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Aggregation and the estimated effects of economic conditions on health

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ABSTRACT

This paper considers the relationship between economic conditions and health with a focus on different approaches to geographic aggregation. After reviewing the tradeoffs associated with more- and less-disaggregated analyses, I update earlier state-level analyses of mortality and infant health and then consider how the estimated effects vary when the analysis is conducted at differing levels of geographic aggregation. This analysis reveals that the results are sensitive to the level of geographic aggregation with more-disaggregated analyses—particularly county-level analyses—routinely producing estimates that are smaller in magnitude. Further analyses suggest this is due to spillover effects of economic conditions on health outcomes across counties.

1. Introduction

Although Harvey Brenner's pioneering research suggested that health deteriorates during recessions (Brenner, 1973, 1975, 1979), follow-up work has revealed that estimates based on aggregate time-series data are quite fragile (Forbes and McGregor, 1984; McAvinchey, 1988; Joyce and Mocan, 1993; Laporte, 2004; Gerdtham and Johannesson, 2005). As Ruhm (2000) points out, this "fragility is not surprising since any lengthy time-series is likely to suffer from substantial omitted variables bias."[1] Out of concern for such biases, researchers have largely stopped considering nationwide changes in favor of an "area approach" that considers how the health of individuals living in an area changes *over and above changes occurring across all areas* when its economic conditions change *over and above changes occurring across all areas*. The intent, however, has remained the same: to estimate the degree to which health outcomes respond to changes in macroeconomic conditions. These studies have repeatedly concluded that "recessions are good for health" in developed countries, though this interpretation relies on the assumption that health is similarly influenced by macroeconomic conditions (broadly defined) and more local area-specific economic conditions.[2] This study is motivated by the idea that this assumption cannot be tested directly since credible estimates of the effects of macroeconomic conditions (broadly defined) would appear to be out of our reach, but that it can be tested indirectly by investigating the extent to which more local and less local economic conditions have different estimated effects on health. More generally, this paper is concerned with the way in which geographic aggregation (or disaggregation) influences the conclusions we draw from our analyses and what analyses we can perform.[3]

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[1] For example, it is problematic for this approach that penicillin became increasingly available as the United States began to recover from the Great Depression.

[2] See Ruhm (2000, 2003, 2005, 2007), Ruhm (2013), Dehejia and Lleras-Muney (2004), Johansson (2004), Neumayer (2004), Tapia Granados (2005), Gerdtham and Ruhm (2006), Lin (2009), Miller et al. (2009) and Stevens et al. (2011).

[3] With few exceptions nearly all area studies using U.S. data define "areas" as states. To my knowledge, the only exceptions are Currie and Tekin (2011) who consider foreclosures at the zip-code level in four states and Dehejia and Lleras-Muney (2004) who consider unemployment rates and supplement their state-level analysis with a county-level analysis of California.

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There are several issues to consider when choosing the level of geographic aggregation and interpreting the results of the analysis. From an economic perspective, we must recognize that there are many mechanisms through which economic conditions can affect health and, from a statistical perspective, we must recognize that the level of geographic aggregation influences the degree to which the estimates capture these different mechanisms. For example, we would expect the effects of individuals' job losses to be captured by changes in economic conditions in the local area where individuals work. However, economic conditions both near and far may affect an individual's health through impacts on re-employment, migration decisions, perceptions about economic conditions, traffic congestion, levels of pollution, the quality of medical care, government policies, and through effects on the members of one's social network. In terms of identification, it is important to keep in mind that the estimated effects of an area's economic conditions are fully inclusive of spillover effects across "subareas" within the area whereas the estimated effects of "subarea economic conditions" are not. For example, estimated effects of state economic conditions are fully inclusive of spillover effects across counties within a state whereas more-disaggregated analyses are not.

At the same time, more-disaggregated analyses can offer more precise estimates because they use variation in economic conditions idiosyncratic to the area in addition to variation driven by broader changes. In particular, more-disaggregated analyses can improve power by leveraging variation in economic conditions that are masked in more-aggregate measures. For example, a contraction in one part of a state that is offset by an expansion in another part of the state would contribute to county-level estimates but not to state-level estimates. Similarly, a county-level analysis would exploit variation in the severity of contractions (and expansions) across different parts of the state whereas a state-level analysis would not. Thus, more-disaggregated analyses may be able to detect statistically significant effects of economic conditions where less-aggregated conditions cannot, even if they do not capture some of the spillover effects captured in more-aggregated analyses.[4]

Another important consideration is that economic indicators are subject to measurement error, which is especially problematic for fixed-effects estimators (Griliches, 1977; Griliches and Hausman, 1986; Hausman, 2001). The most common measure of economic conditions used in this literature is the unemployment rate, produced by the Bureau of Labor Statistics (BLS). However, as one considers smaller areas, one needs to be more and more concerned about measurement error in unemployment rates since they are based in part on household surveys (Bartik, 1996; Hoynes, 2000).[5] For this reason, employment-to-population ratios would seem preferable because they are based solely on administrative data. Still, one may have concerns about measurement-error bias that may be influenced by the level of aggregation.

It is also important to consider the fact that migration is influenced by economic conditions (Blanchard and Katz, 1992; Saks and Wozniak, 2011), particularly among highly educated (Bound and Holzer, 2000; Glaeser and Gyourko, 2005; Wozniak, 2010; Notowidigdo, 2011) and healthy individuals (Halliday, 2007). This heterogeneity implies that the estimated improvements in health associated with recessions will understate the true improvements in health if standard demographic controls do not fully capture these sorts of compositional changes. That said, it is unknown whether education and other characteristics associated with health are more- or less-strongly related to the economic-conditions-migration relationship when one considers different types of moves and different measures of economic conditions. As such, it is unclear whether this sort of composition bias is likely to be of greater or lesser concern for more-disaggregated analyses.[6]

Given the complexity of these issues, I take as my starting point that it is not at all clear what level of geographic aggregation is preferred but that the tradeoffs deserve consideration and that much can be learned by comparing the results of alternative approaches. As such, after describing the different ways that I define areas throughout the subsequent sections in Section 2, I then replicate and update earlier state-level estimates of the relationship between economic conditions and mortality (Ruhm, 2000; Stevens et al., 2011) and the relationship between economic conditions at the time of conception and infant health (Dehejia and Lleras-Muney, 2004) in Section 3. I then consider how and why estimated effects vary when the analysis is conducted at differing levels of geographic aggregation for mortality and infant health in Sections 4 and 5, respectively, before concluding.

My main findings are as follows:

1. The estimated links between economic conditions and health outcomes are sensitive to the level of geographic aggregation with more-disaggregated analyses—particularly county-level analyses—routinely producing estimates that are smaller in magnitude.
2. Analyses that simultaneously consider the economic conditions of a county and the economic conditions of surrounding areas reveal significant spillover effects on health outcomes. For example, the economic conditions outside a county in the same state have economically and statistically significant effects on mortality. These estimates offer an explanation for why the estimated effects of state (or economic area or region) economic conditions are larger than the estimated effects of county economic conditions when each is considered alone—the estimated effects of state economic conditions are inclusive of spillover effects across counties within a state, which are quite important.
3. Because they have more power, more-disaggregated analyses have the potential to reveal statistically significant links between economic conditions and health outcomes even when the estimated effects are smaller in magnitude. For example, while state-level estimates using recent years of data suggest that the link between mortality and economic conditions may no longer exist (Ruhm, 2013), more-disaggregated analyses indicate that the relationship remains highly significant at conventional levels.

[4] On a related note, more-disaggregated analyses can have improved power because they allow for a richer set of control variables in a manner that reduces the amount of unexplained variation in outcomes. This will not necessarily be the case, however, because smaller areas may have more variation in outcomes overall. The richer set of control variables, of course, may also help to mitigate concerns about omitted variable bias.

[5] Angrist and Krueger (1999) provide intuition: "errors tend to average out in aggregate data." Another problematic aspect of unemployment rate data is that the BLS's substate estimates prior to 1990 are no longer considered "official BLS data" because they have not been revised to be consistent with the BLS's current estimation procedure.

[6] The systematic outmigration that occurs when an area's unemployment rises also highlights the importance of well measured population denominators in calculating mortality rates—population measures that do not account for the systematic outmigration caused by economic downturns will lead to mechanical reductions in mortality rates.