Economics Letters 147 (2016) 148–152

Contents lists available at ScienceDirect

Economics Letters

journal homepage: www.elsevier.com/locate/ecolet

On the estimation of the effect of stressors on birth outcomes

Anca M. Cotet-Grecu

Seton Hall University, Stillman School of Business, Department of Economics and Legal Studies, South Orange, NJ 07079, United States

HIGHLIGHTS

- The estimated effect of tornadoes on birth outcomes changed over time.
- Attrition before birth can lead to better outcomes among the surviving infants.
- The estimated effects of stressors on birthweight and prematurity have to be interpreted in the context of changes in mortality in-utero.

ARTICLE INFO

Article history:
Received 10 February 2016
Received in revised form
31 August 2016
Accepted 1 September 2016
Available online 7 September 2016

JEL classification:
I10
I12
Q54

Keywords:
In-utero exposure to stressors
Birth outcomes
Selection

ABSTRACT

Using tornadoes as a source of random variation in exposure to stressors, this papers shows that failure to account for selection through attrition before birth, can lead to significant errors of interpretation of the results of commonly run regressions.

1. Introduction

This paper studies the impact of prenatal environment on infant health by exploiting tornadoes as a natural experiment in maternal exposure to stressors. This inquiry is motivated by a growing literature on the effect of stressors on birth outcomes, a literature yielding inconsistent findings. Some studies find that extreme weather reduces birthweight and gestation, other papers find evidence of labor complications, with no effect on birthweight or gestation (Currie and Rossin-Slater, 2013). Some studies suggest the effect is concentrated in the first trimester of gestation (Almond and Mazumder, 2011; Mansour and Rees, 2012; Valente, 2011), others in the second trimester (Siega-Riz et al., 2001) while others find effects during the last trimester (Painter et al., 2005).

There are several possible reasons for such inconsistencies. Omitted variable bias could confound the association between maternal exposure to stressors and birth outcomes. Even analyses using exogenous sources of variation could lead to inconsistent findings when they rely on variation from rare or geographically localized events and are, thus, not generalizable. A complicating factor is that shocks may lead to positive selection of survivors by increasing mortality in-utero (Bozzoli et al., 2009).

Tornadoes, the source of random variation used in this paper, can potentially affect most geographical areas of the United States (Fig. 1) and all socio-demographic groups; thus, the results are highly representative of the entire country. Tornadoes have low potential for selectivity. Although certain areas are more likely to be affected by tornadoes than others, these areas are vast, so avoidance is difficult. The probability of being directly affected by a tornado in any region is too low to induce significant selection by risk aversion, which could be correlated with birth outcomes. In the two regions with the most tornado days, northeastern Colorado and peninsular Florida, the peak value of the total threat of tornado touchdown is 1.5 tornado days per year (Brooks et al., 2003). Additionally, tornadoes are very difficult to predict. Weather models indicate that there is a higher risk on some days, but cannot predict the exact location where a tornado will form.

This research documents that the effect of tornadoes on birthweight and gestation is not robust over time because attrition

E-mail address: anca.grecu@shu.edu.

http://dx.doi.org/10.1016/j.econlet.2016.09.001
0165-1765/

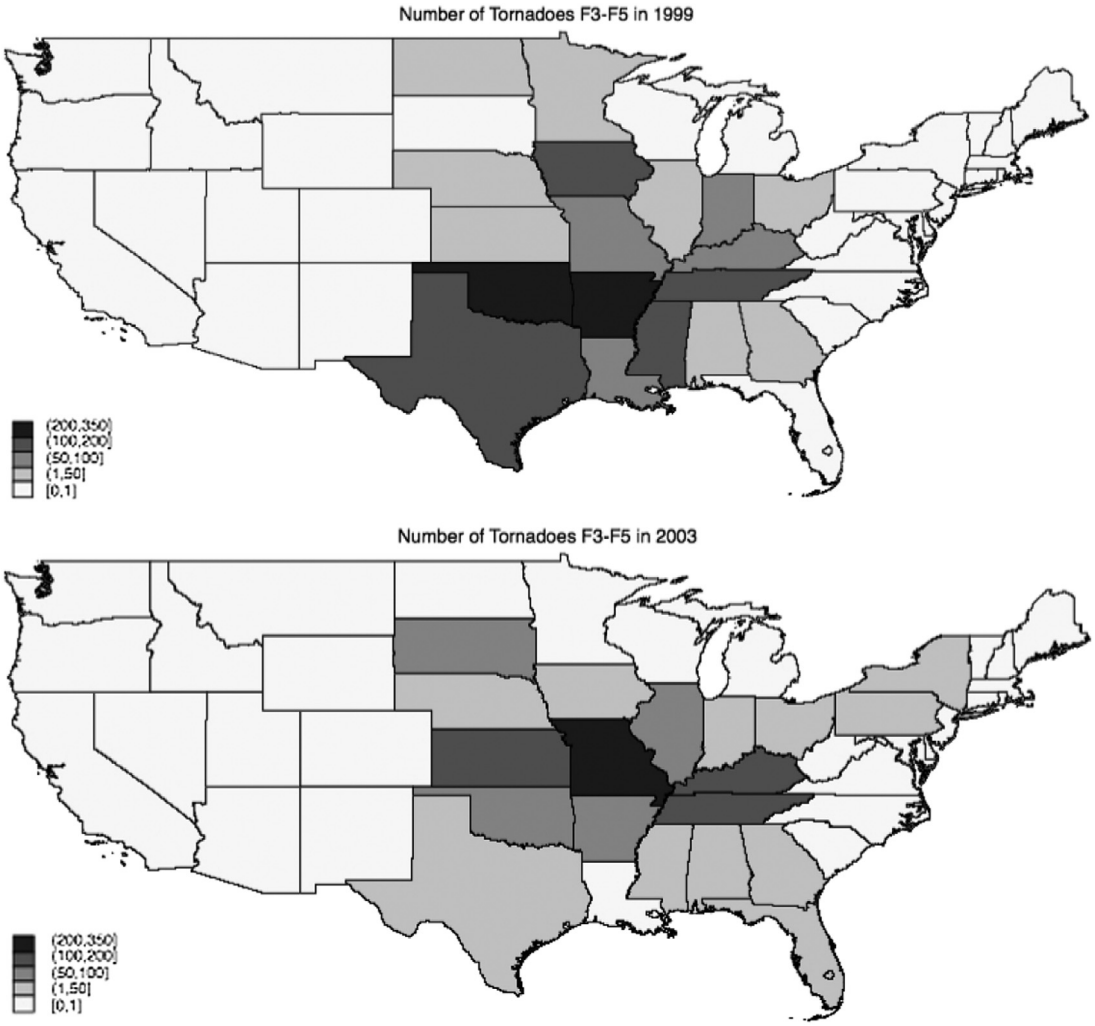

Fig. 1. Frequency of severe tornadoes by state.

can completely obscure the effect of stressors on birthweight and gestation.

2. Empirical strategy

This analysis compares cohorts defined by the date of conception enabling me to investigate the question of "missing" births, i.e. fetal attrition.

Because tornado season in much of Tornado Alley[1] occurs in April through June, disentangling the effect of seasonality from the effect of tornadoes requires data across several years so that comparisons of health outcomes in the same season of birth can be made over time. I utilize a quasi-experimental strategy that exploits variation in tornado density across counties and over time:

$$h_{c,m,y} = \alpha + \sum_{j=1}^{3} \beta_j Tornado_{c,m,y,j} + \delta X_{c,m,y} + \mu Z_{c,y} + \lambda_{c,m} + \gamma_{s,y} + \varepsilon_{c,m,y}$$

where h is the prevalence of an outcome of interest among live births in each cohort defined by the county-month-year of conception, c, m, y. j stands for the pregnancy trimester. The β coefficients measure the impact of the variable of interest, percent live births exposed to tornadoes. $X_{c,m,y}$ is a vector of mothers' demographic characteristics: percent under 25 (omitted), 25–34, or over 35 years old; percent married; percent White (omitted); percent Black; percent other race; percent Hispanic; percent with less than a high-school education (omitted); percent with a high-school education; percent with some college; percent with a college degree; and percent without prenatal care; and infants' characteristics: percent female, percent first child, percent second child, percent third child, percent fourth child, and percent fifth or subsequent child (omitted). The $Z_{c,y}$ vector contains hospitals per 100,000 people, and log per-capita personal income. $\gamma_{s,y}$, the vector of state-by-year fixed effects, captures time-varying differences in the dependent variable common to all counties in a state, such as changes in health-care policies. County fixed effects that are allowed to vary by month, $\lambda_{c,m}$, capture differences in permanent, season-specific determinants of pregnancy outcomes at the county level. $\varepsilon_{c,m,y}$ is the error term.

Being born prematurely reduces the probability of exposure in utero during the third trimester and induces a negative correlation between exposure and prematurity. To account for this possibility, I follow Currie and Rossin-Slater (2013) and instrument exposure with potential exposure under the hypothetical scenario that all infants would reach 39 weeks of gestation.

[1] The southern plains of the central US that consistently experiences a high frequency of tornadoes.