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# Adding Oil to the Global Integrated Monetary and Fiscal Model

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## Outline of the Presentation

1. Motivation

2. Modelling the Oil Sector

3. The Oil Sector in the BoC-GEM

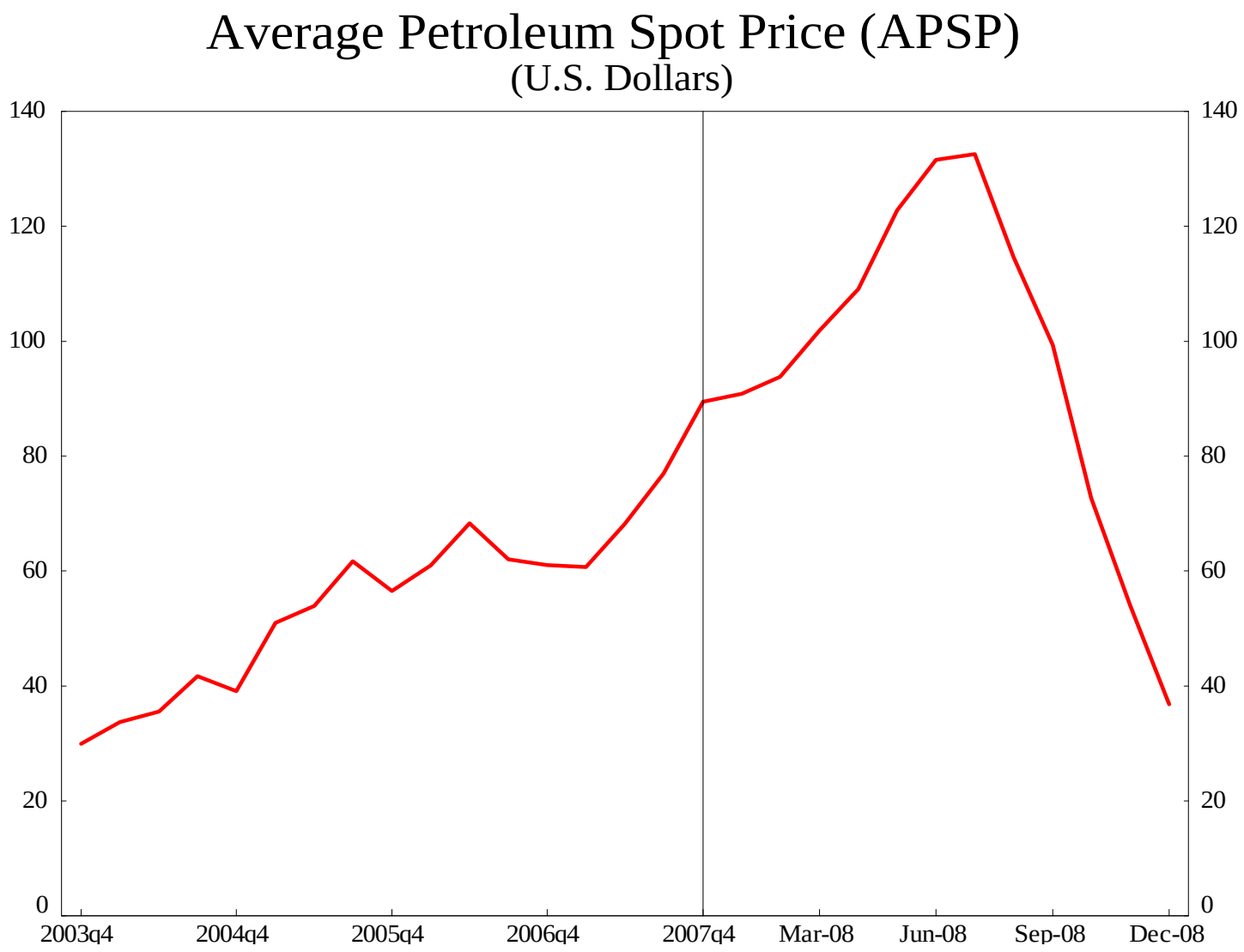
4. The Oil Sector in GIMF

5. Some Oil-Related Shocks

## 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)
140
120
100
80
60
40
20
0
2003q4
2004q4
2005q4
2006q4
2007q4
Mar-08
Jun-08
Sep-08
Dec-08

*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.

  $\Rightarrow$ 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.

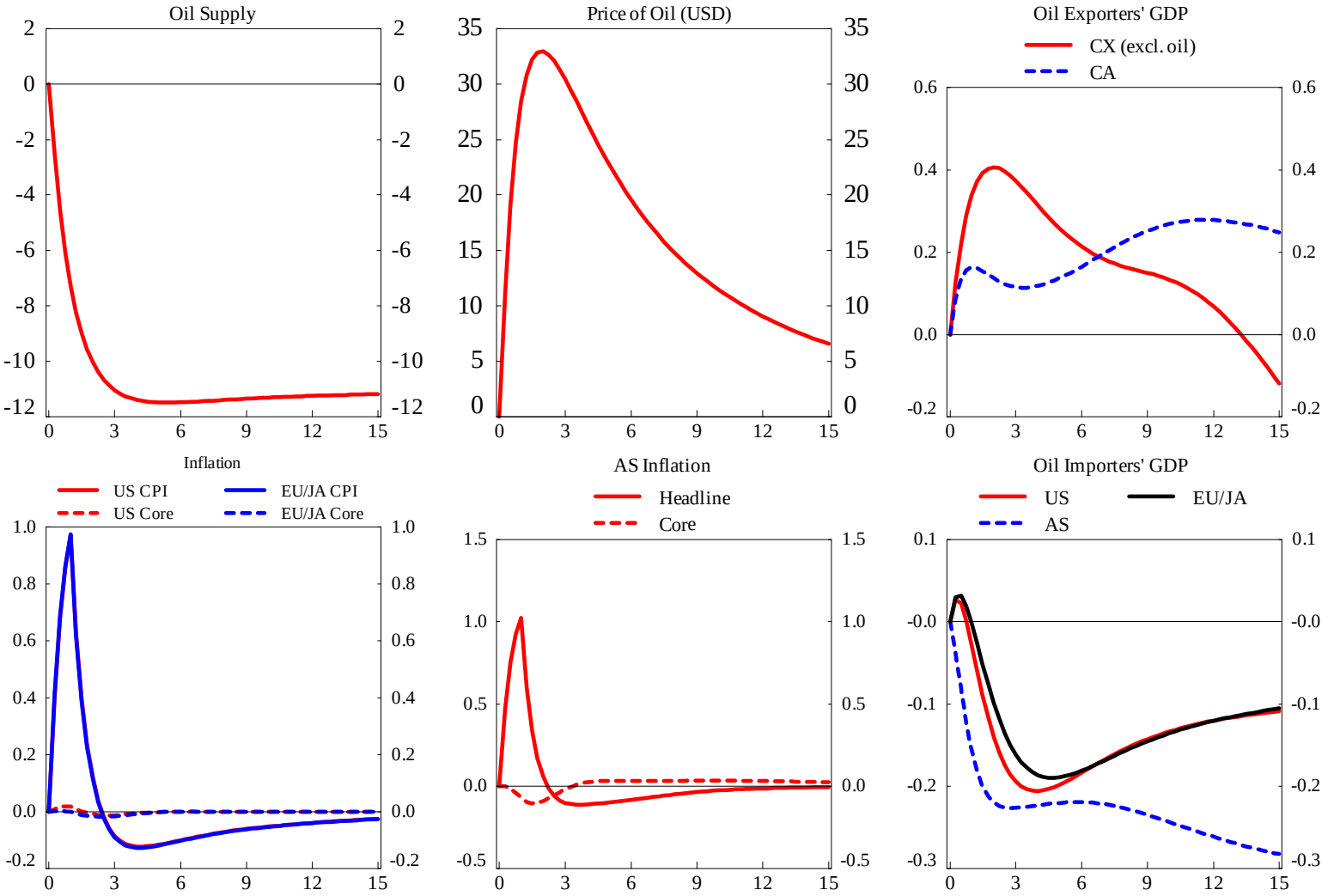
Compare a supply-side and a demand-side shock to oil.

## *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).

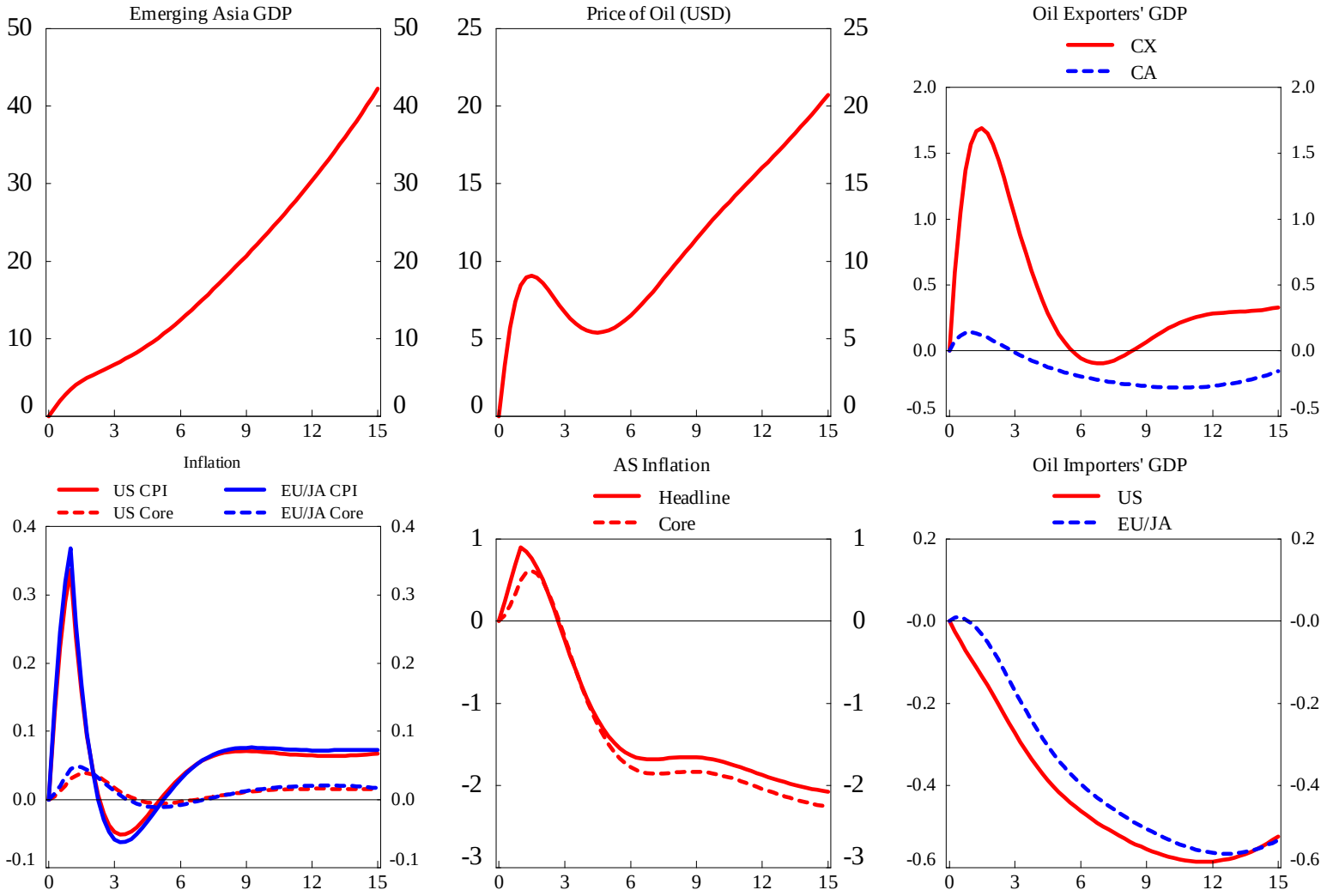
## *A Positive Demand Shock*

- 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

(Percent deviations from control; percentage point for inflation)



## *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.