



Transitory shocks and birth weights: Evidence from a blackout in Zanzibar[☆]



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ABSTRACT

Do transitory economic shocks affect neonatal outcomes? I show that an unexpected, month-long blackout in Tanzania caused a sharp but temporary drop in work hours and earnings for workers in electricity-dependent jobs. Using records from a maternity ward, I document a reduction in birth weights for children exposed in utero to the blackout, and an increase in the probability of low birth weight. The reduction is correlated with measures of maternal exposure to the blackout. The blackout also increased fertility for teenage and first-time mothers, but selection into pregnancy cannot fully explain the drop in weights.

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1. Introduction

For children in the developing world, income shocks suffered in utero have important effects on future health, education, and socioeconomic status (Banerjee et al., 2010; Maccini and Yang, 2009; Van den Berg et al., 2006 among others).¹ One reason for these results is that a shock suffered during gestation can lead to lower birth weights, which are linked to adult health problems (Barker, 1995; Behrman and Rosenzweig, 2004). If this holds true, then it is important to understand which types of shock lead to low birth weights, and why. Past research has focused on large, permanent economic shocks. We still do not know

whether short-lived, transitory economic shocks typical of daily life in developing countries have a similar impact.²

This paper presents evidence that fully transitory shocks affect birth weights of children exposed in utero. The evidence comes from the study of a month-long electric power outage on the island of Zanzibar, in Tanzania. Because the blackout was caused by an unforeseen equipment malfunction, it was completely unexpected, and its timing uncorrelated with the economic conditions then present on the island.³ I first use a unique household survey conducted shortly after the event to study the economic effects of such a disruption. I find evidence that, for some workers, the blackout created a negative income shock. In particular, I find that users of electricity at work reported a steep decrease in earnings and hours worked. I also find some evidence that for at least one category of indirect users of electricity—fishermen—the

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¹ Other papers show the effects of in utero and early childhood exposure to disease (Almond, 2006; Barreca, 2010; Bleakley, 2010; Case and Paxson, 2009).

² For instance, recessions considered by Van den Berg et al. cause unemployment, which in turn changes permanent income; Maccini and Yang look at changes in the monsoon rains, which affect an entire year's worth of agricultural yields and can lead to several months or even years of higher or lower income.

³ Many blackouts, especially in Africa, are categorized as "rolling blackouts" and originate from demand for power outstripping supply. Other economic conditions, such as increases in industrial activity or rainfall, are correlated with the timing of those power outages.

loss of income was significant. While sharp, these declines were temporary, and earnings went back to normal soon after the power resumed. The power outage had modest impacts on other aspects of daily life; most notably, electrified households increased their idle time spent inside the home.

I document the effects of this shock on births by analyzing administrative birth records from the largest maternity ward of the island, which includes information on birth outcomes as well as some demographic and maternal characteristics. I also link birth records to the ward of residence of the mother, and utilize the 2007 Zanzibar Labor Force survey to construct ward-level proxies of household exposure to the effects of the blackout. While the study does not cover children born at home (or indeed, in any of the other maternity wards), the 20,000 births observed represent approximately 25% of all births in the island.

The blackout is associated with several outcomes. First, it increased short-run fertility, as measured by the number of births that occurred in the facility 9 months later. Births increased for teenage women and women with no prior pregnancies, with much lower or nonexistent changes in the frequency of births for all other women. Second, it reduced the average birth weight by 107–165 g in children conceived around the time of the blackout. Third, women whose pregnancy was not associated with the fertility change had the largest birth weight reductions. In contrast, birth weight losses were not as large or statistically significant for first-time mothers and teenagers, possibly because there was *positive* selection into pregnancy. This is consistent with a situation where fertility increased more for a “middle class”—those who have televisions, electric lights, and work in occupations affected by the blackout—that, other things equal, give birth to heavier babies. Fourth, birth weight reductions were generally greater in communities that plausibly had a larger share of workers affected by the income shock. Finally, in addition to average birth weight reductions, there was a relatively large increase in the proportion of children born with a low birth weight (less than 2.5 kg)—a medical condition associated with cognitive and health problems later in life.

In terms of magnitude, the effects found here are larger than, but consistent with, the existing literature on the impact of economic shocks during early gestation periods on birth weights. [Bozzoli and Quintana-Domeque \(forthcoming\)](#) found that exposure to the Peso crisis in Argentina led to up to a 30 g reduction in birth weights, [Eccleston \(2011\)](#) found a 12–14 g reduction in New York City post 9/11, [Almond and Mazumder \(2011\)](#) estimate an average loss of 35–45 g for children in the first trimester during Ramadan in Michigan, and [Brown \(2014\)](#) who found a 75 g reduction in birth weights following an escalation of violence in Mexico.⁴ In terms of impact, my estimates are closer to those found for women in the US with high cortisol levels or who smoke ([Aizer et al., 2012](#); [Lien and Evans, 2005](#)). Of course, the context in Zanzibar is very different from those discussed above—there are significant differences in economic conditions and maternal fitness between low and high-income countries. Moreover, the channel of transmission in Zanzibar is unclear. Households suffered a shock to earnings, time use, and living conditions; consequently, maternal stress, changes in nutrition, and even reductions in the spacing of births could have been contributing factors to the sizable weight declines observed.

This paper makes contributions to three literatures. By using an unexpected economic shock with precise start and end dates, it links birth weight changes to fully transitory shocks. It suggests that a widely observed characteristic of households in developing countries—their

inability to fully insure consumption against transitory shocks—also involves a similar inability to insure birth weights. This is a contribution to a literature that emphasizes longer-lasting household or economic shocks,⁵ or research that shows the effects of fetal exposure to health (as opposed to economic) insults ([Almond, 2006](#); [Case and Paxson, 2009](#)). It also establishes that these birth weight responses are large in magnitude, and involve increases in the proportion of children born with low birth weight. In addition, the setup allows me to provide some interesting results on the short-run effects of electricity blackouts on fertility. Indeed, the idea that providing electricity as a form of birth control (or, conversely, of avoiding blackouts) is common in some policy circles. While to my knowledge this has never been proven correct, a byproduct of electricity–television viewing—has been linked to lower fertility levels ([Chong et al., 2012](#); [Jensen and Oster, 2009](#)). This paper suggests that power interruptions increase procreation, at least in the short run. Finally, to my knowledge this is one of the few papers that can measure, with some degree of precision, the effects of blackouts on labor, earnings, and leisure in developing countries where it is not clear a priori how large of a shock is caused by power outages. As such, it complements work on the effects on firm production and profitability ([Adenikinju, 2003](#)).

The remainder of the paper is structured as follows. [Section 2](#) provides background information on blackouts and the nature of the Zanzibar event. [Section 3](#) uses the post-blackout survey to measure the size of the shock to the labor force. [Sections 4 and 5](#) introduce the birth outcome data sets used in this study and the estimation strategy respectively. The impact on fertility and neonatal fitness is discussed in [Section 6](#). Finally, [Section 7](#) concludes.

2. Background information

2.1. Blackouts in Africa

Although there are no existing statistics on the phenomenon, many countries in Africa suffer from tremendous power instability. Large cities like Lagos, Nigeria are renowned for constant power cuts. Other places where service has historically been considered reliable have been in the news for blackouts, including Addis Ababa, Nairobi, Dar es Salaam, and Johannesburg—all of which have suffered power outages lasting weeks if not months during the past few years. When they occur, outages often take the form of rolling blackouts, in which access to power is rationed but available for a few hours during the day or the week. These types of electricity outages are qualitatively different from the type considered in this paper, which involves a protracted and continuous power cut. Such cases of complete, unexpected, multi-week blackouts are, however, not uncommon. For instance, in the summer of 2008 local Tanzanian newspapers reported a 3-week-long blackout in the Mtwara region on Tanzania. In Zanzibar itself, in addition to the 2008 blackout, there was a longer power outage between December 2009 and March 2010. Rural areas in Africa are particularly prone to these types of accidents because they are often served by a single power line (as opposed to a grid of several lines connected to each other), for which any accident or theft of material can result in a prolonged blackout. It is also possible to find accounts of protracted electricity outages in areas that are at the margin of big cities suffering from rolling blackouts ([BBC, 2010](#)).

⁴ See also [Mansour and Rees \(2010\)](#) and [Camacho \(2008\)](#), who found that maternal stress in the first trimester of gestation was associated with lower birth weights.

⁵ For instance, [Lindo \(2010\)](#) finds that birth weights decline after the loss of a parent's job, indicating that neonatal health responds to *permanent* income. [Dehejia and Lleras-Muney \(2004\)](#) do find that birth weights are counter-cyclical, but cannot say whether recessions affect health through transitory income, permanent income, or adverse selection. Like this paper, the work by Dehejia and Lleras-Muney indicates that positive selection is an important mechanism of transmission from economic shock to birth weights.

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