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The business cycle and mortality: Urban versus rural counties

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ABSTRACT

Many studies have found that mortality declines during recessions, but do such results remain consistent in both urban and rural settings? To help uncover explanations for such a pro-cyclical nature of mortality, the present study revisits this topic but allows for associations between unemployment and mortality to differ between urban and rural areas. Using a total of 66 863 observations across 3066 counties of the U.S. from 1990 to 2013, we allow the coefficient on unemployment to differ between urban and rural counties. With an exception of deaths due to external accidents being pro-cyclical in rural settings, we find that the negative association between unemployment and mortality more generally holds for urban areas, particularly for females and the elderly. Moreover, we find death due to circulatory disease or influenza/pneumonia to be especially more prevalent in urban areas. Given that the negative associations between unemployment and mortality are generally stronger in cities, views attempting to explain pro-cyclical mortality should focus on characteristics in urban settings.

1. Introduction

The association between the business cycle and mortality has been extensively studied. Such studies include Ruhm (2000, 2015) for the United States, Neumayer (2004) for Germany, Tapia Granados (2005) for Spain, Gonzalez and Quast (2010) for Mexico, Ariizumi and Schirle (2012) for Canada, Lin (2009) for Pacific Asian countries, and Gerdtham and Ruhm (2006) for OECD countries. Using unemployment as a proxy for the business cycle, these studies report a pro-cyclical pattern of mortality at the state or national level. Mortality falls when unemployment is high, a claim first reported over 90 years ago (Ogburn and Thomas, 1922). Such a finding, however, is not universal. Brenner (1973, 1975, and 1979) finds a countercyclical association. Moreover, many studies that use either family-level data (Strully, 2009) or individual-level data (Halliday, 2014; Sullivan and Von Wachter, 2009; Gerdtham and Johannesson, 2005) find a countercyclical pattern with mortality rates rising during recessions.

How could mortality be pro-cyclical? For one, the opportunity cost of going to the doctor, of exercising, and taking time to eat healthy is, presumably, higher during expansions than during recessions. Alternatively, people might push themselves harder during expansions such as work overtime or work multiple jobs. Such activities could cause more stress or allow them to become more susceptible to disease. During expansions people become wealthier and that might encourage them to take on risky activities such as excessive drinking or driving more recklessly thereby increasing fatality rates (Ruhm, 1995). In all of these cases, people's behavior changes across the business cycle and such changes hold ramifications for health and mortality. Rising pollution or changes in the quality of medical care could also play roles as factors external to an individual's behavior.

When examining the U.S., the typical approach is to consider state-level variations in unemployment and mortality which is the approach first taken by Ruhm (2000) although Ruhm (2015) and Lindo (2015) use both state and county-level data. We, instead, employ county-level data as do Fontenla et al. (2011). County-level data holds both advantages and disadvantages over state-level data. The degree of within-county variation is likely to be smaller than within-state variation allowing for less heterogeneity within the unit of analysis. Moreover, a greater number of observations can increase the power of statistical tests. On the other hand, larger units of analysis are likely to better filter out random errors since one is averaging over larger units. Pierce and Denison (2006) identify reporting errors from Texas using county-level data. People are also more likely to migrate and commute across county lines as opposed to state lines. See Lindo (2015) for further discussion.

A second reason to conduct a county-level analysis is that it can

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allow us to better understand what could be driving previous results by uncovering differences across heterogeneous settings, in our case urban versus rural ones. Examining such differences across settings could help to offer explanations as to why mortality is countercyclical. For example, one reason is that the opportunity cost of going to a doctor or seeking medical treatment is relatively high during economic booms as people might find it costly to take time off from work. These opportunity costs could differ between urban and rural settings, especially if one from a rural area needs to travel long distances to receive medical care or see a specialist. If true, then the pro-cyclical association between mortality and unemployment should be stronger in rural areas. On the other hand, to the extent that stress contributes to mortality, that stress levels are higher in urban areas, and that stress is higher during expansions then the association between mortality and the business cycle should be stronger in urban areas. To the extent that pollution rises during economic booms thereby contributing to mortality, then associations should be stronger in urban areas where pollution levels are higher. In fact, Davis et al. (2010) find that emissions of particulate matter from trucking in New Jersey were higher during economic booms. Heutel and Ruhm (2013) find evidence at the state level that lower air pollution during recessions provides a partial explanation for why mortality is pro-cyclical (although Sameem and Sylwester (2016) find little evidence that pollution is what drives the pro-cyclicality of mortality).

Thinking of reasons why the overall mortality rate as well as mortality for specific types of death could differ between urban and rural areas is not difficult. As just suggested, more air pollution in cities could contribute to respiratory and related problems (Calderon-Garciduenas et al., 2015; Zhou et al., 2015; Heutel and Ruhm, 2013), especially in infants (Currie and Schmieder, 2009; Foster et al., 2009; Currie and Neidell, 2005; Chay and Greenstone, 2003). Similarly, the higher number of vehicles in metropolitan areas adds to traffic accidents and motor vehicle fatalities (French and Gumus, 2014). In this paper, we consider whether associations between mortality and the business cycle also differ between urban and rural areas. We find substantial differences in mortality rates between urban and rural settings, especially for women and the elderly. We also find significant differences regarding deaths due to heart disease as these deaths are more pro-cyclical in urban areas. External causes of death such as accidents are found to be more pro-cyclical in rural counties.

This analysis could be especially enlightening when comparing findings from individual-level studies that often find that being unemployed raises mortality for individuals. See Winkleman and Winkleman (1998), Burgard et al. (2007), Sullivan and Von Wachter (2009), Strully (2009) and Tapia Granados et al. (2014). Job loss can be associated with depression, greater risks of disease, and deviant behaviors that diminish health and income thereby increasing mortality. An explanation to reconcile these contrasting views is that relatively few people become unemployed during a recession as an increase in the unemployment rate from 5% to 9%, for example, still only directly impacts a minority of the labor force. So even if the newfound unemployed suffer greater mortality, overall mortality could still decrease if the slowing economy lowers pollution levels (which affects all residents) or lowers stress at work (for the majority who remain employed) as people find themselves less busy. Therefore, examining differences between rural and urban areas can help narrow explanations for the macroeconomic associations reported above.

The remainder of the paper is organized as follows: Section 2 describes the data and section 3 presents the methodology. Section 4 provides results and Section 5 concludes.

2. Data

Our sample spans the 24 years from 1990 to 2013 and includes three recessions: 1990–91, 2001, and 2007–09. Data comes from the Bureau of Labor Statistics and the Compact Mortality Files (CMF) of the National Center of Health Statistics. Data on unemployment before 1990 is not compatible with subsequent data and the BLS cautions against using them together. The unemployment rate we use corresponds to U-3 (the official unemployment rate) and is calculated as the number of unemployed people as a percentage of the labor force. The CMF is a detailed databank that has information for the death of every U.S. resident including race, gender, and cause of death (although see Appendix for how the codes as to the cause of death have changed during our sample period). It also has data for population demographics. All mortality rates used here are crude rates that are calculated as the number of deaths per 100 000 people. Of note, however, is that data is suppressed when deaths number less than ten in order to preserve confidentiality. This unavailability is not a problem with overall mortality since almost all counties see at least ten deaths per year. This can be a problem, though, with specific causes of death since small counties might not have at least ten deaths within the year due to, for example, diseases of the digestive system. When data is suppressed in this way, these observations are then missing from the analysis. To determine to what extent data has been suppressed, one can compare the total number of observations and the total number of counties reported in the baseline regressions of Table 2 using overall mortality with their counterparts in later regressions that focus on specific types of mortality or the mortality of specific subgroups in the population. All data is publicly and freely available at the sources mentioned above.

We denote counties as "urban" or "rural" using a 50 000 person threshold (although we will later consider a 100 000 person threshold). This 50 000 person threshold is also what is used by the U.S. Office of Management and Budget to define what counties belong to a Metropolitan Statistical Area. Of the total 3143 counties in the U.S., 1121 (36%) were classified as metropolitan counties in 2013 and the rest as non-metropolitan ones although we will use the more simple terms "urban" and "rural".

Table 1 provides the means and standard deviations of the data. Of note is that mortality is higher in rural counties whether one considers overall mortality rates, rates for specific subpopulations, or rates for specific causes of death. A striking difference is the higher mortality rates for the under-5 and under-1 populations. The rate for both in rural counties is more than double its counterpart in urban counties. Standard deviations in mortality across subgroups are also higher in rural counties. Given differences in these distributions we find it plausible that other characteristics between urban and rural areas could also differ, including associations between mortality and the business cycle.

3. Methodology

To analyze the impact of cyclical fluctuations upon mortalities across urban and rural counties, we relate the natural log of mortality rate for the j^{th} type of mortality in county i at time t (H_{it}^{j}) to the natural log of the annual county unemployment rate (UR_{it}) and several county-year demographic control variables (X_{it}) along with time-invariant county fixed effects (α_i), county-invariant time fixed effects (θ_t) and an error term (ε_{it}). Use of natural logs allows one to interpret coefficient estimates as elasticities. The specification is:

$$H_{it}^{j} = \alpha_i + \theta_t + \beta * UR_{it} + \gamma * X_{it} + \varepsilon_{it} \quad (1)$$

The inclusion of fixed effects captures time-invariant