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Analysis

Climate change and the economy in Baja California: Assessment of macroeconomic impacts of the State's Climate Action Plan

Dan Wei [a,*], Alejandro Brugués [b], Adam Rose [a], Carlos A. de la Parra [b], Rigoberto García [b], Federico Martínez [b]

[a] Sol Price School of Public Policy, University of Southern California, Los Angeles, CA 90089, United States
[b] El Colegio de la Frontera Norte, Escénica Tijuana-Ensenada Km 18.5, San Antonio del Mar, 22560 Tijuana, B.C., Mexico

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ABSTRACT

Despite its developing country status, Mexico ranks 10th worldwide in total greenhouse gas (GHG) emissions. However, Mexico's vulnerability to climate change impacts is a major motivating factor behind its announced intended contributions at COP21 to cut its baseline emissions by at least 25% in 2030. We analyze the macroeconomic impacts of the Climate Action Plan (CAP) process undertaken in the Mexican border state of Baja California (BC). We adapt a state-of-the-art regional macroeconometric model to analyze the BC economy-wide impacts of 22 GHG mitigation policy options recommended in the Baja California CAP. The combined effects include an average annual increase of 1680 new jobs (or about 0.11% of the average annual employment in the baseline economic forecast) and a Gross State Product (GSP) increase of $9.85 billion pesos in NPV over the 2015–2030 planning horizon. Although the main objective of GHG mitigation is to reduce atmospheric concentrations, and hence future potential damages of these pollutants, the stimulus to the BC economy from the implementation of its CAP represents a valuable co-benefit. Moreover, it is a tangible one that will take place in the near-term, in contrast to the more long-term and more uncertain benefits associated with reducing climate change damages.

1. Introduction

In 2012, Mexico contributed approximately 1.6% of total global greenhouse gas (GHG) emissions, ranking 10th worldwide (WRI, 2015). Between 1990 and 2012, Mexico's total GHG emissions have increased from 477 million metric tons of CO_2 equivalent ($MMtCO_2e$) to 749 $MMtCO_2e$, or an increase of 57%, with an average annual increase of about 2.1% (WRI, 2015). Although Mexico only accounts for a small share of total global emissions, the country is an active participant in efforts to reduce its emissions. In March 2015, Mexico submitted its *Intended Nationally Determined Contribution* (*INDC*) to the UNFCCC announcing the country's unconditional and conditional GHG emission reduction targets. At the UN Conference of the Parties to the Framework Convention on Climate Change held in Paris in December 2016, COP21, the country volunteered to unconditionally cut 25% of its baseline emissions in 2030. Conditional on the progress of a global climate agreement that addresses issues such as international carbon pricing and availability of international support, including technology transfer and low-cost financial resources, the country could increase its reduction target to 40% (UNFCCC, 2015a; Averchenkova and Bassi, 2016). These goals will require structural transformation in national and regional development policy.

Mexico is ecologically vulnerable to climate change. Based on the projection by the Mexican Network of Climate Modeling, Mexico is likely to experience higher temperature increases than the global average increases in the future (Federal Government of Mexico, 2013). In the past decade, the country has suffered from an increasing number of climate change-related events, including floods, heatwaves, droughts, heavy rainfalls, landslides, etc. The economic damage caused by such extreme hydro-meteorological events increased from an average of about 700 million pesos yearly in the 1980s and 1990s to over 21 billion pesos in the past decade (Federal Government of Mexico, 2013).[1]

Given its developing country status, the Mexican government has recently begun to think strategically about economic development and poverty reduction. Legislation on social development in 2004 (Ley de Desarrollo Social, 2013) and the recent so-called structural reforms (Ramírez and Robles, 2013) attest to that effect. Although only less than 2% of people in Mexico live below the international poverty line set by

* Corresponding author.
E-mail addresses: danwei@usc.edu (D. Wei), abrugues@colef.mx (A. Brugués), adam.rose@usc.edu (A. Rose), cdelap@colef.mx (C.A. de la Parra), rigo@colef.mx (R. García), fredeko10@hotmail.com (F. Martínez).

[1] The annual average exchange rate between the Mexican peso and the U.S. dollar over the past five years was 14.052:1 (IRS, 2016).

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the World Bank, based on a more comprehensive assessment of poverty by the Mexican government that includes multiple dimensions such as social rights and living standards, 38% of the population (or 41.8 million people) lived in moderate poverty and 9.8% (or 11.5 million people) in extreme poverty in 2012 (Wilson and Silva, 2013). Evidence suggests that Mexico's vulnerability to climate change impacts, as well as its commitment to continued growth as an emerging economy, are the motivating factors behind a major institutional effort underway nationally.

Mexico is the only Non-Annex I nation to issue all of the five National Communications under the UNFCCC guidelines, including two National Climate Change Strategies, two special action plans, one national legislation, and several programs at the federal level (UNFCCC, 2015b). Although Mexico has significantly advanced its agenda on climate change, by the end of the last decade it became clear that actions and policy initiatives had focused only on the national level. Recognizing this, the National Institute of Ecology[2] (INE) determined that state climate change action plans would need to be implemented taking into account the economic, social, geographic and environmental specificities of each region in the country, with local stakeholders and policy makers involved in the regional plan development process. In turn, the INE began a process of capacity building and strengthening on issues of climate change at the subnational level. The most important accomplishment of this strategy was the development of the State Climate Action Plans (PEACC, the acronym in Spanish). By 2012, out of the 32 states, 29 PEACCs, 26 state inventory and forecasts (I&F), and 28 state climate change scenarios had been created, and 15 studies on the impact of climate change on water quality had been conducted.

In this paper, we examine the macroeconomic impacts of the Climate Action Plan (CAP) process undertaken in Mexico's state of Baja California. Baja California (BC) is one of the U.S.-Mexico border states where the binational Border Environment Cooperation Commission (BECC) is building partnerships with experts, academics and state government officials to adapt international CAP methodologies to local conditions. The international border region of Mexico is one of the most economically dynamic regions of the World and strategic not only to Mexico but to the North American Partnership as well. In order for the climate strategy to maintain momentum across changing administrations, those who design policies and implement them are placing greater emphasis on policy relevance, economic stimuli, and cost-effective measures that will create the necessary incentives for state and local government. The importance of this strategy is outlined in this paper through the refinement of an economic model to assess the macroeconomic impact of the Baja California Climate Action Plan in order to facilitate the formulation of useful policy recommendations.

We apply, in an innovative manner, the Regional Economic Models, Inc. (REMI) Policy Insight Plus (PI^+) Model, to analyze the macroeconomic impacts of the Baja California Climate Action Plan. Although the REMI Model has been applied to analyze the economic impacts of climate action plans in several states and regions in the U.S., this is the initial effort at applying the REMI Model to evaluate a climate action plan outside the US; thus, a particular focus of this study is to design the policy analysis to apply to special considerations of the developing region. This paper also represents a contribution to the literature by invoking the "Custom Industry" feature of the Model for the first time to evaluate a climate action plan. Furthermore, the methods we developed using the "Custom Industry" function will prove useful for other users as they can adapt the REMI Model to other developing regions of the World, where greater likelihood exists that data shortcomings will necessitate this remedy as well. Finally, great efforts went into collecting and refining microeconomic data on individual mitigation options (unique to Baja California), and carefully translating these micro level data into the REMI Model inputs, which have significant bearing on the accuracy of the results.

The rest of this paper is structured as follows: In Section 2, we provide an introduction to the climate action planning process in Baja California, including a summary of the microeconomic analysis results of the mitigation policy options recommended in the BC climate action plan. In Section 3, we introduce the REMI Regional Macroeconometric Model, followed by a description of how we translate the micro level analysis results to REMI policy levers and related economic drivers. A list of major assumptions used in the REMI simulations is also presented. In Section 4, we present and discuss the simulation results, which include both aggregate and sectoral impacts, as well as the sensitivity analysis results. The paper concludes with a discussion of policy implications in Section 5.

2. Climate Action Planning in Baja California

2.1. Socioeconomic Conditions of Baja California

With a population of 3.43 million, Baja California accounts for 2.9% of the total population in Mexico in 2014 (CityPopulation, 2015). The Gross State Product (GSP) of Baja California exceeded 437 billion pesos (about $34 billion USD) in 2013, representing 2.8% of the national total. The primary industry (Agriculture and Forestry) only accounts for 3.2% of the state GSP. The secondary industry (including mining, utilities, construction and manufacturing) and tertiary industry (including various types of service activities) account for 35.5% and 61.3% of the state GSP in 2013, respectively (ProMexico, 2015). In 2014, the average salary payment per day in BC was $268.1 pesos, which was lower than the national average of $282.1 pesos. In addition, there is a large variation in the average salary payment across sectors, ranging from $165.6 pesos per day for the Ag, Forestry, Fishing and Hunting sector and $205 pesos for Construction sector to $727.7 pesos for Utility sector (ProMexico, 2015). Baja California used to be among the group of states that have high unemployment records in Mexico (Mngcornaglia, 2013). However, in the first quarter of 2015, the unemployment rate in BC has decreased to 4.1%, which was slightly lower than the national average of 4.2% (INEGI, 2015).

Based on the most comprehensive assessment to date, the GHG emission inventory of Baja California conducted by the Border Environment Cooperation Commission (BECC) and the Center for Climate Strategies (CCS), Baja California generated approximately 15.8 $MMtCO_2$ emissions in 2005, which represents about 2.4% of Mexico's total GHG emissions (BECC and CCS, 2010). From 1990 to 2005, the state gross consumption-based GHG emissions increased by 112%, while the national emissions only increased by about 31%. The two primary drivers of Baja California's fast growing emissions were electricity consumption and transportation activities. It is projected that the state gross GHG emission will continue to grow to 26.5 MMt CO_2 by 2025, an increase of 294% over the 1990 level. The transportation sector is projected to be the largest contributor to future state emission growth, followed by electricity consumption. By 2025, these two sectors will account for 44% and 36% of the total state gross emissions, respectively (BECC and CCS, 2010).

2.2. The Two-Phase Climate Action Planning Process in Baja California

Baja California has undertaken various efforts to reduce GHGs. In 2012, the Law on Prevention, Mitigation and Adaptation of Climate Change for the State (LPMACC) was enacted and in 2014 a council to address climate change was established.

From 2008 to 2012, Baja California's State Environmental Protection Agency (SPA, Spanish acronym of Secretaria de Protección al Ambiente)

[2] On June 6, 2012, Mexico's General Law on Climate Change was enacted, which created the National Institute of Ecology and Climate Change (INECC). Shortly thereafter, the INE became the INECC.