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Exploring the Impacts of Changing Energy Costs on New Zealand Agriculture to 2030: A GTAP-E-RD Application

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In this study, we explore the impacts of changing energy costs using the new GTAP-E-RD model to project the global economy to 2030, with a particular focus on New Zealand agriculture. GTAP-E-RD is based on the well-known Global Trade Analysis Project model (GTAP) (Hertel, 1997; Corong et al., 2017), extended to include recursive dynamics (Aguiar et al. 2919) within the latest energy version of the GTAP model (Corong et al., 2020). In addition to capturing intersectoral and international linkages within a consistent framework, the GTAP-E-RD model enables us to include a relatively detailed specification of energy inputs and associated carbon emissions, as well as recursive dynamics to allow explicit modelling of time.

We use the GTAP version 10 database, with a base year of 2014 (Aguiar et al., 2019). In addition to economic data including on inputs, outputs and trade flows for New Zealand and other economies, the database includes carbon dioxide emissions distinguished by fuel type and user. These data are supplemented with non-CO_2 emissions data on other greenhouse gas emissions. In the standard GTAP database, the beef and sheep meat sectors are combined. However, to facilitate more detailed analysis of meat sectors, we split the GTAP beef and sheep meat (cmt), as well as the associated cattle and sheep (ctl) sectors.

We develop a baseline of the global economy to 2030, including key macroeconomic projections as well as relatively conservative increases in New Zealand carbon emission prices and moderate changes in world oil and gas prices. We then consider the impact of five different scenarios: a moderate increase in the price of carbon emissions in New Zealand; a relatively high increase in the New Zealand carbon emission price; a moderate global carbon tax; lower than baseline fuel price increases; and higher than baseline fuel price increases.

We find that increases in carbon emission prices lead to some reductions in real GDP for New Zealand. However, these scenarios also lead to substantial reductions in carbon emissions in New Zealand, though the global impact of these is small when New Zealand alone increases carbon prices. In the scenarios where increases in global carbon prices or global fuel prices impact all countries, we find a smaller negative impact on New Zealand's real GDP, suggesting the costs are shared amongst countries, while the impact on global emissions is much more substantive. For key New Zealand agricultural sectors, including beef, sheep meat and dairy products, we find that exports and output decline with increases in carbon prices and consequent increases in costs of production. However, carbon price increases lead to significant reductions in emissions in these sectors, contributing potential environmental benefits.

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