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The Impact of Business Cycles on Health Status in the United States During the Past Half-Century

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Abstract

The association between mortality and business cycle is inconclusive. Most macro level studies find mortality to be pro-cyclical whereas micro level studies suggest the opposite. The consensus among these studies, however, is on the use of unemployment rate as a proxy for cyclical variations in economic activity. This study builds upon these findings by implementing an alternative proxy – per capita income – to better understand such a mediating relationship. Using state level annual data of the United States during 1968-2022, this study finds a negative association between state per capita income and mortality rate. Contrary to the findings of macro level studies, this analysis suggests that mortality declines during expansions. The results are robust to the inclusion of both old and new proxies for the business cycle.

JEL Codes: E24, E32, I15.

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1 Introduction

Business cycles do not only impose critical financial burdens on the society but also arise important health implications. The business-cycle-health nexus has been studied extensively in the literature but the scholars have not reached a consensus except that macro level studies have found health outcomes to be improving during recessions and micro level studies showing the opposite results. One of the explanations for such a pro-cyclical nature of mortality at macro level studies is that work can be considered to generate stress and anxiety, and as people lose jobs during recessions, their stress level could possibly decline. Hence, their health status might improve. Furthermore, the opportunity costs of exercise, preparing healthy and nutritious food, taking care of the children and the elderly are very high during expansions. In contrast, such costs are lower during recessions. Hence, it is possible that the health status of individuals might improve. On the other hand, the findings of micro level studies suggest that the declining financial resources during recessions can lead to deteriorating health outcomes in terms of loss of health insurance, inefficient access to nutritious food, and lack of enough resources to support the dependents, children, and the elderly.

The business cycle in the literature is represented by the unemployment rate whereas mortality is used as a proxy for health outcomes. The economic literature is replete with empirical studies designed to address the association between mortality rate and unemployment rate. Majority of the studies that are conducted at levels such as counties (Sameem and Sylwester (2017) and Fontenla et al. (2011)), countries (Stevens et al. (2015), Heutel and Ruhm (2016) and Ruhm (2000, 2015) for the United States, Ariizumi and Schirle (2012) for Canada, Gonzalez and Quast (2010) for Mexico, Tapia Granados (2005) for Spain, Neumayer (2004) for Germany)), or cross-countries (Lin (2009) for Pacific Asian countries, and Gerdtham and Ruhm (2006) for OECD countries) find that mortality declines during recessions or that mortality is pro-cyclical. The consensus among these studies is on the use of proxy – unemployment rate – for cyclical fluctuations in the economy. The first contribution of this paper to the literature in the context of the United States is the introduction of an alternative proxy – per capita income – to better understand this nexus between mortality and recessions. Second, this is the first study, to the best of our knowledge, that utilizes the longest sample period capturing 55 years from 1968 to 2022. Having a longer period of data could provide nuances that could not be achieved by studies of shorter sample periods.

A closely related article by Gerdtham and Johannesson (2005) applies six different proxies for business cycle using micro data from Sweden. The proxies include (1) unemployment rate, (2) notification rate, (3) deviation from GDP trend, (4) GDP change, (5) industry capacity utilization, and (6) industry confidence indicator. The results, at most, show countercyclical pattern of mortality or at least no stronger association between mortality and the various indicators of economic conditions. Though state unemployment rate may look like a better proxy for capturing transitory cyclical fluctuations as such data is released on monthly basis as compared to the data on per capita income which is available on yearly basis, the availability of mortality data on yearly basis for larger sample period as utilized in this study only hinders any benefits from using monthly state unemployment rates. Therefore, per capita income could easily serve as an alternative proxy for unemployment rate when dealing with annual data.

Contrary to the pro-cyclical pattern of mortality found in macro level studies, other works that are conducted using data at levels such as individuals (Halliday, 2014; Sullivan and von Wachter, 2009; Gerdtham and Johannesson, 2005) or families (Strully, 2009) find that mortality rises among the unemployed or what is known as the countercyclical pattern of mortality. Findings of the current study indicate a negative association between state per capita income and mortality rate. In other words, mortality is found to be countercyclical. This could serve as a mediating bridge between micro and macro level studies.

The remainder of the paper is organized as follows: Section II presents data. Section III explains empirical methodology. Section IV explains results and policy implications. Section V concludes.

2 Data

The study sample spans over five decades (55 years) from 1968 through 2022, and includes all 50 states and Washington D.C. Data come from three sources: (a) the Bureau of Economic Analysis (BEA), (b) the Bureau of Labor Statistics (BLS), and (c) the Compact Mortality Files (CMF) of the Centers for Disease Control and Prevention (CDC). The data on state per capita income and unemployment rates are obtained from the former two sources.[2,3] The data on mortality and population demographics are obtained from the CMF.[4] Unless otherwise stated, all mortality rates are calculated as the number of deaths per 100,000 people in the United States. For the main estimations of total population and its categories by sex and race, we use age-adjusted death rates. Age-adjusted death rates are weighted averages of the age-specific death rates, where the weights represent a fixed population by age. They are used to compare relative mortality risk among groups, such as those living in different geographic regions, and over time. This type of measure eliminates differences that would be caused because one population is older than another. It is worth mentioning that CDC marks death rates "unreliable" when death count is less than 20, and "suppressed" when death count is less than 10.[5] Such rates are dropped altogether in this analysis.

Table 1: Summary Statistics

Variable	**Obs.**	**Mean**	**S.D.**	**Min**	**Max**
Total Mortality Rate	2795	926.5	168.6	572	1526.4
Male Mortality Rate	2795	1157.8	244.8	708.4	1999.2
Female Mortality Rate	2795	751.1	118.2	453.2	1214.3
White Mortality Rate	2795	904.2	159.8	371.4	1405.1
African American Mortality Rate	2551	1109.0	280.6	212.5	2446.5
Other Race Mortality Rate	2592	638.1	340.8	110.5	2108.8
Less Than 1 Year Old Mortality Rate	2791	995.1	486.8	287.5	3545.5
Less Than 5 Years Old Mortality Rate	2794	239.6	120.1	68.1	853.3
5-19 Year Olds Mortality Rate	2795	46.0	16.5	14.5	145.6
20-44 Year Olds Mortality Rate	2795	164.3	48.5	87.7	479.8
45-64 Year Olds Mortality Rate	2795	798.3	219.0	439.3	1820.6
Above 65 Year Olds Mortality Rate	2795	4966.7	618.8	3086.6	6827.3
Per Capita Income	2805	26039.1	17687.3	2250	97462
Unemployment Rate	2397	5.9	2.1	2.1	17.3
Population	2795	5255130	5911006	288511	39600000
Percent of Males	2795	49.1	0.9	46.3	55.3
Percent of Whites	2795	83.6	13.8	25.2	99.7
Percent of African Americans	2795	11.2	11.8	0.1	71.1
Percent of Infants	2795	1.4	0.3	0.8	2.9
Percent of People Ages 20-44	2795	34.9	4.5	22.9	47.6
Percent of People Ages 44-64	2795	22.0	3.5	13.3	31.2
Percent of People Ages Above 65	2795	12.6	2.8	2.1	22.5
Notes: The rates are per 100,000 people. Sample period is 1968-2022.					

[2] Data link: https://www.bea.gov/itable/
[3] Data link: http://www.bls.gov/lau/
[4] Data link: http://wonder.cdc.gov/mortsql.html
[5] CDC, 2017. https://wonder.cdc.gov/wonder/help/cmf.html#Age Group

Table 1 provides summary statistics of the data. The top portion of the table shows different types of mortality statistics based on sex, race, and age. The lower portion of the table reports the list of independent variables used in this paper. Of note is that the average mortality rate is higher among men and African Americans compared to their counterparts. A striking difference is the higher mortality rates for the age groups of under-1 as well as those aged 65 and above. The rates are higher in addition to having higher standard deviations. Given such disparate statistics, it is plausible that other characteristics, including their associations with income, could also differ among these groups. Hence, further examination is warranted.

3 Methodology

To empirically test the impact of cyclical fluctuations upon mortalities, the main model in equation (1) follows a similar pattern as the one used in this literature except for replacing the state unemployment rate with the state per capita income. The equation (1) relates the natural log of mortality rate in state i at time t (m_{it}) to the natural log of the annual state per capita income (n_{it}) and several state-year demographic control variables (x_{it}) along with time-invariant state fixed effects (α_i), state-invariant time fixed effects (θ_t) and an error term (ε_{it}).

$$m_{it} = \alpha_i + \theta_t + \beta n_{it} + \gamma x_{it} + \varepsilon_{it} \quad (1)$$

The use of natural logs makes it easier to interpret the coefficient estimates as elasticities. The inclusion of fixed effects captures time-invariant unobserved characteristics of states such as location and geography whereas time fixed effects control for variations across years that are consistent across states such as changes in government policies at the federal level. The control variables include demographic characteristics of the state such as the percentages of the state population that are men, whites, African Americans, infants, and people of the working class (ages 20 or more). All specifications are estimated using clustered standard errors at the state level in order to control for any possible geographical correlation between mortality rates (Cameron and Miller, 2015; Enamorado et al., 2014).[6] The various demographic groups considered for analysis here include all people, males, females, whites, African Americans, other racial groups, under-1 year-old (infants), under-5 year-olds, 5-19 year-olds, 20-44 year-olds, 45-64 year-olds, and 65 and above.[7]

$$m_{it} = \alpha_i + \theta_t + \beta n_{it} + \delta ur_{it} + \gamma x_{it} + \varepsilon_{it} \quad (2)$$

To compare the findings of the current study with the existing literature, we also estimate an empirical model in equation (2) where we incorporate the state unemployment rate (ur_{it}) as one of the independent variables. Here we use the z-scores or the standardized values of the state per capita income and the state unemployment rate to measure the magnitudes of the impact of the two variables on the dependent variable. In equation (2), a one standard deviation change in the state per capita income is captured by the coefficient β whereas a one standard deviation change in the state unemployment rate is captured by the coefficient δ. The remaining variables in equation (2) are kept the same as those in the former equation.

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[6] When dealing with panel data, model errors in different time periods for a given cluster (state here) may be correlated, while model errors for different clusters are assumed to be uncorrelated, and failure to control for within-cluster error correlation can lead to misleading small standard errors, large t-statistics, and consequently misleading inferences (Cameron and Miller, 2015).

[7] Other racial group includes American Indians or Alaska Natives, Asian, and Native Hawaiian or Other Pacific Islanders.

4 Results

Table 2 exhibits results based on the model in equation (1). All estimates include the entire set of explanatory variables mentioned above. However, for comparison, we suffice with reporting only the main coefficient of the state per capita income.[8] Panel A in Table 2 displays the coefficients of state per capita income for all people (column 1), males (column 2), females (column 3), whites (column 4), African Americans (column 5), and other racial groups (column 6). The dependent variables in Panel A are age-adjusted mortality rates. The coefficient on the main independent variable of interest – per capita income, expressed in natural logarithmic form – is negative and statistically significant for all demographic categories considered except for African Americans and other racial groups. The results exhibit that a one-percent increase in the state per capita income is associated with about 0.11 percent decline in the statewide mortality rate for all people, about 0.14 percent decline among males, about 0.11 percent decline among females, and about 0.09 percent decline among whites. This implies that mortality rate declines as the state per capita income increases. Using per capita income as a proxy for economic conditions, this negative association between mortality and income would suggest a countercyclical pattern of mortality, which is contrary to what other macro-level studies have found in this literature, albeit, using unemployment rate as the proxy. These results somehow coincide with the recent findings of Ruhm (2015) that suggest recessions to be no longer healthy.

Panel B in Table 2 reports the results for different age groups. Of all the six age groups considered, the negative relationship between state per capita income and mortality rates seems to hold for almost all, but the results are statistically significant for only two – people ages 45-64 and senior citizens or people ages 65 and above. Hence, as the state per capita income rises, mortality rates for the various age groups tend to decrease. These results seem to counter the findings from Stevens et al. (2015) who argue that the pro-cyclical mortality is mainly driven by the mortality of the senior citizens due to lower quality of care in nursing homes and staffing shortages during economic booms.

Table 2: Mortality-Income Relations at State Level in the United States

Panel A: By Sex and Race						
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Males	Females	Whites	Afr.Amer.	Others
Ln (per capita inc)	-0.106**	-0.139**	-0.107*	-0.092*	-0.347	0.265
	(0.049)	(0.053)	(0.055)	(0.052)	(0.214)	(0.238)
# Observations	2,795	2,795	2,795	2,795	2,551	2,592
R2 Within	0.95	0.96	0.91	0.93	0.71	0.35
Panel B: By Age						
	(1)	(2)	(3)	(4)	(5)	(6)
	>1 Year	>5 Years	5-19 Years	20-44 Years	45-64 Years	65+ Years
Ln (per capita inc)	-0.154	-0.151	-0.070	0.027	-0.277***	-0.075**
	(0.107)	(0.105)	(0.132)	(0.106)	(0.099)	(0.035)
# Observations	2,791	2,794	2,795	2,795	2,795	2,795
R2 Within	0.95	0.95	0.87	0.78	0.92	0.91

Notes: The dependent variable is the natural logarithm of mortality rate per 100,000 people. Sample period is 1968-2022. State and year fixed effects are included in the regressions. Clustered standard errors at the state level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

[8] The extended tables with all the control variables are available upon request.

Broadly speaking, these findings suggest that economic busts could lead to deteriorating health outcomes and financial hardships for a society. Conversely, economic booms may improve both health and financial conditions. As per capita income increases, people can afford better healthcare, pay for health insurance, afford to maintain healthier lifestyles, and take better care of dependents, including children and the elderly. Consequently, the overall standard of living may improve, leading to a decline in mortality rates.

To supplement these findings further, Table 3 displays the results of the model specified in equation (2), which includes the standardized values of both state per capita income and the state unemployment rate. Of note is that controlling for unemployment rate reduces the sample period from 1968-2022 to 1976-2022. The same demographic categories used for estimation in Table 2 are also applied in Table 3. Panel A in Table 3 displays the coefficients of state per capita income and state unemployment rate for all people (column 1), males (column 2), females (column 3), whites (column 4), African Americans (column 5), and other racial groups (column 6). The dependent variables in Panel A are age-adjusted mortality rates. Panel B in Table 3 reports the results for different age groups. All the coefficients of the standardized values of per capita income are not only negative and statistically significant but are also larger in magnitude than the coefficients of the standardized values of unemployment rate. The coefficients of unemployment rate are consistent with the literature indicating negative association between unemployment and mortality or a pro-cyclical pattern of mortality. However, when combined with state per capita income, their impact is modest. More importantly, controlling for unemployment rate exacerbates the coefficient of per capita income. This is evident from comparing the coefficients of per capita income and the state unemployment rate in all specifications in Table 3. For instance, column 1 in Panel A for total population indicates that a one-standard deviation increase in the state per capita income can lower mortality rate for all people by 0.16 percent whereas a one-standard deviation increase in the state unemployment rate can lower mortality rate by 0.01 percent. The remaining specifications could be interpreted in a similar fashion. Since an improvement in the state per capita income can be seen as an indication of economic booms, while an increase in the state unemployment rate suggests economic busts, these findings can be interpreted to show that economic booms have a much stronger impact on reducing mortality rate compared to economic busts. Therefore, economic booms can improve the population health.

Table 3: Mortality-Income-Unemployment Relations at State Level in the United States

Panel A: By Sex and Race						
	(1)	(2)	(3)	(4)	(5)	(6)
	Total	Males	Females	Whites	Afr.Amer.	Others
z-per capita inc	-0.164***	-0.156***	-0.174***	-0.205***	-0.151***	-0.178**
	(0.021)	(0.021)	(0.022)	(0.030)	(0.047)	(0.077)
z-un-rate	-0.012***	-0.012***	-0.012***	-0.012***	-0.005	-0.034**
	(0.002)	(0.002)	(0.002)	(0.003)	(0.010)	(0.016)
# Obs	2,387	2,387	2,387	2,387	2,194	2,267
R2 Within	0.94	0.96	0.87	0.93	0.67	0.32
Panel B: By Age						
	(1)	(2)	(3)	(4)	(5)	(6)
	>1 Year	>5 Years	5-19 Years	20-44 Years	45-64 Years	65+ Years
z-per capita inc	-0.242***	-0.243***	-0.123***	-0.305***	-0.226***	-0.098***
	(0.035)	(0.038)	(0.026)	(0.062)	(0.035)	(0.017)
z-un-rate	-0.022***	-0.035***	-0.026***	-0.032***	-0.023***	-0.003
	(0.006)	(0.006)	(0.008)	(0.006)	(0.005)	(0.003)
# Obs	2,383	2,386	2,387	2,387	2,387	2,387
R2 Within	0.90	0.92	0.83	0.71	0.90	0.89

Notes: Dependent variable is natural logarithm of mortality rate per 100,000 people. Sample period is 1968-2022. State and year fixed effects are included in the regressions. Clustered standard errors at the state level are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

The findings of the current study align with those of Gordon and Sommers (2016), which indicate that economic expansions, as measured by household median income, lead to positive health outcomes, while adverse economic conditions, as indicated by unemployment rate and poverty rate, result in higher mortality. Similarly, our results are consistent with micro level studies such as Halliday (2014), Sullivan and von Wachter (2009), Strully (2009), and Gerdtham and Johannesson (2005), which predominantly suggest a countercyclical pattern of mortality. Furthermore, our findings of a negative nexus between income and mortality contradict those of Ruhm (2000), which indicate that personal income is positively related to mortality. In summary, the current analysis can serve as a mediating bridge between micro and macro level studies. Studies using micro-level data indicate that mortality is higher among the unemployed. Ruhm (2015) supports this perspective, albeit with more recent macro level data. One implication for macro-level studies is that relying on a single proxy, such as the unemployment rate, may not be sufficient to generalize the impact of recessions on health outcomes. Unemployment may not fully capture economic impacts for low income populations and those who are not in the labor force. Therefore, alternative proxies may be necessary to draw accurate conclusions.

5 Conclusion

Using state level annual data on mortality rate during 1968-2022, the results suggest a negative association between the state per capita income and mortality rate. The results are consistent when using different demographic groups such as all people, males, females, whites, and African American. This implies a countercyclical pattern of mortality as opposed to majority of studies using macro level data in this area that suggests a pro-cyclical pattern. The differences in results follow from differences in the proxies for business cycle fluctuations. Majority of prior studies use unemployment rate as a proxy for business cycles whereas this study uses per capita income as an alternative proxy. From policy point of view, these findings suggest that economic recessions are not only destructive to the financial status of the economy but also to the health outcomes of the society as a whole. Our findings are in conformity with those of Gordon and Sommers (2016) whose results also indicate that economic expansions lead to positive health outcomes.

This study is not free from limitations. First, it uses a much coarse data at the state level. Future work using a more refined data such as at county/individual level could provide more nuanced results. Second, this is a very broader analysis of the issue. It could be extended to different regional levels. This does not, however, reduce from the importance of the topic of cycle-mortality nexus itself as the analysis can provide vital information regarding efficient allocation of resources for the policymakers during different economic conditions.

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