Going Dutch? The Impact of Oil Price Shocks on the Canadian Economy

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Introduction

- Forthcoming, *Canadian Public Policy*, Volume 42, No. 2, June 2016
- Examine the **steady-state** impact of a reduction in the price of oil using a CGE model of the Canadian economy
- Base case (10 percent reduction in oil price):
  - National output declines by 1.0 percent
  - Consumer welfare declines by 0.90 percent
  - Welfare losses are shared broadly across the provinces
    - ★ Including the "manufacturing hub" of Ontario
- Sensitivity analysis:
  - Results are robust to alternative assumptions regarding key parameters
  - Effects are proportional to the magnitude and sign of the oil price shock

Why is CGE Analysis Useful?

- The economy is complicated, there are a lot of moving parts!
- "Superficial" analysis misses key interactions and leads to overly simplistic conclusions
  - Fall in oil prices "must" benefit Ontario because:
    - ★ Reduction in energy prices makes "everything" cheaper
    - ★ Exchange rate depreciation makes manufacturing exports more competitive
    - ★ Increases in manufacturing exports are "good"
  - What does this miss?
    - ★ Exchange rate depreciation makes imports more expensive (overall we find that the exchange rate effect on welfare is negative for all provinces)
    - ★ Impact on non-tradable sectors (e.g., services)
    - ★ Reduced demand for labour and capital in energy sector puts downward pressure on wages and return to capital due to factor mobility
    - ★ Propagated throughout the economy as factors shift between sectors and through interprovincial trade flows in final and intermediate goods

Dutch Disease?

- The model does not incorporate many aspects of Dutch Disease (or its "reverse")
  - No learning by doing, knowledge spillovers, economies of scale in manufacturing, etc.
  - No interprovincial labour migration
- BUT, the model emphasizes that the gains in the manufacturing sector from a negative oil price shock can be offset by losses in other non-oil sectors (e.g., services)
  - These losses are widely shared across provinces
  - Again: lots of moving parts; important to consider the GE linkages throughout the economy

Model Overview

- Static multi-sector, multi-region CGE model calibrated to 2007 (oil price approx $65 US)
- Each province is explicitly represented as a region
- Canada is a small open economy, the rest of the world is a destination and source of import and export flows to Canadian provinces, which are price takers on international markets
- Use nested CES aggregation functions throughout (standard)

Model Overview

- A representative agent in each province receives income from labour, capital, and fossil-fuel resources
- Labour is supplied elastically in each province via the representative agent's labour-leisure trade-off.
- Labour is perfectly mobile between sectors within a region, but not mobile between regions
- The capital stock is partially mobile across sectors and provinces
- Emphasis on representing detail in energy use
  - Energy goods include coal, gas, crude oil, refined oil products and electricity
  - Includes major energy-intensive industries
    - ★ Agriculture, Cement, Chemicals, Refining, Transportation, etc.

Results: Output

Table 1: Percentage Change in Output by Sector and Region

	Canada	Alberta	Ontario
Agriculture	1.33	3.32	0.45
Cement	2.18	6.86	-0.64
Chemicals	1.99	6.49	0.52
Coal	3.43	7.58	0.00
Construction	-0.05	-0.12	0.00
Crude Oil	-9.51	-7.83	0.00
Electricity	0.09	-2.16	0.34
Natural Gas	-0.82	-0.80	0.00
Government	-0.03	-0.08	-0.01
Manufacturing	0.84	3.94	0.45
Minerals	-4.76	-7.58	-4.80
Refined Oil	9.35	8.39	0.29
Paper\ Pulp	2.85	9.70	1.50
Primary Metals	2.32	9.17	2.29
Services	-0.32	-0.56	-0.25
Sales Margins	0.02	0.10	0.03
Transportation	1.25	3.68	0.35
Total	-1.00	-3.70	-0.30

Welfare Analysis

- As good and factor flows in the economy adjust to the decline in the price of oil, wages and prices adjust accordingly
  - Affects the real income and consumption of individual consumers, which is what ultimately determines their well-being.
- Measure the net impact of the negative oil price shock on welfare using the Equivalent Variation (EV)
  - The change in income, measured at benchmark (pre-oil price shock) market prices, that is equivalent to the oil price reduction in terms of its impact on the well-being of individuals.

Results: Welfare

Table 5a: Percentage Change in EV Welfare Measure by Region

	TOTAL EFFECT
Alberta	-4.69
Newfoundland-Labrador	-5.24
Saskatchewan	-3.52
British Columbia	-0.26
Manitoba	-0.17
New Brunswick	0.65
Nova Scotia	-0.26
Ontario	-0.16
Quebec	-0.19
Rest of Canada	-0.91
All of Canada	-0.89

Welfare Decomposition

- Two diagnostic simulations:
  - Simulate the same change in the exchange rate as the baseline oil price-shock, but assume that the shock to the exchange rate is not derived from changes in crude oil markets; isolates the **Exchange Rate Effect**
  - Simulate the effect of a 10 percent reduction in the cost of crude oil inputs to Canadian consumers, but assume the shock does not affect the output price of crude oil that Canadian oil producers are paid or results in the exchange rate changes in our baseline experiment; this isolates the **Energy Price Effect**
  - The residual incorporates everything else, but largely reflects income effects resulting from changes in wages, the return to capital and income from fossil fuels; isolates the **Income Effect**
- **Total Welfare Effect = Energy Price Effect + Exchange Rate Effect + Income Effect**

Results: Welfare Decomposition

Table 5: Percentage Change in EV Welfare Measure by Region and Impact Channel

	TOTAL EFFECT	WELFARE DECOMPOSITION		
		Energy Cost	*Exchange*	*(1)-(2)-(3)*
	(1)	(2)	(3)	(4)
	Resource Intensive Provinces			
Alberta	-4.69	0.28	-0.26	-4.71
Newfoundland-Labrador	-5.24	0.77	-0.26	-5.74
Saskatchewan	-3.52	0.06	-0.26	-3.32
	Other Provinces			
British Columbia	-0.26	0.11	-0.27	-0.10
Manitoba	-0.17	0.11	-0.28	0.00
New Brunswick	0.65	1.12	-0.28	-0.19
Nova Scotia	-0.26	0.27	-0.28	-0.25
Ontario	-0.16	0.15	-0.29	-0.02
Quebec	-0.19	0.18	-0.29	-0.07
Rest of Canada	-0.91	0.06	-0.23	-0.74
All of Canada	-0.89	0.19	-0.28	-0.80

Sensitivity Analysis: Different Oil Price Shocks

Table 6: Welfare Impacts of Different Oil Price Shocks

Percent Oil Price Change	Alberta	Ontario	Canada
-20%	-9.05	-0.28	-1.67
-10%	-4.69	-0.16	-0.89
10%	5.01	0.21	1.00
20%	10.29	0.47	2.09

Sensitivity Analysis: Key Parameters

- Sensitivity of three key parameters:
  - Labour mobility between sectors
    - ⋆ Reduce mobility between sectors (assume no mobility)
  - Exchange rate response
    - ⋆ Lower substitutability between domestic and imported goods
  - Flexibility of energy demand response
    - ⋆ Lower substitution elasticity between energy and other inputs to production and final consumption

Sensitivity Analysis: Key Parameters

Table 8: Welfare Sensitivities

	Alberta	Ontario	Canada
Central Case	-4.69	-0.16	-0.89
Low Energy Demand Elasticities	-4.72	-0.16	-0.89
Sector-Specific Labor Supply	-4.69	-0.23	-0.92
Low Trade Elasticities	-4.56	-0.22	-0.90

Policy Counterfactual: Government Revenue Reallocation

- Boadway, Coulombe, Tremblay (2013): changes to tax/transfer regime to redistribute returns to oil wealth more evenly across provinces
- We simulate this by allocating government revenue changes from the oil price shock equally across provinces

Policy Counterfactual: Government Revenue Reallocation

Table 9: Percentage Change in EV Welfare Measure – Baseline versus Revenue-Redistribution Scenario

	Baseline	Redistribution	(1)-(2)
	(1)	(2)	(3)
	Resource Intensive Provinces		
Alberta	-4.69	-3.96	-0.73
Newfoundland-Labrador	-5.24	-4.05	-1.19
Saskatchewan	-3.52	-2.83	-0.69
	Other Provinces		
British Columbia	-0.26	-0.4	0.14
Manitoba	-0.17	-0.31	0.14
New Brunswick	0.65	0.4	0.25
Nova Scotia	-0.26	-0.4	0.14
Ontario	-0.16	-0.32	0.15
Quebec	-0.19	-0.32	0.13
Rest of Canada	-0.91	-1.16	0.25
All of Canada	-0.89	-0.89	--

Conclusion

- Examine the steady-state impact of a reduction in the price of oil using a CGE model of the Canadian economy
- Base case (10 percent reduction in oil price):
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