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## Recoveries After Pandemics: The Role of Policies and Structural Features

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# Recoveries After Pandemics: The Role of Policies and Structural Features

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**Abstract**

To shed light on the possible scarring effects from Covid-19, this paper studies the economic effects of five past pandemics using local projections on a sample of fifty-five countries over 1990-2019. The findings reveal that pandemics have detrimental medium-term effects on output, unemployment, poverty, and inequality. However, policies can go a long way toward alleviating suffering and fostering an inclusive recovery. The adverse output effects are limited for countries that provided relatively greater fiscal support. The increases in unemployment, poverty, and inequality are likewise lower for countries with relatively greater fiscal support and relatively stronger initial conditions (as defined by higher formality, family benefits, and health spending per capita).

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## I. INTRODUCTION[1]

Covid-19 has been a once-in-a-century pandemic that has raised several questions, among which are: What might the recovery trajectory look like? How much scarring is likely to occur? What factors would determine the magnitude and persistence of scarring across countries? Using a variety of methodologies and datasets, studies of real-time post Covid-19 outcomes and of past pandemics suggest that Covid-19 is expected to have a staggering adverse impact on lives and livelihoods, disproportionately affecting the poor and the vulnerable.

While global growth is expected to recover in 2021-22, IMF (2021a) cautions that there would be divergent recoveries across and within countries and persistent economic damage from the crisis. The cumulative per capita income losses over 2020-22, compared to pre-pandemic projections, are around 20 percent of 2019 per capita GDP in emerging markets and developing economies (excluding China) and 11 percent in advanced economies. The divergence in recovery would create significantly wider gaps in living standards compared to pre-pandemic expectations. An additional 95 million persons are expected to have entered the extreme poor level in 2020, with 80 million more undernourished persons.

A host of other studies provide evidence of a persistent increase in inequality absent policy interventions, summarized in Furceri et al. (2021a). Crossley et al. (2020) show that the population in the lowest quintiles of income and ethnic minority groups experienced the largest job losses using survey data of U.K. households. Hacioglu et al. (2020) and Surico et al. (2020) show an increase in market income inequality in the U.K. since Covid-19. Aspachs et al. (2020) find increasing income inequality owing to job losses for low-income households for Spain. Using U.S. monthly Current Population Survey data to understand differential employment responses between men and women, Fabrizio et al. (2021) find that

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less educated women with young children were the most adversely hit during the first nine months of the crisis.

Using history as a guide, an examination of past pandemics point toward detrimental effects on key macroeconomic indicators. Simple stylized facts, without controlling for the effect of other factors, show that pandemics have been associated with a decline in real GDP growth, increase in the unemployment rate, and decrease in progress toward alleviating poverty rates and inequality (Figure 1). The detrimental effects are stronger for some than others. For example, compared to the average experience, Latin America witnessed worse performance in all variables except poverty.

Various recent studies corroborate these findings for output, unemployment, and inequality. Ma et al. (2020) show that past pandemics have resulted in a fall of real GDP growth by around 3 percentage points, with output remaining below pre-pandemic levels five years later. In addition, unemployment for less educated workers is higher and more persistent. These negative effects on GDP and unemployment are less in countries with larger first-year government spending, particularly in health care. Similarly, Emmerling et al. (2021) find that past pandemics led to significant and persistent reductions in disposable income and increases in unemployment, inequality, and public debt-to-GDP ratios. Focusing on inequality, Furceri et al. (2021a) show that past pandemics have led to increases in inequality, while Furceri et al. (2021b) show that episodes marked by extreme fiscal austerity in the years following the pandemic have been associated with an increase in inequality three times as large as in episodes with more supportive fiscal policy.

The existing studies of past pandemics provide a basis for considering the possible recovery trajectory in the current Covid-19 pandemic as well as the role of policies. However, there are a few important areas where further work could enhance our understanding of the possible recovery. While the current crisis has resulted in an alarming spike in poverty and concerns about the reversal of progress made in recent years on this indicator, the impact of past pandemics on poverty has not—to our knowledge—been systematically explored. Similarly, while concerns have been raised about the disproportionately stronger effect of the

current pandemic on informal workers owing to, among other factors, limited recourse to social safety nets (IMF 2021a, IMF 2021b, World Bank 2021, Bussolo et al. 2020), there has not been much systematic work yet on understanding the differential impact of past pandemics depending on the level of formality of the economy. The role of social expenditures—a critical buffer during crises—or of fiscal policy on poverty has also not been studied in a systematic manner to our knowledge.

To the extent that the divergence in the recovery, as highlighted in IMF (2021a), is determined by the divergence among countries—both between advanced and emerging market and developing economies (EMDEs) and within EMDEs—across a range of key structural features (Figure 2), understanding the role of these structural features during pandemics would be important. For example, Latin America—the region that experienced stronger negative impacts than the average in past pandemics (Figure 1)—exhibited higher informality compared to other regions except Sub-Saharan Africa. Health expenditure capita, while increasing, has been lower than other regions except Sub-Saharan Africa and Emerging and Developing Asia. Social expenditures have also been lower than other regional aggregates where data have been available.

This paper aims to contribute to the literature on the economic effects of past pandemics by studying the above-mentioned dimensions. The paper also provides a holistic picture of the impact of pandemics on four key variables (output, unemployment, inequality, poverty) using a common methodology/framework and time/country coverage. Using a sample of 55 countries over the time period 1990-2019, the paper employs local projections to estimate the impact of past five modern pandemics (SARS, 2003; H1N1, 2009; MERS, 2012; Ebola, 2014; Zika, 2016). The paper then examines the differential impact across these variables depending upon the level of fiscal support provided, informality, family benefits (component of social expenditure), and health expenditure per capita.

The findings, which are statistically significant except for unemployment, are as follows: on average, pandemics are associated with a decline in output of about 2.2 percent three years later and an increase in the unemployment rate by 1.0 percentage points after four years. The

poverty rate increases by around 1.1 percentage point in the near term, which persists over the medium term. The poverty gap, which measures poverty intensity by showing the mean shortfall in income or consumption from the indicated poverty line (see footnote 2 for details), also increases, underscoring the hardship caused by pandemics on the poor and the vulnerable. Inequality, as measured by the net Gini index, increases by 1.7 percent after five years; and similar effects are evident when other indicators of inequality are used (i.e., WDI data on income shares by different earners).

The study further finds that the effects of the pandemic are asymmetric, depending upon differential policy responses and structural features of the economy. The negative output effects are found to be smaller for countries that provided higher fiscal support and that had a lower informal sector or higher initial health expenditure per capita. Lower/higher is defined as below (or equal to)/above median across countries. The increase in unemployment is lower for countries with higher fiscal support, lower informality, higher family benefits, and higher health expenditure per capita. The asymmetric responses of output are found to be generally robust for fiscal support (using changes in structural primary balance), but not across all econometric specifications for health expenditure and informality. The latter is in line with literature that finds inconclusive effects of informality on business cycles (see summary and view of literature in World Bank, 2021). The increases in poverty and inequality are also smaller for countries with higher fiscal support and stronger initial conditions (as defined by relatively lower informality, relatively higher family benefits, and relatively higher health expenditure per capita). The relative magnitudes for unemployment, poverty, and inequality for fiscal policy (using changes in structural primary balance) and structural features generally hold across robustness checks.

Several channels are at play. For example, fiscal measures provide resources to vulnerable segments of the population, such as those at risk of poverty and disproportionately affected by pandemic-induced challenges (e.g., relatively less access of quality healthcare, loss of job in contact-intensive industries, and less personal savings to support livelihoods in case of job loss). World Bank (2021, Box 2.1) documents in detail the channels through which informality aggravates Covid-19 affects: workers in the informal sector tend to be lower-

skilled and lower-paid, with limited access to social safety nets and finance, while informal firms tend to have labor-intensive production and are more widespread in the services sector, which is more likely to be hit given the contagious factor related to Covid-19. Finally, countries with larger informal sectors are associated with weaker outcomes in fiscal, institutions, economic and developmental areas. All these channels would make countries with higher informality particularly prone to poverty and inequality risks.

The rest of the paper is organized as follows. Section II discusses the empirical strategy and the data. Section III discusses the results and robustness checks, for both the baseline and the role of policies and structural features. Section IV concludes.

## II. Empirical Methodology and Data

This section discusses the empirical methodology and the data used for the paper. The impulse response of macroeconomic variables of interest across different time horizons is estimated using the popular methodology, Jorda's (2005) local projections. The data on pandemic episodes are taken from Ma et al. (2020).

### A. Empirical Strategy

The objective is to trace out the dynamic response of the macroeconomic variables of our interest (output, unemployment, poverty, inequality) to pandemic shocks. Accordingly, we estimate impulse-response functions using the well-known Jorda's (2005) local projection methods (LPM). This approach allows to retrieve the dynamics of the dependent variable after a shock and has been used in a host of studies: e.g., Auerbach and Gorodnichenko (2013); Jordà and Taylor (2016); Ramey and Zubairy (2018); Furceri et al. (2019). Recently, LPM has been used to study the impact of past pandemic episodes: Ma et al. (2020); Furceri et al. (2021ab); IMF (2021a, Chapter 2).

The baseline regression is specified as follows:

$$y_{i,t+k} - y_{i,t-1} = \alpha_i^k + \gamma_t^k + \beta^k P_{i,t} + \theta^k X_{i,t} + \varepsilon_{i,t} \qquad \text{(I)}$$

where:

- $y_{i,t+k}$ is the outcome variable of interest (log of output, unemployment rate, poverty, log of Gini index) for country *i* at time *t+k*. where *t* is the year of pandemic. *k* ranges from 0 to 5, indicating the year of the pandemic shock (*k*=0*)* to 5 years after the pandemic *(k=5).* Thus, $y_{i,t+k} - y_{i,t-1}$ shows the change in the outcome variable, for each horizon in *k*= 0 to 5, compared to the year prior to the pandemic;
- $\{\alpha_i\}$ are country fixed effects to control for unobserved cross-country heterogeneity. This controls for all time-invariant country characteristics;
- $\{\gamma_t\}$ are time fixed effects to control for global shocks or common shocks and factors;
- $P_{i,t}$ is a dummy variable representing 1 when there is a pandemic shock;
- $X_{i,t}$ is a vector of control variables, including two lags of the dummy variable representing pandemic shock, two lags of dependent variables, and two lags of output. The output and unemployment equations control for two lags of: log of income per capita, trade-to-GDP ratio, private credit-to-GDP- ratio, and a dummy variable indicating banking crisis. Following Furceri (2021a)'s regressions for inequality closely, poverty and inequality regressions do not include these additional control variables in the baseline, but we include these additional control variables in robustness check; and
- ε is an unexplained residual.

For each dependent variable, there is one regression for each time horizon. In other words, six regressions are run separately as specified in equation (I), showing the impact of pandemics for the year of the pandemic and five years afterwards. The coefficients of interest are $\{\beta\}$, the impulse responses of the macroeconomic variables of interest to pandemic shock. In addition, the 90 percent confidence bands are reported based on the respective estimated standard errors (clustered in the country-level).

The baseline regressions assume that pandemics have symmetric effects across countries. We then proceed to find the determinants of scarring: in other words, whether the impact of pandemics varies depending upon policies and structural features of countries. The baseline regression is extended to allow for differential impact of pandemics, depending upon policies and structural features:

$$y_{i,t+k} - y_{i,t-1} = \alpha_i + \gamma_t + \beta^H D^H{}_{i,t}P_{i,t} + \beta^L D^L{}_{i,t}P_{i,t} + \nu X_{i,t} + \varepsilon_{i,t} \qquad (II)$$

The pandemic shock is interacted with dummy variables ($D^H$ and $D^L$) that represent high and low of the corresponding policy or structural feature that is being studied, where high and low represent countries above or below/equal to median of the respective variable across the sample. For example, when the role of fiscal policy is studied: high and low split the sample at median according to the fiscal impulse of the pandemic year, with high representing countries with fiscal impulse above median and low representing the countries with fiscal impulse below or equal to median. For informality and health expenditure per capita, the countries are split according to the values of the year before the pandemic, while social spending indicators are split using decadal average owing to data limitations. Such an approach has been used in a host of studies, including IMF October WEO (2009, Chapter 4), Furceri et al. (2019), and Cubeddu et al. (2021).

In line with the usual practice, the role of fiscal policy and structural features are studied separately. Hence, there might be concerns about any potential correlation between these variables. The correlation in the sample among these variables (fiscal support, lagged informality, lagged health expenditure per capita, family benefits) turns out to be relatively low for most variables (except lagged health or lagged informality): below -0.05 in three cases, 0.27 between family benefits and lagged health, and -0.48 between family benefits and lagged informality, and -0.74 between lagged informality and lagged health. In addition, the country-fixed effects in the regressions should control for time-invariant country characteristics. The regressions for output and unemployment control for, amongst other factors, income per capita and the robustness checks for poverty and unemployment also discuss results that control for, amongst other factors, income per capita. Finally, to mitigate

these concerns further, the robustness section reports results controlling for institutional quality of countries, represented by ICRG indicators (The International Country Risk Guide). The results are robust to the addition of ICRG.

### B. Data

The sample comprises around 55 countries, representing economies that constitute higher than 0.2 percent of world GDP and where data are available (Table 1), in the time period 1990-2019. The data sources are provided in Table 2. Pandemic episodes are taken from Ma et al. (2020). As the authors document in their paper, the postwar pandemic and epidemic events are identified by Jamison et al. (2017)'s volume 9 of *Disease Control Priorities,* a book authored by well-known global health experts. It was a multi-year project managed by the University of Washington's Department of Global Health and Institute for Health Metrics and Evaluation. Using this volume as the guide, Ma et al. (2020) determine the timing of the event from the dates that the World Health Organization (WHO) officially declares a Public Health Emergency of International Concern (PHEIC). Using the pandemic episodes from Ma et al. (2020) and matching our country and time coverages, we have around 108 pandemic episodes from the past five modern pandemics (SARS, 2003; H1N1, 2009; MERS, 2012; Ebola, 2014; Zika, 2016).

As shown in Table 2, the data sources for other variables are World Development Indicators (WDI), Standardized World Income Inequality Database (SWIID), IMF World Economic Outlook (WEO), OECD, Medina and Schneider (2020), Laeven and Valencia (2020).

## III. RESULTS

The results corroborate that pandemics have lasting damaging effects on the economy, with declines in output and increases in unemployment, poverty, and inequality. The intensity of poverty is also found to increase following pandemics. These negative effects on output, unemployment, poverty, and unemployment are found to be lower for countries with relatively higher fiscal support, lower informality and higher health expenditure per capita.

Countries with relatively higher family benefits are found to have relatively lower unemployment, poverty, and inequality. The results, with the exception of output for informality and health expenditure per capita, are generally robust across a range of alternative specifications. For output, we can reject a null hypothesis of equal impacts across states (high versus low) at 90 percent confidence levels for many time horizons when fiscal support is used. For unemployment rate, we can reject a similar null hypothesis for many time horizons when fiscal support and health spending are used. For poverty, we can reject a similar null hypothesis for many time horizons across all outcome variables and all states considered (fiscal policy and structural features). But for inequality, we are unable to reject a similar null hypothesis, owing perhaps to the slow-moving nature of inequality data.

### A. Baseline

The baseline results are shown in Figure 3. Each of the four panels present the estimated dynamic response of key macroeconomic indicators (output, unemployment, poverty, inequality) to a pandemic shock. The solid lines show the average estimated response, while the dotted lines denote 90 percent confidence intervals (using standard errors clustered at the country level). The coefficients (y-axis) for each time horizon represent the change in the indicator at time *t* compared to the value during the year before the pandemic. The x-axis shows time since the pandemic (e.g., $t$=1 is one year after the pandemic).

The findings, which are statistically significant except for unemployment, reveal that that pandemics have detrimental medium-term effects on output, unemployment, poverty, and inequality.

*Output.* Pandemics are associated with a decline in output of about 2.2 percent three years later (top-left chart of Figure 3). Pandemics lead to a decline in output until three years later with the effect statistically significant for the first, second, and third years following the pandemic year. Though improving four years later, output does not recover to pre-pandemic levels within five years, underscoring that the scarring effects of pandemics tend to persist over the medium term. The robustness checks later in the paper show cases where the output decline is more pronounced than the baseline.

*Unemployment rate.* While the impact narrowly misses statistical significance at the 10 percent level, pandemics are associated with an increase in the unemployment rate by 1.0 percentage points after four years (top-right chart of Figure 3). The unemployment rate drops five years later but remains above pre-pandemic levels. The robustness checks later in the paper suggest cases where the negative effect on unemployment rate is statistically significant.

*Poverty.* The poverty rate in the baseline refers to WDI's poverty headcount ratio at $1.90 a day (2011 PPP; as a share of population). Pandemics are associated with an increase in the poverty rate by 1.1 percentage point one year later, and this effect—statistically significant for the first and second year—persists after five years at which point the poverty rate remains 0.9 percentage points above pre-pandemic levels (bottom-left chart of Figure 3). As documented in Figure 4, similar effects are noticed when an alternative definition of poverty is used: the headcount ratio at $3.20 per day (instead of $1.90 a day). Pandemics lead to an increase of 1.1 percentage points in the poverty rate five years later.

Furthermore, the poverty gap[2]—a measure by WDI to express the intensity of poverty—also increases following a pandemic for the two measures corresponding to headcount ratios of $1.90/day and $3.20/day, with the effect statistically significant for both in the second year of the crisis. Similar to poverty rates, the increase in poverty gap persists over the medium term. This suggests that pandemics not only increase the share of population in poverty but also intensify the hardships of those in poverty.

*Inequality.* The baseline regressions use net Gini indices (inequality in disposable post-tax and post-transfer income) from the Standardized World Income Inequality Database (Solt, 2020). While the poverty rates increase in the near term and persist, inequality continues to increase in the time horizon considered with the effect becoming statistically significant in the medium term. After five years, inequality increases by 1.7 percent. While the baseline considers net Gini indices, the corresponding indicator for market inequality (using pre-tax

[2] As documented in WDI: poverty gap at $1.90 a day ($3.20 a day) is the mean shortfall in income or consumption from the poverty line $1.90 a day ($3.20 a day), expressed as a percentage of the poverty line. The non-poor are counted as having zero shortfall.

and pre-transfer income) also suggests similar trajectory, with the effect statistically significant in the medium term and inequality rising by about 1.0 percent after five years.

In addition, impulse responses using WDI's income shares[3] held by subgroups of population (indicated by deciles or quintiles) suggest that the share of income for the bottom 10 and 20 percent of population falls after pandemics, while that of the top 10 and 20 percent of population increases (Figure 5). These effects are statistically significant in the near term for the bottom 10 and 20 percent and both in the near term and in the second year for the top 10 and 20 percent. In line with the results using SWIID's Gini indices, the impulse responses of income shares suggest that these effects persist over the medium term.

### B. Fiscal Policy

Fiscal policy response has been at the center of many governments' actions to combat Covid-19 and to mitigate the impact on lives and livelihoods and economic activity. In April 2021, the IMF's Fiscal Monitor (IMF 2021b) reported that countries have announced $16 trillion in fiscal actions, which strengthened health systems and provided emergency lifelines to households and firms, thereby mitigating contractions in economic activity. The report also found that countries with larger spending and revenue actions experienced smaller output contractions relative to pre-Covid-19 trends, with the result applying across advanced economies and emerging markets.

In this paper, we are interested to understand whether the governments' discretionary fiscal policies are associated with an asymmetric response of pandemics on the macroeconomic variables of interest. Capturing the discretionary fiscal response, particularly across a large set of countries, is an inherently difficult exercise with the literature devising different methods but with caveats (IMF 2018). This task becomes more challenging during crisis years where measurement issues could be complicated by factors like the accurate estimate of potential GDP. In addition, off-budget and below-the-line fiscal support could play a role

[3] As reported in WDI: percentage share of income or consumption is the share that accrues to subgroups of population indicated by deciles or quintiles.

but are not captured by (above-the-line) overall fiscal balances. Fiscal space could affect the size of fiscal support, as has been shown in some studies following Covid-19 (Hosny 2021, IMF 2020), which the fiscal impulse does not capture. However, on the last point, the robustness checks later in the paper show that the results hold (in fact, in some cases, stronger) controlling for lagged public debt-to-GDP ratio.

With these caveats in mind, we opt for fiscal impulse—a common indicator used to gauge the fiscal stance of governments—which is the negative of the annual change in structural primary balance (share of potential GDP). Fiscal impulse tries to determine whether there has been a policy-based change in the government's budget balance and, notwithstanding the potential measurement issues, is useful for few purposes (Schinasi et al., 1991): (i) they summarize in a single measure the aggregate effects of fiscal policy actions on the government's budget balance, (ii) to the extent that they measure the effects of a government's fiscal policies on budget outcome, they are useful for assessing the performance of fiscal authorities, and (iii) they are useful for international comparisons of fiscal policy changes over time.

The underlying structural primary balance data for this calculation has been taken from IMF WEO. As documented in the Statistical Appendix of IMF WEO (April 2021), the structural balance is "the actual net lending/borrowing minus the effects of cyclical output from potential output, corrected for one-time and other factors, such as asset and commodity prices and output composition effects". To gauge whether the response of the macroeconomic variables of our interest to pandemics could be contingent on the fiscal response, we look at the potential asymmetric response of these variables depending upon "high" versus "low" fiscal impulse during pandemic years. "High" and "low" represent countries above or below/equal to median of the fiscal impulse across the sample in the pandemic year. The baseline regressions are augmented, as outlined in equation (II), to interact the pandemic shock variable with dummy variables that represent high/low fiscal impulse.

The results of this exercise suggest that higher fiscal support can mitigate the detrimental effects of pandemics (Figure 6). Output declines by 3.4 percent after three years following

the pandemic shock for countries with low fiscal impulse, compared to 1.5 percent decline for countries with high fiscal impulse and 2.2 percent drop in the baseline case for the same time horizon. The negative output effect is statistically significant for four of the six time-horizons considered for relatively lower fiscal support countries, but not statistically significant for any time horizon for the high-support countries. In addition, output returns close to pre-pandemic levels by the fifth year for high-support countries, but remains below pre-pandemic levels for low fiscal support countries.

Similarly, the unemployment rate rises higher and does not return to pre-pandemic levels within five years for countries that provide lower fiscal support, but smaller effects and return to pre-pandemic levels are witnessed for those who provide higher fiscal support. The effects are statistically significant for the low-support group, but not for the high-support group.

The poverty rate also increases relatively more for countries with low fiscal support and remains persistently above pre-pandemic levels. The poverty rate increases by 0.6 percentage points after the first year for low fiscal support countries (statistically significant), compared to 0.2 percentage points for high fiscal support countries (statistically insignificant). Unlike the trajectory of low fiscal support countries, the poverty rate falls below the pre-pandemic levels for high fiscal support countries.

Finally, inequality continues to increase for low fiscal support countries with a 1.5 percent increase after five years (statistically significant), compared to a 0.7 percent increase for high fiscal support countries (statistically insignificant). Overall, the robustness checks conducted later in the paper find that the relative magnitudes highlighted for output, unemployment, poverty, and inequality for low versus high fiscal support using structural primary balance hold across a range of alternative specifications.

Recent studies on past pandemics find similar results for output and inequality. Ma et al. (2020) find similar results for output using an alternative fiscal indicator. Using the change in government spending or revenues, divided by the previous year's GDP as a measure of

countries' fiscal adjustment in the onset year, the authors find that countries with higher government expenditures, especially on health care, have a higher output growth bounce-back compared to countries with less fiscal expenditure response. We also perform robustness checks in line with Ma et al. (2020)'s approach of dividing the fiscal indicator by the previous year's GDP. In a similar vein and complementing the findings of this paper on inequality, Furceri et al. (2021b) show that the extent of fiscal consolidation following the onset of past pandemics determine the extent of the increase in inequality, with episodes of extreme austerity being associated with an increase in the Gini index three times as large as episodes with more supportive fiscal policy.

### C. Informality

The effect of Covid-19 on labor markets has been huge in depth and breadth, with developing economies, low-skilled workers, informal workers, and youth experiencing the most pronounced effects (IMF 2021b, Chapter 2). Informality is associated with underdevelopment across a wide range of areas that amplify the economic shock to livelihoods during Covid-19: widespread poverty, lack of access to financial systems, deficient public health and medical resources, and weak social safety nets (Yu, 2020). These vulnerabilities could push millions of people into extreme poverty, with an especially severe impact on women.

While the channels of vulnerabilities of informality have been well documented, there has been, to our knowledge, no work on systemically documenting the role of informality in shaping macroeconomic outcomes during past pandemics. To gauge the impact of informality, the same approach is followed as the one on fiscal support (using equation II). Countries are split for pandemic years into "high" and "low" informality using the values of informality for the year before the pandemic. For the analysis of the informal or shadow economy, data are taken from Medina and Schneider (2020) and cover all economic activities that are hidden from official authorities for monetary, regulatory, and institutional reasons.

Higher informality is found to be associated with negative medium-term macroeconomic effects, with the results robust for unemployment, poverty, and inequality (described later in

the section with robustness checks). The output falls by 2.6 percent after three years—the lowest point of output decline—for countries characterized with high informality, compared to a 2.2 percent drop in the same timeframe for those with low informality; the effects are statistically significant for both groups (Figure 7). However, the output decline is higher for low informal group for fourth and fifth year. The unemployment rate rises more for countries with high informality and, unlike low informality, the effect is statistically significant.

However, it must be noted that the robustness section identifies some cases where the relative magnitude of output and for high versus low informality do not hold. This is in line with literature where the empirical evidence on the behavior of the informal economy over the busines cycle is inconclusive owing to differences in country characteristics and the role of different economic shocks (for details on the views in the literature and accompanying studies, see World Bank 2021). For example, the informal sector could facilitate an economic recovery if it absorbs the job losses from the formal sector during economic downturns. On the other hand, the informal economy could magnify macroeconomic fluctuations if there is a positive correlation between the formal and informal sectors, such as in the case where informal firms provide services and final and intermediate goods to the formal sector.

Our results suggest that higher informality leads to higher poverty in the near term following a pandemic and this negative effect persists in the medium term, with the near-term statistically significant for high informality. The poverty rate increases by 1.3 percentage points after the first year for countries with high informality, compared to an increase of 0.7 percentage points in the same timeframe for those with low informality. Five years after the pandemic, the poverty rate remains 1 percentage points above pre-pandemic levels for countries with high informality, compared to a 0.4 percentage point increase for those with low informality. Similarly, inequality is found to be higher in the near term for countries with high informality with a 0.5 percentage point increase after two years, compared to an increase of 0.2 percentage points in the same timeframe for those with low informality. After five years, the rise in inequality is slightly higher for high informality, with the effect statistically significant for both groups. The results for poverty and inequality are found to be generally robust across a range of alternative specifications.

### D. Social Expenditure

An effective system with adequate resources for different social areas could help in absorbing adverse shocks like pandemics. During Covid-19, increased social protection spending, on average 0.6 percent of GDP in the first three quarters of 2020, has been estimated to have reduced the rise of extreme global poverty by about 10 million people (IMF 2021b).

Despite its criticality, the role of social expenditure in combating past pandemics has not been studied in a systematic manner to our knowledge. To gauge the role of social spending in influencing the macroeconomic outcome following pandemics, we use OECD's data for Social Expenditure. The baseline uses a component of social expenditure, family benefits, but we also provide summary outcomes of a few other components and of the total, after discussing the results using family benefits. As documented by OECD, this item refers to public spending on family benefits, including financial support that is exclusively for families and children. There are, broadly speaking, three types of public spending included in this item: (i) child-related cash transfers (cash benefits) to families with children (e.g., child allowances); (ii) public spending on services for families (benefits in kind) with children (e.g., direct financing and subsidizing of providers of childcare and early education facilities); and (iii) financial support for families provided through the tax system (e.g., child tax allowances: amounts for children deducted from gross income and not included in taxable income). For further details, see https://data.oecd.org/socialexp/family-benefits-public-spending.htm.

The baseline regressions are augmented in the same manner as that of fiscal support and informality, using equation II. The decadal average of social expenditures is used to determine "high" and "low" family benefits since OECD data for social expenditures do not provide annual data such as the fiscal impulse, informality, and health expenditure per capita. It must be noted that the coverage for regressions with social expenditure and components is limited to around 30 countries.

The results indicate that lower family benefits are associated with a relatively higher unemployment rise, higher poverty, and higher inequality, with these effects robust across a range of alternative specifications (Figure 8). Countries with lower family benefits tend to have similar output drops as those with higher family benefits. This result could be viewed as inconclusive as robustness checks show that the relative magnitude (both ways) could be contingent on the specification used. Having said that, the unemployment rise is found to be stronger for those with low family benefits, though the effect is not statistically significant for either group.

The rise in the poverty rate, 0.15 percentage points after two years, is also higher for countries with low family benefits, although the effects are statistically significant for the high group and not the low group. Finally, the increase in inequality is 2.2 percent after five years for countries with low family benefits. The increase in inequality is 1.5 percent in the same time period for those with high family benefits. Both the effects are statistically significant.

Figure 9 summarizes the impact across different macroeconomic variables after three years following the pandemic when total social expenditures and some of other components are considered. The negative output effect after three years is higher for the total amount and all the other components considered (with the exception of family benefits, as discussed above) for countries that have lower spending across these items, compared to the ones with higher spending. The unemployment rate, though found not to be statistically significant for both groups, is also higher for countries with lower benefits, compared to the ones with higher benefits across items. The rise in the poverty rate is found to be higher for countries with lower benefits compared to the ones with higher benefits. Finally, the rise in inequality is higher for countries with lower family benefits and lower health spending, but lower for countries with lower total social expenditure and lower active labor market policies.

### E. Health Expenditure per Capita

An effective health system that is prepared and has the capacity to combat the pandemic is crucially important to contain the virus. Deb et al. (2020) found that containment measures during Covid-19 were more effective in countries with higher health security and a better health index. Using state-level data in Mexico, we found that states with higher initial health expenditure and capacity on average had a lower fatality rate (Aguirre and Hannan, 2020). In this section, we find that higher health expenditure per capita is also associated with better unemployment, poverty and inequality post-pandemic outcomes.

Health expenditure per capita, taken from WDI, refers to the current health expenditure per capita in current international dollars (PPP). Figure 10 reports the results on output, unemployment, poverty, and inequality when "high" versus "low" health expenditures are considered. The output-effect is found to be stronger for countries with lower health expenditure with output falling by 3.8 percent after three years, compared to 3.4 percent for high expenditure group; both the effects are statistically significant. However, the negative output-effect is stronger for the higher expenditure group four and five years after the pandemic. The rise in unemployment, 1.7 percentage points after four years for the low group compared to 0.8 percentage points for the same time period for the high group, is also found to be higher for low health expenditure countries (the effects are statistically significant for the low expenditure group).

The poverty and inequality outcomes are found to be worse for countries in relatively lower health expenditure group. The poverty rate increases by 1.0 percentage points within the first year for the low health expenditure group, underscoring the hardship on the poor if the health system does not have adequate resources, and remains 0.7 percentage points above pre-pandemic levels after five years. This effect is statistically significant in the near term. For high health expenditure countries, the poverty rate increases by 0.4 percentage points after the first year and falls slightly below pre-pandemic levels after five years. The effects on poverty are not statistically significant for the estimates for the high health expenditure group. Finally, inequality increases higher for low health expenditure countries, to 1.2 percent after five years compared to 0.6 percent increase for the high expenditure group

over the same period, with the medium-term effect being statistically significant for the low expenditure group only.

Overall, the regressions suggest that the effects on output, unemployment, poverty, and inequality are worse for countries with relatively lower health resources, again underscoring the importance of health resources in mitigating prolonged negative effects of pandemics. However, the results on output are not robust across all specifications and further work could be done to understand the channels better. Similar to our baseline findings, Ma et. al (2020) find that the negative effects on output and unemployment in past pandemics have been less in countries with larger first-year responses in government spending, especially on health care. Echoing our findings for inequality using past pandemic episodes, Furceri et al. (2021b) find that episodes characterized with extreme austerity—measured using either the government's fiscal balance, health expenditure or redistribution—have been associated with an increase in inequality three times as large as episodes with more supportive fiscal policy.

### F. Robustness Checks

The robustness of the key messages is checked employing a battery of alternative formulations. The robustness checks include: (i) dropping all control variables, except output; (ii) dropping all control variables, including output; (iii) including all control variables; (iv) including all control variables except credit; (v) including additional control variables. As discussed previously, fiscal space could affect countries' fiscal response. To address this issue to some extent, we run regressions controlling for two lags of public-to-GDP ratio. In addition, we run regressions controlling for two lags of ICRG indicators, which captures the institutional quality of countries; (vi) including sample from 2000; (vii) adding four lags, instead of two lags as specified in the baseline and augmented regressions, (viii) splitting the sample using different percentiles. The augmented regressions incorporate policy and structural features by splitting the sample in the median. We consider splitting the sample using bottom 25$^{th}$ percentiles versus the rest (fiscal support, health expenditures per capita) and top 75$^{th}$ percentiles versus the rest (informality); (ix) using contemporaneous

values of control variables. In addition to two lags, this check also includes contemporaneous values of the control variables; (x) using contemporaneous values of informality and health expenditure per capita. The main regressions use the lagged values (one year before the pandemic) to split the sample. An alternative specification uses contemporaneous values instead (the year of the pandemic) for informality and health; (xi) using alternative indicators for fiscal. The main regressions use the fiscal impulse, which is the negative of the annual change in structural primary balance (share of potential GDP, expressed in percentage points). One concern could be measurement issues related to estimation of potential GDP, particularly during pandemic years. To mitigate this concern to some extent, we divide the negative of the change in primary structural balance (in level terms) by the nominal GDP of the previous year (following Ma et al. (2020) who divide their indicator similarly). In addition, the augmented regressions are run using changes in structural overall fiscal balances, cyclically adjusted overall and primary fiscal balances, and overall and primary fiscal balances (instead of changes in structural primary balances); and (xii) using alternative definition of health. More specifically, using lagged current health expenditure as a share of GDP (instead of per capita) and general government health expenditure (as a share of GDP).

The main findings from robustness checks are: (i) the output decline in the baseline is found to be more pronounced in some cases; (ii) the unemployment results come out statistically significant in some cases, compared to the baseline where it narrowly misses statistical significance; (iii) the relative magnitudes highlighted using fiscal policy are found to be robust using the main/baseline definition of fiscal impulse in the paper. In fact, the output decline in many cases is more pronounced for the relatively lower fiscal support group. The results hold when using overall structural balances and cyclically adjusted overall and primary balances, except poverty for cyclically adjusted balances. With the exception of output when primary balance is used and inequality when overall balance is used, the results do not hold when overall and primary fiscal balances (net lending/borrowing) are used. However, given that we are interested in the discretionary fiscal support and the overall balances also include additional factors, the findings of the paper on the role of discretionary fiscal policies remain intact; and (iv) the results for the structural features (informality, family benefits, health) are found to be generally robust for unemployment, poverty, and

inequality. The exception is that the relative magnitudes for output using informality, family benefits, and health expenditure per capita do not always hold. It must be noted that, while the impact of family benefits on output is inconclusive in robustness checks, the total social expenditure and other components show higher output decline for relatively lower support groups after three years (Figure 9).

Overall, the battery of checks corroborate that relatively higher fiscal support is associated with less output drops following pandemics. In addition, relatively higher fiscal support and better initial conditions (lower informality, higher family benefits, and higher health expenditure per capita) could mitigate the negative effects of pandemics on unemployment, poverty, and inequality.

## IV. CONCLUDING THOUGHTS

Using a sample of 55 countries over 1990-2019 and employing the local projection methodology, the paper finds that past pandemics had lasting damaging scarring effects with detrimental impacts on output, unemployment, poverty, and inequality. However, a relatively stronger fiscal response helped to mitigate the negative output effects. Similarly, a relatively stronger fiscal response and better initial conditions in informality, family benefits, and health expenditure per capita helped to alleviate the negative effect on unemployment, poverty, and inequality (see summary chart, Figure 11). As discussed by the literature on past pandemics, given the considerably higher severity of Covid-19, these results can be regarded as lower bounds. Applying empirical estimates from past pandemics on inequality, Emmerling et al. (2021) project significant scarring effects of Covid-19, which could be associated with an increase in poverty of about 75 million people worldwide.

The results in the paper point to the need for supportive policies across many fronts to limit long-lasting scarring effects of pandemics, especially on vulnerable groups, and mitigate the persistent loss of human capital from Covid-19. The role of structural features, shown to be important in this paper, is likely to be critical. Adequate fiscal support, higher health spending, and targeted family benefits should be part of the package. Higher policy support

and complementary policies might be required in countries with high informality who might—as the findings of the paper suggest—witness more negative impacts on unemployment, poverty, and inequality. For example, noting that addressing informality is urgent to support inclusive economic development and reduce poverty worldwide and that Covid-19 has reinforced this sense of urgency, Delechat et al. (2020) discuss a range of policy recommendations to address informality: (i) improve access to and quality of education, (ii) avoid tax system design that inadvertently increases incentives for individuals and firms to remain in the informal sector, (iii) enhance financial inclusion by promoting access to formal financial services, and (iv) pursue a range of structural policies (e.g., in labor market regulations, competition policies, digitalization) to increase incentives and lower the cost of formalization.

Certain Covid-19 specific effects point toward higher detrimental effects for countries with weaker initial conditions. For example, the social distancing during the pandemic meant reliance on online schooling across many countries. The UN (2020) contends that Covid-19 resulted in the largest disruption of education systems in history, affecting nearly 1.6 billion learners in more than 190 countries. The Covid-19 pandemic is exacerbating pre-existing education disparities by reducing the opportunities for many of the most vulnerable children, youth, and adults. To the extent that countries with higher informality are characterized by lower internet access, the already comparatively lower school enrolment rates could be exacerbated, resulting in persistent loss of human capital and deterioration in poverty and inequality outcomes (Figure 12). Higher informal economies also tend to have a lower share of population with account ownership at a financial institution or with a mobile-money-service provider, which would affect access to financial resources. Similarly, countries with lower social expenditure have less internet and financial access, which could exacerbate poverty and inequality outcomes (Figure 13). This further underscores the need for supportive policy actions as studied in this paper.

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# VI. TABLES

## Table 1: List of Countries

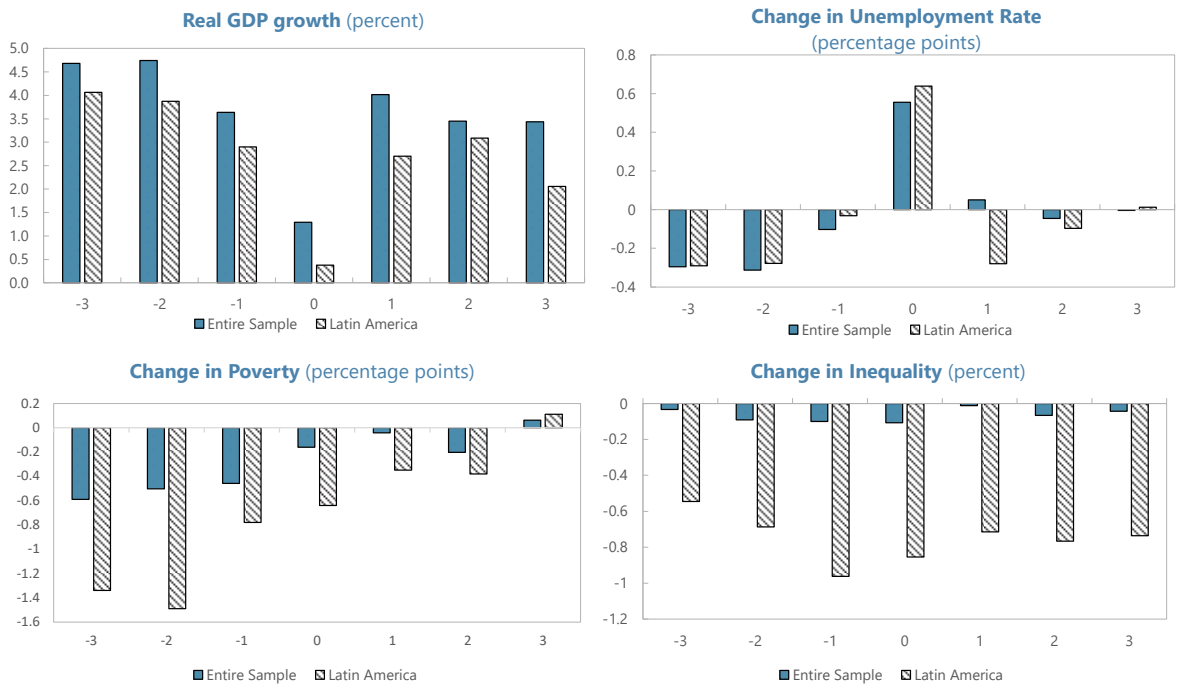
| | | | |
|---|---|---|---|
| Algeria | France | Korea, Rep. | Singapore |
| Argentina | Germany | Malaysia | South Africa |
| Australia | Greece | Mexico | Spain |
| Austria | Hong Kong SAR | Netherlands | Sweden |
| Belgium | Hungary | New Zealand | Switzerland |
| Brazil | India | Nigeria | Thailand |
| Canada | Indonesia | Norway | Turkey |
| Chile | Iran, Islamic Rep. | Pakistan | Ukraine |
| China | Iraq | Philippines | United Arab Emirates |
| Colombia | Ireland | Poland | United Kingdom |
| Czech Republic | Israel | Portugal | United States |
| Denmark | Italy | Romania | Venezuela, RB |
| Egypt, Arab Rep. | Japan | Russian Federation | Vietnam |
| Finland | Kazakhstan | Saudi Arabia | |

## Table 2: Data Sources

| Indicators | Source |
|---|---|
| **Pandemic episodes** | Ma et al. (2020) |
| **Outcome variables** | |
| Output, unemployment, poverty, income shares across different deciles | World Development Indicators (WDI) |
| Inequality (Gini indices) | Standardized World Income Inequality Database (SWIID) |
| **Policy and Structural Features** | |
| *Fiscal impulse, percentage points of potential GDP* | IMF World Economic Outlook (WEO) |
| Negative of change in structural primary balance | |
| *Informal sector, percent of GDP* | Medina and Schneider (2020) |
| Covers all economic activities that are hidden from official authorities for monetary, regulatory, and institutional reasons | |
| *Social expenditure and its components, share of GDP* | OECD |
| *Current health expenditure per capita, PPP (current intl. $)* | WDI |
| **Control variables** | |
| Trade/GDP, private credit/GDP, income per capita | WDI |
| Banking crisis | Laeven and Valencia (2020) |
| **Other variables** | |
| Institutional quality | PRS Group, International Country Risk Guide (ICRG) |
| Public debt/GDP, fiscal balances | IMF WEO |
| General government health expenditure/GDP, current health expenditure/GDP | WDI |

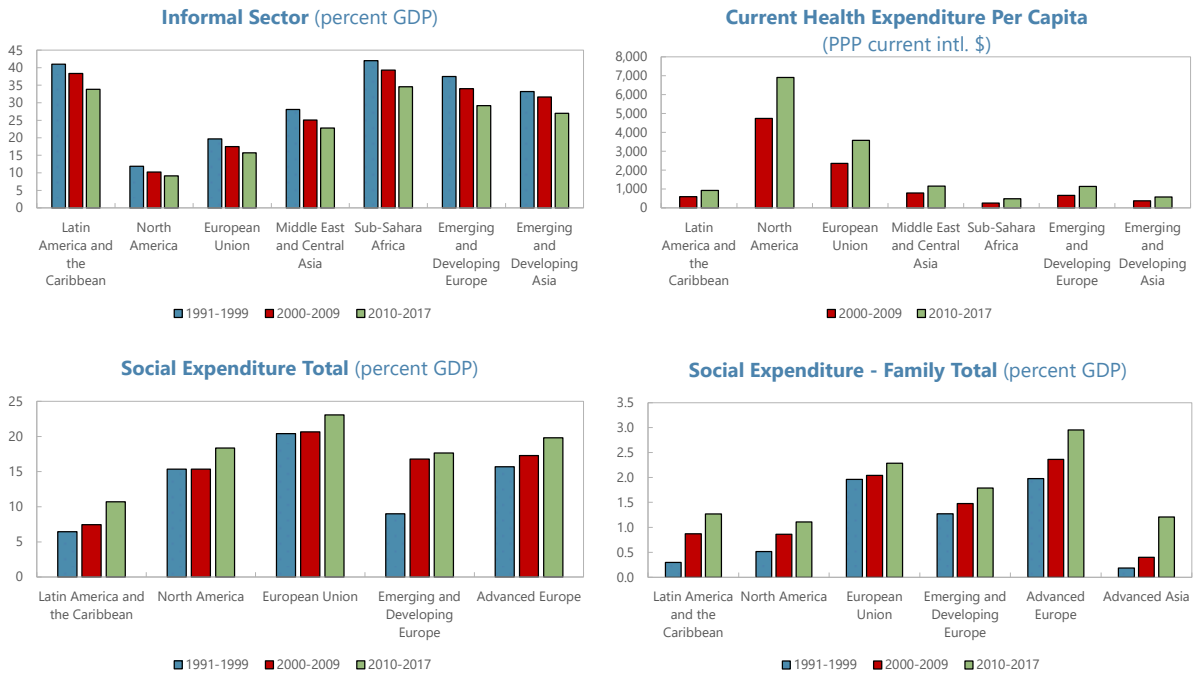
# VII. FIGURES

**Figure 1: Macroeconomic Variables Before and After Pandemics**



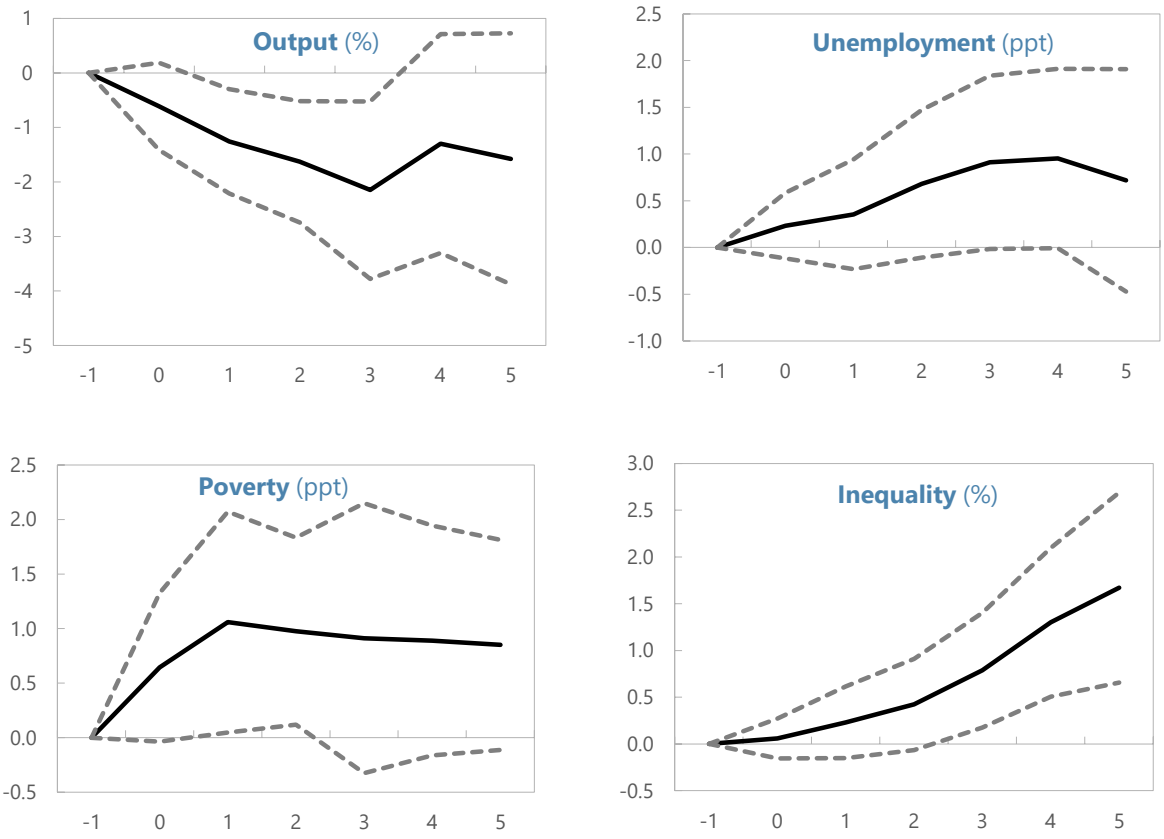

Note: The sample includes a wider set of countries than the regression sample. The pandemic episodes are taken from Ma et al. (2020) for the last five pandemics. The x-axis refers to years before and after pandemic, where t=0 is the year of the pandemic.

**Figure 2: Structural Features Across Regions**



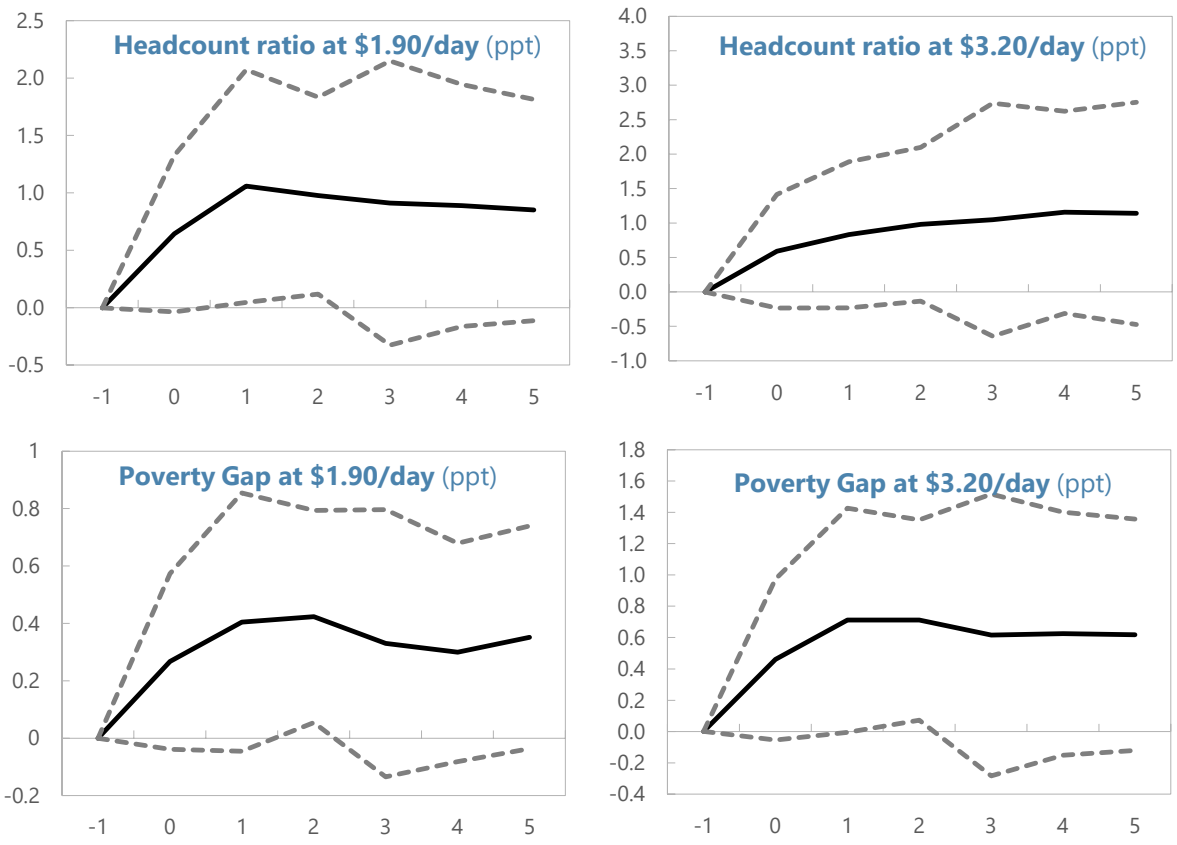

Note: The sample includes a wider set of countries than the regression sample. For each indicator, the simple average of each region is calculated in cases where there are at least two countries with data for the region. Data are more restricted for social expenditure.

**Figure 3: The Effect of Past Pandemics**



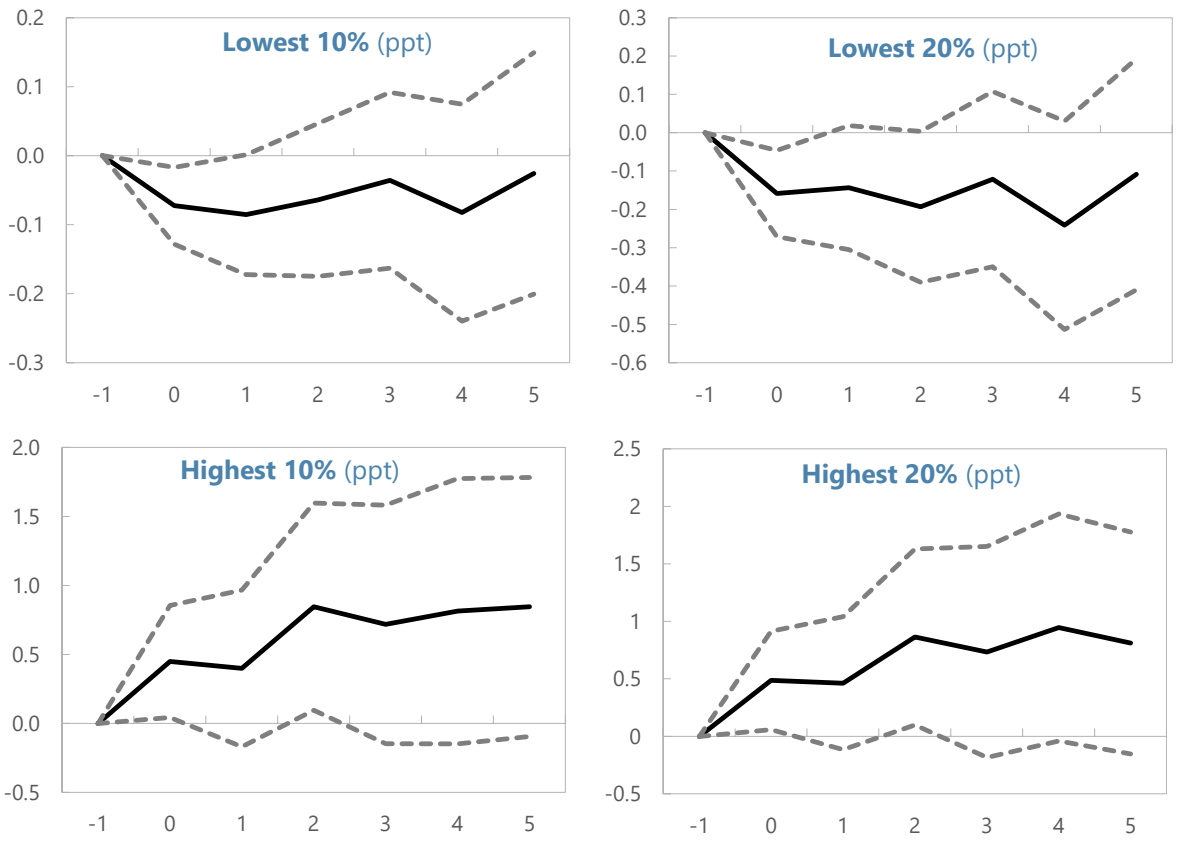

Note: Impulse response functions of the relevant variable on pandemics are estimated using a sample of 55 countries over the period 1990-2019. The solid line indicates the response while the dotted lines correspond to 90 percent confidence bands using standard errors clustered at the country level. The x-axis denotes time: t=0 is the year of the change. The y-axis denotes the change in the variable of interest at time t, compared to the year before pandemic. Poverty refers to WDI's poverty headcount ratio at $1.90 a day (2011 PPP; as a share of population), while inequality is represented by net Gini index from SWIID database. All equations include a dummy variable (and two lags) to capture the pandemic, two lags of the dependent variable, two lags of output, and country- and time-fixed effects. In addition, the equations for output and unemployment rate control for two lags of: log of income per capita, trade-to-GDP ratio, private credit-to-GDP ratio, and banking crisis (Laeven and Valencia 2020).

**Figure 4: The Effect of Pandemics on Poverty**



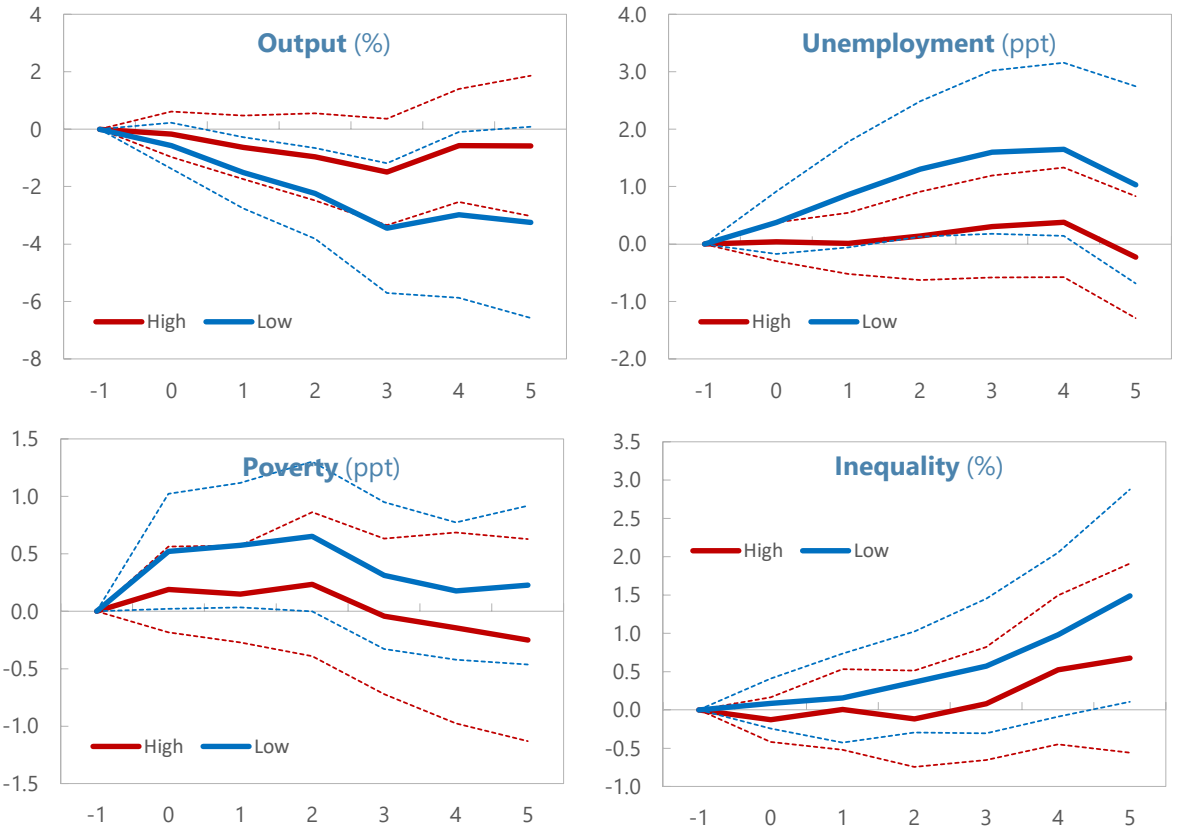

Note: Impulse response functions of the relevant poverty indicator on pandemics are estimated using a sample of 55 countries over the period 1990-2019. The solid line indicates the response while the dotted lines correspond to 90 percent confidence bands using standard errors clustered at the country level. The x-axis denotes time: t=0 is the year of the change. The y-axis denotes the change in the variable of interest at time t, compared to the year before pandemic. All equations include a dummy variable (and two lags) to capture the pandemic, two lags of the dependent variable, two lags of output, and country- and time-fixed effects.

**Figure 5: The Effect of Pandemics on Income Shares Held by Subgroups of Population Indicated by the Deciles or Quintiles**



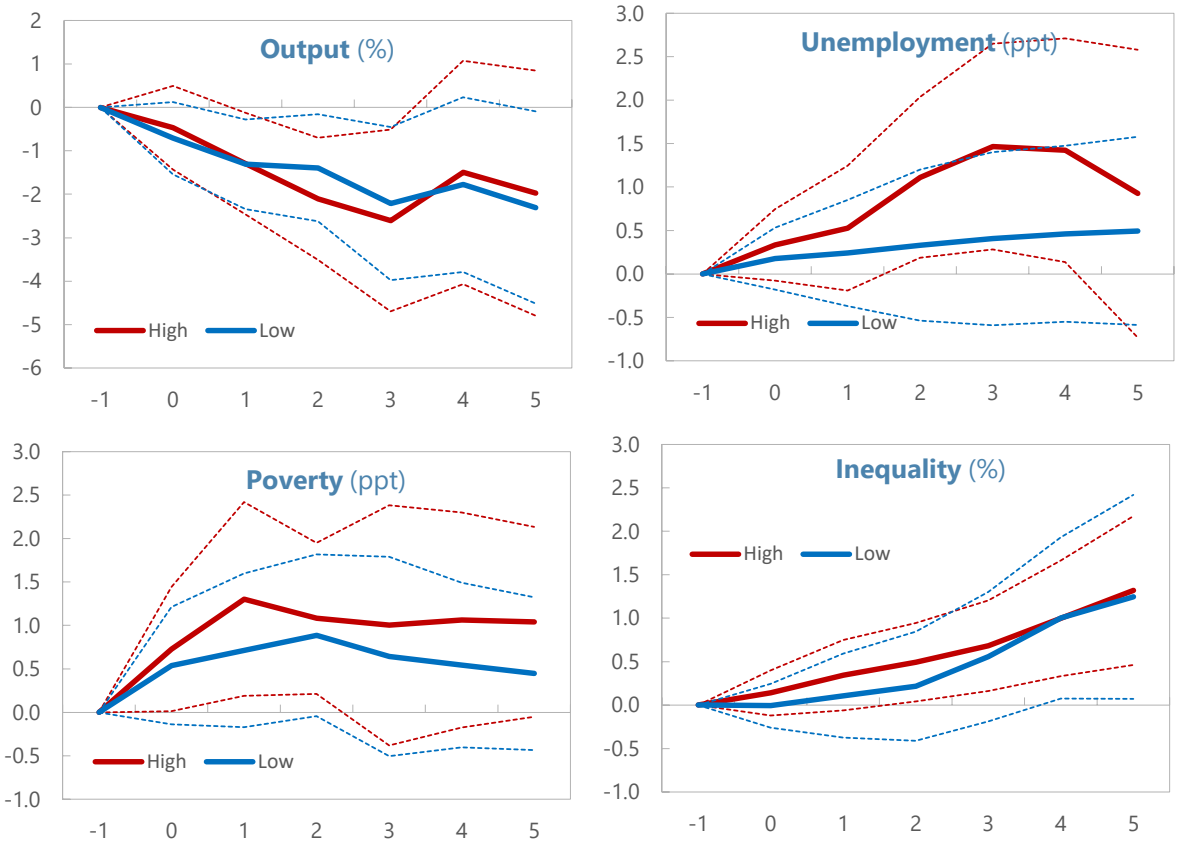

Note: Impulse response functions of the relevant income share indicator on pandemics are estimated using a sample of 55 countries over the period 1990-2019. The solid line indicates the response while the dotted lines correspond to 90 percent confidence bands using standard errors clustered at the country level. The x-axis denotes time: t=0 is the year of the change. The y-axis denotes the change in the variable of interest at time t, compared to the year before pandemic. All equations include a dummy variable (and two lags) to capture the pandemic, two lags of the dependent variable, two lags of output, and country- and time-fixed effects.

**Figure 6: The Effect of Pandemics: High versus Low Fiscal Support**



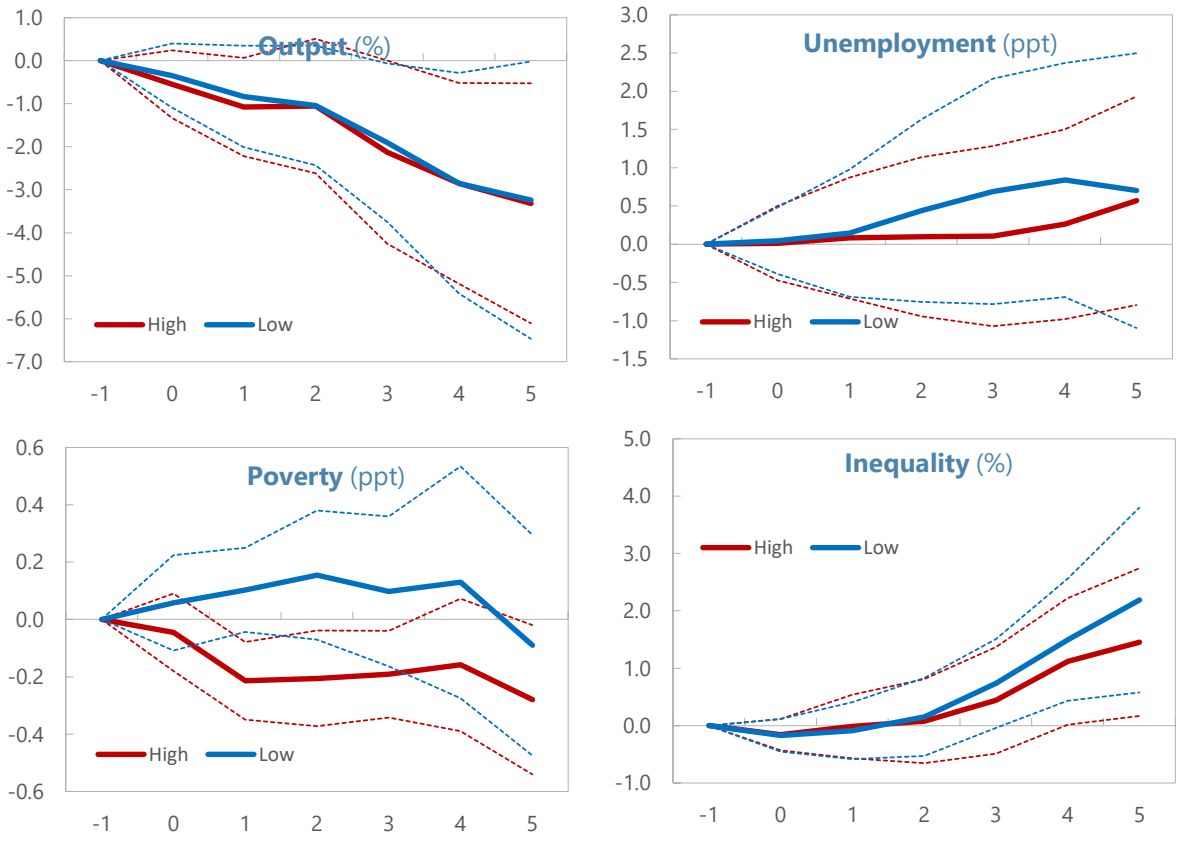

Note: The solid line indicates the response of the relevant variable to pandemics while the dotted lines correspond to 90 percent confidence bands using standard errors clustered at the country level. The x-axis denotes time: t=0 is the year of the change. The y-axis denotes the change in the variable of interest at time t, compared to the year before pandemic. The equation of the impulse function is reported as equation II in the text. This is the same as the baseline (see Figure 3 and equation I of text). The only difference is that the pandemic shock is interacted with dummy variables that represent high/low fiscal impulse where high and low represent countries above or below/equal to median of the fiscal impulse across the sample in the pandemic year. The fiscal impulse is the negative of the annual change in structural primary balance as a share of potential GDP.

**Figure 7: The Effect of Pandemics: High versus Low Informal Sector**



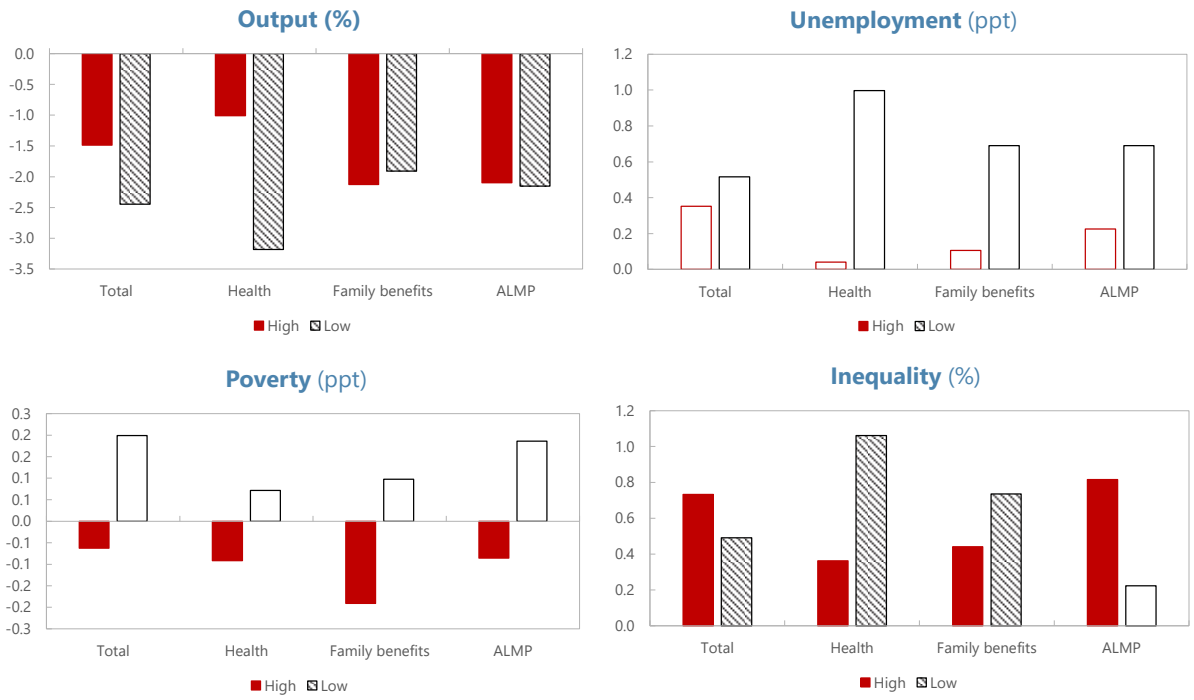

Note: The solid line indicates the response to pandemics while the dotted lines correspond to 90 percent confidence bands using standard errors clustered at the country level. The x-axis denotes time: t=0 is the year of the change. The y-axis denotes the change in the variable of interest at time t, compared to the year before pandemic. The equation of the impulse function is reported as equation II in the text. This is the same as the baseline (see Figure 3 and equation I of text). The only difference is that the pandemic shock is interacted with dummy variables that represent high/low informal sector (share of GDP) where high and low represent countries above or below/equal to median of the informal sector across the sample for the year before pandemic. The informal or shadow economy, taken from Medina and Schneider (2020), covers all economic activities that are hidden from official authorities for monetary, regulatory, and institutional reasons.

**Figure 8: The Effect of Pandemics: High versus Low Family Benefits**



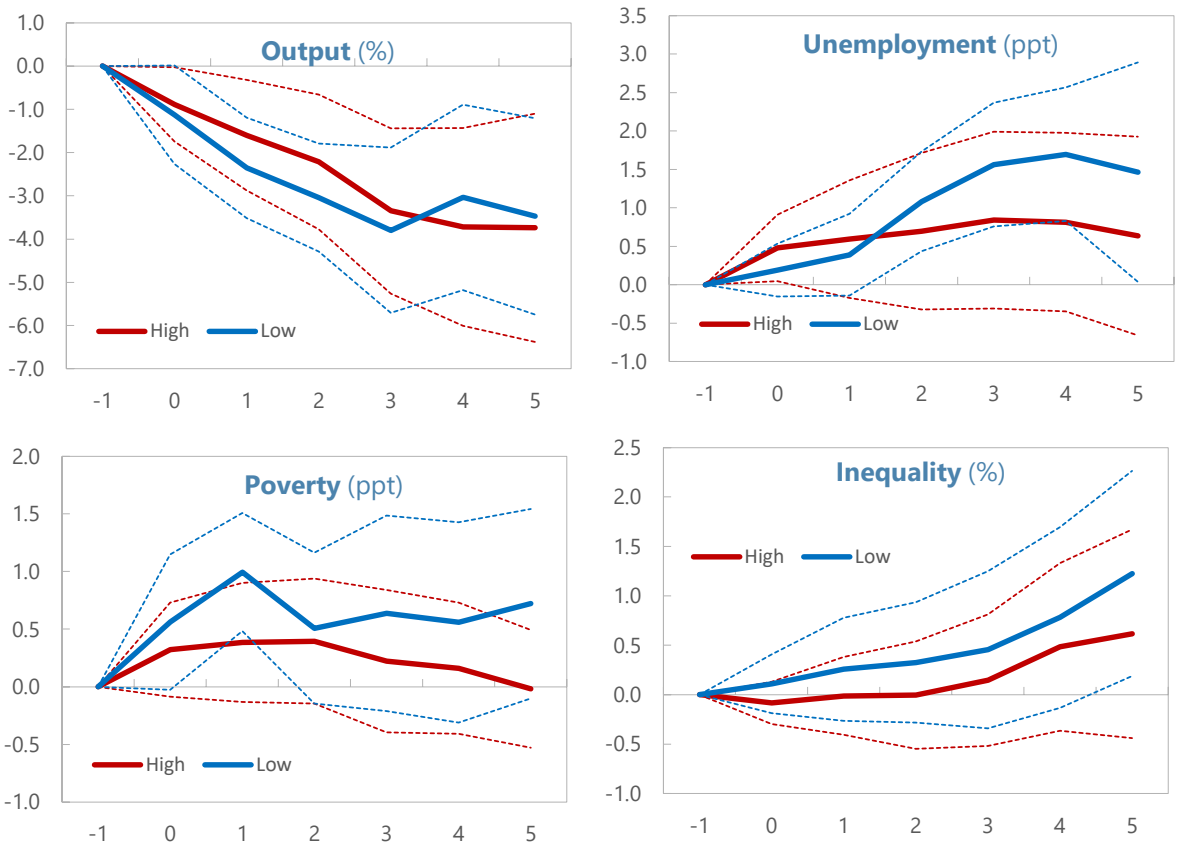

Note: The solid line indicates the response to pandemics while the dotted lines correspond to 90 percent confidence bands using standard errors clustered at the country level. The x-axis denotes time: t=0 is the year of the change. The y-axis denotes the change in the variable of interest at time t, compared to the year before pandemic. The equation of the impulse function is reported as equation II in the text. This is the same as the baseline (see Figure 3 and equation I of text). The only difference is that the pandemic shock is interacted with dummy variables that represent high/low family benefits (share of GDP) where high and low represent countries above or below/equal to median of the family benefits across the sample using decadal average. Family benefits spending data, a component of social expenditure, is taken from OECD. As documented by OECD, this item refer to public spending on family benefits, including financial support that is exclusively for families and children. There are, broadly speaking, three types of public spending included in this item: (i) child-related cash transfers (cash benefits) to families with children (e.g., child allowances); (ii) public spending on services for families (benefits in kind) with children (e.g., direct financing and subsidising of providers of childcare and early education facilities; and (iii) financial support for families provided through the tax system (e.g., child tax allowances: amounts for children deducted from gross income and not included in taxable income). For further details, see https://data.oecd.org/socialexp/family-benefits-public-spending.htm.

**Figure 9: The Effect of Pandemics After Three Years: Role of Social Expenditure**




Note: ALMP = Active Labor Market Programmes. The bars show the coefficient of impulse functions three years after pandemic shock: the estimated change in the variable of interest three years after pandemic shock, compared to the year before pandemic. Filled bars represent variables that are statistically significant (90 percent) for at least one year of the t=0 to t=5 time horizons. The equation of the impulse function is reported as equation II in the text. This is the same as the baseline (see Figure 3 and equation I of text). The only difference is that the pandemic shock is interacted with dummy variables that represent high/low social expenditure/some of its components (share of GDP), where high and low represent countries above or below/equal to median of the relevant variable across the sample using decadal average. Social expenditure and some of its components are taken from OECD. For further details, see https://stats.oecd.org/Index.aspx?datasetcode=SOCX_AGG.

**Figure 10: The Effect of Pandemics: High versus Low Health Expenditure Per Capita**

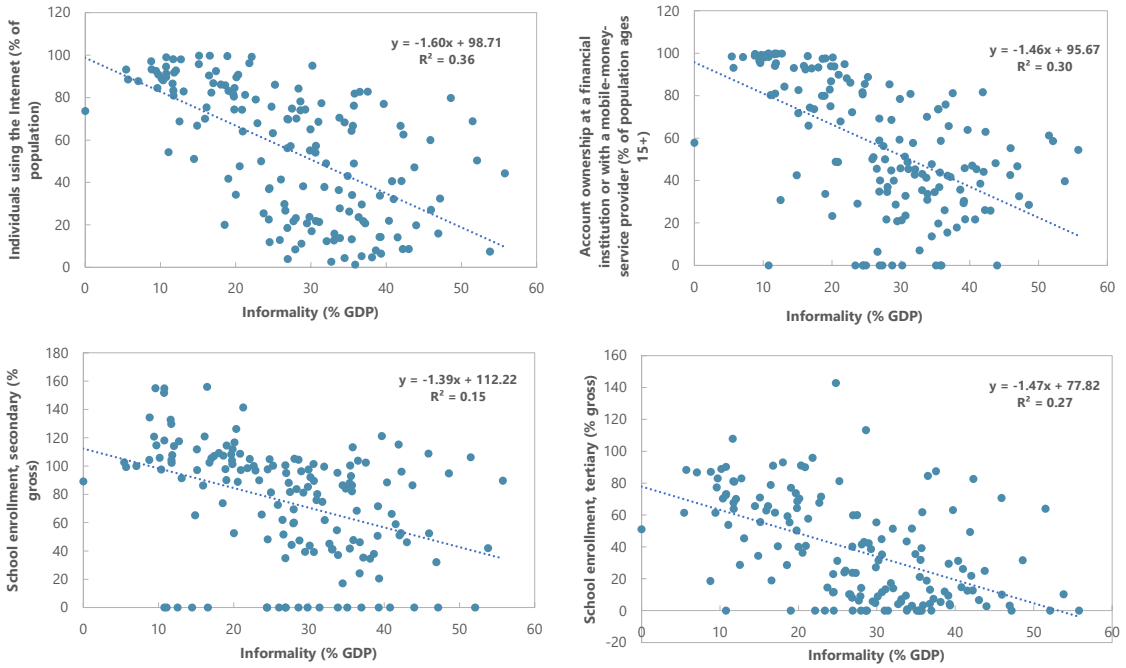



Note: The solid line indicates the response to pandemics while the dotted lines correspond to 90 percent confidence bands using standard errors clustered at the country level. The x-axis denotes time: t=0 is the year of the change. The y-axis denotes the change in the variable of interest at time t, compared to the year before pandemic. The equation of the impulse function is reported as equation II in the text. This is the same as the baseline (see Figure 3 and equation I of text). The only difference is that the pandemic shock is interacted with dummy variables that represent high/low current health expenditure per capita (PPP current international dollars, taken from WDI) where high and low represent countries above or below/equal to median of the health expenditure per capita across the sample for the year before pandemic.

**Figure 11: The Differential Responses Three Years After Pandemic Shock**

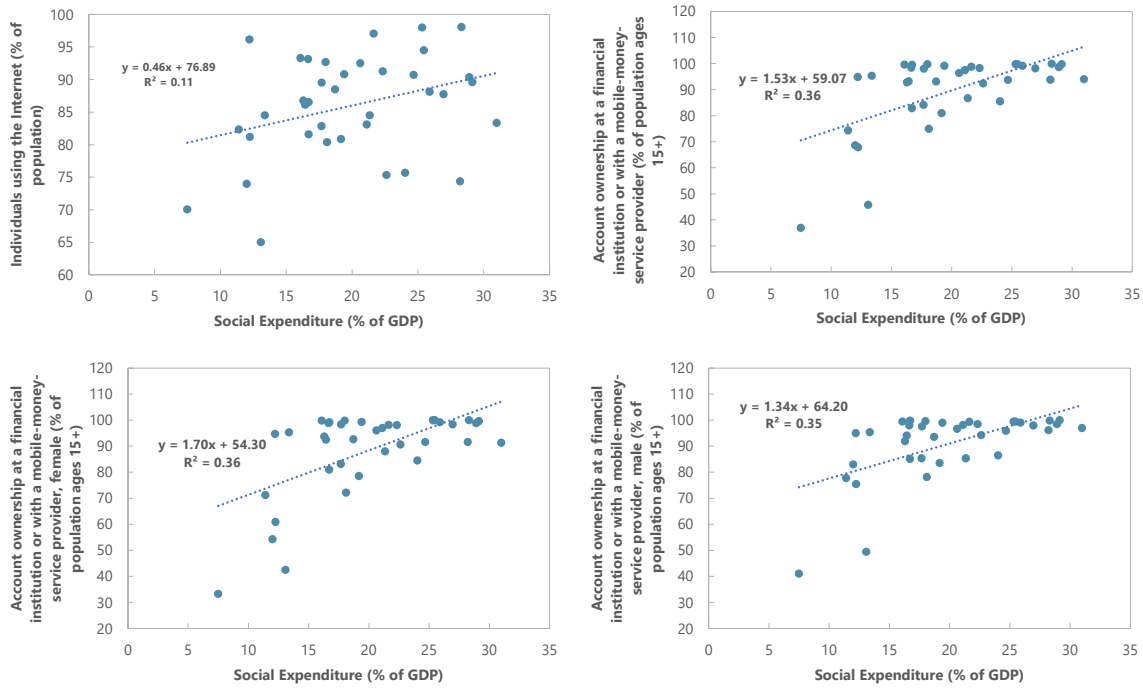

Note: The bars show the coefficient of impulse functions three years after pandemic shock: the estimated change in the variable of interest three years after pandemic shock, compared to the year before pandemic. Filled bars represent variables that are statistically significant (90 percent) for at least one year of the t=0 to t=5 time horizons. The equation of the impulse function is reported as equation II in the text. This is the same as the baseline (see Figure 3 and equation I of text). The only difference is that the pandemic shock is interacted with dummy variables that represent high/low fiscal impulse (informality, family benefits, health spending per capita) where high and low represent countries above or below/equal to median of the respective variable across the sample in the pandemic year (except in family benefits where it is the decadal average). The fiscal impulse is the negative of the annual change in structural primary balance as a share of potential GDP. The informal or shadow economy, taken from Medina and Schneider (2020), covers all economic activities that are hidden from official authorities for monetary, regulatory, and institutional reasons.

**Figure 12: Informality versus Development Indicators**




Source: WDI and Medina and Schneider (2020).

**Figure 13: Social Expenditure versus Development Indicators**




Source: WDI and OECD.