Regional Impacts of Climate Change on Health and Labor in Brazil

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Global climate and environmental change have aggravated in the last decades (Nordell, 2007). Increased health stress is one of the most alarming consequences of these changes. The impacts of climate change on human health is complex, ranging from more direct consequences, such as increase in the prevalence of climate-sensitive diseases and in the demand for health care, to more indirect impacts, such as loss in labor supply (temporary through morbidity or permanent through deaths) and productivity (Pattanayak et al., 2009).
Although many studies have tried to estimate the direct and indirect consequences of a warmer and dryer environment for the economy, both at a global and local scale, a smaller number of studies have addressed the mid and long term health implications of these changes at a regional level. This study takes a multi-stage approach to estimate the climate-related consequences on cardiovascular/respiratory and infectious/vector-borne diseases, morbi/mortality, and labor supply in Brazil. Combining Spatial Bayes Smoothing, Spatial Econometrics, data on the Global Burden of Disease,and a Regional Computable General Equilibrium (CGE) model, this study estimates the future development of climate-sensitive health disorders, their implications for loss (gain) in morbidity and mortality, and the consequences for labor supply and productivity for the Brazilian states and regions from 2010 to 2040. As far as we know, this is the only study estimating the impact of climate change on health and economic development at the regional level.
To evaluate the impact of climate change on the Brazilian economy as a result of its impacts on the labor supply through health, we combine diï¬€erent sources of data and analytical strategies. Population health was proxied by two groups of variables: disease notiï¬•cations (dengue, malaria, and leishmaniosis) and hospitalizations (circulatory, respiratory, and infectious diseases). These health indicators were derived from administrative health records by municipality. Climate parameters were proxied by precipitation (total amount of rain within one year and its standard deviation) and temperature (12-month average). The climate scenario used in this analysis was the Representative Concentration Pathways 8.5. The eï¬€ect of climate change on the labor supply was obtained by a two-step strategy. The ï¬•rst step estimates the relationship between climate change and health. Building on Bosello et al. (2006) and Pattanayak et al. (2009), the second step analyses to what extent health losses due to climate change aï¬€ects the labor supply based on the Global Burden of Disease parameters (WHO, 2016). The change in the number of cases estimated for the working age population (labor supply) was used in a computable general equilibrium model to verify the eï¬€ect of climate change on the Brazilian economy by 2040.
Our IMAGEM-B (Integrated Multiregional Applied General Equilibrium Model - Brazil) incorporates detailed data for the Brazilian economy, yielding the climate impact on the main macroeconomic variables, such as Gross Domestic Product (GDP), employment, and family consumption. These impacts are reported at both national and state levels and are evaluated as the percentage cumulative deviation from a base scenario without considering the change in the climate parameters (business-as-usual).
We found a link between climate change and health, although this relation varies by disease and by region. The prevalence of circulatory diseases is expected to decline from 2005 to 2040 due to the projected increase in average temperature across most municipalities in Brazil. Consequently, the morbi-mortality rate from circulatory disease is expected to decline, yielding an increase in the labor supply by 2040. This eï¬€ect is more pronounced in the South. The impact of future climate change on vector borne and infectious diseases is higher in magnitude when compared to the chronic conditions. Overall, prevalence of infectious diseases, wit large, and dengue more speciï¬•cally, is expected to increase across all regions, resulting in higher morbimortality rates and signiï¬•cant loss

in the labor force by 2040. Change in the prevalence of all three diseases will be higher in the North and in the Center West. Despite the increase in the prevalence, rates themselves are low in magnitude (but high if compared to other countries). Therefore, additional morbi-mortality and loss in the labor force due to climate change would increase only marginally. The impact of the projected climate change on labor (from the demographic model) is higher than its computed eï¬€ect in the economy (from the computable regional general equilibrium model). The CGE result shows that increased morbi-mortality and labor loss would be higher for vector-borne and infectious than for non-communicable diseases, and mostly concentrated in less developed regions of the country.