Adding Oil to the Global Integrated Monetary and Fiscal Model

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Outline of the Presentation

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Motivation

- An important feature of the global economy is commodity markets, in particular the oil market.

- Prices have been very volatile in the last 5 years.
Average Petroleum Spot Price (APSP) (U.S. Dollars)
Oil Price Movements

- The average global oil price (APSP) rose from US$30 to US$90 from end-2003 to start-2008.

- 2008 was a rollercoaster:
  - peaked over US$140 in July.
  - retreated to US$114 in August.
  - starting in September, began plunge to US$37 at the end of the year.
The Role of Oil in the World Economy

- Oil price volatility is driven, in part, by the price inelasticity of demand and supply.

  ⇒ Small movements in pressure on the volume of oil leads to large price swings.

- Strong implications for oil exporting regions, and oil importing regions – increase in prices result in a wealth transfer from importers to exporters.
  
  – effects reinforced by fact that importers are the largest consumers of oil on a per capita basis, while exporters consume less.
Modelling the Oil Sector in the BoC-GEM

There have been efforts to model the oil sector at the IMF, in the GEM (in cooperation with the Bank of Canada).
The Model

1. Endogenous price and volume response, on both the demand and supply sides, in an integrated global market.

2. Oil production depends on capital, labour, and a fixed factor of production.

3. There are short-run real adjustment costs:
   - supply side – capital and labour.
   - demand side – demand for oil for tradables, nontradables, and gasoline.
Advantages

1. Short-run real adjustment costs allow for differentiation between short- and long-run price elasticities.

2. Two oil sectors - one for oil in production (tradable), one for consumer gasoline and heating fuel (nontradable).

3. Allows for the distinction between core and headline inflation for countries following inflation-targeting regimes.
Disadvantages

1. Oil is still an inexhaustible resource.

2. The full structure is complicated, requiring careful calibration to provide for an integrated global market.
   - leads to complicated dynamics with unintended effects.
   - i.e. - the link between supply shocks and oil prices is too weak, leading to perverse output responses in oil-exporting regions.
Lessons from the GEM

- Oil sector provides key dynamics in the world economy, particularly the presence of an integrated world market.

- It is very hard to correct for the weaknesses in the conceptual structure of the model, particularly oil as an exhaustible resource.

- It is easy to preserve the features of the sector in a much simpler structure
  - gasoline can be treated the same as oil, since no questions have been posed on the productive capacity for gasoline (as opposed to oil in general).
Modelling the Oil Sector in GIMF

- Why are we still interested in moving an oil sector to GIMF?
  - look at interaction of fiscal levers and the oil sector, in a simplified oil model framework.
  - also an opportunity to work on the simplified structure of oil production / consumption.
Modelling the Oil Sector in GIMF (cont’d)

- Each country:
  - has an endowment of oil.
  - is either a net exporter or net importer of oil.

- The global oil market can be thought as a global repository. Net exporters provide oil, and net importers withdraw it. The global oil price clears the market.
Where We Stand Now in the GIMF

- We have introduced the structure referred to above. We have begun experiments, but there are some wrinkles to still iron out.
  - it seems that supply shocks elicit a much stronger oil price response than demand shocks.

- May be related to the fixed vertical supply curve.
Properties of the Oil Sector in the BoC-GEM

For now, we will use a five region, four sector (tradables, nontradables, oil, commodities) version of the BoC-GEM (Bank of Canada’s version of the Global Economy Model) with quarterly dynamics.

- Oil importing regions are emerging Asia, (AS) the United States (US), and the remaining countries (primarily EU and Japan – EU/JA).

- Oil exporting regions are Canada, and the commodity exporter (CX), which contains, for example, OPEC, Mexico, Norway, and Russia.

Compare a supply-side and a demand-side shock to oil.
**A Negative Supply Shock**

- We consider a permanent 10% fall in the oil supply in the main oil exporting region, CX.
  - since the short-run demand curve for oil is steep, the global USD oil price increases by 35% in the first year, before retreating to a long-run increase of 8%.

- a global market implies all regions will reduce their demand for oil in the short run, resulting in a negative income effect.
Permanent 10% Decrease in the Oil Supply from the Oil Exporting Region
(Percent deviations from control; percentage point for inflation)
A Negative Supply Shock – Wealth Effects

- however, oil exporters since their income increase = wealth transfer effect of the positive terms of trade shock.

- negative terms of trade shock; negative wealth transfer from everywhere else.
  - particularly true of Emerging Asia, which is the largest user of oil (as a share of domestic GDP).
A Negative Supply Shock – Inflation

- Headline consumer price inflation is 1% higher – recall that oil as a share of consumer is between 3%-4% in each region.

- Core inflation (excluding consumer oil prices) is much more muted, around 0.1%.
  
  - any permanent pass-through of oil prices to core inflation is dampened by monetary policy, which focuses on core inflation as the operational target.

  - emerging Asia sees a fall in core inflation, which is consistent with defending its nominal exchange rate peg (a higher real interest rate).
A Positive Demand Shock

- We consider a gradual increase in demand for oil in emerging Asia, because of a persistent shock to the growth rate of economy-wide productivity (2% per year, for 20 years).

- Oil prices rise initially by about 10% - initial spike is caused by the real adjustment costs in the oil sectors.
  - they decline over time as the rigidities loosen.
  - then trend upwards as there are diminishing returns on the production of oil coupled with continued strong global growth.
Permanent 10% Increase in Productivity in Emerging Asia

(Percents deviations from control; percentage point for inflation)

Emerging Asia GDP

Price of Oil (USD)

Oil Exporters' GDP

Inflation

US CPI
EU/JA CPI
US Core
EU/JA Core

AS Inflation

Headline

Core

Oil Importers' GDP

US
EU/JA
A Positive Demand Shock – Wealth Effects

- once again, there is a terms of trade shock, and a wealth transfer effect.
  - CX increases by 1.5% on impact, lowers to 0.5% as income effect (i.e. higher consumer imports) takes hold.
  - US, EU/JA lose 0.6% in the long run.
  - emerging Asia’s growth is lower than it would be in a model without oil.
A Positive Demand Shock – Inflation

- Headline consumer price inflation is higher by about 0.3%.

- Core inflation (excluding consumer oil prices) is much more muted, around 0.1%.

- Emerging Asia, after the effects of oil price increases hit in the first year, benefits from the disinflationary impacts of productivity gains.