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Canada

OFFICE OF THE CHIEF ECONOMIST

APPROACH TO QUANTITATIVE ENVIRONMENTAL ASSESSMENTS

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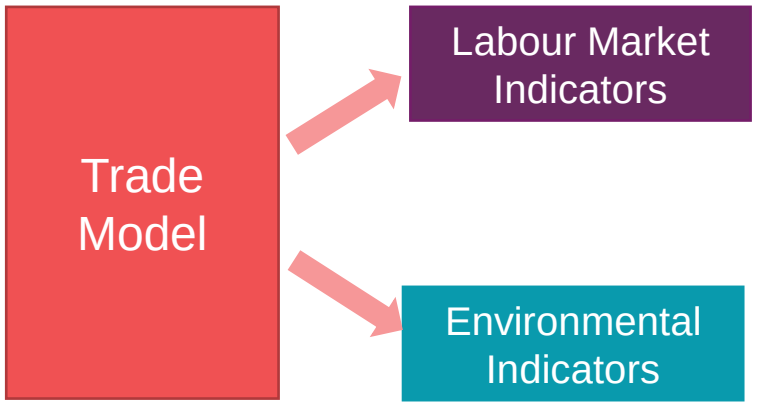
EX-ANTE VS EX-POST ANALYSIS

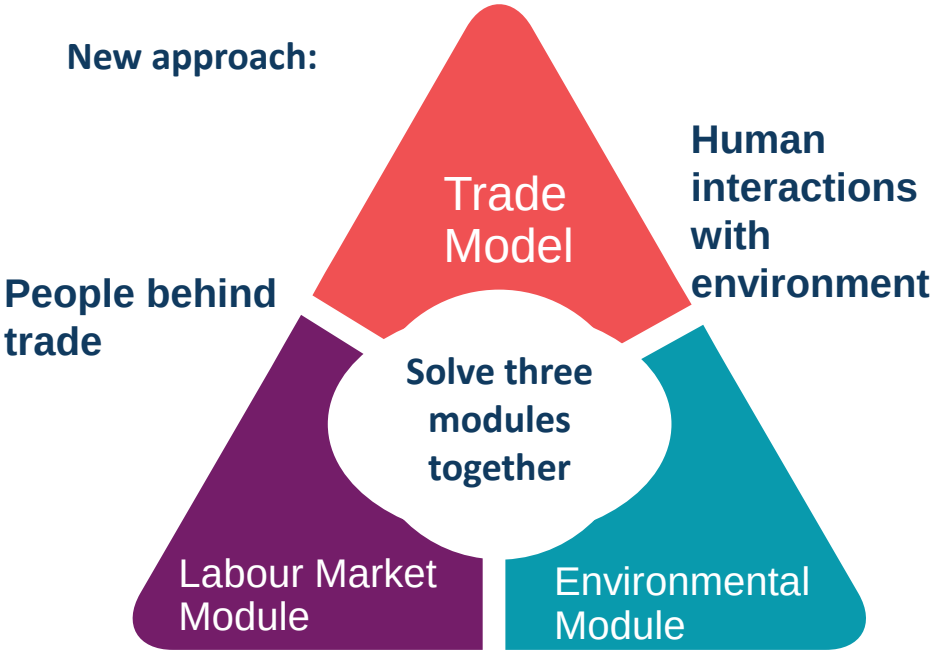
- Most environmental assessments of FTAs are done ex-ante, since it is easier to build the hypothetical policy scenario and do the comparison.
- Very rare to see ex-post environmental analysis of trade policy in the literature.
- Challenge is to isolate the effect of trade policy exclusive of other changes unrelated to the trade policy. This gets more challenging to do the longer the trade policy has been implemented.
- Environmental assessments in the Government of Canada are done ex-ante.

MODELLING TOOLS FOR EXPANDED IMPACT ASSESSMENT OF TRADE AGREEMENTS

Old approach:



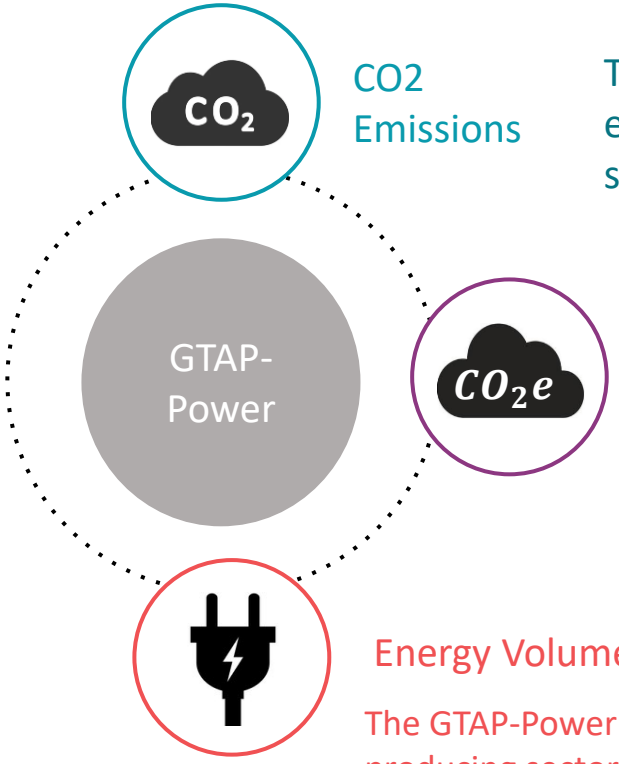
New approach:



DATA FRAMEWORK

- We use the Global Trade Analysis Project (GTAP) version 11 database along with satellite databases
- GTAP version 11 has 5 reference years (2004, 2007, 2011, 2014, and 2017), distinguishes 65 sectors in each of 141 countries and 19 aggregate regions
- Individual countries in the database account for 99.1% of world GDP and 96.4% of the world population
- GTAP-E incorporates carbon dioxide (CO2) emissions data distinguished by fuel and by user for each country. The data is from the International Energy Agency's (IEA) extended energy balances.

DATA FRAMEWORK



CO2 Emissions

The GTAP-Power database uses energy volume data to estimate combustion-based CO_2 emissions by energy type, sector, and country.

Non-CO_2 Emissions (CO_2 equivalents)

Methane (CH_4)
Nitrous Oxide (N_2O)
Fluorinated Gases (F-gases)

The non-CO2 emissions are based on data retrieved from:

1) FAOSTAT: Agricultural non-CO_2 emissions
2) EDGAR: Non-agricultural non-CO_2 emissions

Energy Volumes

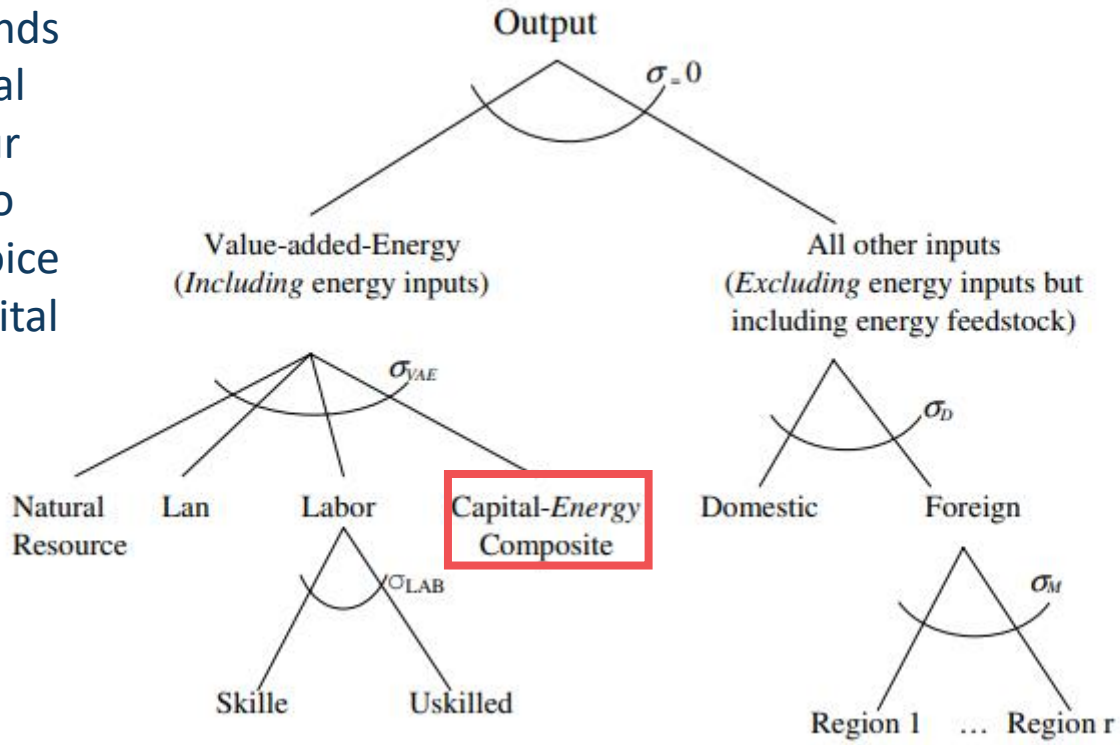
The GTAP-Power database disaggregates the GTAP 'ely' sector into several electricity-producing sectors: transmission & distribution, nuclear, coal, gas, oil, hydroelectric, wind, solar, and other power technologies.

These new sectors are combined with the regular GTAP sectors to create a data base with 76 sectors.

Source: GTAP 11 Satellite Data and Utilities (https://www.gtap.agecon.purdue.edu/databases/utilities/v11.aspx)

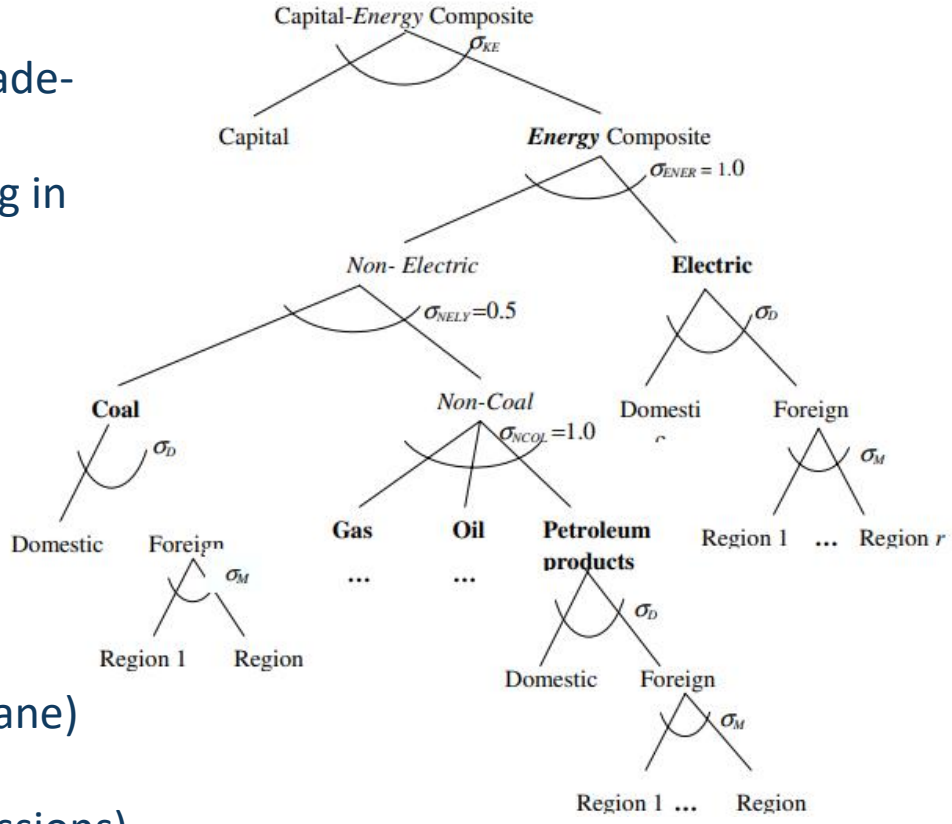
GTAP-E PRODUCTION STRUCTURE

GTAP-E expands the traditional capital/labour production to include a choice between capital and energy.



GTAP-E CAPITAL-ENERGY COMPOSITE

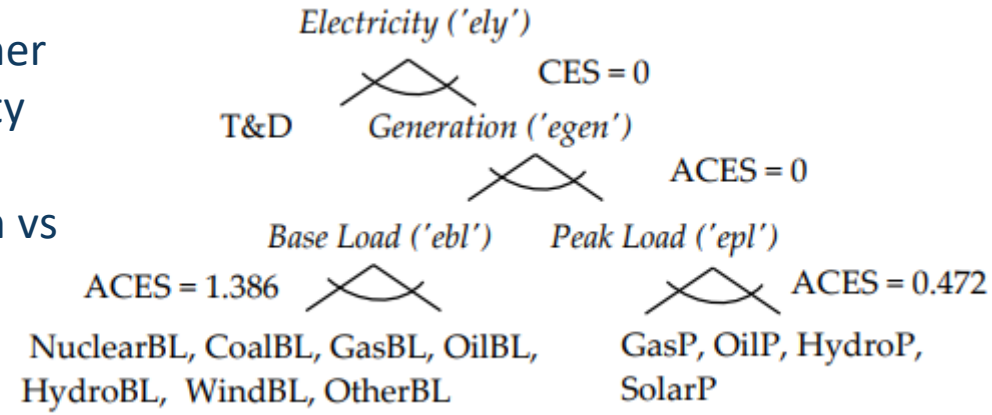
Model allows for trade-off between using energy and investing in capital.



Non-CO2 (ex: methane) and air pollutants (process-based emissions) are also incorporated.

GTAP-E-POWER STRUCTURE

The addition of GTAP Power to the GTAP-E framework gives further detail on the electricity nest, allowing for consideration of clean vs dirty electricity.



ACES: Additive CES ensures total output for energy = total inputs

MEASURING INCREMENTAL CHANGES

- Important to only measure the impact of changes to the economy due to trade policy, not changes that would have occurred regardless.
- We are measuring the difference between business as usual vs. how we estimate the economy would change as a result of trade policy.
- This means both the baseline and policy scenario are important to get right.
- With an integrated model where the environmental outcomes are estimated at the same time as the trade outcomes, it is important to focus on estimating the trade policy changes.

BASELINE SCENARIO

- The most recent GTAP database benchmark is 7 years behind.
- Need to update trade flows and trade barriers to have a good starting point.
- Important to keep database balanced using standard methodologies (i.e.: use GTAP Adjust to scale the database appropriately).
- In a dynamic modelling framework, estimating how the economy will grow in the baseline.
- Necessary to incorporate up to date macroeconomic forecasts, such as those from Oxford Economics.

POLICY SCENARIO

- Important to accurately capture expected or actual trade policy outcomes.
- Estimating the change in trade barriers based on actual or expected outcomes (i.e.: tariff reductions weighted to real trade patterns).
- Reality checking model estimates. Do we have the capacity to increase exports? Do we produce the specific products that are experiencing tariff reductions? Are there other barriers that the model would not capture that would prevent us from increasing trade following an FTA?
- Need to go back and adjust model after reality checking.

EXAMPLE: CANADA-INDONESIA INITIAL ENVIRONMENTAL ASSESSMENT

- The Canada-Indonesia initial environmental assessment is an example of where this methodology has been put into practice.
- The assessment is based on initial economic modelling with assumptions regarding the potential FTA, then the environmental outcomes are examined.
- Estimated changes in CO2 emissions, non-CO2 emissions, air pollutants, at the country and sectoral level.
- Typical finding is that incremental changes due to a potential FTA leads to negligible environmental outcomes on the aggregate level (i.e.: an increase in CO2 emissions by less than 0.01%).

EXAMPLE: CANADA-INDONESIA INITIAL ENVIRONMENTAL ASSESSMENT

Table 1: Projected Change in Greenhouse Gas Emissions in Canada by 2040, resulting from the potential agreement, Mt CO2e

	Change	Proportion of Total
CO2		
CO2	0.063	66.2%
Non-CO2		
N2O	0.004	4.2%
CH4	0.012	12.0%
FGAS	0.017	17.7%
Total	**0.096**	**100%**

EXAMPLE: CANADA-INDONESIA INITIAL ENVIRONMENTAL ASSESSMENT

Table 4: Change in Carbon Dioxide Emissions vs. Non-CO2 Emissions by Source by 2040, resulting from the potential agreement, Mt CO2e

Change in CO2 Emissions

	Canada		Indonesia	
	Change	**Proportion**	**Change**	**Proportion**
Production	0.052	81.9%	0.650	81.0%
Consumption	0.011	18.1%	0.153	19.0%
Total CO2	**0.063**	**100%**	**0.803**	**100%**

Change in Non-CO2 Emissions

	Canada		Indonesia	
	Change	**Proportion**	**Change**	**Proportion**
Production	0.032	99.2%	0.186	98.8%
Consumption	0.000	0.8%	0.002	1.2%
Total Non-CO2	**0.032**	**100%**	**0.188**	**100%**

EXAMPLE: CANADA-INDONESIA INITIAL ENVIRONMENTAL ASSESSMENT

Table 5: Top 10 Sectors in Canada Contributing to Change in Greenhouse Gas Emissions by 2040, resulting from the potential agreement, Mt CO2e

Sector	Change	Proportion
Land and pipeline transport	0.019	19.5%
Petroleum, coal products	0.014	14.9%
Computer, electronic and optical products	0.012	12.4%
Chemical products	0.006	6.2%
Gas	0.006	6.2%
Water	0.005	5.0%
Air transport	0.004	4.6%
Machinery and equipment	0.004	4.1%
Cereal grains	0.004	4.0%
Water transport	0.004	3.9%

EXAMPLE: CANADA-INDONESIA INITIAL ENVIRONMENTAL ASSESSMENT

Table 7: Change in Air Pollutant Emissions in Canada by 2040, resulting from the potential agreement, Gg

	Change	Proportion
BC	0.007	0.4%
CO	0.800	45.2%
NH3	0.077	4.4%
NMVOC	0.211	11.9%
NOX	0.390	22.1%
OC	0.007	0.4%
PM10	0.058	3.3%
PM2.5	0.053	3.0%
SO2	0.164	9.3%

CONCLUDING REMARKS

- Assessing the environmental implications of trade policy quantitatively is difficult. Ex-ante approaches remain the norm.
- Best practice is to evaluate just the changes in environmental conditions that are linked to the trade policy.
- Economic modelling and scenario-based analysis provide a useful tool for isolating the effect of trade policy and estimating environmental impacts as a result.
- When used in combination with other assessment methods, they help to provide a better picture of the estimated impact of trade policy.

Thank you