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Policy reform in agriculture and the environment Linkages in the crops sector

Marinos Tsigas, U.S. International Trade Commission
Marinos.Tsigas@USITC.gov

Outline of presentation

- Methodology
 - Simulation model
 - Regional and sectoral specification
 - Agricultural production modeling
 - Hypothetical scenarios of trade liberalization
- Conclusions
- Simulated impacts
- How sensitive are the conclusions?
- Further work

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Methodologies

Ideally

- Global trade, economy wide model,
- Significant spatial, commodity detail
- Environmental indicators,
- Trade and domestic policies, and
- Environmental regulations

In practice

- A global trade, economy wide model could simulate trade/world price impacts, which could then be passed to
- National or sub-national models which have environmental indicators

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Linkages in the crops sector

- Methodology
 - Liberalization simulated with GTAP (Global Trade Analysis Project) model
 - Base year 2001
 - 24 economies, 30 sectors
 - Focus on grains and oilseeds
 - Linkages among other crops, livestock, and food processing maintained
 - Revised modeling of agricultural production
 - Discussion of environmental implications for grains and oilseeds based on
 - Simulated impacts on scale of production and intensity of input use
 - Environmental data supplement model simulations to assess
 - pesticide use,
 - nitrogen uptake and off load, and
 - emissions of greenhouse gases (GHGs)
- Not considered
 - Soil management and conservation systems
 - Integrated plant nutrient and pest management systems
 - Organic farming
 - Environmental policies and regulations

GTAP regional specification

No.	Region	No.	Region
1	Australia	19	Switzerland, rest of EFTA (Iceland, Norway, and Liechtenstein)
2	New Zealand		
3	China		Ten new EU member countries
4	Japan	20	(Czech Republic, Hungary, Poland, Slovakia, Latvia, Lithuania, Slovenia, Estonia, Malta, and Cyprus)
5	Korea		
6	Rest of Asia		
7	Canada		Rest of Europe
8	United States	21	(Albania, Bulgaria, Herzegovina, Romania, Russia, and rest of former Soviet Republics)
9	Mexico		
10	Brazil	22	Turkey, Morocco, and rest of Middle East and North Africa
11	Argentina		
12	Rest of Americas	23	Rest of Africa
13	Denmark, Finland, and Sweden		
14	UK and Ireland	24	Rest of World
15	France		
16	Germany		
17	Austria, Belgium, Netherlands, and Luxembourg		
18	Portugal, Spain, Italy, and Greece		

GTAP sectoral specification

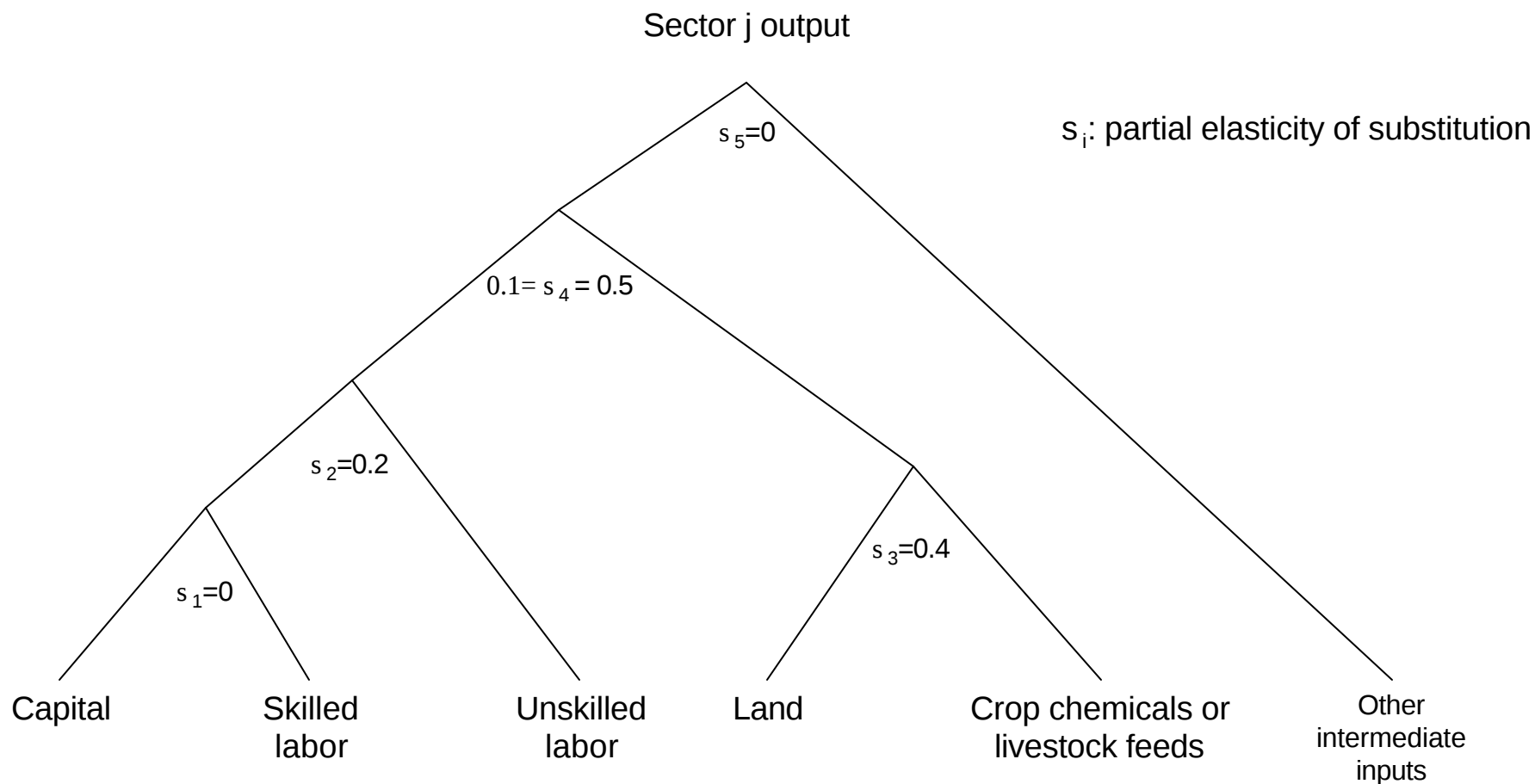
No.	Sector	No.	Sector
1	Paddy rice	16	Red meats
2	Wheat	17	Other meats
3	Other grains	18	Vegetable oils and fats
4	Fruits, vegetables, and nuts	19	Dairy products
5	Oil seeds	20	Processed rice
6	Sugar crops	21	Sugar manufacturing
7	Plant fibers	22	Other processed foods
8	Other crops	23	Beverages and tobacco
9	Cattle	24	Textiles, clothing, and footwear
10	Other livestock	25	Petroleum, and coal products
11	Dairy farms	26	Chemical, rubber, and plastic products
12	Wool and silk	27	Other manufacturing
13	Forestry	28	Wholesale and retail trade
14	Fishing	29	Transportation services
15	Minerals	30	Other services

4 Focus sectors

20 Liberalizing sectors

Specification of crop and livestock output

Nested CES function



Trade liberalization & reduction in support in food & agriculture

Scenario specification

Partial liberalization reductions

- Import tariffs & export subsidies
 - 36% in developed countries
 - 24% in developing countries
- Domestic support
 - 20% in developed
 - 14% in developing

Complete liberalization

- All import tariffs & export subsidies removed
- All domestic support removed

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Conclusions

- In several regions, environmental issues would not become more problematic
 - there is little change in land use, chemical use, output, and rate of chemical application (i.e. lbs/acre)
- In New Zealand and EU-15, environmental issues associated with intensity of chemical use might become more problematic
 - In New Zealand, land use declines but output and chemical use expand
 - In EU-15, output and input use decline, but the rate of chemical application increases

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Conclusions

- Simulated impacts suggest that
 - Gross nitrogen balance would increase in New Zealand
 - Pesticide use would decline in OECD as a whole
 - Global methane (CH_4) emissions from paddy rice would decline
 - Global nitrous oxide (N_2O) emissions from arable crops soils would decline
- Modeling of agricultural production
 - Does not affect simulated impacts for arable crops as a whole, but
 - It affects simulated impacts for specific crops

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Output and chemical intensity impacts, 10% or larger

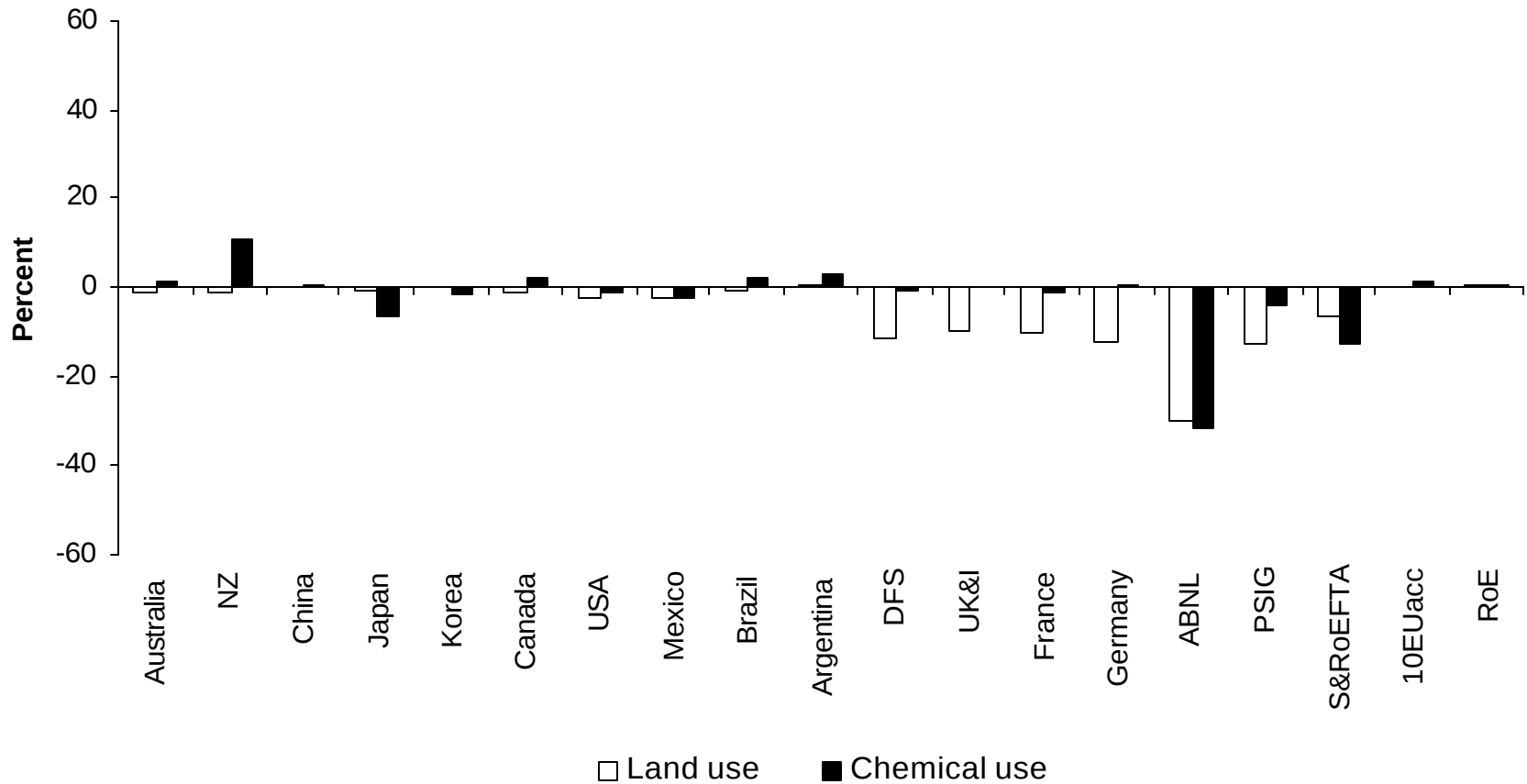
Region	Partial liberalization					Total liberalization				
	Paddy rice	Wheat	Other grains	Oil seeds	Arable crops	Paddy rice	Wheat	Other grains	Oil seeds	Arable crops
Australia						O, I				I
New Zealand		I	I	I	I	I	O, I	O, I	O, I	O, I
Japan										
Korea							O			
Canada						O	O, I		I	I
United States							I			
Mexico										
France		I		I	I	I	I	I	I	I
Germany			I	I	I		I	I	I	I
Denmark/Finland/Sweden			I	I	I		O, I	I	I	I
United Kingdom/Ireland			I	I	I		O, I	I	I	I
Austria/Belgium/Netherlands			I					I		
Portugal/Spain/Italy/Greece		I					I	I		I
10 new EU members										
Switzerland/Iceland/Norway								O, I		
Argentina							I	I	I	I
Brazil						I	I	O, I	I	I
China									O, I	

“O”: output would increase by 10% or more;

“I”: intensity of chemical use (*i.e. lbs/acre*) would increase by 10% or more.

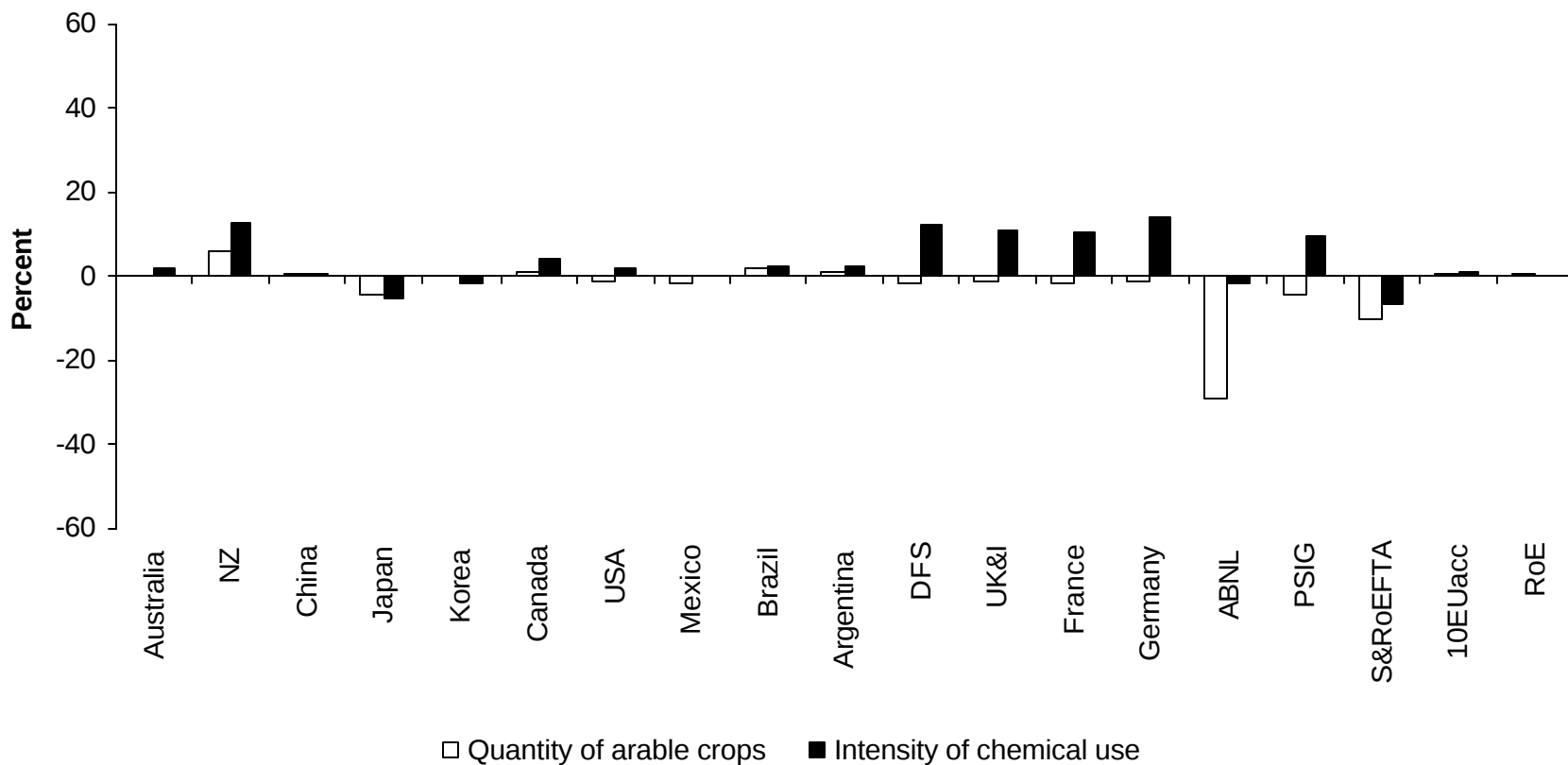
Simulated impacts of partial liberalization in agriculture

Arable crops, land and chemical use



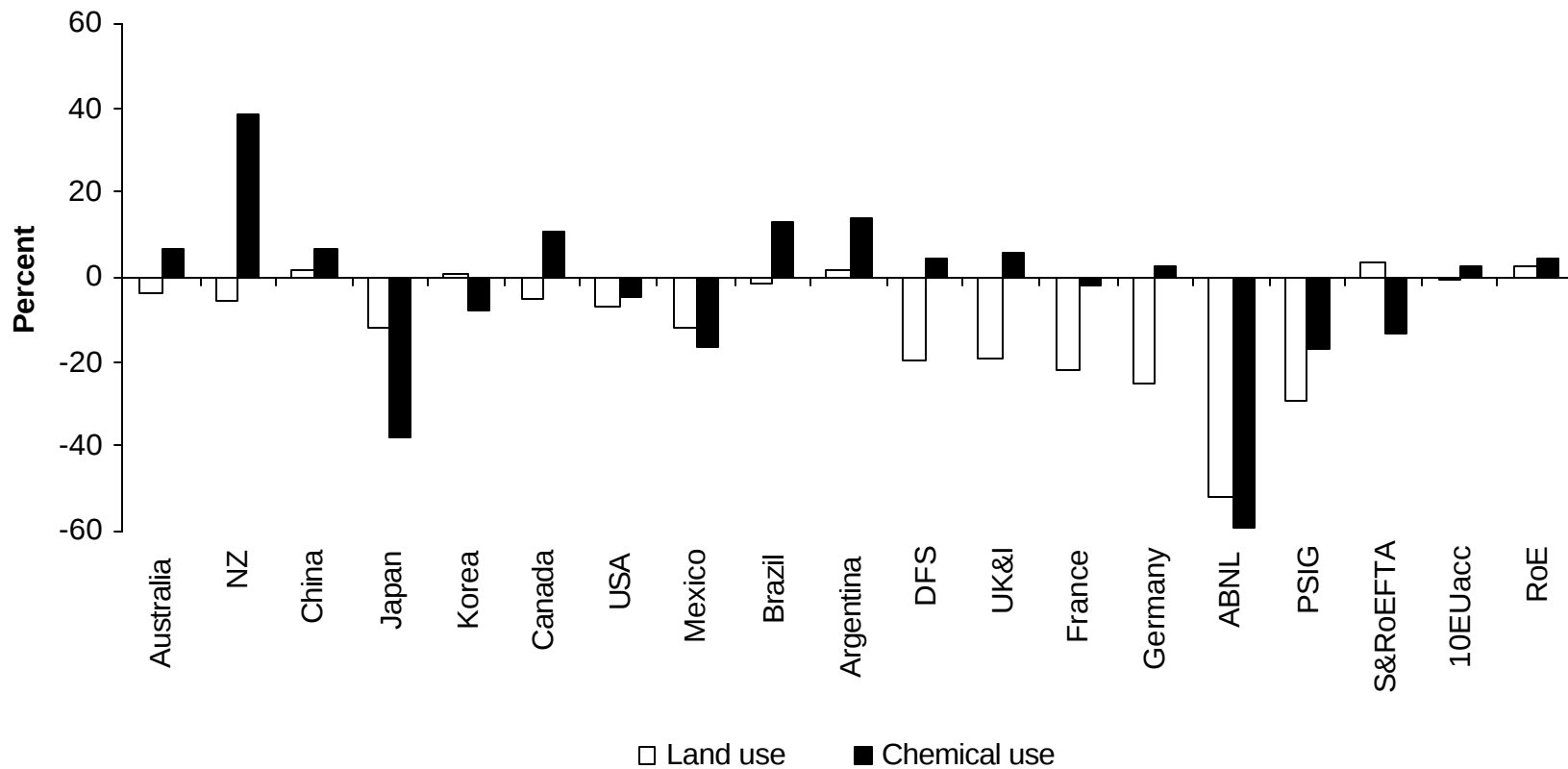
Simulated impacts of partial liberalization in agriculture

Arable crops, output and intensity of chemical use



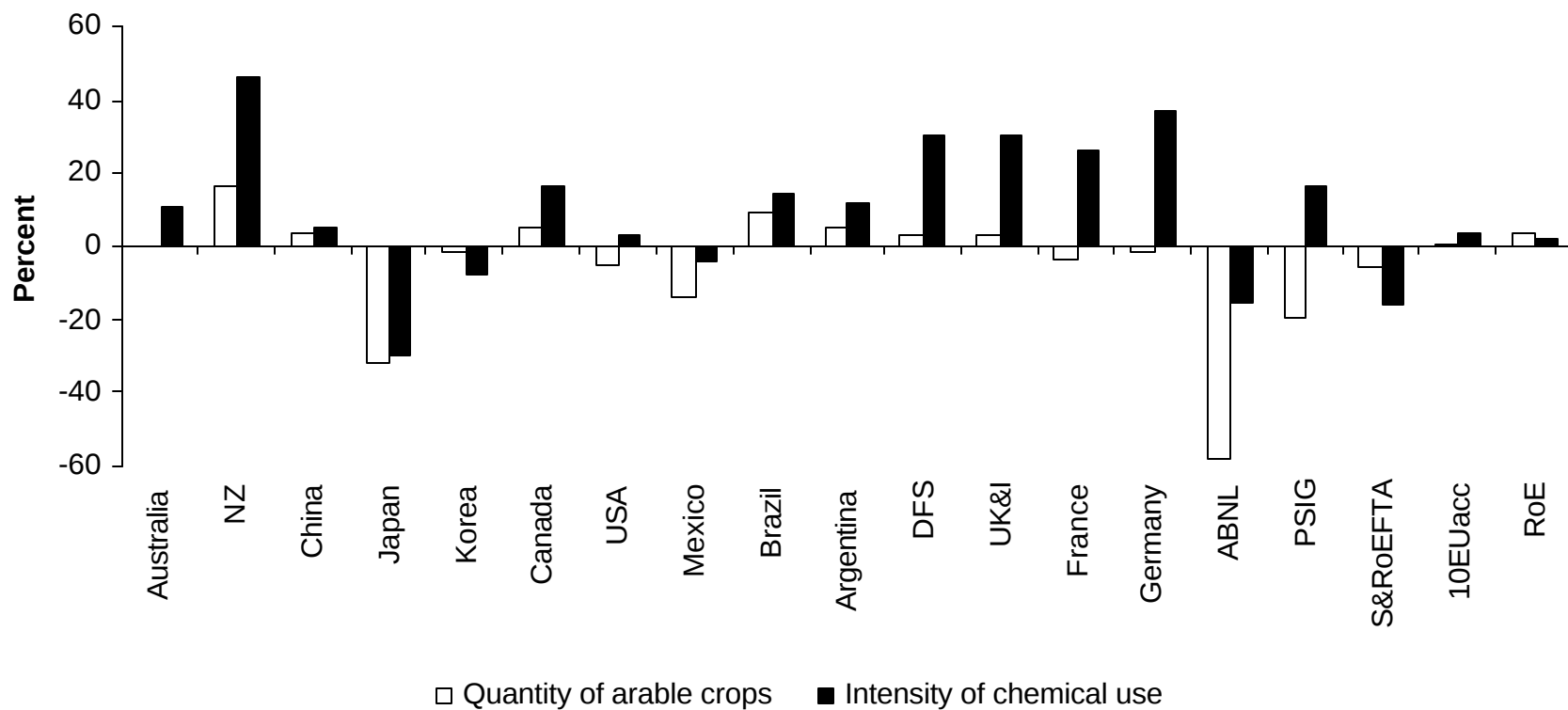
Simulated impacts of total liberalization in agriculture

Arable crops, land and chemical use

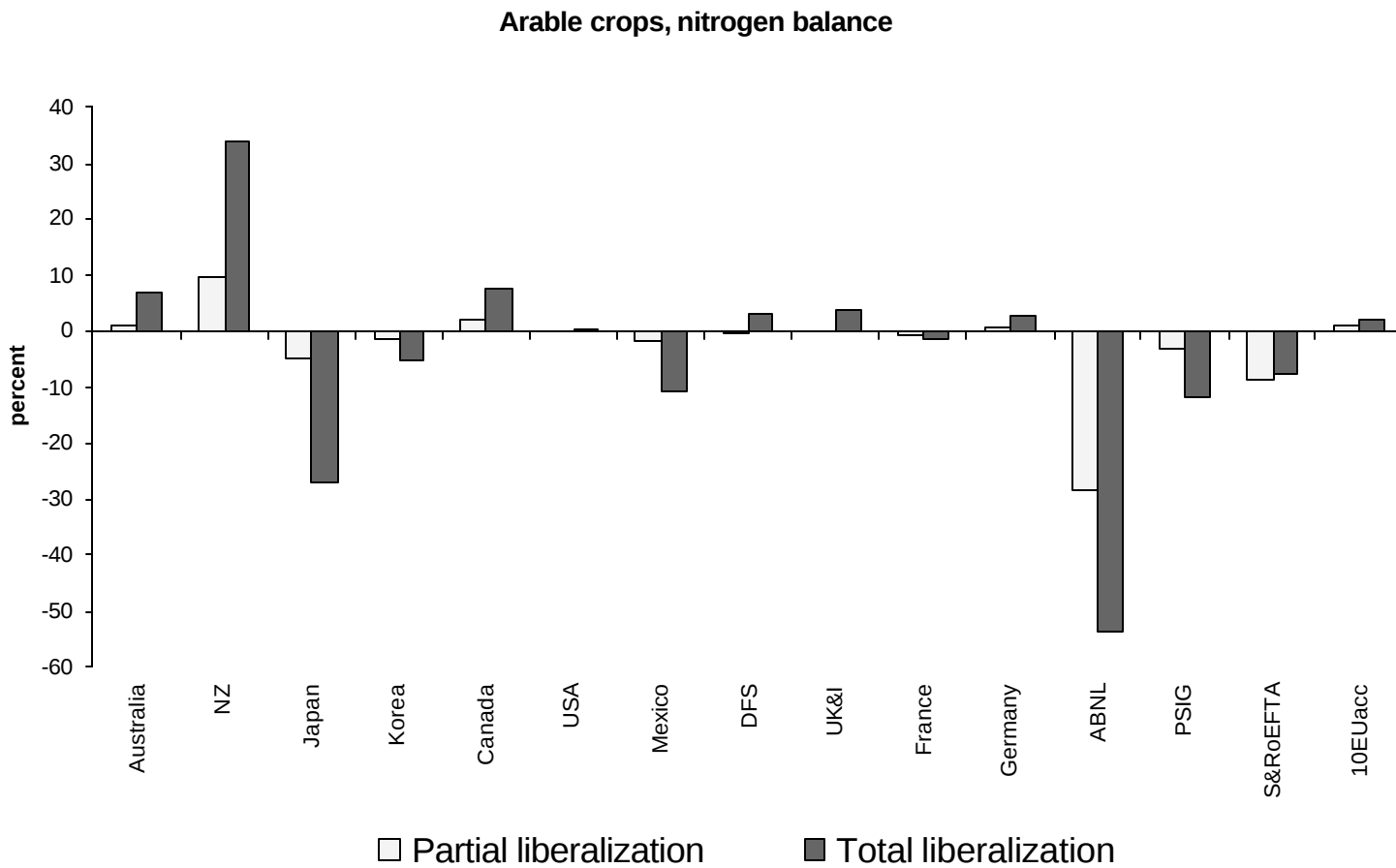


Simulated impacts of total liberalization in agriculture

Arable crops, output and intensity of chemical use

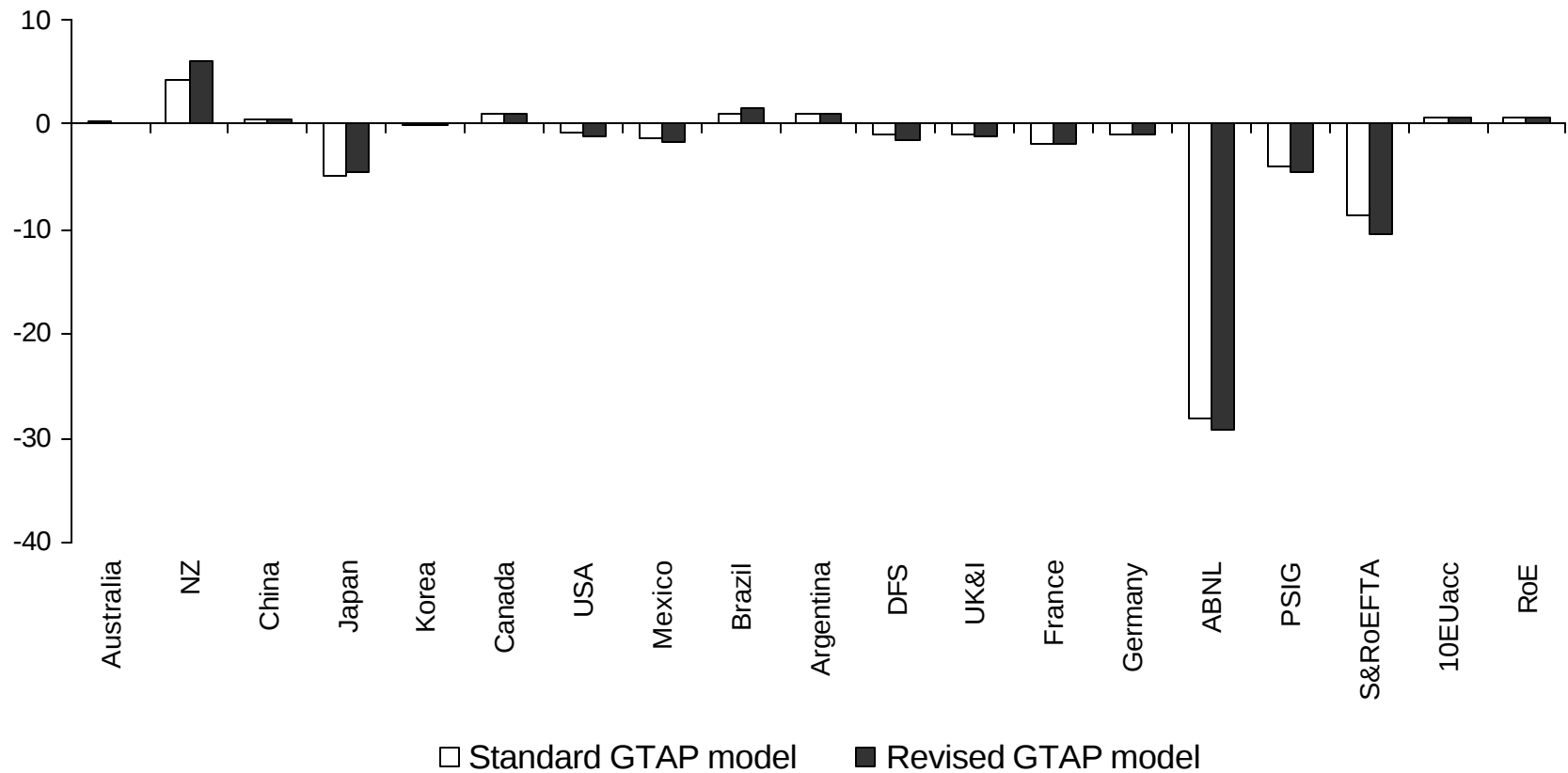


Simulated impacts of liberalization in agriculture



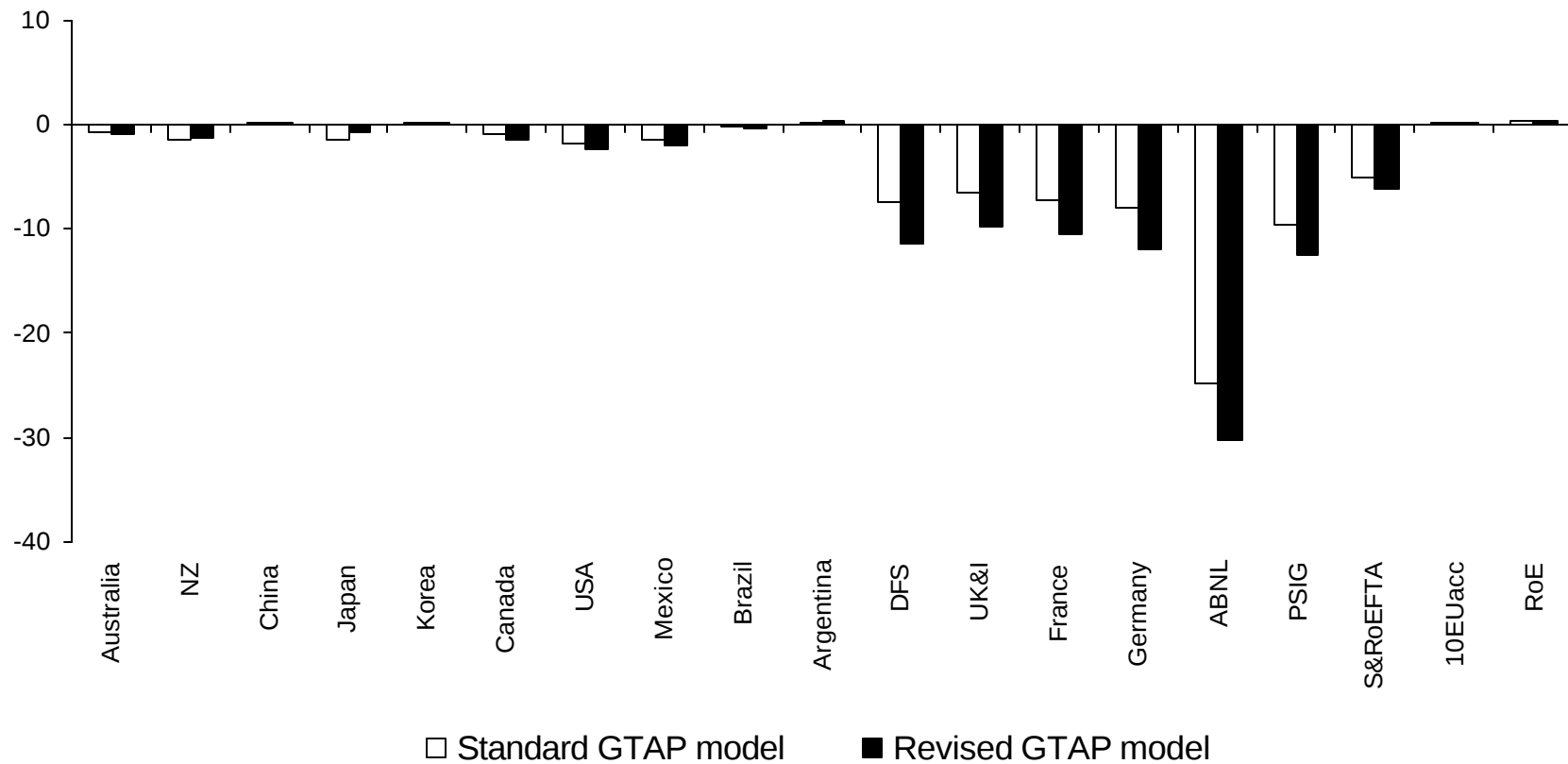
Simulated impacts of partial liberalization in agriculture

Arable crops output, comparison of standard and revised GTAP models



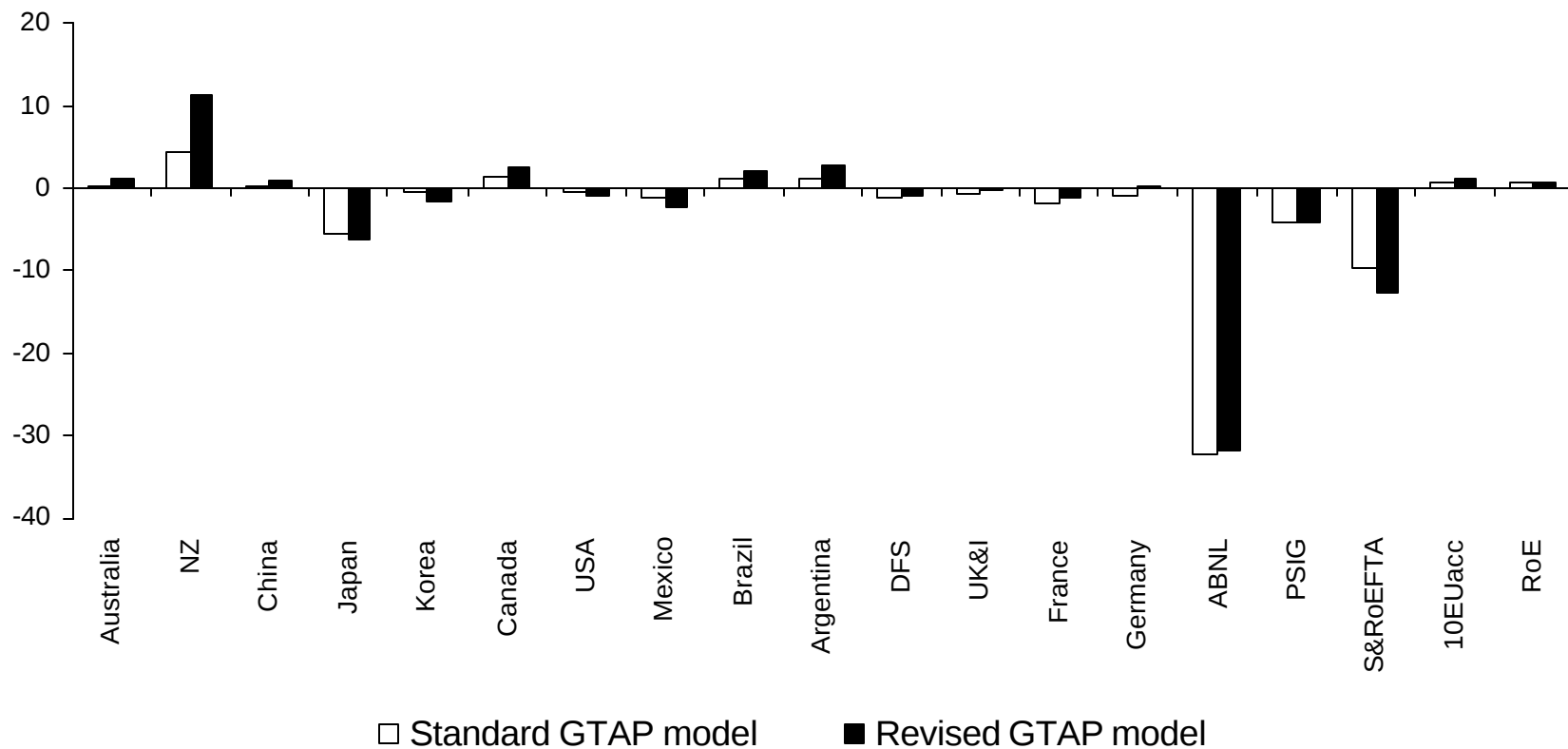
Simulated impacts of partial liberalization in agriculture

Arable crops land use, comparison of standard and revised GTAP models



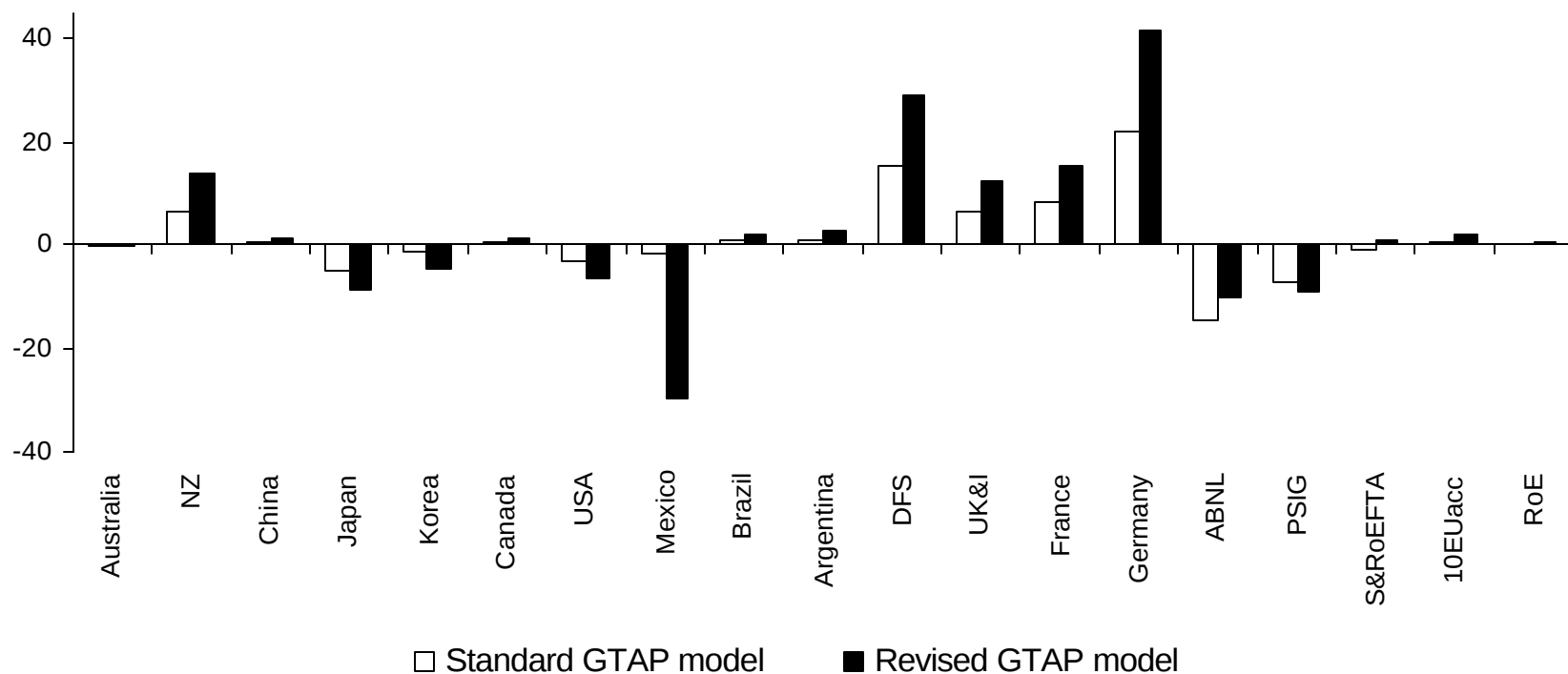
Simulated impacts of partial liberalization in agriculture

Arable crops chemical use, comparison of standard and revised GTAP models



Simulated impacts of partial liberalization in agriculture

Oilseeds rate of chemical use, comparison of standard and revised GTAP models



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Further work

- Country-specific analysis to assess the environmental impacts of trade liberalization at the sub-national level and at more detailed commodity specification
 - Promising approaches applied in
 - Horner, *et al.* (1992),
 - Cooper, *et al.* (2003), and others