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The Effect of Climate Change on Thailand's Agriculture

Abstract:

Agriculture is potentially affected by climate change especially in developing countries where the agricultural sector plays a crucial role including Thailand. The objectives of this study are to analyze the effect of climate change on Thailand's agriculture and investigate implications for greenhouse warming under future climate change scenarios using the Ricardian approach allowing a variety of the adaptations that farmers make in response to changing economic and climate conditions. The study finds that both temperature and precipitation significantly determine farmland values. Summer temperature, precipitation in the early rainy and summer season negatively affect the farmland values, while winter temperature, precipitation in the late rainy and winter season enhance the farmland values. Overall, the projected negative impacts of climate change on Thailand's agriculture during 2040-2049 range from $24 to $94 billion. By downscaling the analysis to the province level, this article finds that western, upper part of central, and the left part of northern regions are projected to be better off, while southern, eastern regions, lower part of central, and the right part of northern regions is projected to be worse off.

Key words: Thailand's agriculture, climate change, Ricardian analysis, regional climate model, farmland value

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1. INTRODUCTION

Recent studies, including those by the Intergovernmental Panel on Climate Change (IPCC) (2001a; 2001b; 2007a; 2007b), indicate that greenhouse gas (GHG) emissions and resultant atmospheric concentrations have led to changes in the world's climate conditions, such as increases in temperatures, extreme temperatures, droughts, and rainfall intensity. Such changes are expected to continue and agriculture is potentially the most sensitive economic sector to climate change, given that agricultural production is highly influenced by climatic conditions (e.g., IPCC 2007b; Mendelsohn, Nordhaus, and Shaw 1994; Deschenes and Greenstone 2007; McCarl, Villavicencio, and Wu 2008; Schlenker and Roberts 2009). Compared with developed countries, developing countries are more vulnerable to climate change since they are already in a hot climate zone, depend on labor-intensive technologies with fewer adaptation opportunities, and a majority of people in these countries rely heavily on the agricultural sector (Mendelsohn et al. 2001).

Thailand is one of developing countries that agriculture plays a crucial role. For example, in 2011 the agricultural sector employed about 14.88 million people, accounting for 38.7 percent of the Thai labor force (National Statistical Office Thailand 2012) and agricultural activities generate about $40 billion, which contributed to 12.8 percent of the gross domestic production (Office of the National Economic and Social Development Board 2012). Thailand is also a major exporter for many agricultural commodities such as rice, natural rubber, and cassava. Therefore, climate change impacts on agriculture are expected to significantly affect the economy and the livelihood of the people in this country.

The objectives of this study are to analyze the effect of climate change on Thailand's agriculture and investigate implications for greenhouse warming under future climate change scenarios on Thailand's agricultural sector using the Ricardian approach firstly proposed by Mendelsohn et al. (1994). Although there are many studies (Office of Environmental Policy and Planning 2000; Buddhaboon, Kongton, and Jintrawet 2005; Pannangpetch et al. 2009; Isvilanonda et al. 2009) analyzing the effect of climate change on Thailand's agriculture, most studies (except for Khamwong and Praneetvatakul 2011) use the traditional production function approach, which potentially overestimates the damage from climate change since the model allows little adaptation of farmers (Mendelsohn et al. 1994).

The current article differs from Khamwong and Praneetvatakul (2011) in several aspects. First, it expands the scope of the previous research from the northeast region to cover entire country. Second, the current paper uses the finer scale of dataset, a farm-level dataset, which could improve the estimated results since it reflects the farmer's decision regarding the climate adaptation strategies more than the use of provincial-level data. Third, the current article employs the land value as a dependent variable similar to the original Ricardian approach, which could address the potential problem from the use of the annual net farm revenue. Fourth, more constructed important explanatory variables determining the farmland values collected from various sources are included to address the problem of endogeneity bias. Lastly, the current article projects the impacts of climate change under climate scenarios using the unique dataset from regional climate models.

2. LITERATURE REVIEW

In view of its importance to economic well-being, effects of climate change on agriculture have been well research and documented, dating back at least 25 years (e.g. Smith and Tirpak 1989; Mendelsohn et al. 1994; Adams et al. 1999; Reilly et al. 2003; McCarl et al. 2008; Attavanich et al. 2013; and various IPCC reports). Overall, the effect of climate change on agriculture is mixed in developed countries, but negative impacts are found in developing countries. Moreover, in a country, the damage is heterogeneous across regions.

Using an agricultural sector model, Adams et al. (1999) find that agricultural welfare strictly increases in the United States (U.S.) with a 1.5°C warming and further warming could decrease this benefit at an increasing rate. The welfare gain from a 1.5°C warming with 7 percent precipitation is $55 billion in 2060. Further warming by 2.5°C could reduce these benefits to $47 billion. With similar approach, Reilly et al. (2003) estimated the net effect in terms of economic welfare of the combined changes in crop yields including adaptation and CO_2 fertilization effects, water supply, irrigation demand, pesticide expenditures, and livestock effects was generally positive. The increase in economic welfare was ranged from $0.8-$7.8 billion in 2030 and $3.2-$12.2 billion in 2090. U.S. producers generally suffered income losses due to lower commodity prices while consumers gained from these lower prices.

Using the Ricardian analysis, Mendelsohn et al. (1994) find that higher temperatures in all seasons except autumn reduce average U.S. farm values, while more precipitation outside of