A global macroeconomic model as a guide in uncertain times

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There is significant uncertainty about the global economy in mid-2019

• What is the effect of different tariffs between US and its trading partners?
• What is the effect of a no-deal Brexit? How can it be mitigated?
• What is the effect of a loosening of Fed policy on US and rest of the world?
• Why is inflation so weak and what might cause it to pick up?

We need models to analyse these types of issues.
Different types of models have different purposes

<table>
<thead>
<tr>
<th>Type of model</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foundational model</td>
<td>To make deep theoretical point</td>
</tr>
<tr>
<td>DSGE models</td>
<td>To explore the macro implications of distortions</td>
</tr>
<tr>
<td>Policy models</td>
<td>To study the dynamic effects of specific shocks</td>
</tr>
<tr>
<td>Toy models</td>
<td>To present essence of answer from more complicated model</td>
</tr>
<tr>
<td>Forecasting models</td>
<td>To provide best forecasts</td>
</tr>
</tbody>
</table>

Taxonomy based on Olivier Blanchard in *Oxford Review of Economic Policy*, 2018
Our focus is on NiGEM, a policy model

- *Policy models* are ‘aimed at analysing actual macroeconomic policy issues. Models in this class should fit the main characteristics of the data, including dynamics, and allow for policy analysis and counterfactuals. They should be used to think, for example, about the quantitative effects of a slowdown in China on the United States, or the effects of a US fiscal expansion on emerging markets.’ (Blanchard, 2018)
Models evolve as theory and evidence grow

- Aim to respond to new theory, techniques and evidence.
- But have to manage Pagan trade off.
- Won’t be suitable for all purposes.

Type I hybrid: long-run equilibrium implicit. Type II hybrid: long-run equilibrium explicit.
NiGEM is a global policy model

- Policy changes and shocks in one country spill over to other countries.
- Global economy appears more integrated than ever.

Figure A1. Standard deviation of real GDP per capita growth, 1871–2017

Sources: Bolt et al. (2018) and NiGEM database.
Notes: Shaded areas represent world wars. Based on a balanced sample of 20 OECD countries that have unbroken historical national accounts stretching back to 1870, including Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom and United States. Results have been capped at 10 percentage points for clarity.
NiGEM: the leading global macroeconomic model

• A transparent, peer-reviewed, global econometric model maintained by NIESR that has evolved over 30 years of regular use

• Used by policymakers and private sector organisations around the world for economic forecasting, scenario analysis and stress testing

• Consists of individual country models for the major economies, linked through trade in goods and services and integrated capital markets
NiGEM country coverage:

- There are country models for all 36 OECD countries, except Iceland and Israel.
- Plus country models for Argentina, China, India, Russia, Hong Kong, Taiwan, Brazil, South Africa, Romania and Bulgaria.
- Plus separate regional blocs covering the rest of the world.
NiGEM based on modern text-book macro

• Individual country models have following features:
  • Sticky prices
  • Forward-looking consumption and investment
  • Taylor rule and other options for monetary policy
  • Long-run fiscal solvency
• Individual countries related by trade relations – all adds up - and asset pricing relationships (UIP etc)
NiGEM dynamic properties

• In the long term, GDP is determined by potential output reflecting factor inputs.
• In the short to medium term, GDP is driven mainly by the demand side.
• Deviations of actual output from potential output set in motion adjustment processes that bring the economy back to potential in the long run.
• Further details are in:

Benefits of model-based policy analysis

1. Model can have multiple applications, so don’t need to reinvent wheel each time.
2. Model incorporates key magnitudes
3. Provides a tool for thinking about possible outcomes and scenarios.
4. But need to be aware of trade-offs made in developing the model.
Policymakers and advisors need to grapple with macroeconomic issues
Applications

1. Global implications of US protectionist trade measures
2. Global impact of different Brexit scenarios
3. What might cause US inflation to pick up?
Impact from increase in US-China tit-for-tat tariffs

Peak impact on GDP level over five years

- 10% tariffs on $200bn Chinese exports & 10% tariffs on $60bn US exports
- Initial 10% tariffs on $200bn Chinese exports increasing to 25%; 10% tariffs on $60bn US exports
## Impact from increase in US-China tit-for-tat tariffs

Table 1. GDP losses from a 10 percentage point increase in tariffs on US trade would be substantial

<table>
<thead>
<tr>
<th>GDP impact (peak impact over three year period, %)</th>
<th>US</th>
<th>UK</th>
<th>EA</th>
<th>World (PPP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trade war</td>
<td>−2½</td>
<td>−½</td>
<td>−1</td>
<td>−1¼</td>
</tr>
<tr>
<td>Tighter financial conditions</td>
<td>−1</td>
<td>−1</td>
<td>−¼</td>
<td>−½</td>
</tr>
<tr>
<td>Greater uncertainty</td>
<td>−½</td>
<td>−¼</td>
<td>−¼</td>
<td>−¼</td>
</tr>
<tr>
<td>Permanent tariffs</td>
<td>−¼</td>
<td>0</td>
<td>−½</td>
<td>−½</td>
</tr>
<tr>
<td>Total</td>
<td>−5</td>
<td>−1¼</td>
<td>−2¼</td>
<td>−2½</td>
</tr>
</tbody>
</table>

Note: Bank of England calculations using NiGEM.
Fiscal stimulus in China to counteract tariff imposition

Impact on GDP level in the first year

Source: NiGEM simulations.
Applications

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## Transmission channels of Brexit

<table>
<thead>
<tr>
<th>Channel</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Reduction in trade</td>
<td>• Tariff and non-tariff barriers reduce trade volume between UK and EU</td>
</tr>
<tr>
<td>2 Foreign Direct Investment</td>
<td>• Free movement of capital makes it easier to invest • The reduction in trade makes the UK a less attractive FDI destination</td>
</tr>
<tr>
<td>3 EU budget contributions</td>
<td>• Depending on the continued participation in EU programmes budgetary contributions will reduce and can be recycled into domestic spending</td>
</tr>
<tr>
<td>4 Migration</td>
<td>• Barriers to movement of labour from the EU may be put in place • The UK may become a less attractive destination for workers from the rest of the world</td>
</tr>
<tr>
<td>5 Productivity</td>
<td>• Immediate: rebalancing of the economy to less productive industries as trade impeded • Long-run: less competition due to reduced trade, lack of FDI and skilled migration reduce productivity while lack of unskilled migration may encourage innovation</td>
</tr>
<tr>
<td>6 Uncertainty</td>
<td>• Not considered in the long run</td>
</tr>
</tbody>
</table>
The impact of different Brexit scenarios on real GDP

Source: NIESR, NiGEM simulation.
Long-term economic impact

Deal + FTA scenario relative to Stay scenario, per cent difference in GDP

- EU budget contributions
- Productivity
- Net migration
- FDI
- Trade
- Total

National Institute of Economic and Social Research
Long-term economic impact: supply components

Impact on components of supply, % difference

- Capital input
- Labour input
- TFP
- Potential output

% difference to 'soft' Brexit

2019 2020 2021 2022 2023 2024 2025 2026 2027 2028 2029
Short-term impact of ‘orderly’ hard Brexit

- If negotiations were to fail and the UK would revert to trade under WTO rules in 2019, a mild recession would set in and inflation rise.
The impact of a no-deal Brexit on other countries

- Ireland
- Germany
- Netherlands
- France
- Spain
- United States
Applications

1. Global implications of US protectionist trade measures
2. Global impact of different Brexit scenarios
3. What might cause US inflation to pick up?
What might cause inflation to go up?

A key property of the model, and our view of the world, is that inflation is determined by monetary policy.

This means that inflation would result from either deliberate policy or failure to respond adequately to shocks (Bullard-Mitra conditions not met).

We look at a combination of demand and supply shocks that add to inflationary pressure in the United States and might weaken the resolve of the FOMC.

Shocks considered are: a further fiscal expansion, higher import prices due to tariffs and higher oil prices.
The impact on inflation and unemployment under RE

Note: Taylor rule is assumed to operate beyond simulation period
The impact on inflation and growth when shocks are expected to be temporary

### Inflation

*Percentage point difference from base*

<table>
<thead>
<tr>
<th>Period</th>
<th>2018Q3</th>
<th>2019Q3</th>
<th>2020Q3</th>
<th>2021Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inflation</td>
<td>-0.5</td>
<td>0.0</td>
<td>0.5</td>
<td>1.0</td>
</tr>
</tbody>
</table>

### Output

*Per cent difference from base*

<table>
<thead>
<tr>
<th>Period</th>
<th>2018Q3</th>
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<th>2020Q3</th>
<th>2021Q3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Output</td>
<td>-1.5</td>
<td>-1.0</td>
<td>-0.5</td>
<td>0.0</td>
</tr>
</tbody>
</table>

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National Institute of Economic and Social Research
The impact on short-term and long-term interest rates when shocks are expected to be temporary

Note: Taylor rule is assumed to operate beyond simulation period
What if combined shock is thought to be temporary but turns out to be persistent?

Inflation

*Figure 12. Response of US inflation to more persistent shock*

Output

*Figure 13. Response of US output to more persistent shock*

Succession of temporary shocks keep inflation elevated for longer.

Dates show timing of new temporary shocks.
What if combined shock is thought to be temporary but turns out to be persistent?

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*Figure 12. Response of US inflation to more persistent shock*

**Output**

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Succession of temporary shocks mean rise in short rates persists, but never reflected in long rates and so prevent transmission mechanism working effectively.
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Short rate

Figure 14. Response of US short rate to more persistent shock

Long rate

Figure 15. Response of US long rate to more persistent shock

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## What might cause inflation to go up?

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<th>Sources of Inflation</th>
<th>Symptoms</th>
<th>Likelihood of sustained effect on inflation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fiscal expansion, or other stronger demand</td>
<td>Falling unemployment, strong growth, wage and price inflation</td>
<td>Low – provided adequate FOMC response</td>
</tr>
<tr>
<td>Oil price shock</td>
<td>Easy to spot – higher gas prices</td>
<td>Low – FOMC knows how to respond</td>
</tr>
<tr>
<td>Tariff shock</td>
<td>Easy to spot – higher import prices at early stage</td>
<td>Low – as with oil price shock</td>
</tr>
<tr>
<td>Inadequate FOMC response</td>
<td>Pressure from President, rising long-term inflation expectations, no change in real interest rates</td>
<td>Increasingly likely</td>
</tr>
<tr>
<td>Broken transmission mechanism</td>
<td>Higher short-term rates fail to pass through to long rates, mortgages etc</td>
<td>Important risk, though no evidence yet.</td>
</tr>
</tbody>
</table>
Key benefits of global macroeconomic models for forecasting and what-if exercises:

1. Provide a quantified framework for understanding how economies work and interact.
2. Are a tool for thinking about possible identifiable risks, policy responses and wider consequences.
3. Incorporate key magnitudes and impose consistency - make sure things add up.
4. Have evolved in reaction to new ideas and events.
5. Can have multiple applications, so don’t need to reinvent wheel each time.