

U.S. agricultural and biofuel markets: Short- and medium- term challenges and opportunities

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Links between agricultural and energy markets

- Until the mid of 2000s, fuel demand of agricultural activities was the only link between the US agriculture and energy markets
- Since then, these markets interacted in various ways due to expansions in biofuel production
- Currently, large portions of corn and oilseeds produced in the US are used for biofuel production about 38% of corn and 50% of soybeans equivalent (USDA, 2024a)
- The joint share of corn and soybean in the US total planted areas for principal crops was 55% in 2024 (USDA, 2024b)
- These figures express the role of corn and soybean in the US agriculture and highlight the connection between the US agricultural and biofuel markets.

Biofuel markets and expansion in demand for EVs

- The current supply of the US biofuel industry is about 23 billion gallons of ethanol equivalent (EIA, 2024)
- Most of the biofuel produced in the US is used in road transport
- Biofuels compete with gasoline and diesel fuels that are used in the road transportation.
- In recent years, the US demand for gasoline, has flatulated around 137 billion gallons per year with a tendency to decline in most recent years (EIA, 2024)
- Demand for gasoline is expected to decline due to more demand for electric vehicles
- The joint share of hybrid, electric, and plug-in hybrid cars in the US sales of light duty vehicles has increased from about 2 percent in 2015 to 19% in 2014 (EIA, 2024)
- The share of Electric Vehicles (EVs) in the U.S. fleet is expected to increase to 30-35% by 2035
- The expansion in EVs could limit the use of biofuels in the road transportation sector
- Reduction in demand for biofuels could negatively affect markets for the main US crops.

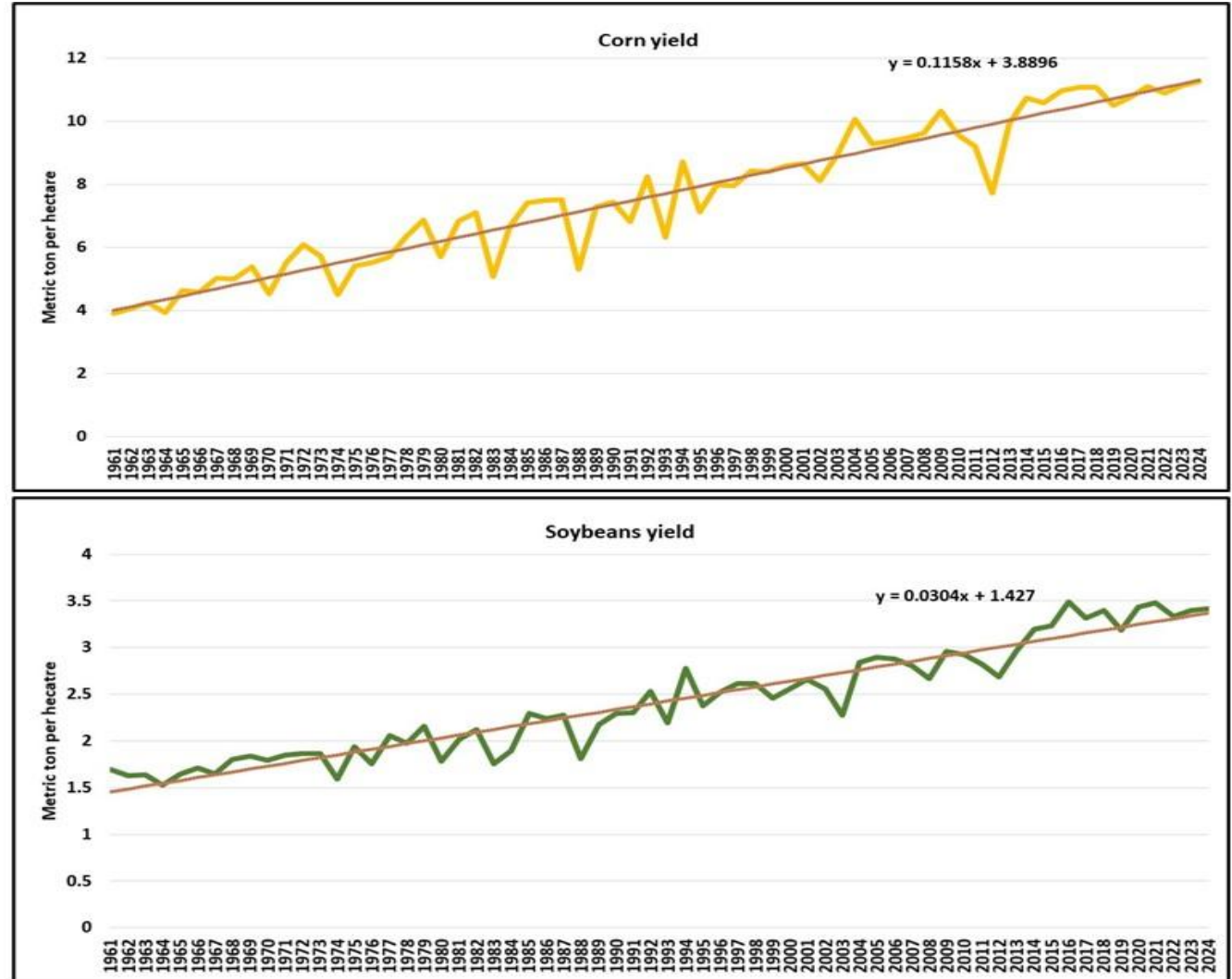
Potential challenges in the global markets for US agricultural products

- Important global challenges are:
 - Tight competitions with Brazil and other emerging producers in markets for corn and soybeans
 - End of conflict between Russia and Ukraine that could lead to more grains exported by these countries to the global markets
 - Disruption in the global trade of agricultural products due to new tariffs
- These challenges in general may limit global markets for the US agricultural products

Intensifications and increases in the US supplies of corn and soybeans

➤ The US supplies of corn and soybeans have increased over time due technological progress:

- Between 2000-2025 corn and soy yields have increased over their long-term trends by 33% and 28%, respectively
- Over this period, supplies of corn and soybean have increased by about 50% and 58%, respectively
- These trends are expected to continue, at least in short run
- Lack of demand for these crops could generate significant economic losses



Sustainable Aviation fuels: An opportunity to grow

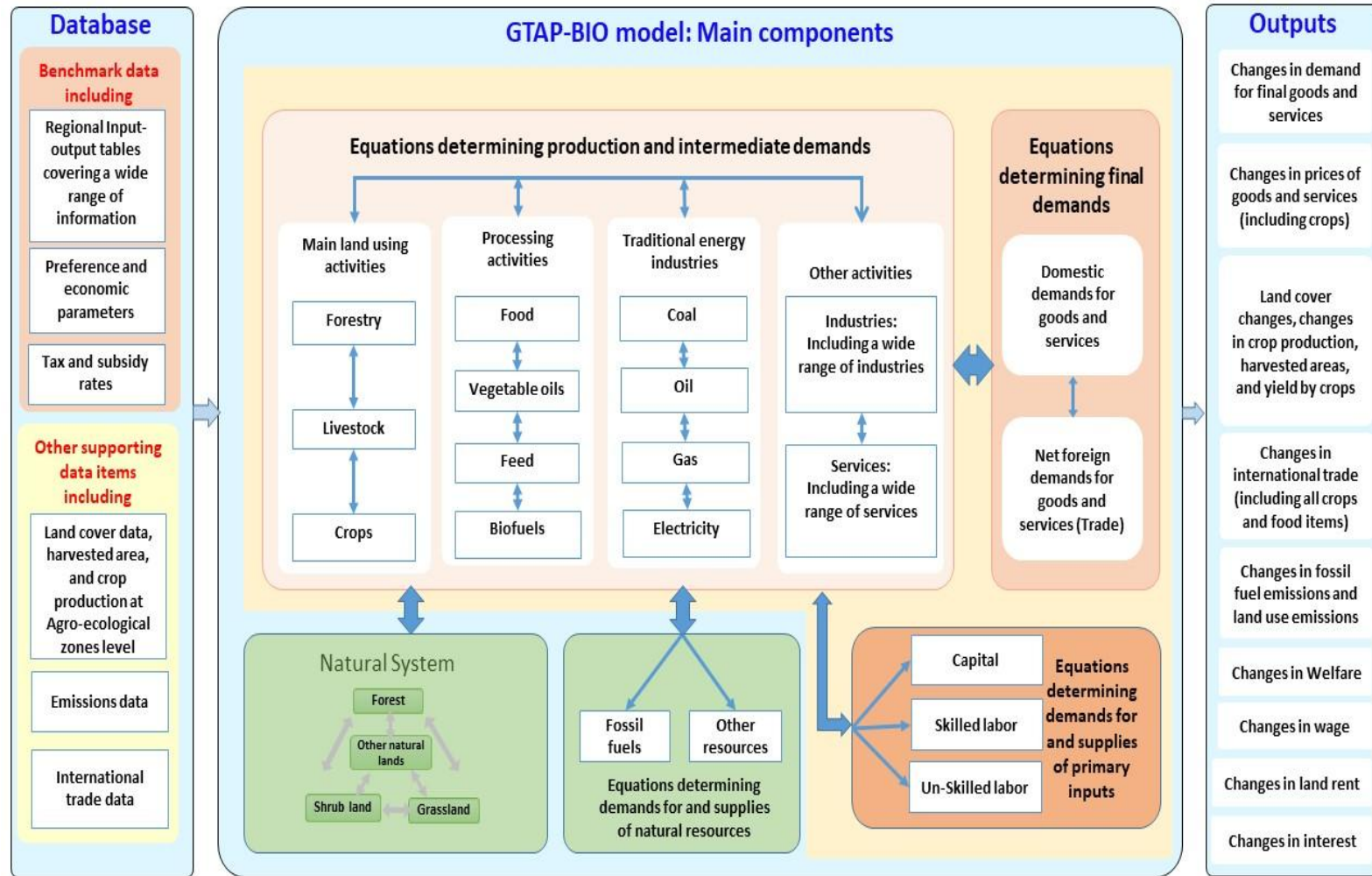
- While the US agriculture faces some short-term challenges due to lack of domestic and international demands, the US Sustainable Aviation Fuel Grand Challenge (SAFGC) policy (DOE 2024) offers some opportunities to overcome these challenges
- This policy aims at producing 3 billion gallons of Sustainable Aviation Fuel (SAF) by 2030, with a target of 35 billion gallons by 2050.
- The US agricultural resources can be leveraged to reach the goals of this policy

Goals and motivations of this paper

- Evaluate the extent to which expansions in EVs may affects the US agriculture – *EV effects*
- Assess the potential economic implications of an international tariff on the US agricultural sector – *Tariff effects*
- Study the extents to which increases in production of aviation biofuels could mitigate the EV and tariff effects on the US agricultural sector.

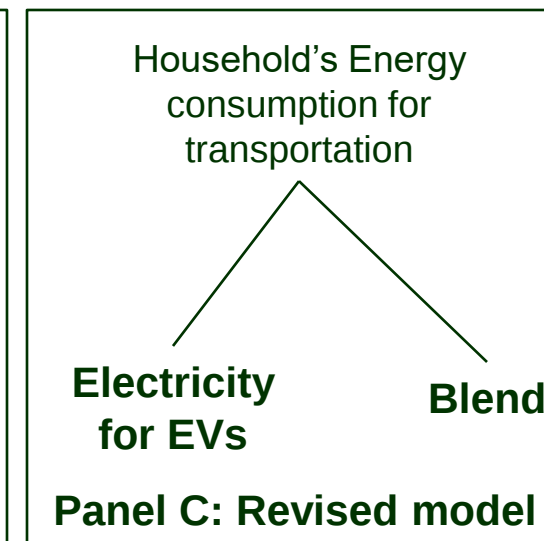
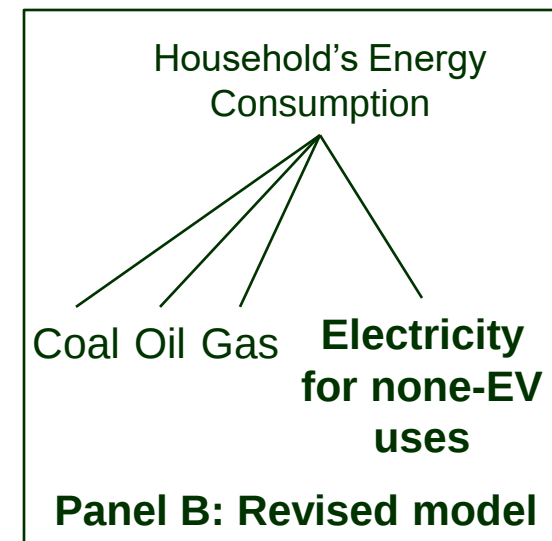
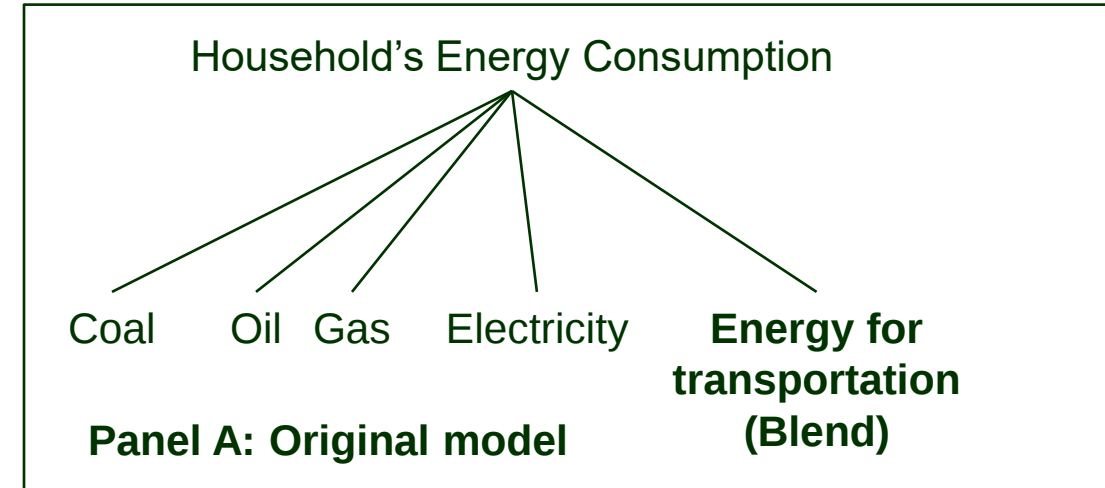
Modeling approach

- We extended the GTAP-BIO model developed by Taheripour et al. (2017) to achieve the goals of this paper
- This model has been widely used to assess the economic and environmental effects of environmental, energy, trade, and biofuel policies (Taheripour and Tyner, 2018; Zhao et al., 2021; Prussi et al., 2021; Taheripour et al., 2022)
- Since the goal of this paper is to capture the effects of expansions in EVs on the biofuels and agricultural markets, the GTAP-BIO model has been modified to represent the use of EVs by households through the electricity consumed by these vehicles



Modeling approach

- Following the standard GTAP model, the GTAP-BIO model uses a non-monotonic Constant Difference Elasticity (CDE) form to represent the households demand system
- As shown in **Panel A**, the original GTAP-BIO model represents the use of energy for transportation as a blended fuel, a mix of refined fuels and biofuels in the lower nest of the household CDE demand system
- As shown in **Panel B** and **Panel C**, a new nesting structure is defined to include electricity used by EVs in the household demand system
- In the new structure electricity is divided into two segments: ***Electricity for none-EV uses*** and ***Electricity for EVs***
- In the new household demand system:
 - ***Electricity for none-EV uses*** remains in the nest of household's demand for energy as shown in **Panel B**
 - ***Electricity for EVs*** is bundled with the blended fuel in the household's demand system. A substitution elasticity is defined for this nest
- To support this approach, the GTAP-BIO data base has been modified to split the use of electricity by household into the above segments

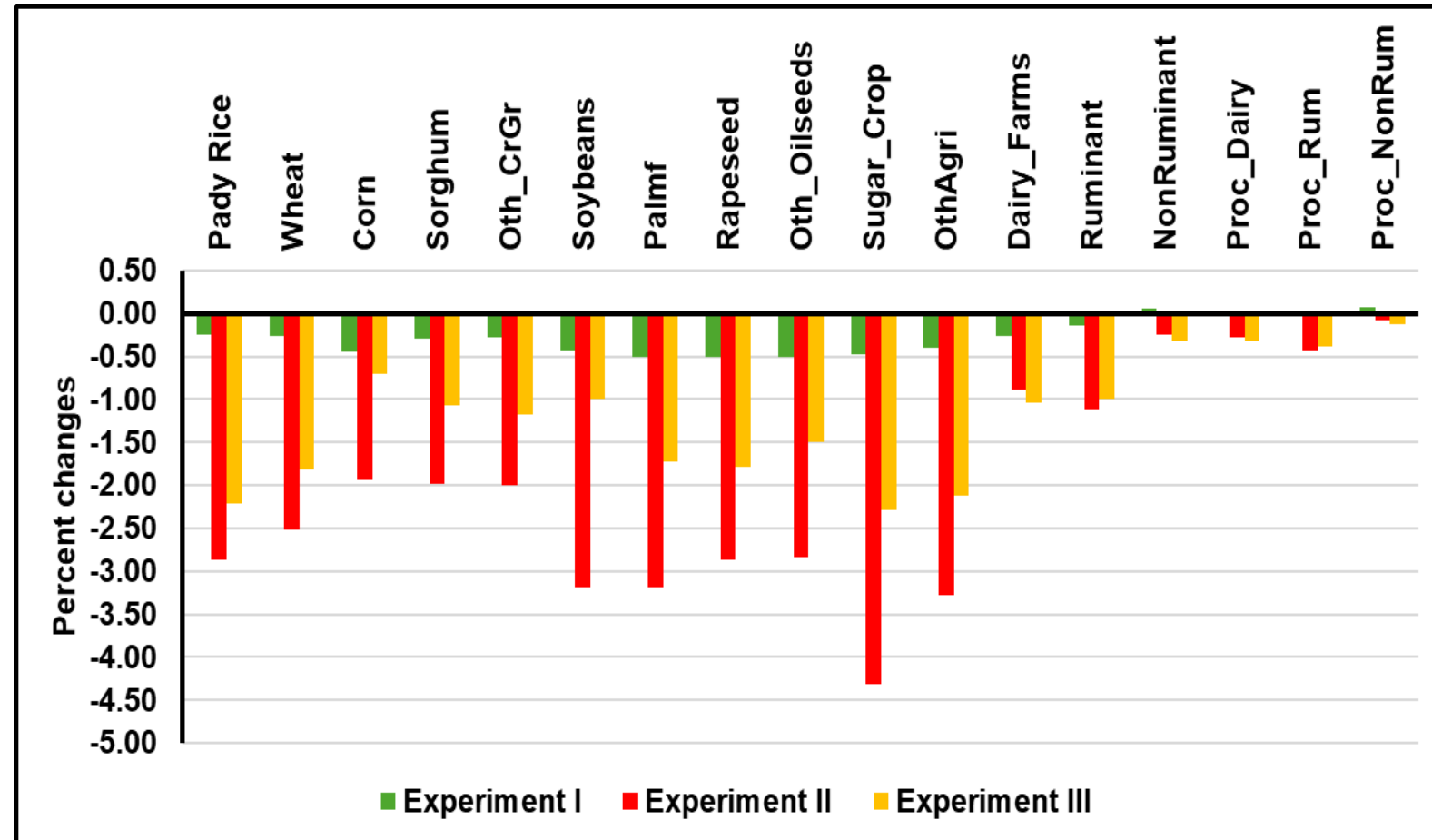


Examined Experiments

- Three experiments were developed to achieve the goals of this paper:
 - ***Experiment I:*** An expansion in household's demand for EVs by 75 million vehicles with equivalent miles driven per year per EV as the base year (2017)
 - ***Experiment II:*** The first experiment plus a uniform 5% tariff on imports of agricultural products from the US
 - ***Experiment III:*** The second experiment plus an expansion in ethanol used in SAF production by 2 billion gallons.

Results: Impacts on supply prices of US agricultural products

- Supply prices of agricultural products decline under the three examined experiments
- These prices decline slightly, by less than 0.5% due the examined expansion in demand for EVs
- The supply prices decline considerably, up to 5% due to the 5% import tariff
- The expansion in SAF produced from ethanol mitigates partially the price impacts of EVs and tariffs on imports of the US



Results: Impacts on supplies of US agricultural products (% changes)

- With some exceptions supplies of agricultural products decline under the three examined experiments
- The supply of corn declines moderately (by 2%) with the expansion in EVs under the first experiment.
- The supplies of US agricultural produces declines further and more significantly under the second experiment, except for corn with a 2% reduction similar to the first experiment.
- The expansion in SAF produced from ethanol increases supplies of corn and soybeans and further declines supplies of other products

Products	Experiment I	Experiment II	Experiment III
Pady Rice	0.60	-10.64	-13.76
Wheat	0.17	-7.42	-9.25
Corn	-2.04	-2.00	2.41
Sorghum	-0.11	-2.07	-2.54
Oth_CrGr	0.05	-3.34	-4.39
Soybeans	0.01	-1.75	2.75
Palmf	0.14	0.18	-1.73
Rapeseed	-0.52	0.56	-3.60
Oth_Oilseeds	-0.49	1.27	-1.09
Sugar_Crop	-0.21	-0.10	-0.12
OthAgri	0.48	-0.59	-2.93
Dairy_Farms	-0.21	-0.89	-0.89
Ruminant	-0.23	-1.38	-1.49
NonRuminant	-0.35	-2.81	-2.81
Proc_Daury	-0.22	-1.05	-1.05
Proc_Rum	-0.25	-1.38	-1.45
Proc_NonRum	-0.37	-3.20	-3.18

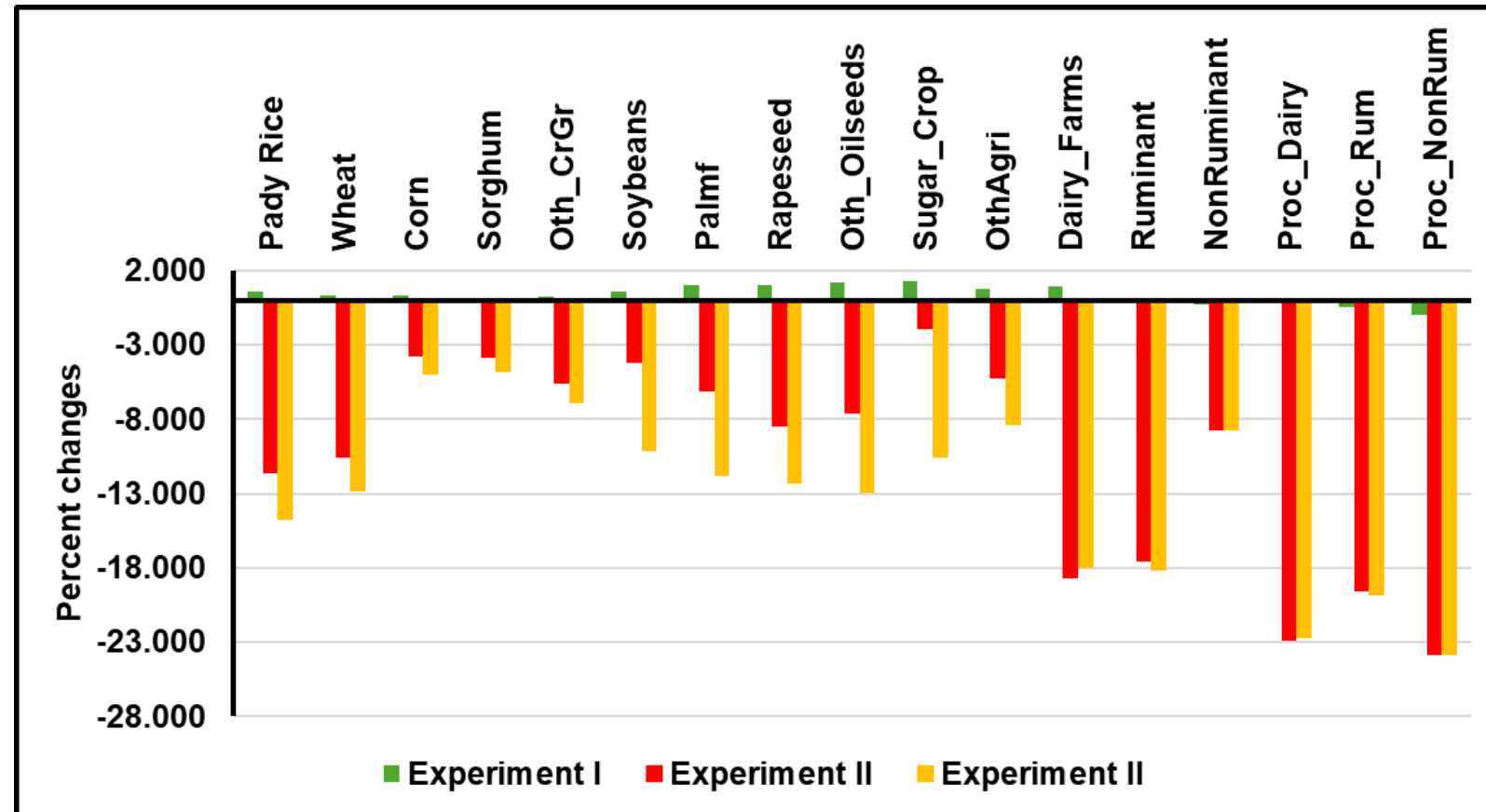
Results: Changes in US harvested areas (in ha)

- Total area declines under the examined experiments, means increases in idled land
- With expansion in EVs under the first experiment area of corn declines due to reduction in demand for corn ethanol.
- Under the second experiment, harvested area of corn declines. But less than the first experiment because the imposed tariff allows more ethanol production in the US.
- Unlike the first two experiments, under the third simulation the US harvested area of corn increases to support SAF production.
- Changes in crop yields and crop switching justify most changes in areas of other crops

Crops	Experiment I	Experiment II	Experiment III
Pady Rice	10,654	-85,128	-133,882
Wheat	93,410	-842,585	-1,302,015
Corn	-504,712	-128,727	699,982
Sorghum	7,952	-9,114	-55,647
Oth_CrGr	8,121	-25,415	-67,304
Soybeans	209,734	117,637	885,314
Palmf	0	0	0
Rapeseed	474	20,664	-29,739
Oth_Oilseeds	1,363	48,550	-18,617
Sugar_Crop	3,319	16,712	-1,699
OthAgri	88,298	145,737	-213,332
Total	-81,386	-741,671	-236,940

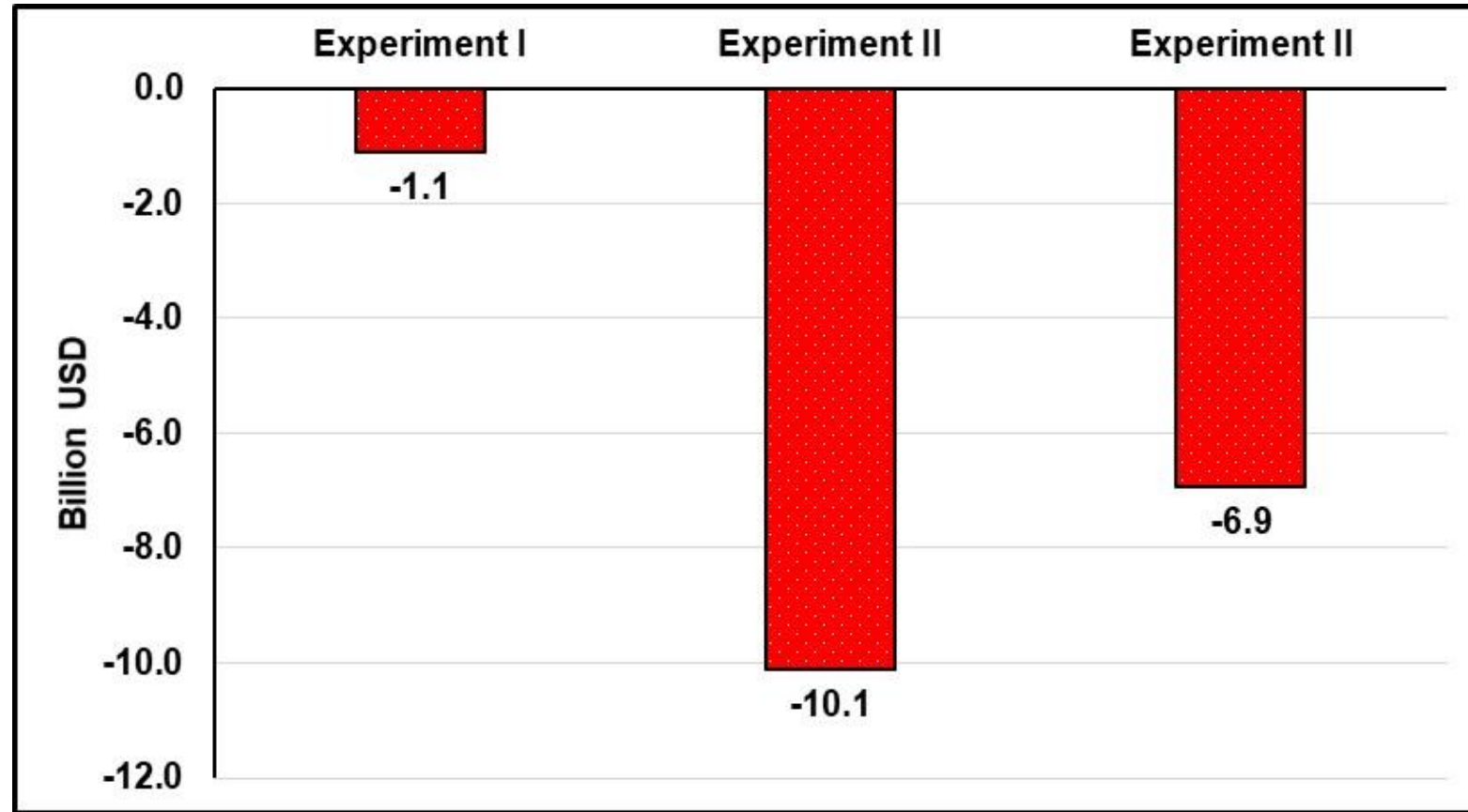
Results: Changes in exports of US agricultural products (in %)

- Under the first experiment, the expansion in EVs slightly increases the US agricultural exports
- Under the experiment the US exports of agricultural products decline significantly
- Under the third experiment, producing more SAF could lead to more reductions in the US exports of agricultural products



Results: Changes in value added of US agriculture (in billion USD)

- Under all examined experiments value total value added of US agriculture declines by 1.1 billion USD
- The 5% tariff on imports of agricultural products from US in combination with expansion in EVs decline total value added of US agriculture by 10.1 billion USD
- The expansion in SAF mitigates a portion of these losses by 3.2 billion USD



Main conclusions

- Increases in demand for EVs could slightly and negatively affect the US agricultural activities
- An international tariff on imports of agricultural products from US could badly damage the US agricultural activities
- SAF production could mitigate a portion of the losses induced by the examined trade tariff

Thanks for your attention
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