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Recessions and mortality: a global perspective*

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Abstract

Using panel data covering 180 countries over six decades, this paper shows that recessions are systematically associated with higher mortality rates. During years when GDP falls, death rates rise, primarily in emerging market and developing economies and there among children in particular. In advanced economies, death rates increase only slightly. We further find that the scarring effects of recessions persist for several years and that deeper recessions lead to larger increases in mortality. In contrast, booms or periods of subdued growth are not associated with a marked decline in death rates. Our findings have implications for the policy response to Covid-19 and suggest that the eventual death toll of the pandemic may be understated if the impact of the coronavirus recession is neglected.

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1 Introduction

The Covid-19 pandemic has led to the most severe contraction in global economic activity in post-WWII history. Strikingly, countries with a stronger predicted GDP decline in 2020 have so far also seen a higher number of excess deaths after taking into account official Covid-19-related fatalities, especially among emerging market and developing economies (EMDEs). Figure 1 plots the predicted decline in GDP in 2020 on the horizontal axis against excess deaths (standardised by total population) on the vertical axis. Among EMDEs, there is a clear negative relationship: the deeper the expected recession, the higher excess deaths (panel a). Among advanced economies (AEs), the relationship is only weak (panel b).

The negative correlation between excess deaths and recession depth could reflect differences in the severity of the pandemic across countries. Higher infections may lead to deeper recessions through voluntary restrictions on movements and lockdown measures; and at the same time to higher excess deaths through under-measurement of Covid-19 fatalities or a congestion of health care systems. However, the negative link between recession depth and mortality in Figure 1 persists after taking into account the number of infections and hospitalisation capacity.[1] Differences in the severity of the pandemic and health care system capacities cannot fully explain the pattern.

In this paper we investigate an alternative explanation: could there be a link between recessions and mortality that differs among rich and poor economies? For a sample of 180 countries over the period from 1961 to 2018 we analyse how recessions affect overall death rates and child mortality rates. We also investigate how the effects differ across countries depending on income levels and to which extend they vary with the depth of the recession.

The data suggest stark differences in the link between recessions, defined as years of negative GDP growth, and mortality across countries. Panel (a) in Figure 2 shows average death rates during non-recession and recession years in (rich) advanced economies and (poorer) emerging market and developing economies. While average mortality rates are not statistically different during recessions in AEs, they are significantly higher in EMDEs. These differences are even starker

[1] A regression of excess deaths over total population on the predicted decline in GDP yields a coefficient $\beta^{EMDE} = -0.17$ for EMDEs and $\beta^{AE} = -0.01$ for AEs. When we control for the number of infections per capita and the number of hospital beds per capita in the regressions, the respective coefficients are $\beta^{EMDE} = -0.14$ and $\beta^{AE} = -0.00$. In other words, a more severe course of the pandemic, characterised by higher infection rates, and a less well-equipped health sector, characterised by fewer hospital beds, explain only part of the observed correlation.

for child mortality rates, which increase dramatically in EMDEs in years when the economy contracts, but barely change in AEs (panel b).

Investigating the link systematically in regressions, we find that recessions are associated with a sizeable and highly significant increase in mortality. During years of falling GDP, death rates rise by 0.4 deaths per 1,000 people (4% of the mean). Child mortality rates surge by 4 deaths per 1,000 births (6% of the mean). Importantly, we find that recessions cast a long shadow: they lead to significantly higher death rates for up to ten years and higher child mortality rates for up to twelve years.

A key finding of our analysis is that recessions increase mortality rates primarily in EMDEs, and there in particular child mortality rates. Specifically, in a recession the mortality rate increases by 0.5 deaths per 1,000 people (4.5% of the mean) and the child mortality rate by almost 5 deaths per 1,000 births (7% of the mean). These effects are statistically highly significant. By contrast, recessions have a small and often insignificant effect on death rates in AEs. We further find that the deeper the recession, the larger the increase in mortality rates among EMDEs. For example, years of just below-zero GDP growth see a smaller increase in death rates than years in which GDP declines by at least 2.5%.

Our results hold in a large number of robustness tests. In the analysis we control for trend GDP per capita to account for the general negative relation between the level of development and death rates. We also account for armed conflicts, epidemics or famines that could simultaneously trigger recessions and rising death rates. Further, our estimates are unaffected when we focus on the period after 1990 to account for the increase in living standards in many EMDEs over time; are similar when we use alternative definitions of what constitutes a recession; are robust to controlling for unobservable regional development through time-varying fixed effects at the regional level; and are insensitive to controlling for demographic trends.

The recession-mortality link is weaker for higher levels of national income: while countries in the bottom quartile of GDP per capita see an increase of 1 death per 1,000 people during a recession, the effect declines to 0.38 deaths for countries in the second quartile of the per capita income distribution; the effect further declines to near-zero for countries in the third and fourth quartile. This finding implies that downturns that lower per capita incomes permanently increase the mortality impact of recessions. In that respect, a possible scenario of longer-lasting declines in per capita GDP levels across the world in the wake of the pandemic would be particularly worrying.

Finally, we also contrast the mortality impact of recessions with that of other phases of the business cycle. Specifically, we consider episodes of economic booms (above-trend growth) and of slow growth (below-trend but positive growth). The findings of these exercises suggest an asymmetric effect: while recessions significantly increase mortality, booms and periods of slow growth do not have any statistically significant effect on death rates.

Through which channels could economic contractions affect death rates? On the one hand, recessions could engender higher death rates through lower income levels (Cutler et al., 2006). In many countries, earning a regular income is essential to "make a living". Recessions that reduce incomes and lead to unemployment can give rise to malnutrition with potentially lethal consequences (O'Connell and Smith, 2016). Job losses in an economic downturn can trigger existential angst, increasing stress-related health problems and suicide rates (Case and Deaton, 2020). At the same time, economic growth often sustains public spending. Recessions can therefore be associated with an inadequate provision of these public services.

These adverse direct effects of recessions on health are particularly relevant in poorer countries, where incomes are often close to subsistence levels and healthcare systems underdeveloped (Grigoli and Kapsoli, 2018). Economic downturns could disproportionately hurt children as the weakest part of societies. During recessions, parents may need to cut back on child care provisions. Governments are often forced to reduce medical care provision, which may affect children in particular (Maruthappu et al., 2017).

In contrast, private or state-provided financial buffers largely protect individuals' living standards during economic downturns in richer economies. Healthcare system are generally better funded. As a consequence, indirect effects of recessions on living conditions and lifestyle habits could dominate and give rise to a "healthy recession paradox" (Ruhm, 2016). Such beneficial effects of recessions may arise because a slowdown in economic activity could be associated with fewer job-related and traffic accidents, less air pollution, a healthier diet or more exercise (Burgard et al., 2013).

The finding that recessions increase mortality has important policy implications and holds lessons for the response to the Covid-19 pandemic. While a recession has only modest effects on mortality rates in AEs (according to our estimates), global economic spillovers could spread recessions in AEs to EMDEs and raise mortality there. In consequence, our results suggest that macro-financial stabilisation policies reducing the risk of recessions might also mitigate mortality risk – either directly or indirectly through global economic spillovers (Kohlscheen et al., 2020).

Our results also imply that the death toll of the Covid-19 pandemic likely exceeds that directly attributable to the disease. In EMDEs a recession induced by the pandemic or the containment responses could lead to higher mortality rates, especially among children. This contrasts with the direct mortality impact of Covid-19, which is mainly affecting older age cohorts that represent a larger share of the population in AEs.[2] The results would further imply that the trade-off involved in virus containment policies is more complex: most of the academic literature and the public debate has focused on the trade-off between saving lives from the pandemic and sacrificing incomes (Eichenbaum et al., 2020; Alvarez et al., 2020; IMF, 2020), but neglected the recession-mortality nexus. If recessions increase mortality rates, then lockdown policies will be more effective in reducing mortality rates if they take their economic consequences directly into account.

The remainder of the paper is organised as follows. Section 2 reviews the related literature. Section 3 discusses the data. Section 4 first presents a panel analysis of the link between recessions and mortality, including a large number of robustness checks. It then investigates the dynamic effects of recessions on mortality in the decade following a recession. Section 5 explores whether, besides recessions, also booms or periods of slow growth affect mortality. Section 6 concludes.

2 Related literature

Our paper contributes to the health economics literature on the effects of economic conditions on mortality. Early studies hypothesise that a contraction of incomes would lead to more deaths as it becomes harder for households to 'make a living', a result established in the literature based on time series analysis (Brenner, 1979). However, more recent empirical papers employing panel data show that economic downturns appear to reduce mortality. For instance, Ruhm (2000) and Gerdtham and Ruhm (2006) show that mortality is procyclical, specifically that mortality drops when unemployment rises.[3] This "healthy" effect of economic

[2] Studies show that the vast majority of casualties from the Covid-19 pandemic is concentrated among the population 60 years and older. See Natale et al. (2020) and the website of the Centers for Disease Control and Prevention on "COVID-19 Pandemic Planning Scenarios".

[3] Evidence reported in Lam and Piérard (2017) suggests, however, that in the United States, the procyclicality of mortality has weakened recently.

downturns is partly linked to lower traffic and work related accidents, but also to improved physical health due to behavioural changes such as less alcohol and tobacco consumption (Ruhm, 2005).[4] These effects appear to obtain not only for general cyclical fluctuations in the unemployment rate, but also for outright recessions. Tapia Granados and Ionides (2017) analyse the evolution of mortality in 27 European countries around the Great Recession of 2009 and find that those countries where the crisis was particularly severe experienced larger reductions in mortality. Ruhm (2016) shows for the United States that recessions reduce death rates in ways similar to those of less severe downturns.

However, most of the literature establishing the healthy recession paradox focuses on the richest economies, often the United States.[5] We assess the link between recessions and mortality in both rich and poor countries and distinguish between the effects of recessions on total and child mortality. Moreover, we extend the literature by also considering dynamic effects of recessions over several years.

Our paper also relates to the newly emerging literature on the macroeconomic consequences of epidemics. Several papers investigate the trade-off between lives saved and incomes lost involved in virus containment policies.[6] Eichenbaum et al. (2020) extend an epidemiological model to study the interaction between economic decisions, epidemics and containment measures. They show that the optimal containment policy increases the severity of the recession to save lives.[7] Alvarez et al. (2020) study the optimal lockdown policy for a planner who wants to control the fatalities of a pandemic while minimising the output costs of the lockdown.

[4] At the same time, mental health appears to deteriorate during downturns due to heightened psychological stress. In particular, suicides and non-psychotic mental disorders are countercyclical (Ruhm, 2000, 2005).

[5] The few studies that focus on EMDEs reach mixed conclusions: Lin (2009) establishes a procyclical pattern of mortality in a panel of eight countries in Asia-Pacific, pooling advanced and emerging market economies. Gonzalez and Quast (2011) show for Mexico that mortality tends to drop when unemployment rises, mainly in the age group 20-49, but that the cyclicality of different causes of death varies. Schady and Smitz (2010) and Baird et al. (2011) provide evidence that reductions in aggregate income increase child mortality.

[6] Generally, the literature agrees that pandemics reduce economic activity. Correia et al. (2020) estimate that the "Spanish flu" of 1918-20 curtailed U.S. manufacturing activity by around 20%, while Barro et al. (2020) estimate its negative impact on U.S. GDP to be around 6-8%. Kohlscheen et al. (2020) show that the reduction of GDP due to confinement measures during Covid-19 is likely to drag on over several quarters. For a review of the literature, see also Boissay and Rungcharoenkitkul (2020). Lockdowns could benefit economic activity if they mitigate the direct economic damage of the pandemic through illness and fatalities of workers. For the Spanish flu, Correia et al. (2020) suggest that U.S. cities that intervened more aggressively experienced stronger economic activity after the pandemic subsided. Lilley et al. (2020) present evidence, however, that this finding is partly explained by pre-pandemic population trends.

[7] See also Abel and Panageas (2020).

They show that the optimal policy prescribes a severe initial lockdown that is gradually withdrawn. Bloom et al. (2020) also show that early policy interventions can often mitigate economic costs.

In general, most papers assume a trade-off between the severity of the recession and lives saved. We present, to the best of our knowledge, the first evidence that the trade-off is more complex. Existing studies that investigate the trade-off between lives saved through containment measures and their economic damage abstract from any indirect effects of recessions on mortality rates. Our paper contributes to the debate by showing that recessions not only reduce incomes and wealth, but also increase death rates. Moreover, we show that the effects of recessions are uneven: the impact is hardest among children in poorer countries.

3 Data

For the analysis we use panel data for 180 countries over the period 1961 to 2018, provided by the World Bank. Our main outcome variables are the death rate and child mortality rate. The death rate is defined as 'death rate, crude (per 1,000 people)' and indicates the number of deaths occurring during the year, per 1,000 population estimated at midyear. Child mortality is measured by the 'mortality rate, under-5 (per 1,000 live births)', defined as the probability per 1,000 live births that a new-born baby will die before reaching age five, if subject to age-specific mortality rates of the specified year.

We define a dummy *recession* identifying years of negative annual GDP growth (at market prices based on constant local currency). The dummy takes on the value one when real GDP growth was negative in a given year, and zero otherwise. In alternative specifications, we define the dummy *deep recession*, taking on the value one in years when real GDP growth was below -2.5%. In robustness exercises, we alternatively measure recessions as the continuous yearly decline in real GDP or as the cumulative GDP decline for recessions that last more than one year. We define the dummy *advanced economy (AE)* that takes on the value one for countries that belong to the group of high-income countries, and zero for countries that belong to the group of upper and lower middle- and low-income countries (as defined by the World Bank). In further robustness checks, we use alternative definitions of 'advanced economy' based on different thresholds for per capita income.

We further collect data on total population, GDP per capita (in current USD) and the unemployment rate, also from the World Bank. We also collect country-level data on violent conflicts, for example wars, civil wars or riots (Sundberg and Melander, 2013), epidemics, and famines.[8] We define the dummy variable *conflict or epidemic or famine* that takes on the value one when there was a conflict with casualties, an epidemic, or a famine in a given year, and zero otherwise.

Table 1 provides descriptive statistics of the main variables. The average death rate equals 10 deaths per 1,000 people, the average child mortality rate (under-5) averages 70 per 1,000 births. 15% of our observations are recession years, 9% are years of deep recessions. On average, GDP declines by 0.63% during recessions, while the average cumulative decline in GDP is 1.53%. GDP growth averages 3.8% over the sample period, and 32% of all country-year observations are classified as advanced economies. Finally, 16% of our country-year observations are associated with conflicts, epidemics or famines.

4 The link between recessions and mortality

This section investigates the empirical relationship between recessions and mortality, as well as the heterogeneous effects across countries and demographic groups. We first estimate panel regressions in Section 4.1 and then analyse the dynamic impact of recessions on mortality in Section 4.2.

4.1 Panel analysis

To investigate the effect of recessions on death rates and on child mortality rates, we estimate country-year level panel regressions of the following form:

$$y_{c,t} = \beta \; recession_{c,t} + controls_{c,t} + \theta_c + \tau_t + \varepsilon_{c,t}. \tag{1}$$

The dependent variable y is either the mortality rate or the child mortality rate. The dummy variable *recession* takes the value one in years of negative real GDP growth and zero otherwise. All regressions include country and year fixed effects. Control variables include *log population* and the HP-filtered trend component in *log GDP per capita*. The latter controls for the general negative relation between

[8]For data on epidemics and famines, see Wikipedia, List of epidemics and Wikipedia, List of famines.

the level of development and death rates. Cross country differences in per capita income also proxy for differences across countries in social safety net coverage and government health expenditures.[9] We also control for the incidence of wars, epidemics, and famines through the dummy variable *conflict or epidemic or famine* that takes the value one for any given country-year observation with such an occurrence.[10] Standard errors are clustered at the country level.

A short note on causality: our analysis at the macro level does not allow for a strict causal interpretation. However, a scenario of reverse causality seems unlikely. Rising total death rates or child mortality rates are unlikely to trigger recessions after controlling for conflicts, epidemics and famines. The coefficient β can hence be interpreted as measuring how a year of negative GDP growth affects death rates, accounting for country size and the level of economic development.

The results reported in Table 2 show that recessions significantly increase death rates and child mortality rates. Columns (1)-(4) use the death rate as dependent variable. Column (1) shows that recessions affect death rates significantly in the pooled sample of all AEs and EMDEs together. During recession years, the mortality rate increases by 0.4. Columns (2) and (3) split the sample into AEs and EMDEs. They show that, while the effect of a recession is positive in both groups, it is statistically significant only in EMDEs where it is also around five times larger relative to AEs (0.51 compared to 0.09 in AEs). Finally, column (4) shows that also in a specification that interacts the recession dummy with a dummy for AEs, recessions increase death rates more strongly in EMDEs. The estimates imply an effect of recessions on death rates in EMDEs of 0.53 and of 0.09 in AEs, consistent with the results reported in columns (2) and (3). Moreover, the coefficient on the interaction coefficient is significant at the 1% level and negative, implying that the impact of recessions on mortality in EMDEs is significantly larger than in AEs.

Columns (5)-(8) show estimates for the impact of recessions on child mortality rate. Similar to the findings for death rates, recessions have a highly significant effect on child mortality in the pooled sample (column (5)). Recessions raise child mortality rates by about 4 deaths per 1,000 births. This effect is fully driven by

[9]Data on social safety and health care expenditure are only available for recent years, and even then mostly for advanced economies. However, recent World Bank data on 'Government health expenditure (% of current health expenditure)', 'Coverage of safety net (% of population)' and 'Benefits for poorest (% of total safety net benefits)' shows a highly significant and positive relation between GDP per capita and social safety net coverage and healthcare expenditures, suggesting that the GDP trend component is a reasonable proxy for the level of development of social safety nets and of healthcare systems. The correlations are available upon request.

[10]In robustness checks, we show that our results are robust to excluding all these country-year pairs in which the dummy takes on value one.

EMDEs: while child mortality remains statistically unaffected by recessions in AEs (column (6)), it rises in an economically and statistically significant way in EMDEs (column (7)). The interaction specification in column (8) confirms this picture and shows that the difference between AEs and EMDEs is statistically significant. Quantitatively, the effects of recessions on child mortality rates are about ten times as large as the effects of recessions on overall death rates: recessions increase child mortality rates in EMDEs by 4.17 vs. a decrease of −0.86 in AEs.

Does the severity of the recession matter for death rates? To answer this question, we estimate regression Equation 1 distinguish recessions with declines in GDP by more than $0\% andmorethan 2.5\%$ per year. Figure 3 plots the estimated coefficient β and associated t-values from each estimation of Equation 1. Panel (a) reports coefficients for death rates and panel (b) for child mortality rates. Both panels provide a similar picture: deeper recessions lead to a larger increases in death rates among EMDEs. In advanced economies, there is no significant differential increase. This finding implies that stabilisation policies dampening the depth of the recession could also reduce the fatalities associated with economic contraction.

Robustness We perform a set of additional exercises to ensure that our results are robust to alternative specifications of Equation 1. First, we want to understand the sensitivity of our results to the country sample and to the measure of the business cycle used in the estimation.

One possible explanation for this discrepancy is different country coverage of our analysis. The majority of the previous studies have focused on the United States or other rich economies, while our sample covers 180 countries including both AEs and EMDEs. Table 3 confirms that the healthy recession paradox is also present in our data set, once we restrict the sample to countries covered in previous studies. Column (1) shows that if we estimate regression Equation 2 on U.S. data only, we also find a significant *negative* effect of recessions on mortality. For a larger group of advanced economies covered in earlier studies, we also find a negative effect, which is however insignificant (column (2)).

Column (3) shows that when we use instead of a recession dummy the unemployment rate as our indicator of economic conditions, as most of the previous studies on the subject do, we also find for this broader group of major AEs a negative link between economic downturn (reflected in a rise in the unemployment rate) and death rates. For the full set of countries for which unemployment data is available (mostly advanced economies in more recent years), the link between the unemployment rate and death rates is economically and statistically insignificant (column (4)).

Overall, these results suggest that (i) the positive link between recessions and mortality is primarily a poorer-country phenomenon, an issue we will explore in more detail further below; and (ii) that recessions have a more detrimental effect on mortality than non-recession induced fluctuations in the unemployment rate, also an issue we will explore in greater detail from a different perspective in Section 5 below.

Second, we explore the robustness of our findings to structural changes over time. Our analysis covers a fairly long time span from 1961 to 2018. Over this period, some EMDEs made significant progress in improving living standards by growing their way out of deep poverty. Our regressions partly control for the effect of this development on mortality through the inclusion of per capita GDP as control variable. As a more stringent robustness check of the sensitivity of our results to structural changes over time, we rerun regression Equation 1 including only the years 1990-2018. Columns (5) and (6) show that over this shorter sample period, the estimated link between recession and death rates or child mortality rates is qualitatively and quantitatively similar to that estimated over the full sample.

To further account for different development trends across regions, in columns (7) and (8) we include time-varying fixed effects at the regional level (regions as defined by the World Bank). These fixed effects absorb any unobservable factors that affect different regions over time; for example, they account for the economic catching-up of several countries in East Asia. The results confirm that our main findings are also robust to this extension of the baseline specification.

Third, we check robustness with respect to completely excluding observations associated with conflicts, epidemics and famines and controlling for demographic structure. In column (9) we exclude all country-year cells for which the dummy *conflict or epidemic or famine* takes on value one. In column (10) we control for the demographic structure of each country by including the shares of population between age 0-14 and age 15-64 as control variables. The results are again similar to our baseline results.

Finally, Table 4 and Table 5 show that our findings are also robust to alternative definitions of the dummy *recession* and the dummy *advanced economy*. Table 4 reports results for the death rate. Column (1) defines recessions as years with GDP growth below −2% as independent variable, thus focusing on deep economic contractions. Column (2) uses the continuous yearly decline in GDP growth during recession years as independent variable, taking into account in continuous form the depth of a contraction; column (3) employs the cumulative GDP decline over the full length of the recession (several recessions last more than one year). The results show that, irrespective of the measure of recession used, falling GDP leads to an increase in death rates in EMDEs, but not in AEs, consistent with our baseline results.

Column (4) replaces the dummy for AEs with dummies for the second, third, and fourth quartile of yearly GDP per capita. It shows, from a different perspective, that the positive effect of recessions on death rates declines with countries' income levels. While countries in the lowest income quartile see an increase of 1/1,000 in their death rate during recessions, the effect is close to zero for countries in the highest income quartile. Columns (5)-(7) use alternative definitions of AEs. Column (5) splits the sample along the yearly median in terms of GDP per capita and classifies countries above the median as advanced; column (6) classifies countries in the top quartile of yearly GDP per capita as advanced; and column (7) all countries with yearly GDP per capita above USD 10,000. The results are qualitatively and quantitatively in line with our baseline results, suggesting that our results do not depend on the specific way in which we split our country sample into AEs and EMDEs.

Table 5 repeats the exercise using child mortality rates as dependent variable. The results are fully in line with those obtained in Table 4 and further highlight the robustness of our findings to alternative definitions of our main explanatory variables. All in all, Tables 2-5 corroborate our baseline result that recessions lead to a strong increase in death rates and child mortality rates, especially in EMDEs.

4.2 Dynamic analysis

To explore the dynamic effects of recessions on mortality, we estimate the following panel regression at the country-year level:

$$y_{c,t+k} = \beta_k \ recession_{c,t} + controls_{c,t} + \theta_c + \tau_t + \varepsilon_{c,t}. \tag{2}$$

The dependent variable is either the death rate or the child mortality rate. *recession* is a dummy variable taking the value one in years of negative GDP growth and zero otherwise. As before, each regression controls for country size through the log of total population, trend log per capita GDP, as well as for years of conflicts, epidemics or famines. The regressions also include country and year fixed effects and standard errors are clustered at the country level. Equation 2 is estimated for leads of the dependent variable of up to 10 years ($k = 1, \ldots, 10$). The sequence of coefficients β_k thus provides the dynamic effect of recessions on death rates over time. If recessions increase death rates in year k (relative to the pre-recession level) this would be reflected in $\beta_k > 0$.

Figure 4 shows the coefficients for for the full sample of countries, panel (a) for death rates and panel (b) for child mortality rates. The solid lines denote coefficient estimates, the dashed lines 90% confidence intervals. In the wake of a recession, death rates rise significantly, with a maximum increase after four years of 0.4 deaths per 1,000 people, before the effect starts to diminish. The effect remains significant for around ten years. These results suggest that recessions have a persistent effect on death rates. A similar picture obtains for child mortality rates. Recessions persistently increase child mortality rates for up to eleven years. In terms of magnitude, the peak impact of recessions on child mortality rates is more than ten times larger than that on death rates, with an increase of over 4 deaths per 1,000 live births after around five years.

To investigate the differences in the effect of recessions on mortality between country groups, we estimate the dynmaic regression Equation 2 separately for AEs and EMDEs. The results reported in Figure 5, confirm those of our baseline panel analysis: in AEs (panel (a)), recessions increase death rates to a small and mostly insignificant extent. In EMDEs (panel (b)), recessions significantly increase death rates for several years. The size of the effect, which peaks at around 0.5 deaths per 1,000 after five years, is several orders of magnitudes larger than that in AEs.

Panels (c) and (d) report the coefficient for child mortality rates. In AEs (panel (c)), recessions lead to a modest and statistically insignificant decrease in child mortality rates. In EMDEs (panel (d)), the impact of recessions on child mortality is large in magnitude and statistically highly significant. The effect peaks after five years at more than 5 deaths per 1,000 and remains significantly positive for twelve years.

All in all, the results from Equation 1 and Equation 2 provide a similar picture: recessions increase death rates and child mortality rates, especially in EMDEs. The dynamic analysis further shows that these effects are highly persistent and linger on for several years.

5 Booms, slow growth and mortality

Our analysis has so far has shown that recessions lead to a significant increase in mortality. We now investigate whether mortality is also affected by other, non-recession states of the business cycle. In principle, the reasons why recessions increase mortality may work at least partly in reverse during economic booms, when incomes grow and fiscal budgets increase. By the same token, the adverse mechanisms playing out in recessions may also be at work in somewhat milder forms in periods of slow growth.

To test these questions, we estimate the following panel regression:

$$\begin{aligned} y_{c,t} = {} & \beta_1 AE_c + \beta_2 \ recession_{c,t} + \beta_3 \ BC \ state_{c,t} + \\ & + \beta_4 \ AE_c \times recession_{c,t} + \beta_5 \ AE_c \times BC \ state_{c,t} \\ & + controls_{c,t} + \theta_c + \tau_t + \varepsilon_{c,t}. \end{aligned} \tag{3}$$

The dependent variable y is either the mortality rate or the child mortality rate. The dummy variable *BC state* captures the state for the economy, distinguishing between states of boom and states of slow growth. In the regressions testing for the effects of booms, the dummy *BC state* takes the value one in years when real GDP growth is above its (Hodrick-Prescott filter) trend and zero otherwise. When testing for the effects of slow growth, the dummy *BC state* takes the value one when real GDP growth was positive and below its (Hodrick-Prescott filter) trend and zero in periods when this condition was not met. The controls and fixed effects are identical to those included in Equation 1.

Table 6 shows results, panel (a) for booms and panel (b) for slow growth. In each panel, columns (1)-(4) report results for the mortality rate and columns (5)-(8) for the child mortality rate. Column (1) shows that booms or a period of slow growth do not have a statistically significant effect on death rates in the pooled sample of AEs and EMDEs. In columns (2) and (3) we split the sample into AEs and EMDEs and also find no significant effects. This is confirmed in column (4) that interacts the respective business cycle dummy with a dummy for AEs. Columns (5)-(8) show the same pattern of results for specifications with child mortality rates as the dependent variable.

In conclusion, there are asymmetric effects of the business cycle on mortality: while recessions significantly increase mortality and child mortality rates (especially in EMDEs), economic booms or periods of slow growth do not have any economically or statistically significant effect on mortality.

6 Conclusion

Our analysis of data spanning six decades suggests that the recession-related mortality effects differ across countries and age groups: poor countries suffer more than rich countries, and children more than adults. Moreover, death rates rise persistently for several years in the wake of recessions and deeper recessions lead to higher mortality rates.

The recession-mortality nexus seems to hold also during the coronavirus recession: as Figure 1 shows, excess deaths are significantly higher among poorer countries with a stronger predicted decline in GDP. While excess deaths could reflect undiscovered casualties from the Covid-19 pandemic, these patterns are also consistent with those observed during past episodes of economic distress.

Our findings imply that the death toll of Covid-19 will likely be higher than the fatalities directly due to the disease, as also the deaths arising from the pandemic-induced recession have to be taken into account. As EMDEs have a high share of young age cohorts in their populations, the coronavirus recession could be particularly damaging there. This stands in contrast to the direct mortality impact of Covid-19, which is mainly affecting seniors representing a larger share of the population in AEs.

Our results also have implications for pandemic response policies. Studies of the design of optimal containment measures (e.g. (Eichenbaum et al., 2020; Alvarez et al., 2020; IMF, 2020) rest on a trade-off between lives saved and the depth of the recession due to policy interventions. This trade-off could be more complex as the economic consequences of virus containment policies may also have repercussions on mortality. Policies suppressing infections at an early stage that minimise the economic damage of the pandemic and policy response itself could prove particularly effective (Correia et al., 2020). More generally, our analysis suggests that limiting the economic fallout of the pandemic may also reduce excess mortality. These considerations apply to rich and poor countries alike: even if the recession-mortality nexus is mostly present in EMDEs, in a globalised world recessions in AEs spill over to EMDEs (Kohlscheen et al., 2020), possibly raising mortality rates in poorer countries.

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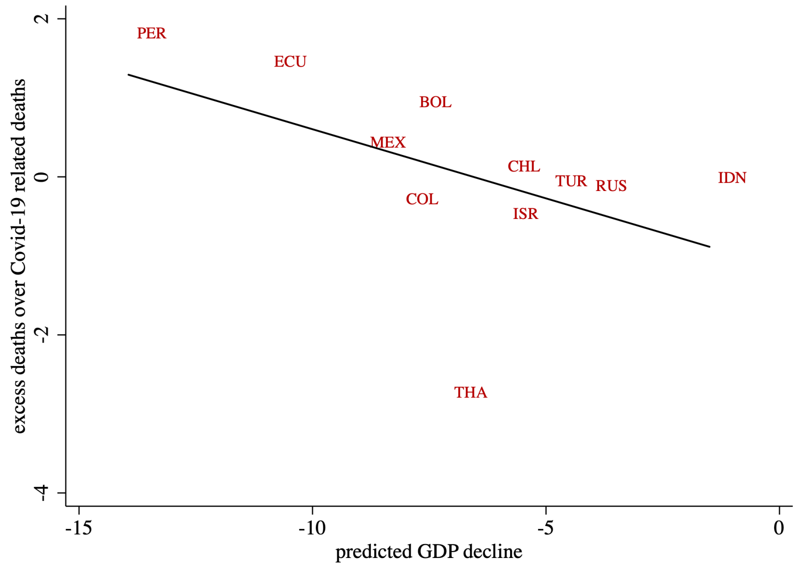
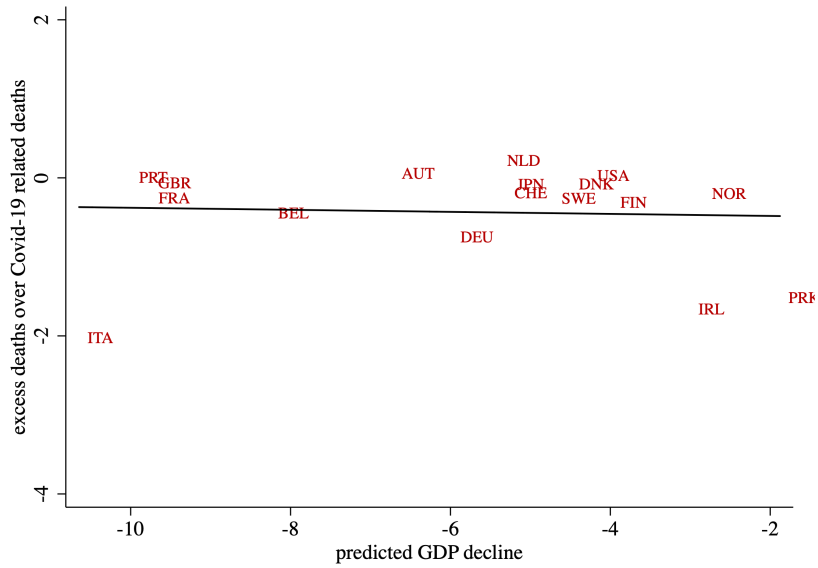
Figures and Tables

Figure 1: **The coronavirus recession and excess deaths**

(a) EMDEs



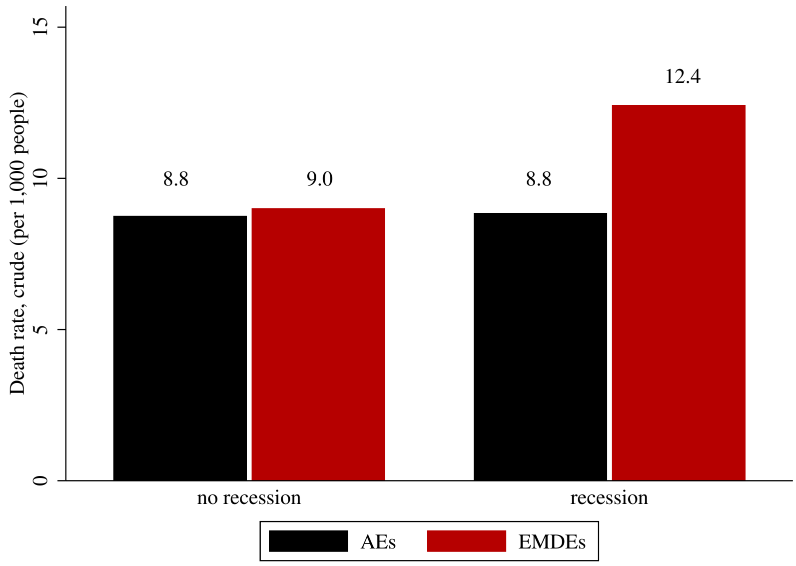
(b) AEs



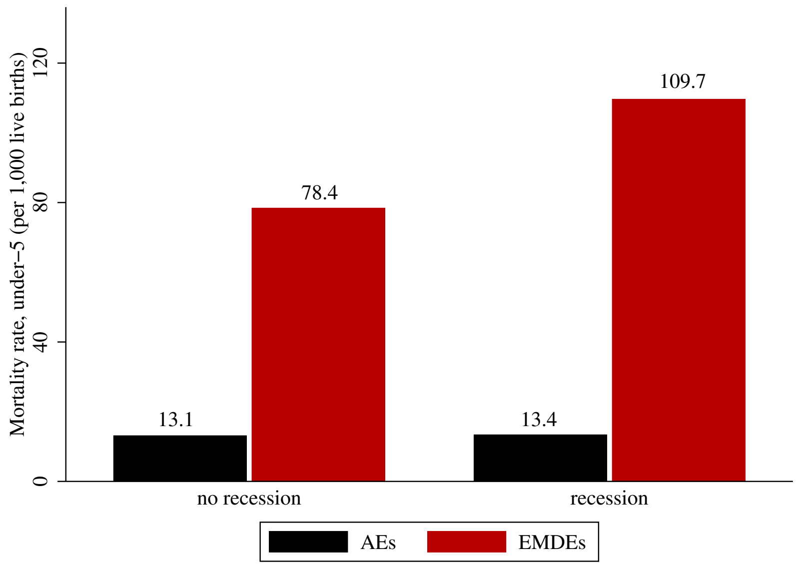
Panels (a) and (b) provide scatter plots of the predicted decline in GDP growth in 2020 on the horizontal axis and deaths in excess of Covid-19 related deaths on the vertical axis. Excess deaths are deaths above and beyond Covid-related deaths in 2020, minus average total deaths in years 2016-2019. The series is then standardised by total population. Preliminary data for 2020 GDP growth is from the World Economic Outlook by the International Monetary Fund. Panel (a) restricts the sample to emerging market and developing economies (EMDEs), panel (b) to advanced economies (AEs). Advanced economies are high-income countries, emerging market and developing economies are middle- and low-income countries.

Figure 2: **Mortality rates during recession and non-recession years**

(a) Mortality



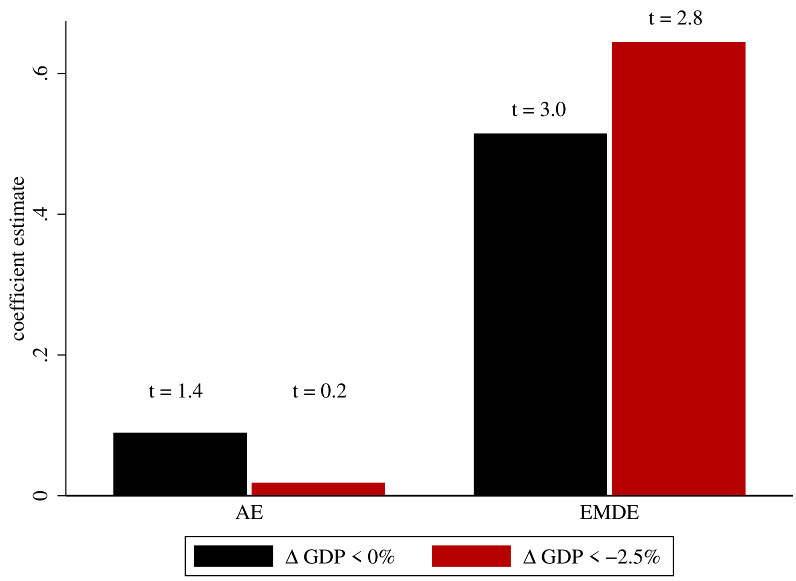
(b) Child mortality



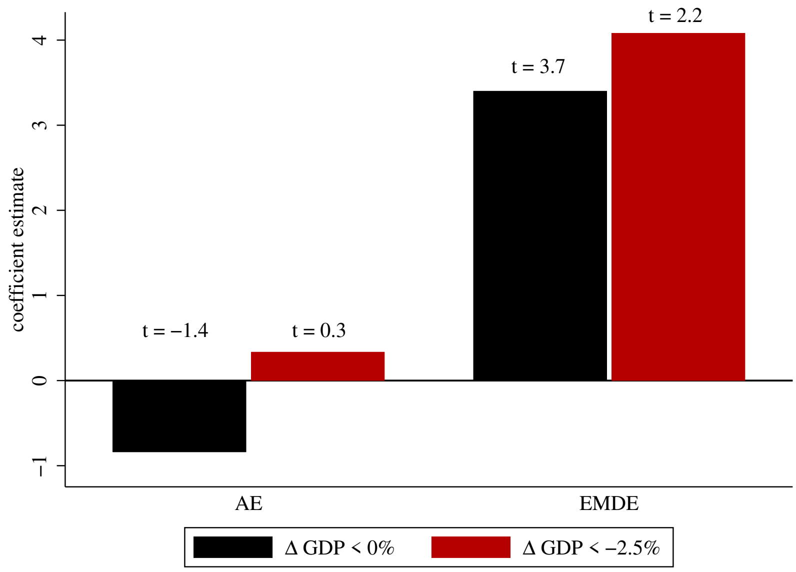
Panel (a) shows average mortality rates in non-recession and recession years for advanced economies (AEs) and emerging market and developing economies (EMDEs). Panel (b) shows average child mortality rates in non-recession and recession years for AEs and EMDEs. Recession years are defined as years with negative GDP growth, advanced economies are high-income countries, emerging market and developing economies are middle- and low-income countries.

Figure 3: **The severity of the recession and mortality rates**

(a) Mortality rate



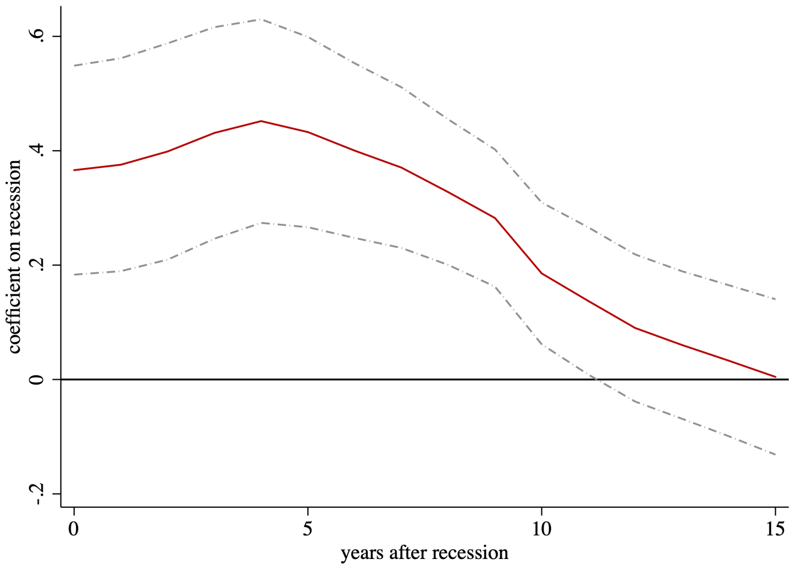
(b) Child mortality rate



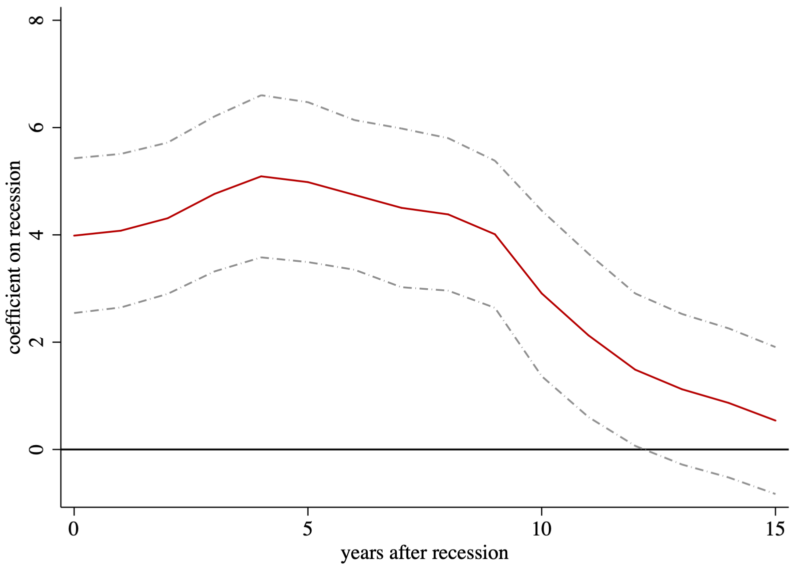
This figure reports coefficient estimates and t-values for coefficient β in Equation 1, estimated separately for advanced economies (AEs) and emerging market and developing economies (EMDEs). In each regression, recession is a dummy with value one in years with GDP growth below 0% or below -2.5%, respectively. The dependent variable is the mortality rate in panel (a), so the coefficient estimates reflect the increase in deaths per 1,000 population in response to a recession. The dependent variable is the child mortality rate in panel (b), so the coefficient estimates reflect the increase in deaths among children under-5 per 1,000 births in response to a recession. *** p<0.01, ** p<0.05, * p<0.1.

Figure 4: **Dynamic effects of recessions on mortality**

(a) Mortality rate



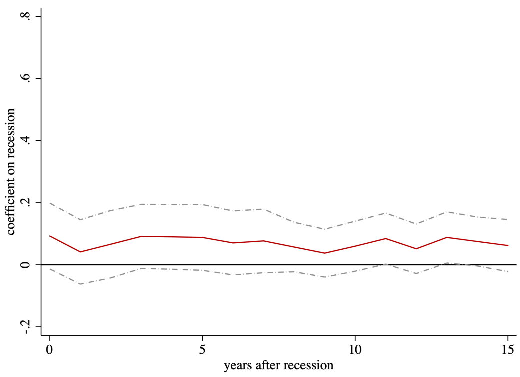
(b) Child mortality rate



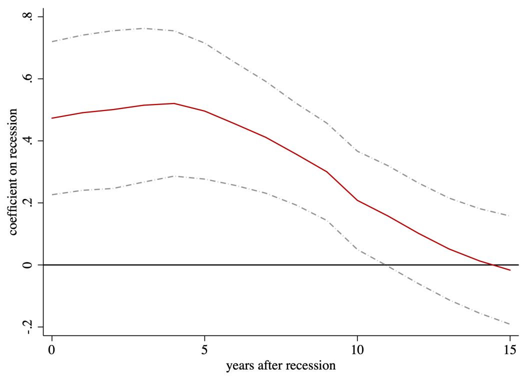
Panels (a) and (b) provide coefficient plots from Equation 2. Solid lines denote coefficient estimates, dashed lines 90% confidence intervals. The dependent variable is the mortality rate in panel (a), so the coefficient estimate reflects the increase in deaths per 1,000 population in response to a recession over time. The dependent variable is the child mortality rate in panel (b), so the coefficient estimate reflects the increase in deaths among children under-5 per 1,000 births in response to a recession over time.

Figure 5: **Dynamic effects of recessions on mortality – advanced vs. emerging markets and developing economies**

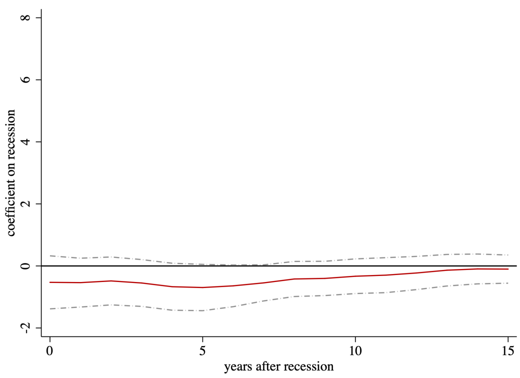
(a) Mortality: AE



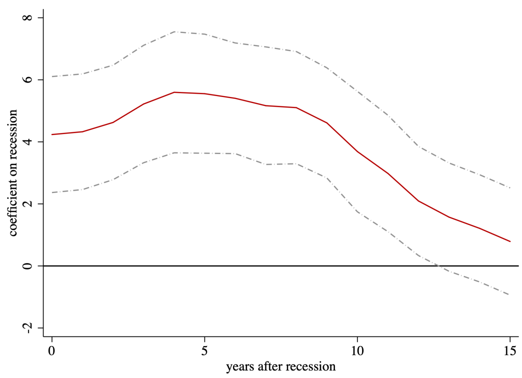
(b) Mortality: EMDE



(c) Child mortality: AE



(d) Child mortality: EMDE



All panels provide coefficient plots from Equation 2. Solid lines denote coefficient estimates, dashed lines 90% confidence intervals. The dependent variable is the mortality rate in panels (a) and (b), so the coefficient estimates reflect the increase in deaths per 1,000 population in response to a recession over time. Panel (a) restricts the sample to advanced economies, panel (b) to emerging market and developing economies. The dependent variable is the child mortality rate in panels (c) and (d), so the coefficient estimates reflect the increase in deaths among children under-5 per 1,000 births in response to a recession over time. Panel (c) restricts the sample to advanced economies, panel (d) to emerging market and developing economies.

Table 1: **Summary statistics**

Variable	Obs	Mean	Std. Dev.	Min	Max	P25	P50	P75
mortality rate	7690	10.01	4.73	1.13	41.36	6.72	8.9	12.11
child mortality rate	7690	69.96	73.09	1.7	382	14.6	38.65	106.7
recession	7690	.15	.36	0	1	0	0	0
deep recession	7690	.09	.28	0	1	0	0	0
GDP decline during recession (annual %)	7690	-.63	2.61	-62.08	0	0	0	0
cumulative GDP decline during recession (%)	7690	-1.53	6.33	-78.22	0	0	0	0
GDP growth (annual %)	7690	3.79	5.62	-62.08	123.14	1.55	3.87	6.25
GDP per capita growth (annual %)	7690	2.03	5.52	-62.38	121.78	-.11	2.23	4.48
log(total population)	7690	15.65	1.92	9.78	21.05	14.65	15.77	16.87
total population (in million)	7690	34.66	125.81	.02	1392.73	2.29	7.08	21.27
log GDP per capita (current USD)	7690	7.61	1.66	3.62	11.69	6.31	7.48	8.85
log(GDP p.c.) HP trend	7690	7.61	1.64	3.67	11.64	6.32	7.48	8.83
dummy advanced economy	7690	.32	.47	0	1	0	0	1
conflict or epidemic or famine	7690	.16	.36	0	1	0	0	0

This table provides summary statistics for main variables at the country-year level. Yearly data for 180 countries from 1961 to 2018 are provided by the World Bank. Data for conflicts are taken from (Sundberg and Melander, 2013). Episodes of epidemics and famines are taken from Wikipedia (respective lists).

Table 2: **Recessions and mortality – panel evidence**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
		AE	EMDE			AE	EMDE	
VARIABLES	death rate	death rate	death rate	death rate	child mort.	child mort.	child mort.	child mort.
recession	0.399***	0.088	0.506***	0.527***	3.971***	-0.863	4.168***	5.781***
	(0.127)	(0.066)	(0.168)	(0.174)	(0.891)	(0.611)	(1.154)	(1.193)
recession × AE				-0.437**				-6.172***
				(0.212)				(1.917)
Observations	7,690	2,445	5,245	7,690	7,690	2,445	5,245	7,690
R-squared	0.858	0.888	0.863	0.858	0.920	0.746	0.920	0.921
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Cluster	Country	Country	Country	Country	Country	Country	Country	Country

This table reports results from Equation 1. *recession* is a dummy with value one in years with negative GDP growth and zero otherwise. *AE* is a dummy with value one if a country is an advanced economy, and zero if it is an emerging market and developing economy. The dependent variable is the mortality rate in columns (1) to (4), and the child mortality rate in columns (5) to (8). *** p<0.01, ** p<0.05, * p<0.1.

Table 3: **Recessions and mortality – robustness**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	US only	HR sample	HR sample	urate	1990-2018	1990-2018	Region FE	Region FE	no conf	demo
VARIABLES	death rate	death rate	death rate	death rate	death rate	child mort.	death rate	child mort.	child mort.	child mort.
recession	-0.179**	-0.010			0.503**	5.864***	0.422**	4.269***	4.764***	5.267***
	(0.076)	(0.108)			(0.219)	(1.236)	(0.172)	(1.180)	(1.280)	(1.090)
recession × AE					-0.403*	-4.310***	-0.308	-4.406***	-4.889***	-5.773***
					(0.217)	(1.374)	(0.195)	(1.669)	(1.807)	(1.653)
unemp. rate			-0.072**	0.003						
			(0.028)	(0.006)						
Observations	57	476	476	4,403	4,828	4,828	7,690	7,690	6,492	7,631
R-squared	0.793	0.895	0.905	0.863	0.853	0.931	0.883	0.939	0.927	0.925
Country FE	-	✓	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	-	✓	✓	✓	✓	✓	R*Y	R*Y	✓	✓
Cluster		Country	Country	Country	Country	Country	Country	Country	Country	Country

This table reports robustness results from Equation 1. *recession* is a dummy with value one in years with negative GDP growth and zero otherwise. *AE* is a dummy with value one if a country is an advanced economy, and zero if it is a emerging market and developing economy. Column (1) estimates the regression for the United States only. Columns (2) and (3) restrict the sample to a set of advanced economies with yearly information on the unemployment rate to test the healthy recession (HR) paradox. Columns (3) and (4) use the unemployment rate as explanatory variable for the subset of countries where data is available.Columns (5) and (6) exclude all years before 1990 from the analysis. Columns (7) and (8) include time-varying fixed effects at the regional level (7 regions). Column (9) excludes all country-year cells for which the dummy *conflict or epidemic or famine* takes on value one. Column (10) controls for differences in demographic structures by including the shares of population between age 0-14 and age 15-64, respectively. *** p<0.01, ** p<0.05, * p<0.1.

Table 4: **Recessions and mortality – alternative definitions of recessions and of advanced economies**

VARIABLES	(1) deep recession death rate	(2) cont. GDP death rate	(3) cum. decline death rate	(4) GDP quartiles death rate	(5) AE p50 death rate	(6) AE p75 death rate	(7) AE 10k death rate
deep recession	0.647***						
	(0.233)						
deep recession × AE	-0.897***						
	(0.276)						
GDP decline during recession		-0.074**					
		(0.028)					
GDP decline × AE		0.110***					
		(0.037)					
cumulative GDP decline in a recession			-0.038**				
			(0.015)				
cumulative GDP decline × AE			0.041**				
			(0.019)				
recession				1.020***	0.803***	0.522***	0.462***
				(0.363)	(0.222)	(0.160)	(0.150)
recession × 2nd GDP p.c. quartile				-0.622*			
				(0.367)			
recession × 3rd GDP p.c. quartile				-1.130***			
				(0.397)			
recession × 4th GDP p.c. quartile				-1.017***			
				(0.388)			
recession × AE					-0.852***	-0.501**	-0.395*
					(0.247)	(0.209)	(0.221)
Observations	7,690	7,690	7,690	7,690	7,690	7,690	7,690
R-squared	0.858	0.858	0.859	0.869	0.860	0.861	0.860
Country FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Cluster	Country	Country	Country	Country	Country	Country	Country

This table reports results from Equation 1. The dependent variable is the mortality rate. *recession* indicates alternative measures of $recession_{c,t}$. Column (4) interacts *recession* with GDP p.c. quartiles, where the lowest quartile is the omitted category. Columns (5)-(7) use alternative definitions of AE: column (5) classifies all economies with above-median GDP per capita as advanced, column (6) those with GDP per capita in the top quartile. Column (7) classifies all countries with GDP per capita above USD 10,000 as advanced. *** p<0.01, ** p<0.05, * p<0.1.

Table 5: **Recessions and child mortality – alternative definitions of recessions and of advanced economies**

VARIABLES	(1) deep recession child mort.	(2) cont. GDP child mort.	(3) cum. decline child mort.	(4) GDP quartiles child mort.	(5) AE p50 child mort.	(6) AE p75 child mort.	(7) AE 10k child mort.
deep recession	5.937***						
	(1.677)						
deep recession × AE	-8.265***						
	(2.681)						
GDP decline during recession		-0.772***					
		(0.174)					
GDP decline × AE		1.201***					
		(0.373)					
cumulative GDP decline in a recession			-0.379***				
			(0.073)				
cumulative GDP decline × AE			0.454***				
			(0.138)				
recession				6.555***	7.414***	5.714***	4.844***
				(2.384)	(1.569)	(1.105)	(1.018)
recession × 2nd GDP p.c. quartile				-0.949			
				(2.843)			
recession × 3rd GDP p.c. quartile				-5.891**			
				(2.791)			
recession × 4th GDP p.c. quartile				-8.275***			
				(2.869)			
recession × AE					-7.772***	-7.046***	-5.908**
					(2.027)	(2.148)	(2.351)
Observations	7,690	7,690	7,690	7,690	7,690	7,690	7,690
R-squared	0.920	0.921	0.921	0.930	0.921	0.924	0.926
Country FE	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓
Cluster	Country	Country	Country	Country	Country	Country	Country

This table reports results from Equation 1. The dependent variable is the child mortality rate. *recession* indicates alternative measures of $recession_{c,t}$. Column (4) interacts *recession* with GDP p.c. quartiles, where the lowest quartile is the omitted category. Columns (5)-(7) use alternative definitions of AE: column (5) classifies all economies with above-median GDP per capita as advanced, column (6) those with GDP per capita in the top quartile. Column (7) classifies all countries with GDP per capita above USD 10,000 as advanced. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: **Booms, slow growth and mortality – panel evidence**

Panel (a): Booms vs. recessions

VARIABLES	(1) mort.	(2) AE mort.	(3) EMDE mort.	(4) mort.	(5) child mort.	(6) AE child mort.	(7) EMDE child mort.	(8) child mort.
recession	0.393***	0.093	0.501***	0.520***	3.897***	-0.801	4.097***	5.684***
	(0.128)	(0.064)	(0.170)	(0.175)	(0.885)	(0.571)	(1.142)	(1.180)
recession × AE				-0.436**				-6.151***
				(0.213)				(1.912)
boom	-0.061	0.068	-0.047	-0.071	-0.681	0.786	-0.655	-0.943
	(0.038)	(0.052)	(0.050)	(0.047)	(0.509)	(0.857)	(0.613)	(0.613)
boom × AE				0.031				0.805
				(0.054)				(0.648)
Observations	7,690	2,445	5,245	7,690	7,690	2,445	5,245	7,690
R-squared	0.858	0.888	0.863	0.858	0.920	0.746	0.920	0.921
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Cluster	Country	Country	Country	Country	Country	Country	Country	Country

Panel (b): Periods of slow growth vs. recessions

VARIABLES	(1) mort.	(2) AE mort.	(3) EMDE mort.	(4) mort.	(5) child mort.	(6) AE child mort.	(7) EMDE child mort.	(8) child mort.
recession	0.412***	0.051	0.514***	0.549***	4.193***	-1.216	4.360***	6.202***
	(0.125)	(0.081)	(0.164)	(0.170)	(0.932)	(0.964)	(1.224)	(1.271)
recession × AE				-0.460**				-6.729***
				(0.209)				(2.012)
slow growth	0.028	-0.083	0.018	0.046	0.496	-0.790	0.411	0.897
	(0.041)	(0.066)	(0.055)	(0.051)	(0.533)	(1.083)	(0.679)	(0.673)
slow growth × AE				-0.043				-1.072
				(0.059)				(0.756)
Observations	7,690	2,445	5,245	7,690	7,690	2,445	5,245	7,690
R-squared	0.858	0.888	0.863	0.858	0.920	0.746	0.920	0.921
Country FE	✓	✓	✓	✓	✓	✓	✓	✓
Year FE	✓	✓	✓	✓	✓	✓	✓	✓
Cluster	Country	Country	Country	Country	Country	Country	Country	Country

This table reports results from Equation 1. *recession* is a dummy with value one in years with negative GDP growth and zero otherwise. *boom* in panel (a) is a dummy with value one in years with GDP above its HP-filtered trend component (λ = 100). *slow growth* in panel (b) is a dummy with value one in years with GDP below its HP-filtered trend component but above zero (λ = 100). *AE* is a dummy with value one if a country is an advanced economy, and zero if it is an emerging market and developing economy. Dependent variable is the mortality rate in columns (1) to (4), and the child mortality rate in columns (5) to (8). *** p<0.01, ** p<0.05, * p<0.1.

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