# The Human Cost of Economic Crises

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Working Paper Series

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Paper No. 2009-0009

April 2009

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## Abstract

Policy makers rely on a mix of government spending and tax cuts to address the imbalances in the economy during an economic crisis, by promoting price stability and renewed economic growth. However, little discussion appears to focus explicitly on the costs of economic crises in terms of human lives, especially the lives of the most vulnerable members of society, infants. This paper quantifies the effect that economic crises, periods of prolonged economic recession, have on infant mortality. Moreover, we investigate whether different levels of public spending on health across advanced industrialized democracies can mitigate the impact of crises on infant mortality. We find that economic crises are extremely costly and lead to a more than proportional increase in infant mortality in the short-run. Substantial public spending on health is required in order to limit their impact.

Keywords: economic crises, infant mortality, quantile regression, forecasting.

## Acknowledgements

## 1. Introduction

Infant mortality is in large part driven by *in utero* conditions and perinatal medical care (Cutler, 2004). Therefore economic crises that force pregnant women to cut consumption or restrict their access to health care can be expected to increase the mortality of newborns. While the long term impact of an economic crisis on mortality is confounded by a large number of health shocks over an individual's lifetime (Cutler, Miller, and Norton, 2007), health shocks early in life can have a major impact on an infant's survival. In this paper, we quantify exactly how many infant lives are lost when macroeconomic crises strike, defined as periods of prolonged negative economic growth.

There is a wide variation in the amount of support governments provide to their citizens in cases of economic hardship: most advanced industrialized democracies have established robust welfare states to cushion their populations from such shocks but countries like the United States have relatively weaker protections, including stringent limits on both the duration and amount of unemployment benefits and government-funded health care (Alesina and Glaeser, 2004). As a result, in addition to quantifying the human costs of crises, we also quantify the difference that public expenditure can make in saving infant lives during hard times.

Our empirical approach combines a comprehensive macroeconomic dataset with a new statistical approach based on quantile regressions designed to address issues of robust inference in data with unobserved cross-country heterogeneity. Our data consists of multiple time-series macroeconomic indicators collected for all advanced industrialized economies (defined as member of the Organization for Economic Cooperation and Development, or OECD) from 1950 to 2000, as well as detailed infant mortality data that is sex-specific.

## 2. Economic Crises and Infant Mortality

Data from the US suggests that improved neonatal medical care for low birthweight babies has been a major driver behind reducing infant mortality since 1960s, accounting for as much as 19 percent of total life expectancy increase (Cutler, 2004). Second, historical studies suggest that overall improved nutrition measured as increases in caloric intake are important in extending life expectancy ever more so than medical advances (Fogel, 1997, 2004). Third, it is well established that socioeconomic differences at any given time within countries translate into differences in infant mortality (Lochner, Pamuk, Makuc, Kennedy, and Kawachi, 2001; NCHS, 2006; Case, Lubotsky, and Paxson, 2002). For these three reasons alone, economic crises that cause even short-term consumption cuts, loss of access to health care, and relative downward socioeconomic mobility can be expected to increase infant mortality. Yet no study has systematically tested this relationship across countries. The existing evidence is mixed, with earliest results showing long-lasting negative effects of recessions (Barker, 1990), while subsequent studies have successfully challenged those results, showing at best mixed or no effect of economic crises on life expectancy generally (Cutler, 2004; Rasmussen, 2001).

A separate line of research challenges this reasoning by reporting that economic hardship can result in improvements in health status and reduction of mortality risk (Ruhm, 2000). According to evidence from national survey data, being a working-age adult and being a male is associated with higher risk of being affected by temporary economic downturns (Ruhm, 2003). Reductions in smoking, excess weight and work hours (allowing for more exercise) have all been implicated as possible channels affecting adults during crises (Ruhm, 2005). Therefore, in contrast to the above hypotheses, it is also conceivable that pregnant women's changes in health behaviors, especially secession of smoking, would reduce the risk of infant mortality. However, while this research has focused on investigating ways in which health behaviors change during economic crises, it has not reached conclusive results on how economic crises affect infant mortality in particular (Gerdtham and Ruhm, 2006). While the effect of economic crises on the health outcomes of the adult population remains a matter of debate, it is difficult to identify robust channels through which it would correspond to anything other than a negative shock to the health of infants.

## 3. Infant Mortality in the OECD

Advanced industrialized economies differ greatly in their infant mortality rates, with the US currently ranked at the bottom (Schroeder, 2007). In Figure 1 we plot the trends in infant mortality for OECD countries over the period 1950-2000. The sex-specific mortality rate is defined as the total number of deaths in a given year for every 1,000 infants of a given gender under the age of 5 in a given country. For all countries this measure has shown a strong downward trend over the past half-century, reflecting improvements in medical technology. For example, the mortality rate of male infants in the US has been reduced from 8/1000 to just under 2/1000 over this period. Notice, however, that while mortality rates have trended downwards for all countries, the rate at which mortality has been reduced has varied substantially across countries. Thus, while the US was situated close to the median of the distribution of cross-country mortality rates in 1950, it has achieved substantially fewer reductions in mortality rates than any of the other industrialized countries and by the year 2000 found itself at the extreme of the distribution with the highest infant mortality rate in the OECD.

These variations within and across advanced industrialized countries raise four concerns that must be addressed empirically: (1) The changes in the very high mortality rates in countries such as the US may be driven by different factors than the changes in the very low mortality rates in countries such as Finland. (2) An implication of this phenomenon is that economic crises could be expected to affect very differently countries with high and low mortality rates. (3) Because OECD countries have developed very different welfare states to deal with poverty and care for the sick, an estimation of determinants of mortality should include public spending on health care. (4) Ultimately, the differences in infant mortality rates may be driven in part by hard to quantify (or measure) factors, which should therefore be modeled statistically as

country-specific heterogeneity. Econometric methods designed to address these concerns will be introduced below.

4. **Economic Crises**

It is difficult to accurately measure an economic crisis and no unique definition exists. While economists proverbially fail to agree on many things, they tend to locate an economic crisis somewhere in between a recession and a depression. A recession is formally defined as two consecutive quarters of negative growth while a depression is defined as a period of prolonged economic decline of at least 3 years with a fall in output in excess of 10%. Advanced industrialized nations have not experienced a depression since the 1930's, while recessions are relatively common. Economic crises are usually conceptualized are severe recessions lasting for a year or more and often originate in the banking sector (Reinhart and Rogoff, 2009).

In this study we define an economic crisis to be an annual recession, that is we require output to fall as measured in the annual national accounts. This measure is insensitive to short run fluctuations in output which are evened out at yearly frequency. A yearly measure not only focuses our attention on more severe recessions than the standard definition, but it is also more appropriate in studies of mortality for which data is only reported at yearly frequency. We consider our definition to be a minimal concept of an economic crisis that is nevertheless broad enough to capture some of the main channels through which economic hardship affects infant health and mortality. A year is a long enough period for us to see a variety of mechanisms. As the economy starts to contract, consumers cut spending, including nutritional and health care expenses associated with perinatal care. Employer sponsored health care becomes a binding constraint as unemployed workers are forced to liquidate savings and are ultimately left without access to health care during pregnancy and after birth with dramatic effects on infant health and development.

There is substantial heterogeneity in the timing and severity of economic crises in OECD countries over the period 1950-2000 as captured by Figure 2. Most economic crises have corresponded to yearly output contractions of less than 3%. Much of the economic history of advanced industrialized countries is immediate in a display of economic growth which shows pronounced clustering of the crises in the mid 1970s, early 1980s, and early 1990s. The period immediately after World War II corresponded to a prolonged period of economic expansion that ended with the oil price crisis of 1974. The early 1980s featured a series of economic crises resulting from the Central Banks' attempt to control high inflation. The economic crises in the early 1990s were generated by a complex sequence of events that combined the Stock Market crash of 1987 with a spike in oil prices resulting from the First Gulf War. Some countries such as Finland, which experienced an extreme recession, were additionally hit by unique factors such as the collapse of trade with the disintegrating Soviet Union. All these crises led to widespread unemployment and affected the lives of individuals worldwide.

## 5. Methods and Data

### 5.1. Quantile Model

In this paper we depart from a traditional mean regression analysis of the data and instead pursue a quantile regression framework (Koenker and Basset, 1978; Koenker, 2005). Cross-country studies are often criticized for their lack of robustness to unobserved heterogeneity both across countries and across time. This is an unavoidable fact of studies employing aggregate data since it is not possible to estimate different specifications for each country in each time period. While a fully random coefficient model is not possible, quantile regression provides a convenient and easily interpretable alternative framework which is substantially more robust to this critique than the linear regression model.

In Equation 5.1 we model the $\tau$-th conditional quantile functions of the logarithm of infant mortality $M_{it}$ using the data for country $i$ at time $t$.

$$(5.1) \qquad Q_{\log(M_{it})}(\tau | c_{it}, x_{it}, \alpha_i) = \gamma(\tau)c_{it} + x'_{it}\beta(\tau) + \alpha_i(\tau).$$

The quantile $\tau$ corresponds to the area under the conditional distribution of mortality. Thus, a model for $\tau = 0.5$ corresponds to a statistical model of the median of the distribution of mortality across countries. Each quantile of the distribution of mortality is modeled conditionally on a variable $c_{it}$ measuring the existence and extent of an economic crisis and also on a number of other control variables $x_{it}$ such as unemployment or inflation, which will be discussed below. Notice that the coefficients $\gamma(\tau)$ and $\beta(\tau)$ measuring the impact of each right hand side variable are quantile specific. This provides us with the flexibility of estimating the effect of an economic crisis at different quantiles of the conditional distribution of mortality.

The econometric model of Equation 5.1 also allows for the presence of another source of heterogeneity as measured by the unobserved quantile effect $\alpha_i(\tau)$. This unobserved effect is country-specific and time-invariant yet representing a distributional shift on the conditional distribution of mortality. It is designed to capture all the unobserved country-specific factors which are not explicitly controlled for by the inclusion of the observable variables on the right hand side of the equation. This individual effect captures the totality of social and political institutions and attitudes which remain unobserved yet may potentially drive the mortality outcomes. While we assume that these factors don't evolve smoothly over time, we nevertheless allow for them to change at crucial points in a country's development as reflected by shifts of its relative position in the conditional distribution of mortality.

In order to estimate the unknown coefficients of Equation 5.1 we proceed by minimizing the residuals over all countries $i$ and years $t$ and solving the linear programming problem of Equation 5.2 for each quantile $\tau$ (Koenker, 2004).

$$(5.2) \qquad \min \sum_{i=1}^{N} \sum_{t=1}^{T} \rho_\tau(\log(m_{it}) - \gamma(\tau)c_{it} - x'_{it}\beta(\tau) - \alpha_i(\tau))$$

The quantile specific loss function $\rho_\tau(u)$ is defined as $\rho_\tau(u) = (\tau 1(u > 0) + (1-\tau)(u < 0))|u|$. Simultaneously, we estimate the quantile specific individual effect $\alpha_i(\tau)$ representing a simple variation of (Koenker, 2004) as discussed in (Harding and Lamarche, 2008; Alexander, Harding, and Lamarche, 2008).

## 5.2. Data

The World Health Organization (WHO) provides annual reported data on mortality statistics by age, sex, and cause of death as obtained from civil registration systems in countries. The underlying cause of death is coded by the respective national authority and is meant to capture the disease which ultimately led to death according to the rules specified by the International Classification of Diseases system. This international classification system is revised periodically in light of scientific advances and adopted by all member countries. Thus, subject to the correct implementation at the country level it provides a directly comparable set of figures for mortality in different countries. In spite of the great care which has been taken to collect consistent information across countries, it is difficult to exclude the possibility of systematic bias due to misdiagnosis and under-reporting. By restricting our attention to only the advanced industrialized countries we minimize the impact of biases due to incorrect and incomplete recording of death certificates which is a very prevalent problem in the developing world.

The International Classification of Diseases system, while providing a detailed image of the causes of mortality, also presents an important challenge. The fine categories into which it classifies deaths are often difficult to interpret. Therefore, we prefer to follow (Girosi and King, 2008) and focus our attention on the four main causes of infant mortality, broadly defined from the underlying subcategories: cardiovascular, digestive, perinatal and respiratory (both infectious and chronic). Perinatal in this context refers to deaths around the time of delivery and includes both fetal deaths (of at least 20 weeks of gestation) and neonatal, or early infant deaths. (MacDorman and Kirmeyer, 2009) Our analysis will focus both on the aggregate mortality numbers for these four categories as well as on the individual determinants. By restricting our attention to a more limited set of causes, we wish to remove certain channels which we deem to be *a priori* implausible. For example, we do not believe that economic crises will affect the number of casualties from car accidents and thus we wish to exclude this type of cause of death from our sample.

To measure economic performance, we use the most comprehensive and accurate measurements of the main economic indicators, available from the OECD Statistical Database. Our main variable of interest is an indicator of economic crises defined as annual recessions. In order to control for the different magnitudes of recessions, we define the variable as equal to the magnitude of the recession conditional on the country

being in a recession. The variable is zero during normal periods of economic growth. We additionally control for a number of country-specific variables such as the level of GDP in the previous year, unemployment, government expenditures on health, change in unemployment, inflation, gender and the level of human capital. In order to account for the trending behavior of mortality as illustrated in Figure 1, we also control for the logarithm of mortality lagged by one year.

There are large variations in public expenditure on health across the OECD. To illustrate, the US spends 15.2% of its GDP on health related expenses but only 45% of this comes in the form of public spending. By contrast, Germany spends 10.6% of its GDP on health related expenses but 77% of this consists of public spending on health. In recent years Germany has topped the list of public spending on health by advanced economies by spending 8.2% of its GDP on health, closely followed by other European countries such as Norway and Sweden. It is perhaps surprising that the US, in spite of coming last in terms of mortality outcomes, only spends 1.36% less in the form of public expenditures on health than Germany (as a percentage of GDP).

## 6. Results

In order to estimate the impact of economic crises on infant mortality, we first estimate the panel quantile regression model of Equation 5.1 for the log mortality rate, where the mortality rate is computed as the sum of the deaths from the four main causes. We compute the quantile coefficients corresponding to the $\tau = \{0.1, 0.25, 0.5, 0.75, 0.9\}$ quantiles. This allows us to determine how economic crises impact mortality at different quantiles of the distribution of mortality. The regression results are reported in Table 1. The impact of an economic crisis is increasing in the quantiles of the mortality distribution. The results indicate that for a country at the median of the distribution of mortality, a crisis corresponding to a 1% annual recession corresponds to 2.04% higher infant mortality (p=0.025), while a country at the 90-th percentile of the distribution of mortality experiences a 3.4% higher mortality rate (p=0.007). The effects are statistically significant in the upper tail of the distribution of mortality but insignificant at the 95% confidence level in the lower tail of the distribution corresponding to countries with low mortality. The impact of an economic crisis is thus substantially higher in an already poorly performing country. Unfortunately, the US is precisely such a country, and while we cannot pin-point its location in the conditional distribution of mortality, it is reasonable to place the US in the right tail of the distribution given its poor performance on child mortality indicators in recent years. Therefore, a crisis of equal magnitude will impact the US to a much higher degree than a low mortality country such as Finland. An economic crisis serves to exacerbate the mechanisms by which a country has high infant mortality and the effect is more than proportional to the underlying economic shock.

In Table 1 we also investigate the effect of government expenditures on health. The effect is statistically insignificant at the low quantiles of the mortality distribution, but becomes negative and statistically significant at the high quantiles of the mortality distribution. At the 90-th percentile of the distribution of mortality, a 1% increase in government spending leads to only a 0.3% decrease in infant mortality (p¡0.001). This indicates that while the government can use spending on health to mitigate some of the negative effects of an economic crisis, spending alone, keeping everything else equal, is insufficient and the effect of an economic crisis will likely dominate and cost lives. At the median of the distribution, a 1% increase in spending reduces infant mortality by only 0.07% (p=0.095). The fact that government spending appears to be irrelevant at the low levels of mortality may indicate the importance of existing institutional structures independent of the amount of spending. Countries that perform well in terms of having low infant mortality do not necessarily spend more than their poorly performing neighbors if they have the right institutions in place designed to reduce infant mortality. However, in countries such as the US with high infant mortality government spending on health can make a real impact.

We should be careful when interpreting the results on the government expenditure on infant mortality. It is possible that this variable is not truly exogenous and subject to reverse causality or affected by some other missing variable which jointly determines both infant mortality and government expenditure. We partly deal with this issue by controlling for the most comprehensive set of main economic indicators, not previously considered in mortality forecasting. It is not immediately clear how to construct an instrumental variable strategy to address concerns that remain; however, we have developed an instrumental variables version of our econometric model that can be easily applied when new empirical strategies are developed. While our focus on infant mortality rather than total mortality may limit some of these concerns, we nevertheless urge caution in interpreting these results in a causal manner.

The above discussion suggests that unobserved factors may ultimately share a substantial responsibility in determining whether a country has high or low infant mortality. The same factors may also determine to what extent a country is affected by a substantial economic shock or whether government spending can be used to minimize the impact of business cycles on infant mortality. In Figure 3 we plot the estimated quantile individual effects for all countries over the distribution of mortality. It is remarkable to see that the individual effect for the US is positive and dominates all the other individual effects. This suggests that unobserved social and institutional features in the US affect infant mortality to a very substantial degree. This captures the often cited puzzle that the US spends vast amounts on health yet performs poorly relative to other countries. Notice that the individual effect for countries with low mortality such as Finland, Norway or Austria is small and in fact negative, thus contributing to lower infant mortality at all quantiles. Since these unobserved factors will determine the relative position of a country within the overall distribution of mortality, they are thus indirectly responsible for the differential effects of an economic crisis. The same underlying social and institutional factors that are responsible for the high infant mortality in the US are

also responsible for the vulnerability of the US to a major economic crisis and lead to the disproportionately high number of deaths in the aftermath of a major economic shock.

Additionally, we consider a series of robustness checks (detailed tables are available from the authors). First, we investigate whether the measured effects of economic crises on infant mortality differ by mortality category. For this purpose we re-compute the above quantile regression analysis for each of the four main categories: cardiovascular, digestive, perinatal and respiratory. We find a very similar result: the increasing effect of an economic crisis over the quantiles of the mortality distribution for each of the four categories, with the exception of perinatal conditions for which the quantiles are not statistically significant. The magnitude of the estimated coefficients is also similar across conditions with the exception of mortality due to digestive conditions which seems to be substantially more sensitive to economic crises than the other mortality categories. This may indicate nutrition as a potential channel through which economic crises adversely affect infants' health. The effect of government spending is also comparable across mortality categories. We find stronger effects for cardiovascular and digestive conditions and substantially lower effects of government spending on reducing infant mortality due to respiratory conditions.

Second, we investigated the possibility that an economic crisis has a more permanent detrimental effect on infant mortality. We expanded our analysis by adding a series of indicators for the five years following an economic crisis and estimating the presence of an effect over the five years following a crisis. We have not found any statistically significant effects of an economic crisis on infant mortality later on. This may be due to the fact that the negative effect of a crisis is short-lived and the health outlook of infants improves substantially once the economy re-emerges from a deep recession. Since we do not have individual level data the lack of any statistically measurable effect may also reflect the addition of new generations of infants, born after the economic crisis to the same cohort, thus making it impossible to separate in the aggregate figures the infants who were affected by the economic shock and those who were not.

## 6.1. Counterfactual Analysis

How many lives would have been saved if the economic crises did not happen? In order to answer this question we perform a series of in-sample simulations based on our estimated quantile specification for the period 1970 to 2000. Quantile regression has several equivariance properties including the so called equivariance to monotone transformations. Logarithmic functions are monotonic, therefore we can write model 5.1 as

(6.1) $$Q_{\log(M)}(\tau|c,x,\alpha) = \log(Q_M(\tau|c,x,\alpha)),$$

and then use $\exp(\hat{Q}_{\log(M)}(\tau|c,x,\alpha))$ to obtain quantile-specific in-sample predictions. We perform the analysis for the US. Since it is not possible to determine the position of the US in the conditional distribution of infant mortality exactly, we compute possible scenarios at both the median of the distribution and the 90-th percentile. In order to estimate a counterfactual scenario we let the variable identifying economic crises

$c$ be zero everywhere and re-compute the model prediction. The difference between the model prediction which includes an economic crisis variable and the hypothetical model prediction without an economic crisis corresponds to our estimate of the cost of an economic crisis in terms of infant mortality.

We report the results in Table 2. The difference between the two forecasts is substantial and we estimate that each economic crisis costs the lives of several hundred to close to two thousand infants, depending on the severity of the crisis and the strength of the impact of the economic crisis. If we use the conservative forecasts at the median, we find that the 1982 economic economic crisis was associated with a 4% (temporary) increase in infant mortality while the 1991 recession was associated with a 1.9% increase in mortality. These numbers are surprising in that they show that even under conservative estimates the impact of an economic crisis on infant mortality is more than double the size of the economic recession. We also compare our model predictions with the actual number of deaths at each point in time and find that the model discussed above performs remarkably well in matching the number of deaths on the basis of a small number of economic determinants. For most observations the model predictions at the median and the 90-th percentile bracket the actual number of deaths. The remaining discrepancies are due to the unexplained component of our model. The overall very good fit, especially in more recent years, appears to suggest that our predictions of the counterfactual effect of a world without economic crises are reasonably accurate.

While we have to be cautious in interpreting the effect of government spending due to a potential endogeneity problem, the current economic crisis in the US makes it unavoidable to ask the question whether increased government spending will help mitigate the impact of the crisis on infant mortality. In order to answer this question we solve for the amount of government spending required to compensate for each level of a potential crisis.

In Figure 4 we use the median and the 90-th percentile forecasts to construct the bounds for the severity of an economic crisis that the US can overcome by increasing its government spending on health in order to avoid an increase in infant mortality. If the US were to increase its level of government spending on health to the level currently in effect in Germany (as a percentage of GDP), it would avoid an increase in infant mortality for an annual recession of magnitude between 1% and 2%. Current forecasts for 2009 predict a 1% recession. Our counterfactual analysis seems to imply that an increase in government spending on health in the US to the levels seen in Europe would avoid the costly loss of human life which is historically associated with economic crises. Notice, however, how costly economic crises ultimately are. Figure 4 also shows that no amount of feasible government spending on health can compensate for an economic crisis corresponding to a 4% annual recession.

## 7. Discussion

Very little attention has been given to the human costs of economic crises when developing economic policy. The evidence presented in this paper suggests that economic crises are extremely costly. While the increase in the number of infants dying during an economic crisis may not seem very large when compared to the population of the US, it is nevertheless very substantial when we remember that infant mortality is a rare event in an advanced industrialized country. A 2% increase in infant mortality during an average economic crisis is not easy to ignore. We suggest that government spending on health may help to alleviate the human cost of economic crises and an increase in public spending on health to the level observed in Europe may be the appropriate response to the current economic crisis in order to avoid an increase in infant mortality.

The current analysis focuses on aggregate demographic and economic data and remains silent on the micro-determinants of mortality. This is due to the lack of suitable data. Nevertheless, we hope that the stylized facts identified in this paper will stimulate additional research aimed at identifying the exact economic and biological channels through which economic crises affect mortality. It is our view that the effects are driven by a mixture of immediate channels such as poor nutrition but also by the availability of appropriate highly advanced medical care to prevent, detect and treat many of the conditions that drive infant mortality during economic recessions.

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TABLE 1. Summary of the quantile fixed effects regression results

| | Quantiles | | | | | |
|---|---|---|---|---|---|---|
| Variables | 0.1 | 0.25 | 0.5 | 0.75 | 0.9 | Mean |
| Economic Crisis | 1.851 | 1.836 | 2.040 | 2.004 | 3.440 | 2.195 |
| | (0.083) | (0.071) | (0.025) | (0.005) | (0.000) | (0.007) |
| Government Expenditure on Health (in logs) | 0.150 | 0.033 | -0.072 | -0.172 | -0.301 | -0.104 |
| | (0.010) | (0.524) | (0.095) | (0.000) | (0.000) | (0.007) |

Note: p-values in parenthesis. The variable Economic Crisis is an interaction between an indicator for annual economic recessions and negative annual growth. Other included variables are: logarithm of mortality and logarithm of GPD $t - 1$, unemployment, changes in unemployment, inflation, gender, human capital, a linear trend, and country fixed effects.

TABLE 2. Comparison of in-sample predictions with and without economic crisis: United States, 1970-1995.

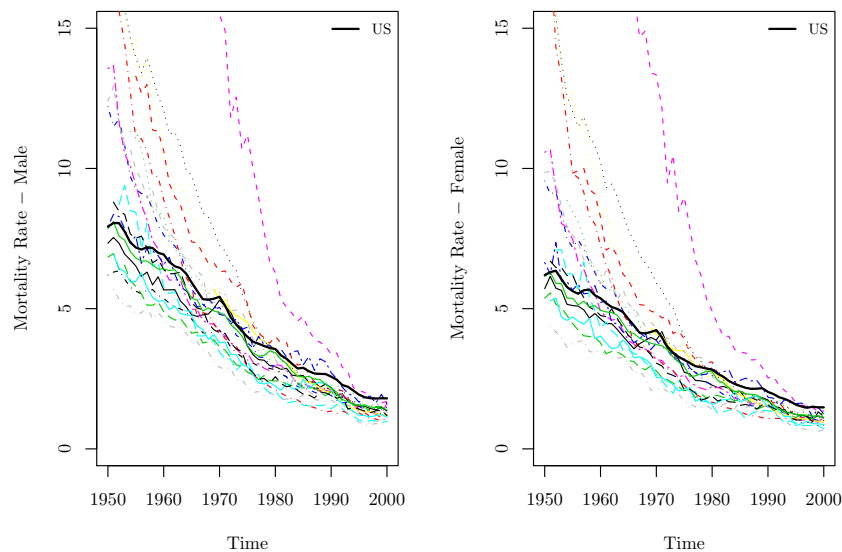| | | Female | | | | | | | Male | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Year | Annual | Data | Mean | 0.5 Quantile | | | Data | Mean | 0.5 Quantile | | |
| | Recession | | Prediction | Prediction | Counterfactual | Diff | | Prediction | Prediction | Counterfactual | Diff |
| 1974 | 0.43 % | 16349 | 17486 | 17206 | 17055 | 151 | 22515 | 24189 | 23791 | 23583 | 208 |
| 1975 | 0.39 % | 15363 | 15646 | 15501 | 15378 | 123 | 20857 | 21495 | 21269 | 21100 | 169 |
| 1980 | 0.66 % | 11891 | 11503 | 11581 | 11425 | 156 | 15852 | 15286 | 15315 | 15109 | 206 |
| 1982 | 1.98 % | 10750 | 10579 | 10726 | 10302 | 424 | 14405 | 14100 | 14232 | 13669 | 563 |
| 1991 | 0.95 % | 8978 | 8748 | 8938 | 8766 | 172 | 11856 | 11657 | 11856 | 11628 | 228 |
| Year | Annual | Data | Mean | 0.9 Quantile | | | Data | Mean | 0.9 Quantile | | |
| | Recession | | Prediction | Prediction | Counterfactual | Diff | | Prediction | Prediction | Counterfactual | Diff |
| 1974 | 0.43 % | 16349 | 17486 | 17905 | 17642 | 263 | 22515 | 24189 | 24656 | 24294 | 362 |
| 1975 | 0.39 % | 15363 | 15646 | 15885 | 15673 | 212 | 20857 | 21495 | 21713 | 21423 | 290 |
| 1980 | 0.66 % | 11891 | 11503 | 11891 | 11623 | 268 | 15852 | 15286 | 15686 | 15333 | 353 |
| 1982 | 1.98 % | 10750 | 10579 | 11188 | 10452 | 736 | 14405 | 14100 | 14807 | 13833 | 974 |
| 1991 | 0.95 % | 8978 | 8748 | 9346 | 9045 | 301 | 11856 | 11657 | 12366 | 11968 | 398 |

FIGURE 1. Trends in infant mortality for OECD countries 1950-2000.

Time series of sex-specific infant mortality for males (left) and females (right) measured as the number of deaths of infants below the age of 5 per 1,000 births, obtained from the World Health Organization (WHO). Time series for each member country of the Organization for Economic Cooperation and Development (OECD) shown separately, illustrating the differential decay rates, with the US infant mortality rate (thick black line) changing from the median of the range in 1950 to the top in 2000 for both sexes.
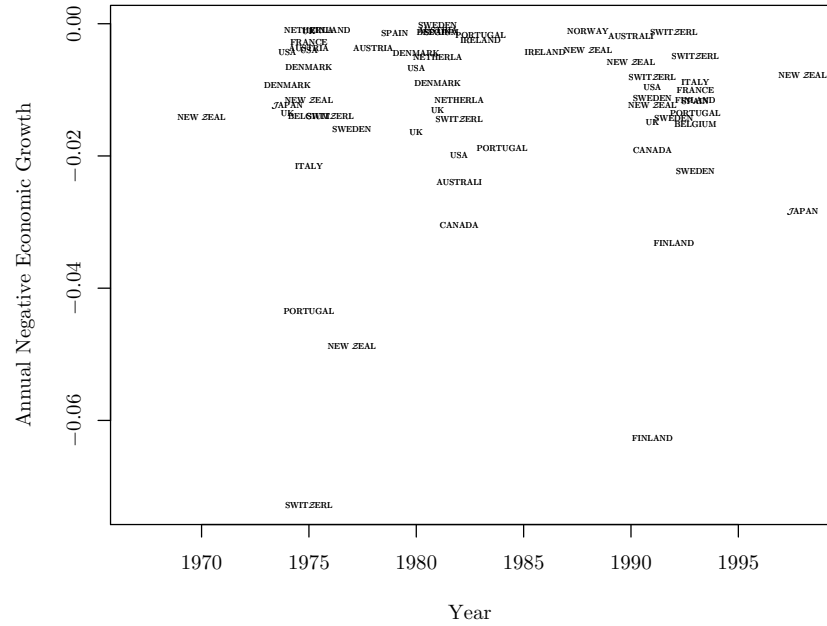
FIGURE 2. Economic crises in OECD countries 1960-2000

The timing, severity and location of economic crises, 1960-2000, according to the national accounts of member states of the Organization for Economic Cooperation and Development (OECD). An economic crisis is defined as an annual recession, showing a fall in economic output as measured by the annual national accounts.
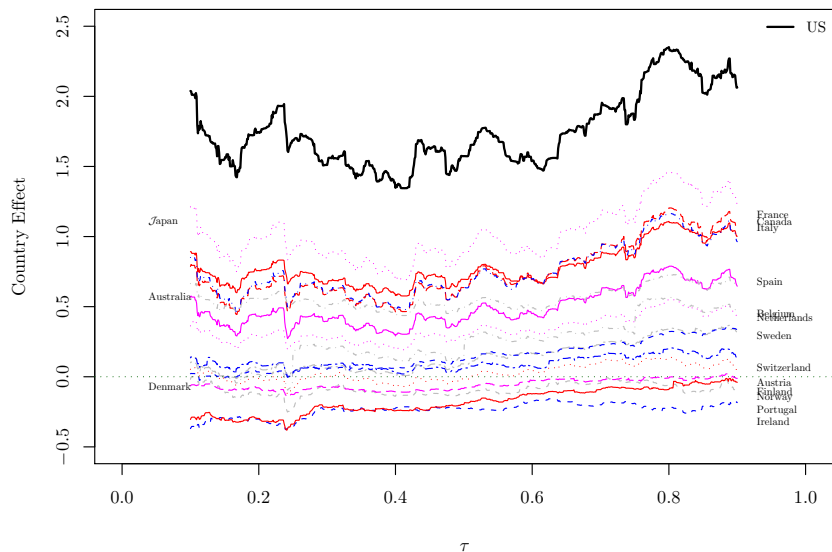
FIGURE 3. Individual country effects over quantiles $\tau$ of the conditional distribution of the logarithm of infant mortality rate

Unobserved country-specific effects are estimated using the panel quantile regression with dynamic unobserved heterogeneity that we developed (see Eq. 1 in the text and description under methods). The estimated dynamic country-specific effect for the US is positive and dominates the individual effects for all other countries.
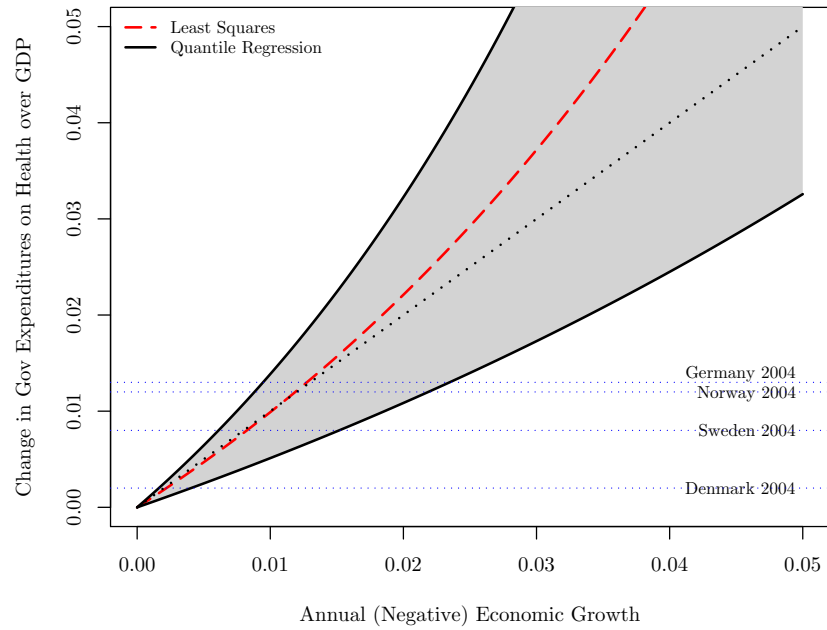
FIGURE 4. Extent to which government spending can help mitigate the impact of an economic crisis on infant mortality

Estimates obtained using the panel quantile regression with dynamic unobserved heterogeneity (see Eq. 1 in the text and description under methods), whose parameters are reported in Table 1. The prediction includes the estimated dynamic country-sepcific effect for the US and all controls described in Table 1.