



## Regional inequality and polarization in the context of concurrent extreme weather and economic shocks



Julie A. Silva <sup>a,\*</sup>, Corene J. Matyas <sup>b,1</sup>, Benedito Cunguara <sup>c,2</sup>

<sup>a</sup> Department of Geographical Sciences, University of Maryland, 2181 LeFrak Hall, College Park, MD 20742, USA

<sup>b</sup> Department of Geography, University of Florida, 3141 Turlington Hall Box 117315, Gainesville, FL 32611, USA

<sup>c</sup> International Development Research Associate, Michigan State University, Department of Agricultural, Food, and Resource Economics, 446 West Circle Drive Room 207, East Lansing, MI 48824, USA

### ARTICLE INFO

#### Article history:

Available online 2 March 2015

#### Keywords:

Regional inequality  
Economic polarization  
Extreme weather events  
Economic globalization  
Decomposition analysis

### ABSTRACT

This study examines how extreme weather influences regional inequality and polarization within Mozambique in the context of on-going economic shocks. Utilizing satellite-based estimates of rainfall spatially analyzed within a GIS, we establish a 16-year rainfall climatology and calculate monthly rainfall anomalies for 665 villages. We approximate storm-total rainfall from all tropical cyclones entering the Mozambique Channel, as well as the extent of damaging winds for those making landfall, between 2005 and 2008. We group villages according to tropical cyclone impacts and use hierarchical cluster analysis to group the remaining villages according to shared patterns of monthly rainfall anomalies. Using economic data from the 2005 and 2008 National Agricultural Surveys of Mozambique, we relate weather patterns associated with near normal rainfall, tropical cyclones, flooding, and drought to changes in inequality and polarization by conducting decomposition analyses of the Gini index and Duclos-Esteban-Ray (DER) polarization index. Our findings mainly correspond to the generally accepted view that weather shocks exacerbate existing income and power disparities within societies. However, in some cases we find evidence that inequality and polarization can decline in the aftermath of an extreme event, and increase even where the weather is relatively good. By identifying varying effects of extreme events on inequality and polarization at subnational level, our study enables a more detailed understanding of weather-related effects on socio-economic outcomes in rural societies rapidly integrating into the global economy.

© 2015 Elsevier Ltd. All rights reserved.

### Introduction

Residents of least developed countries (LDCs) face increasing exposure to climate variability and higher frequencies of extreme events (IPCC, 2007). Research has found that poorer inhabitants of LDCs are disproportionately vulnerable to the negative effects of environmental shocks (Ahmed, Diffenbaugh, & Hertel, 2009; Leichenko & O'Brien, 2008). They are more likely to engage in livelihoods that depend on climate-sensitive sectors like agriculture or on low-income informal or temporary jobs with little protection against climate-related employment disruptions (Cunguara, Langyintuo, & Darnhofer, 2011; Jones, LaFleur, & Purvis, 2009). They also tend to have fewer assets or insurance to help them

recover from climate shocks and are more likely to live in areas with high exposure to climate variability and extreme events (Carter, Little, Mogues, & Negatu, 2007; Skoufias, Rabassa, & Olivieri, 2012). A growing consensus exists within the research literature that differential ability to cope with extreme weather events exacerbates existing inequalities and power disparities (e.g., polarization) within societies (IPCC, 2014a, 2014b). However, with few exceptions (Grineski et al., 2012; Reardon & Taylor, 1996), empirical work on the effects of such events on income disparities at the subnational level in less developed economies remains relatively limited (Leichenko & Silva, 2014).

In this study we use the case of Mozambique to examine how different weather shocks influence changes in regional income inequality and polarization in the context of concurrent economic shocks. While measures of regional inequality examine the dispersion of incomes along a distribution (i.e., spread), polarization measures are sensitive to the size of income groups and where they cluster along the distribution. As polarization increases, the income distribution takes on an hourglass shape and households

\* Corresponding author. Tel.: +1 301 405 4052.

E-mail addresses: [jasilva@umd.edu](mailto:jasilva@umd.edu) (J.A. Silva), [matyas@ufl.edu](mailto:matyas@ufl.edu) (C.J. Matyas), [cunguara@gmail.com](mailto:cunguara@gmail.com) (B. Cunguara).

<sup>1</sup> Tel.: +1 352 392 0494.

<sup>2</sup> Tel.: +1 258 21 462 222.

become clustered around two distinct poles forming two classes (rich and poor). Since income disparities allow economic power to be translated into political power, polarization can intensify the vulnerability of the poor (Sen, 1981, 1999) and further decrease their ability to mitigate the effects of extreme weather events (Grineski et al., 2012).

Our study examines how weather influences changes in regional inequality and polarization directly preceding extreme events at the subnational level in agriculturally dependent societies characterized by widespread poverty. We also explore how economic shocks influence weather-related effects on inequality and polarization. Given the conclusions of the 2014 IPCC reports (2014a, 2014b), we hypothesize that regions in Mozambique affected by extreme weather will experience increasing inequality and polarization due to varying household capacity to mitigate the impacts of these events. We also expect that, *ceteris paribus*, regions with normal or near-normal rainfall will experience declines in inequality and polarization as income disparities decrease between subsistence farmers and wealthier households that tend to have more formal, non-agricultural sources of income.

In our analysis, we first control for the differential effects of extreme weather events on income inequality and polarization by grouping regions according to shared weather events. According to the World Bank (2014b), Mozambique is the only African country considered to be at high risk from all three major climate hazards: floods, droughts, and cyclones. During the time period of this study (2005–2008) Mozambique experienced multiple weather shocks including extreme rainfall and wind damage from tropical cyclones, major flooding along the Zambezi River, and drought across the southern region of the country. Thus, we place households into groups based on the percentage of normal rainfall received in each study month, or receipt of high rainfall and/or damaging-force winds from tropical cyclones.

After testing our hypotheses by decomposing inequality and polarization within regions with shared weather patterns, we then contextualize our findings employing the Double Exposure (DE) framework (Leichenko & O'Brien, 2008). The DE framework emphasizes the need to analyze the effects of discrete events (e.g., extreme weather) in the context of other types of global change (e.g., economic globalization) to better understand how exposure to multiple and simultaneous stressors affect regional inequality and polarization. Mozambique also experienced a severe economic shock during the study period. Dramatic increases in food and fuel prices peaked in 2008 (Arndt et al., 2012) and contributed to widespread rioting in February of that year (Hanlon, 2009). Empirical studies using the DE framework find that the rural poor in developing countries tend to be 'double losers' in that they are negatively impacted by both climate change and economic globalization via disproportionately high vulnerability to weather shocks and economic crises (Leichenko & O'Brien, 2002; McKune & Silva, 2013; O'Brien et al., 2004; Silva, Eriksen, & Ombe, 2010). These findings suggest that negative effects of economic shocks amplify the hardships caused by bad weather, and vice versa. However, the DE framework recognizes that, in some cases, economic development could theoretically offset the effects of climate change, and vice versa (O'Brien & Leichenko, 2000). Using the DE framework we analyze and interpret how the hypothesized weather-related effects on changing regional inequality and polarization are affected by economic shocks.

#### *Drivers of rural income inequality*

While the literature on regional income inequality is vast, much less work has examined the drivers of polarization. A large body of research has identified many demographic, structural, and physical

factors that influence levels of regional inequality, a full review of which is beyond the scope of this paper. We briefly focus on the relationship between inequality and off-farm income, given the evidence that off-farm diversification figures as a prominent coping strategy for rural African households that have experienced a weather shock (Barrett, Reardon, & Webb, 2001; Cunguara, Garrett, Donovan, & Cássimo, 2013; Demke & Zeller, 2012; Ersado, 2005; Oyekale & Gedion, 2012). In cases where agricultural productivity declines or remains extremely low, households may participate in what Lay, Mahmoud, and M'Mukaria (2008) refer to as survival-led diversification into low-skill, off-farm employment. Conversely, high agricultural productivity can increase household wealth, allowing investments in human capital and diversification into higher skilled off-farm activities that offer greater returns (Reardon, 1997). Whether or not off-farm employment increases or decreases rural inequality remains theoretically ambiguous, and the empirical results have been mixed (Ellis, 2000; Reardon, Taylor, Stamoulis, Lanjouw, & Balisacan, 2000). Low-return, low-skilled activities undertaken by households to off-set poor agricultural productivity may be inequality-decreasing, while participation in high-return activities may increase inequality as wealthier households tend to have better access to these types of jobs. Reardon and Taylor (1996) suggest that weather shocks will have greater unequalizing effects on income distributions in regions where households have less diverse income sources. Arndt, Benfica, Maximiano, Nucifora, and Thurlow (2008) also suggest that food price shocks could reduce rural inequality by increasing the returns to unskilled labor, a factor used intensively in agricultural production, relative to skilled labor.

#### *The Case of Mozambique*

Mozambique provides a particularly useful case for examining the linkages between extreme weather, inequality, and polarization in the context of high poverty and economic shocks. Over 70% of Mozambicans live in rural areas (INE, 2008), and 99% of rural households are still largely reliant on rain-fed, semi-subsistence agriculture (Cunguara & Hanlon, 2012). Mozambican farmers experience high weather vulnerability, with substantial inter- and intra-annual rainfall variability ranging from extreme drought to flooding rainfall from tropical cyclone systems (Arndt et al., 2011; Matyas & Silva, 2013). Mozambican farmers tend to have very small land holdings and low productivity making them net buyers of food staples (Donovan & Tostão, 2010), and thus vulnerable to volatile international markets (Ngare, Simtowe, & Massingue, 2014). Although Mozambique's GDP per capita rose from \$313 in 2005 to \$435 in 2008 (World Bank, 2014a), 57% of rural Mozambicans still lived below the official poverty line as of 2008/09 (DNEAP/MPD, 2010). In addition, the Mozambican government reports high levels of national-level inequality, as measured by the Gini coefficient which remained virtually unchanged between 2002/03 (0.42) and 2008/09 (0.41) (DNEAP/MPD, 2010).<sup>3</sup> Official estimates of polarization are not available, however this measure provides an important indicator of power inequities and is thus analyzed in our study.

#### *Weather shocks*

Multiple weather shocks contributed to declines in per capita agricultural production during the time period of our study (Arndt et al., 2012) and widespread damage to infrastructure. Between 2005 and 2008, two tropical cyclones made landfall in

<sup>3</sup> Official inequality figures use consumption expenditure data which typically result in lower Gini coefficients than those derived from income data.

Download English Version:

<https://daneshyari.com/en/article/83227>

Download Persian Version:

<https://daneshyari.com/article/83227>

[Daneshyari.com](https://daneshyari.com)