVID-19 shows a disproportionally higher frequency of death for the elderly suggesting that the loss of life may be severe for countries and regions with a high share of older people (Farzanegan, Feizi and Gholipour 2020; Sornette et al 2020; Verity et al. 2020).[3]

Health care systems and social safety nets. Low- and lower-middle-income economies may suffer particularly high loss of life from disease outbreaks as a result of low-quality health care systems and poor access to water and sanitation services (Corburn et al. 2020; Farzanegan, Feizi, and Gholipour 2020; McKibbin and Sidorenko 2006). Weak social safety nets can magnify the economic impacts of pandemics for lower-income households. Because low-income workers typically have limited savings to buffer income shocks, and because telecommuting is not an option for many low-paid service jobs, these workers may be forced to work in environments where the risk of infection is high.

Cross-country spillovers. Simulations have shown that global trade would fall by as much as 14 percent in a medium-scale outbreak of avian flu, even if viral cases were limited to South and East Asia (Bloom, de Wits, and Carangal-San Jose 2006). During the SARS outbreak, the high dependence of Hong Kong SAR, China on tourism and services exports was found to have magnified GDP losses (Siu and Wong 2004). Disruption to global value chains provides an additional channel that can increase the economic cost of pandemics and epidemics. The impact of COVID-19 on global trade has been a major concern in part because countries that collectively account for the majority of global manufacturing production and exports (China, Germany, Italy, Korea, and the United States) have also experienced some of the largest outbreaks (Baldwin and Tomiura 2020).

Macroeconomic policy response. Fiscal and monetary policy support can blunt the adverse economic impacts of disease outbreaks and aggressive mitigation measures. With much of the global economy under lockdown during the COVID-19 pandemic, such support has been essential to offset drastic interruptions to the normal income, credit, and spending patterns among businesses and households. The effectiveness of policy support depends on the credibility of the measures, and the extent of pre-existing vulnerabilities such as high debt levels and large external financing needs, and structural issues. For example, fiscal multipliers are typically lower in economies with high debt (Huidrom et al. 2019). The effectiveness of fiscal policy also depends critically on a well-functioning social security system, and could be complicated by high levels of informality (Box 1.4; Loayza and Pennings 2020). Monetary policy easing also may be less effective in economies with large informal sectors and low financial inclusion (Alberola-Ila and Urrutia 2019).

[3] The U.S. Department of Health and Human Services (2020) estimates that the case fatality rate for patients ages 20-44 is less than one-tenth of the rate for patients ages 65-74.

Estimates of economic losses

The literature has studied the economic impacts of disease outbreaks using both model-based simulations and empirical analysis of historical pandemics.

- **Computable general equilibrium (CGE) models**. Several global CGE models have been applied to estimate losses of simulated pandemics (Lee and McKibbin 2004; McKibbin and Fernando 2020; McKibbin and Sidorenko 2006; Verikios 2011). These models offer rich sectoral disaggregation that allows the consideration of differential effects across industries, estimation of trade spillovers, and endogenous policy responses.

- **Empirical estimates of historical episodes.** Estimates of the impact of actual pandemics have the advantage of taking account of the actual losses experienced (Barro, Ursua, and Weng 2020; Correia, Luck, and Verner, 2020; Keogh-Brown and Smith 2008; Siu and Wong 2004). However, they are often unable to distinguish the effects of the pandemic from other factors.

Simulated outbreaks

Studies of simulated pandemics typically use mortality rates to classify the severity of the event (Table A.3.1.2).[4] Simulations with higher mortality rates tend to generate larger economic losses. Containment and mitigation measures, including social distancing and restriction of movements, are largely absent from the literature on simulated pandemics. However, a study of the United Kingdom reports that a three-week school closure in response to a simulated influenza outbreak reduces GDP by about 0.5 percentage point in the first year, in addition to the 0.8-1.7 percent loss of output directly attributable to infections (Smith, Keogh-Brown, and Barnett 2011).

Mild pandemics. These are defined to have mortality rates of less than 20 per 10,000 people.[5] Historical examples are the Hong Kong flu, with about 2 deaths per 10,000; and the Asian flu, with about 4 deaths per 10,000. In model simulations, their impact reduces GDP by 0.7-0.8 percent in both advanced economies and EMDEs in the first year (Figure 1.1; McKibbin and Sidorenko 2006).

Intermediate pandemics. These are defined to have mortality rates of 20-50 per 10,000 population. Model simulations suggest, during the first year, reductions of 1.6-3.5 percent of GDP in EMDEs, and 2.0-4.6 percent of GDP in advanced economies (Burns, van der Mensbrugghe, and Timmer 2006; Verikios et al. 2011).[6] Relative to mild pandemics, modeled intermediate pandemics show larger losses from reduced labor supply, negative shocks to consumption, financial market disruption, and increases in business costs (Table A.3.1.2).

Severe pandemics. These are defined to have more than 50 deaths per 10,000 population. In model simulations, pandemics on this scale reduce GDP by 3.6-7.0 percent in EMDEs, and 3.0-8.0 percent of GDP in advanced economies (McKibbin and Sidorenko 2006; Burns, van der Mensbrugghe, and Timmer 2006).

Historical outbreaks

Historical analysis of the economic costs of previous pandemics and epidemics is complicated by lack of data and the simultaneous presence of other shocks. For example, the Spanish flu overlapped with World War I, while the swine flu pandemic broke out during the global financial crisis. Empirical investigations of these episodes suggest that the results of the model-based simulations are in the right range (Table A.3.1.3). Thus, the Spanish flu is estimated to have lowered GDP by about 6 percent during 1918-19, with

[4] Mortality rates are more variable than infection rates. Estimates put the mortality rate of the Spanish flu at more than 500 times that of the 2009 swine flu pandemic, and the infection rate only 1.5 times larger.

[5] Here and in the subsequent two paragraphs, the 10,000 figure refers to the whole population, rather than just the infected population.

[6] Pandemics can also be differentiated into those with high mortality but low infection rates and vice versa. A pandemic with a moderate case fatality rate but high contagion could generate economic losses many times higher than a pandemic with a high fatality but low contagion (Verikios et al. 2011).

more cyclical economic sectors, such as manufacturing, experiencing output reductions of up to 18 percent (Barro, Ursua, and Weng 2020; Correia, Luck, and Verner 2020). In contrast, estimates for more moderate episodes of influenza, such as the Asian flu, which killed approximately 1 million people globally, show GDP losses that are largely indistinguishable from normal growth volatility (Henderson et al. 2009). SARS is estimated to have reduced output by 1-4 percent in some of the worst affected economies in the second quarter of 2003, with less clear impacts on growth during the whole of 2003 (Siu and Wong 2004).

COVID-19: Short and long-term losses

Several studies have published initial estimates of the possible economic losses from the COVID-19 pandemic (Table A.3.1.4). Some take account of the economic impacts of the stringent containment and mitigation measures, which could make the economic impacts of this pandemic much more severe relative to past episodes (Boissay and Rungcharoenkitkul 2020).[7]

Short-term economic losses

The existing estimates of the economic consequences of COVID-19 have a wide range, reflecting the large uncertainty surrounding contagiousness, the eventual infection and fatality rates, the stringency and duration of policies to reduce virus transmission, and other factors (Figure A.3.1.1). The first estimates showed small economic losses. Subsequent estimates were higher, as the pervasiveness and severity of the disease, and the containment and mitigation measures, became more apparent.[8]

One study puts output losses from the COVID-19 pandemic at 2-6 percent of GDP in EMDEs in the first year, and 2-8 percent in advanced economies (McKibbin and Fernando 2020). This would be comparable to the estimated 6 percent global economic losses due to Spanish flu (Barro, Ursua, and Weng 2020). Maliszewska, Mattoo, and van der Mensbrgghe (2020) estimate losses of 2.5-4.0 percent in EMDEs, and 1.8-3.8 percent of GDP in advanced economies. This results from a fall in employment, lower consumption, rising trade costs, and reduced travel and tourism. However, these studies do not factor in the full stringency of the controls that were later imposed globally.

Several studies have attempted to separate the losses of output that preventive controls may impose from those of a hypothetical COVID-19 outbreak with no such restrictions. Restrictions on retail, travel, and other services industries could reduce output by 25 percent in OECD economies during their enforcement (OECD 2020a). Were these restrictions to remain in place over three months in 2020, this would imply a 6 percent reduction in annual GDP, equivalent to estimates of lost output in severe simulated pandemics (without explicit containment measures) and empirical estimates of losses from Spanish flu. Other estimates suggest that growth will be approximately 5-8 percentage points lower in advanced economies and EMDEs in 2020 due to the effects of COVID-19 and associated containment measures. The impact on growth would be an additional 3 percentage points if the duration of containment measures is extended to increase the number of lost working days by 50 percent (IMF 2020).

A developing strand of the literature models the economic impact of imposing "optimal" containment measures to limit the spread of COVID-19. In a model of the United States, consumption falls by 22 percent under optimal containment measures, compared to just 7 percent if only the effect on labor supply owing to illness and mortality and consumer behavior is considered (Eichenbaum, Rebelo, and Trabandt 2020).[9] Another model-based approach applied to the United States finds that targeting containment

[7] Keogh-Brown et al. (2010) estimate that extending a four-week school closure to 15 weeks alongside increased levels of prophylactic absenteeism might double economic losses in a medium-scale pandemic but only reduce the rate of infection by 2-15 percent.

[8] For example, ADB (2020) initially estimated a "worst-case scenario" of 0.4 percent of global GDP. A similar scenario with moderate global contagion modeled by the OECD (2020c) estimated that world GDP would be reduced by around 1.5 percent relative to baseline.

[9] The "optimal" containment measures are assumed to reduce deaths as a share of the initial population from 0.4 percent to 0.26 percent.

measures to older age groups results in a 10 percent reduction in output over one year, compared to a 24 percent loss of output with universally-applied lockdown measures (Acemoglu et al. 2020). Age-targeted containment measures may be particularly effective at limiting output losses in EMDEs, which have a smaller share of their population in vulnerable age groups (Alon et al. 2020).

Medium- and long-term impacts

Scarring effects and offsetting policy. Most analysis of the economic costs of pandemics and epidemics focuses on short-term impacts. However, severe economic contractions of the magnitude expected in 2020 have historically cast long shadows, typically lowering potential growth for four to five years (Box Lasting damage of recessions; Martin, Munyan, and Wilson 2015; World Bank 2018). This can result from reduced investment, credit constraints, and slower adoption of new technologies (Anzoategui et al. 2019; Queralto 2019).[10] History suggests that good policy may reduce the adverse effects of severe contractions. Regions implementing significant containment measures during the Spanish flu are found to have experienced faster rates of growth than other regions in the five years following the pandemic (Brainerd and Siegler 2003; Correia, Luck, and Verner 2020).

Debt and insolvency risk. The negative shock from COVID-19 is occurring at a time of heightened vulnerabilities in sovereign and private sector debt. Historically, episodes of rapidly accumulating debt are associated with an increased likelihood of a financial crisis (Kose et al. 2020). The unprecedented scale of the current fiscal stimulus will stretch public sector balance sheets even further in many EMDEs, and in some advanced economies. Private sectors may experience a wave of insolvencies, posing a threat to banking systems in various jurisdictions. One of the lasting effects of the COVID-19 induced recession may be increased financial fragility.

[10] Downward pressure on real rates of return following a pandemic may be particularly persistent, lasting for about 40 years (Jordá, Singh, and Taylor 2020).

Human capital implications. Schools and universities have been closed across the world as part of the policy response to slow the spread of COVID-19 (UNESCO 2020). The associated learning disruptions, although partially compensated by home schooling and remote teaching, are likely to have the most adverse effects for disadvantaged students, including on health and safety (World Bank 2020d). School closures may cause lasting setbacks to human capital accumulation and earnings potential (Psacharopoulos et al. 2020; Wang et al. 2020). Missed learning opportunities can have larger impacts for low-income families, who often have limited ability to support learning at home (Van Lancker and Parolin 2020). Evidence from the Ebola epidemic in West Africa in 2014 suggests that school closures were associated with higher dropout rates and wider gender gaps in educational attainment (UNDP 2015). Large declines in household income are also associated with increased school dropout rates in EMDEs (Glick, Sahn, and Walker 2016). In addition, closure of workplaces will deprive many people of opportunities to improve skills and productivity through apprenticeships and on-the-job learning.

Poverty implications. The COVID-19 pandemic could have severe effects for the poor through multiple channels, including greater vulnerability to declines in labor and non-labor income, increased risk of infection and mortality, and lower availability of essential items due to market disruptions hit the poor particularly hard (Barnett-FAO et al. 2020; Howell and Mobarak 2020; World Bank 2020d). Although the social assistance measures that have been implemented by many countries may soften the impacts on households, they do not fully offset the income losses from shutdowns. Moreover, the poorest members of society have little capacity to manage negative income shocks. Less than 20 percent of workers are covered by social insurance or assistance programs in low-income countries (LICs), in part due to their large informal sectors (World Bank 2019b). All this suggests that recent progress on the reduction of poverty and inequality will likely be lost (Sumner, Hoy, and Ortiz-Juarez 2020).

Structural changes in production, consumer behavior, and work patterns. The fragility of the global trading system, highlighted by disruptions in global value chains, and by shortages of essential goods in many countries during the COVID-19 outbreak, may lead governments and firms to reassess the benefits of low-cost, off-shore sourcing. Onshoring efforts will have costs, however. Domestically, resources may be diverted into capital-intensive import-substitution. Aside from this, efforts to avoid viral contamination may linger long after the pandemic dissipates. This could lead to changes in the structure of production on a much larger scale than those which past recessions have triggered. Certain restrictions, and adjustments in consumer behavior, to reduce the risk of infection may prove highly persistent (Smith et al. 2014). For example, the experience with widespread remote working may permanently change the nature of workplaces. Avoidance of crowds may mean that established business models of popular entertainment are no longer viable. It may take the travel industry years to recoup the tourist losses it has suffered in 2020.

TABLE A.3.1.2 Economic impacts of simulated influenza pandemics

Paper	Total mortality (per 10,000 people)	Channels and shocks	Containment measures and policy response	Time horizon	Method	Peak GDP loss in advanced economies (percent)	Peak GDP loss in EMDEs (percent)
McKibbin and Sidorenko (2006)	2.2-22	- Illness: the labor force is reduced by 1.15% - Mortality: 0.02-2.2% of the labor force is killed by influenza - Tourism and trade reductions - Financial market disruption - Business costs rise, with the largest increase in sectors requiring more social interaction - Costs shocks for the most affected sectors - Demographics and health care quality affect the illness and mortality rates across economies	No explicit containment or policy measures	1 year	DSGE/CGE	0.7-7.1	0.7-6.3
Burns, Mensbrugghe, and Timmer (2006)	108	- Illness and mortality - Reduction of 20% in travel, transport, and restaurant consumption for 1 year	No explicit containment or policy measures	1 year	DSGE/CGE	3.0	3.6
Smith, Keogh-Brown, and Barnett (2011)		- Illness: 35% of working labor force is infected - Case fatality rate of 0.06-0.35%	School closures and prophylactic absenteeism considered in alternate scenarios	1 year	CGE	United Kingdom: 0.3-0.6 considering disease only; 3.4-4.3 with school closures and prophylactic absenteeism	-
Verikios et al. (2011)	20	- Illness and mortality - *unspecified* - School closures add 75% to lost working days - Reduction of tourism and travel of 70%	School closures	Multi-year. Losses largely unwound after one year	CGE	3.9	2.4

Note: Losses are reported relative to a baseline level of GDP or growth rate, which are approximately equivalent. Median of the first year GDP loss in advanced economies or EMDEs are reported, except Burns, Mensbrugghe, and Timmer (2006), which only reports aggregated GDP impact. "High-income countries" in Burns, Mensbrugghe, Timmer (2006) are presented in the tables as advanced economies and "low and middle-income countries" are presented as EMDEs.

TABLE A.3.1.3 Estimates of economic impacts of historical pandemics and epidemics

Event	Study	Estimation technique	Geographical coverage	Estimate of immediate impact	Estimate of subsequent impact
Spanish flu	Brainerd and Siegler (2003)	Growth regressions controlling for the death toll from flu and other factors as explanatory variables in 1918 for per capita growth over the subsequent 10 years	United States (state by state)	n/a	+0.2 percentage points per year growth for 10 years following the pandemic
Spanish flu	Karlsson, Nilsson, and Pichler (2014)	Growth regressions exploiting regional differences in influenza incidence and mortality rates during 1918-19	Sweden	No discernable effect on aggregate earnings or GDP per capita but a large increase in poverty rates	
Spanish flu	Barro, Ursua, and Weng (2020)	Growth regressions controlling for country-specific factors, war-related deaths, and influenza-related deaths to assess the influenza-specific fall in GDP	43 advanced economies and EMDEs	GDP reduced by 6%, consumption reduced by 8%	
Spanish flu	Correia, Luck, and Verner (2020)	Exploits state and city influenza deaths to assess the specific effects on manufacturing output and employment	United States	Manufacturing output reduced by 18% and employment by 23% by 1919	Regions with longer-lasting public health interventions (46 days longer) experienced a 6% rise in manufacturing employment and a 7% rise in output following the pandemic
Asian flu	Henderson et al. (2009)	Event study of industrial production	Canada	1% fall in industrial production at the time of the outbreak	
SARS	Lee and McKibbin (2004)	CGE modeling exercise calibrated following the SARS epidemic	Asia-Pacific	Reduction in 2003 GDP: Hong Kong SAR, China -2.6% China -1.1% Singapore -0.5%	
SARS	Siu and Wong (2004)	Event study of the effects of SARS using sectoral, trade, and tourism data	Hong Kong SAR, China	Initial 15% decline in year-on-year retail sales growth during the peak of the outbreak; tourist arrivals decline 10% at peak; unemployment rate increases by more than one percentage point at peak; tourist arrivals and consumption subsequently recover to pre-SARS levels but no indication that lost growth is recovered	
SARS	Keogh-Brown and Smith (2008)	Event study examining a range of aggregate and sectoral indicators	16 economies, primarily in Asia	One-quarter losses: China -3% Hong Kong SAR, China -4.75% Canada -1% Singapore -1% Losses are concentrated in travel, leisure activities, and tourism; results do not specify whether quarterly impacts are recovered in subsequent quarters	
SARS	Kholodilin and Rietha (2020)	VAR using monthly data on industrial production and index of news about flu-like disease	Eight major economies	News of SARS outbreak reduced industrial production by 2% in China and 10% in Republic of Korea during the peak of the episode	
MERS	Joo et al. (2019)	Event study of tourism, travel, accommodation, and food sectors during 2015	Republic of Korea	Permanent losses in affected sectors equivalent to -0.2% of GDP	

TABLE A.3.1.4 Preliminary estimates of economic impacts of COVID-19

Paper	Total mortality (per 10,000 people)	Channels and shocks	Containment measures and policy response	Time horizon	Method	Peak GDP loss in advanced economies (percent)	Peak GDP loss in EMDEs (percent)
IMF (2020)	Not specified	- Labor supply falls by 5-8% globally in 2020 - Financial market disruption and credit tightening in 2020, fading in 2021. Downside scenario assumes an additional 75 basis point rise in sovereign credit spreads in EMDEs and an additional 50 basis point rise in advanced economies - Commodity prices sharply fall in 2020. Oil prices remain around 15% below baseline in 2021	- Containment measures implemented in 2020Q2 and withdrawn in 2020Q3; more severe case restrictions last 50% longer - Unconventional monetary policy is implemented in advanced economies, alongside fiscal measures	2 years	Baseline WEO forecast and semi-structural DSGE model	7.7 – 10[1]	5.4-8[1]
Maliszewska, Mattoo, and van der Mensbrugghe (2020); World Bank (2020c)	Not specified	-Illness and mortality reduce labor input by 3% in year 1 -Trade costs increase by 25% across all goods and services -Tourism fall implemented with a 50% increase in costs -Demand "reallocated" away from high-risk service sectors	- Effect of containment embedded in assumptions about labor input and consumption reduction	1 year	CGE	1.8-3.8	2.5-4.0
McKibbin and Fernando (2020)	20-90	-Illness and mortality: -0.4 to -4.6% fall in labor supply -Consumer behavior: initial -0.8 to -4.5% fall in total consumption, including targeted tourism and trade reductions -Financial market disruption: 1.1-2.9 percentage point increase in equity risk premium -Costs of doing business: 25-50% increase, varying by sector -Demographics and health care quality indexes vary mortality rates across economies	- No explicit containment measures - 0.2-2.7% positive shock to government expenditure - Endogenous fiscal and monetary response to shocks	1 year (year of shock); reversion to baseline after 1 year	DSGE/ CGE	2.0-8.0	1.6-6.0
WTO (2020)		- Illness and mortality reduce labor supply by 1-4% in year 1 -Tourism declines 20-80% over 3-6 months -Retail activity declines 5-20% over 3-9 months -Manufacturing falls by a maximum of 80% for 3 months and 40% for 6 months -Trade costs increase: 22.5% rise in cost of services transport and specialized equipment transport over 6-18 months, 70% rise in air cargo costs over 6-18 months	-Work from home for 3 months to 1 year and school closures for 3 months	2 years	CGE	4.8-11.1 in year 1 (global)	
Baker et al. (2020b)	Not specified	-Based on U.S. stock return and volatility from February 24 to March 31	n/a		VAR	3-20 (United States)[2]	
Banco de España (2020)	Not specified	-Spillovers from weak global economy -Weak domestic demand due to containment - Discretionary fiscal policy to support the economy	- 8-12 weeks of containment measures, reducing domestic demand	2 years, with strong rebound in year 2	Hybrid macro model	8.5-14.1 (Spain)	

TABLE A.3.1.4 Preliminary estimates of economic impacts of COVID-19 *(continued)*

Paper	Total mortality (per 10,000 people)	Channels and shocks	Containment measures and policy response	Time horizon	Method	Peak GDP loss in advanced economies (percent)	Peak GDP loss in EMDEs (percent)
Breisinger et al. (2020)	Not specified	- Zero internal tourism during crisis - 10-15% reduction in remittance and Suez Canal revenue - Shocks last 3-6 months	n/a	1 year	Social accounting matrix		2.1-4.8 (Egypt)
Çakmaklı et al. (2020)	0.2-96	- Illness and mortality - Changing consumer demand - 18-23% decline in exports due to weaker external demand for final goods and intermediate goods	- 0-35 weeks of lockdown - Only selected industries are active during full lockdown	1 year	DSGE/CGE/ SIR		4.5-11.0 (Turkey)
Duan et al. (2020)	0.24	- Household consumption declines 5-10% in Q1	- Labor supply reduced by 10-50% in Q1 and rebounded in Q2	1 year	CGE		0.6-1.7 (China)
Eichenbaum, Rebelo, and Trabandt (2020)	20-30	-Illness and mortality -Consumer behavior – consumption falls by 7% without containment measures in year 1; consumption falls by 22% with containment measures	- Optimal containment measures at their peak during the year restrict 76% of the population from working	2 years – effects largely dissipate in year 2	DSGE/CGE/ SIR	4.7-14.5 (United States)[3]	

Note: Losses are reported relative to a baseline level of GDP or growth rate, which are approximately equivalent. Median of the first year GDP loss in advanced economies/EMDEs are reported.

1. Calculated as the deviation of the forecast in the IMF's April 2020 *World Economic Outlook* relative to its January 2020 *World Economic Outlook Update*. Upper bound is calculated under the scenario such that containment measures last 50 percent longer than baseline. Upper bound numbers are rounded to nearest integer.

2. 90 percent confidence interval of year-on-year change on quarterly GDP in the worst quarter.

3. Indicates a GDP impact based on the study's cited consumption impact of 7 percent without containment and 22 percent with containment, and assuming that consumption accounts for two-thirds of GDP.

ANNEX 3.2 Bayesian vector autoregression model

A Bayesian vector autoregression model (BVAR) is employed, in reduced form, to capture past empirical relationships through multiple channels. These channels operated historically, including during previous global synchronized downturns. Spillovers are estimated using the BVAR model including, in this Cholesky ordering, the GDP-weighted average of GDP growth in China, the Euro Area, and the United States; oil prices (unweighted average of Brent, WTI, and Dubai prices); a measure of global interest rates (GDP-weighted average of up to 122 central bank policy rates); a measure of EMDE sovereign borrowing costs (J.P. Morgan's EMBI Emerging Market Bond Index); and GDP-weighted average GDP growth of groups of EMDEs. GDP-weighted averages are at 2010 market exchange rates and prices. These variables correspond to those used in VAR-based estimations of spillovers across economies and in standard small open economy DSGE models that have been used to examine the transmission of shocks across economies (Huidrom et al. 2020). The sample includes quarterly data for 1998-2019.

The VAR is estimated using four lags, as is standard in quarterly VARs, and using Normal-Wishart priors, taking the form:

$$Y_t = C + \sum_{i=1}^{4} B_i Y_{t-i} + \epsilon_t$$

where Y_t is an $m \times 1$ vector of endogenous variables, C is an $m \times 1$ vector of constants, B_i is an $m \times m$ vector of coefficients for each lag of Y, and ϵ_t is an $m \times 1$ vector of reduced-form error terms.

The BVAR is identified using an assumption on the exogeneity of the variables with respect to one another in the first quarter following an economic shock (using a Cholesky decomposition of the error variance-covariance matrix). In particular, the identification assumes that a shock to all three major economies' (China's, Euro Area's and U.S.) GDP growth combined is initially exogenous to changes in the other variables, such that they can only affect growth in the three major economies with a lag of at least one quarter. Oil prices, global interest rates, and the EMBI are also assumed to be initially exogenous to growth in each of the EMDE regions under consideration, but not exogenous to fluctuations in growth of the three major economies. This is consistent with the three major economies, and in particular China, accounting for a major proportion of global demand for oil (Baffes, Kabundi, and Nagle 2020). It is also consistent with research suggesting that monetary policy in the United States is a key driver of global financial conditions, in part reflected by the EMBI, which can subsequently drive macroeconomic developments in EMDE regions (Miranda-Agrippino and Rey 2020).

Impulse response functions (IRFs) are estimated to account for the impact of shocks from growth in the three major economies to each EMDE aggregate. Due to the identification of the VAR, these shocks also contemporaneously affect oil prices, interest rates, and the EMBI, allowing additional spillovers through commodity and financial channels to EMDE aggregates.

ANNEX 3.3 EMDE vulnerability index

Methodology. For each country, six vulnerability sub-indexes are calculated that capture the main challenges EMDEs are facing in the current pandemic: health, financial, fiscal, trade, tourism, and poverty.

- The *financial* vulnerability index is compiled from current account and fiscal balances (percent of GDP); government, corporate, and external debt (percent of GDP); the share of short-term external debt; and the share of foreign-currency-denominated government and corporate debt.
- The *fiscal* vulnerability index is compiled from government debt and fiscal balances (in percent of GDP) and the share of foreign-currency government debt.
- The *trade* vulnerability index is compiled from the share of trade in GDP; the share of commodity exports in total goods exports; the

share of external value added in domestic exports (backward global value chain integration); and the share of domestic value in foreign exports (forward global value chain integration).

- The *tourism* vulnerability index is derived from tourism revenues as a share of GDP.
- The *health* vulnerability index is derived from the number of beds, nurses and doctors per 1000 people; the DALY; and health expenditures as percent of GDP.
- The *poverty* vulnerability index is derived from the share of the informal economy in GDP, the share of adults with access to emergency funds, the share of firms with accounts, and the share of firms with bank loans.

The indicators are aggregated in three steps. First, for each indicator, its percentile in the full panel is calculated. Second, for each sub-index, a country-specific sub-index is calculated as the unweighted average of all indicators within the sub-index. A sub-index with a value above 50 therefore indicates that, on average, indicators in this sub-index score worse than the median in their largest available sample of data. Third, country-specific sub-indexes are aggregated into GDP-weighted averages (at 2010 market exchange rates and prices) of EMDE sub-indexes.

Data. Fiscal indicators are drawn from the International Monetary Fund's *World Economic Outlook* and the International Institute of Finance. Financial indicators are drawn from the International Monetary Fund's *World Economic Outlook*, the International Institute of Finance, and the World Bank's *External Debt Hub*. Trade indicators are drawn from the OECD's *TiVA database* and the World Bank's *WITS*. The tourism indicator is drawn from the World Tourism Association. The health indicators are drawn from the World Bank's *World Development Indicators* and the World Health Organization. The poverty indicators are drawn from World Bank (2019d) and the World Bank's Findex database (World Bank 2017). The database is an unbalanced sample of 197 countries, of which 154 EMDEs, for 1960-2019.

ANNEX 3.4 Long-term implications of recessions: Data and methodology

Definitions and data. Potential growth is defined as in Kilic Celik, Kose, and Ohnsorge (2020) and World Bank (2018) and is based on a production function approach. Annual data is available for up to 95 EMDEs for 1982-2018. *Recessions* are defined as years of negative output growth, as in Huidrom, Kose, and Ohnsorge (2016). Depending on data availability for potential growth estimates, this definition yields up to 65 recession events in 32 advanced economies and up to 203 recession events in 75 EMDEs during 1982-2018. Hence, outright output contractions are rare, at about 6 percent of the country-year pairs in the sample.

Financial crises are defined as having an economic crisis in the form of systematic banking crises, currency crises, or sovereign debt crises as identified in Laeven and Valencia (2018). During 1982-2018, there have been 42 financial crises in 26 advanced economies and 274 financial crises in 87 EMDEs in the regression sample—almost 7 percent of country-year pairs in the sample.

Oil price plunges are defined as periods when the average of Brent, WTI, and Dubai oil prices declined by 30 percent or more over a seven-month period. Before 2020, there were six such oil price plunges: two supply-driven plunges, when OPEC agreements were abandoned (1986, 2014-15) and four demand-driven plunges when the global economy went into a downturn or an outright recession (1990-91, 1998, 2001, 2008).

Methodology. A local projection model (LPM) is used to assess and quantify the effects of recessions on potential and actual growth and output levels (Jorda 2005). Impulse response functions show the duration, smoothness, and recovery of potential output levels after the onset of an event.

$$\begin{aligned} y_{i,t+h} - y_{i,t-1} &= \alpha_i + \beta_h event_{i,t} \\ &+ \sum_{p=1}^{h-1} \gamma_p event_{i,t+h-p} \\ &+ \rho_h event_{i,t-1} + \delta\, dy_{i,t-1} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where y is log potential output level, dy is potential growth and β_h is the main coefficient of

the interest. The equation controls for country-specific effects (α_i) and persistence of the shock by including the lagged shock in a forward bias correction (Teulings and Zubanov 2014).

Five shocks are considered: recessions, financial crises, oil price plunges, a combination of recessions and financial crises, and a combination of recessions and oil price plunges. The final event is estimated for the subsample of 26 energy-exporting countries, including 24 energy-exporting EMDEs.

In a second step, regressions are estimated with three separate interaction terms to explore the role of vulnerabilities to financial crises: external debt in percent of GDP, current account balances in percent of GDP, and the presence of an inflation targeting regime.

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