



A global macroeconomic model as a guide in uncertain times

Arno Hantzsche and Garry Young

St Louis Workshop July 2019



National Institute of Economic and Social Research

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

Type of model	Purpose
Foundational model	To make deep theoretical point
DSGE models	To explore the macro implications of distortions
Policy models	To study the dynamic effects of specific shocks
Toy models	To present essence of answer from more complicated model
Forecasting models	To provide best forecasts

Taxonomy based on Olivier Blanchard in *Oxford Review of Economic Policy*, 2018



Our focus is on NiGEM, a policy model

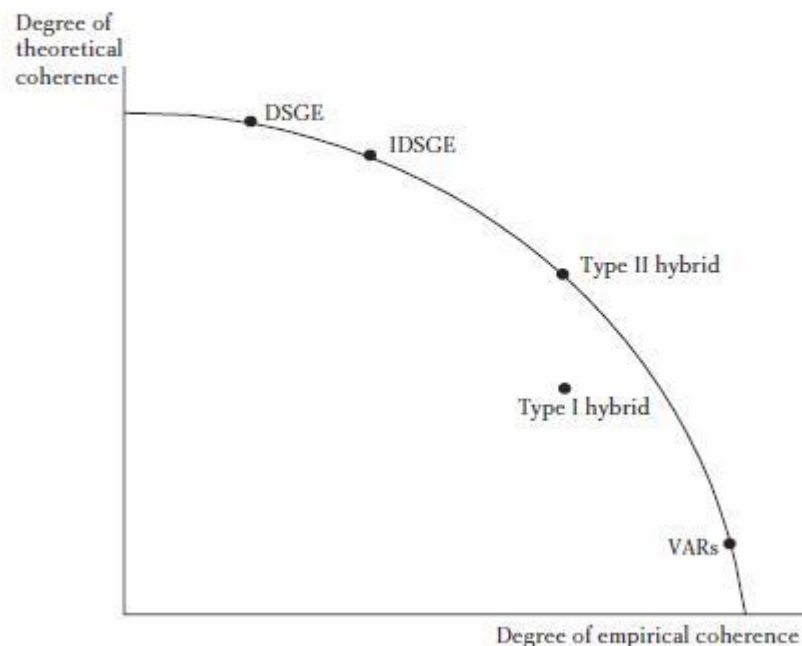
- *Policy models* are ‘aimed at **analysing actual macroeconomic policy issues**. Models in this class should fit the main characteristics of the data, including dynamics, and allow for policy analysis and counterfactuals. They should be used to think, for example, about the quantitative effects of a 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.

Figure 1
Trade-off between theoretical and empirical coherence for models



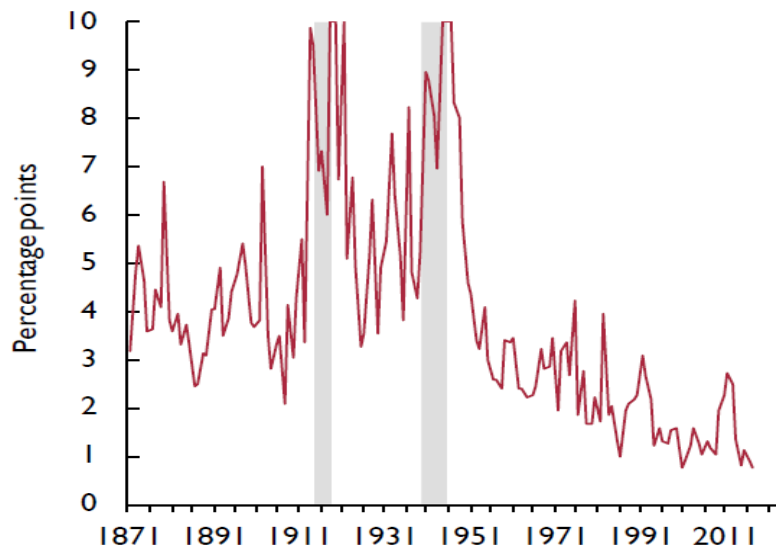
Type I hybrid: long-run equilibrium implicit. Type II hybrid: long-run equilibrium explicit



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:

Hantzsche, A., Lopresto, M., and Young, G. (2018), 'Using NiGEM in Uncertain Times: Introduction and Overview of NiGEM', National Institute Economic Review, No 244, May 2018.



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



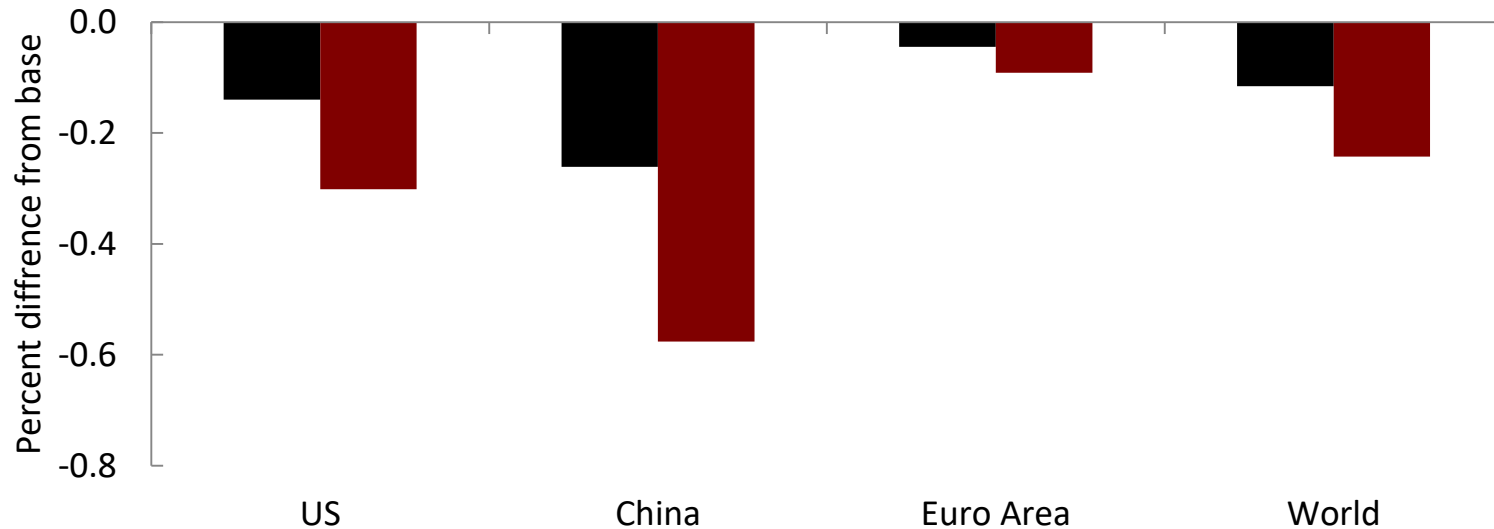
Applications

- 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

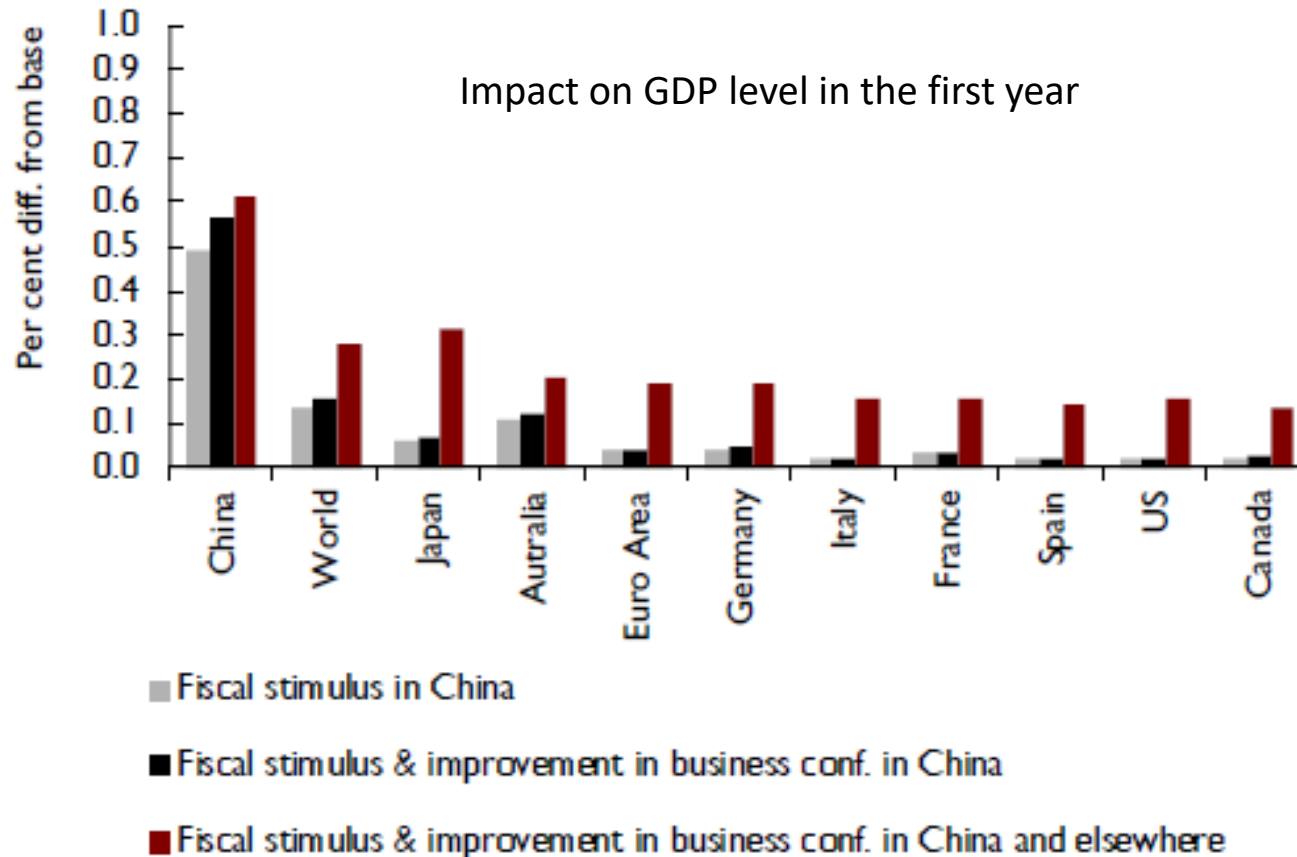
Table 1. GDP losses from a 10 percentage point increase in tariffs on US trade would be substantial

GDP impact (peak impact over three year period, %)	US	UK	EA	World (PPP)
Trade war	$-2\frac{1}{2}$	$-\frac{1}{2}$	-1	$-1\frac{1}{4}$
Tighter financial conditions	-1	-1	$-\frac{3}{4}$	$-\frac{1}{2}$
Greater uncertainty	$-\frac{1}{2}$	$-\frac{1}{4}$	$-\frac{1}{4}$	$-\frac{1}{4}$
Permanent tariffs	$-\frac{3}{4}$	0	$-\frac{1}{2}$	$-\frac{1}{2}$
Total	-5	$-1\frac{3}{4}$	$-2\frac{1}{4}$	$-2\frac{1}{2}$

Note: Bank of England calculations using NiGEM.



Fiscal stimulus in China to counteract tariff imposition



Source: NiGEM simulations.



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?

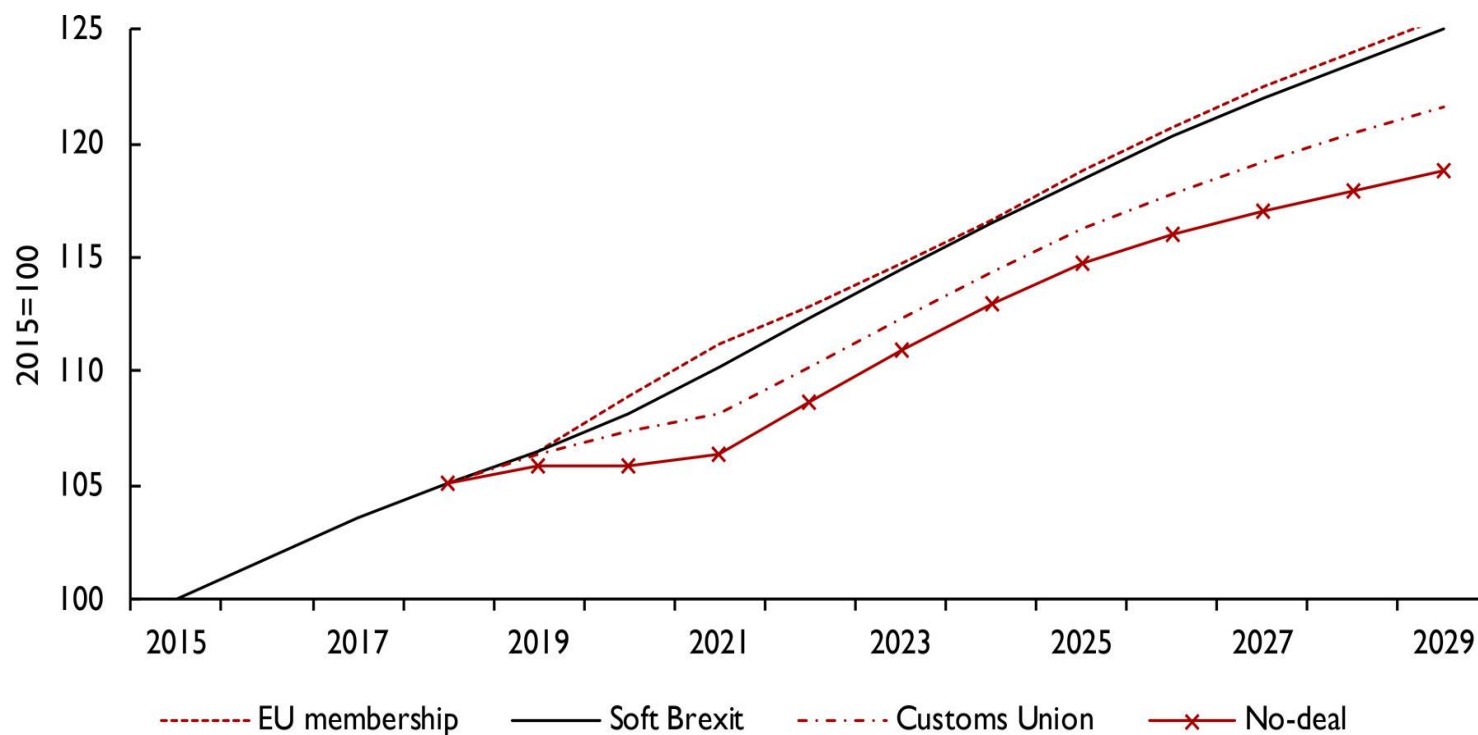


Transmission channels of Brexit

Channel	Rationale
1 Reduction in trade	<ul style="list-style-type: none">• Tariff and non-tariff barriers reduce trade volume between UK and EU
2 Foreign Direct Investment	<ul style="list-style-type: none">• Free movement of capital makes it easier to invest• The reduction in trade makes the UK a less attractive FDI destination
3 EU budget contributions	<ul style="list-style-type: none">• Depending on the continued participation in EU programmes budgetary contributions will reduce and can be recycled into domestic spending
4 Migration	<ul style="list-style-type: none">• 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
5 Productivity	<ul style="list-style-type: none">• 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
6 Uncertainty	<ul style="list-style-type: none">• Not considered in the long run



The impact of different Brexit scenarios on real GDP

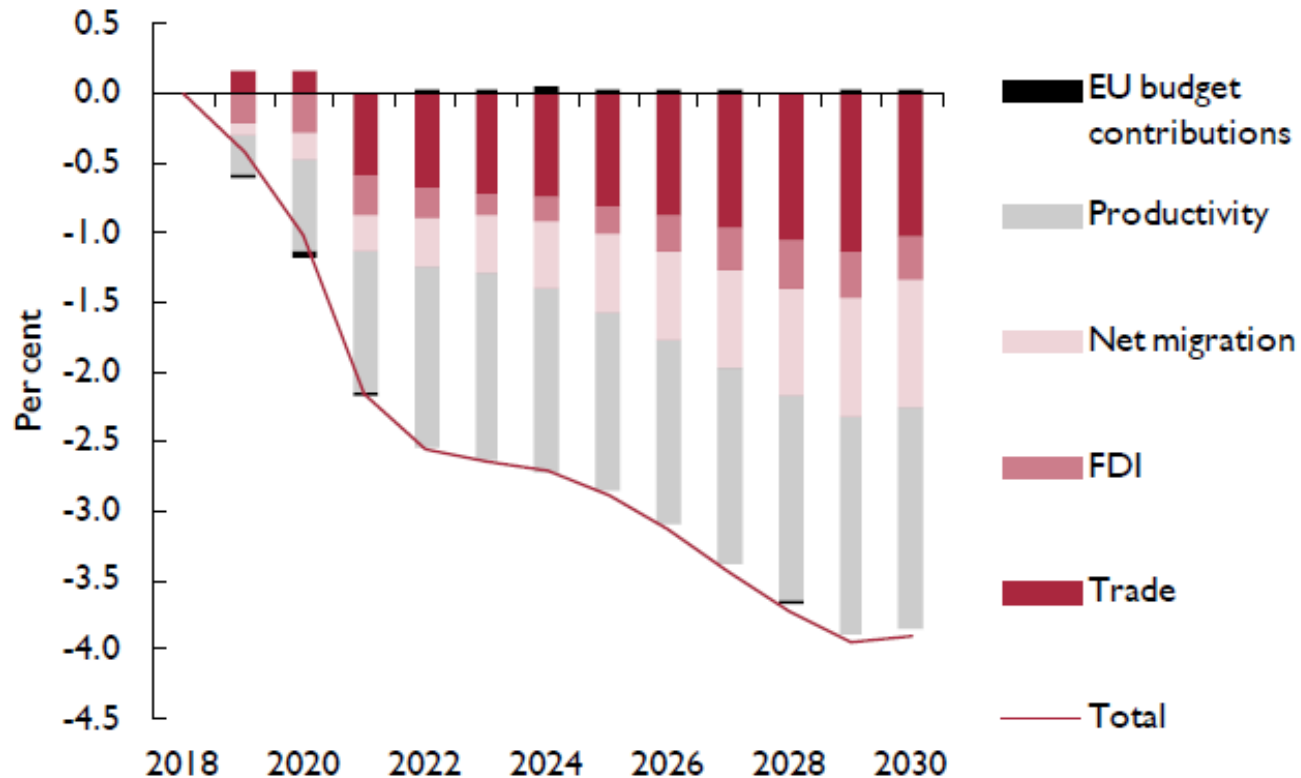


Source: NIESR, NiGEM simulation.



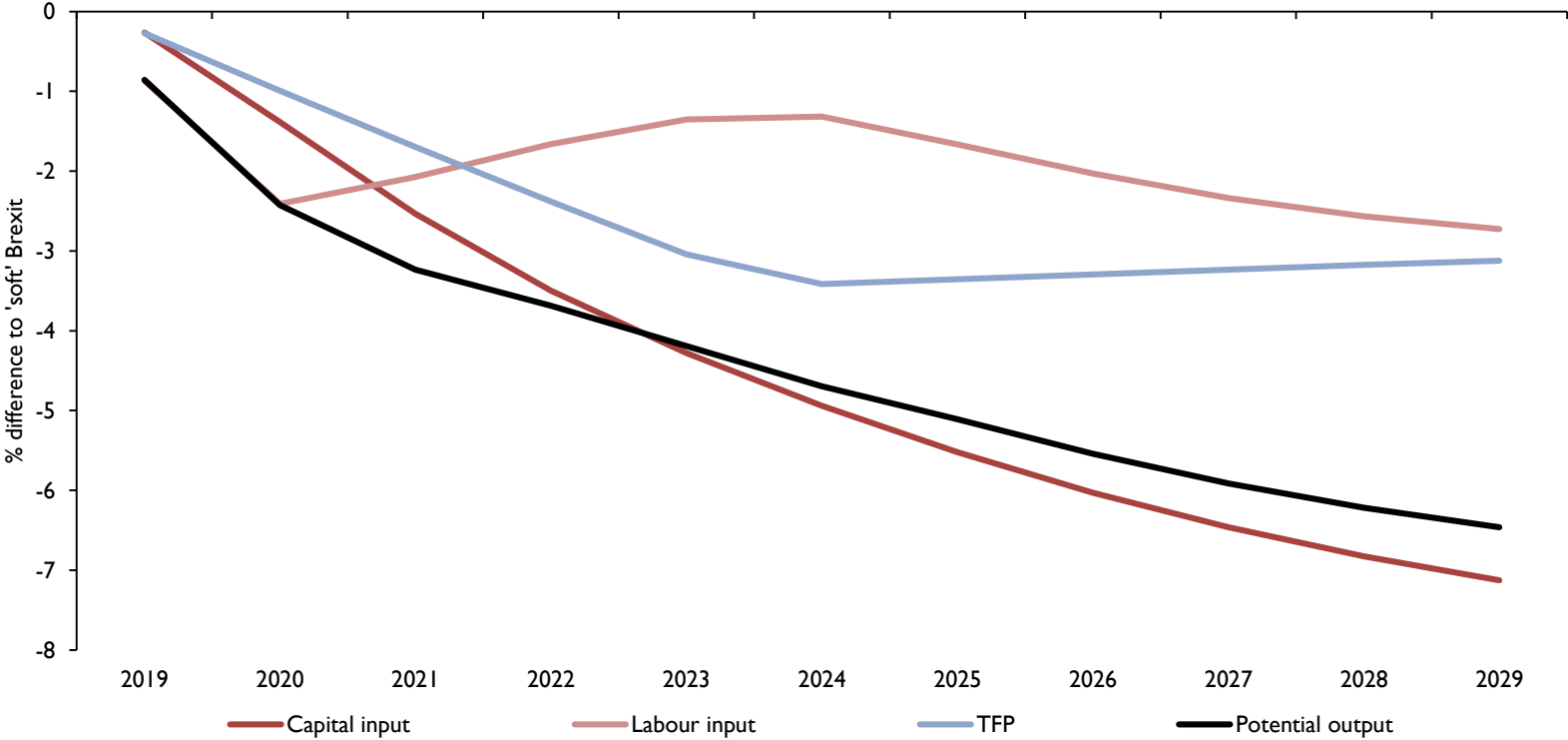
Long-term economic impact

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



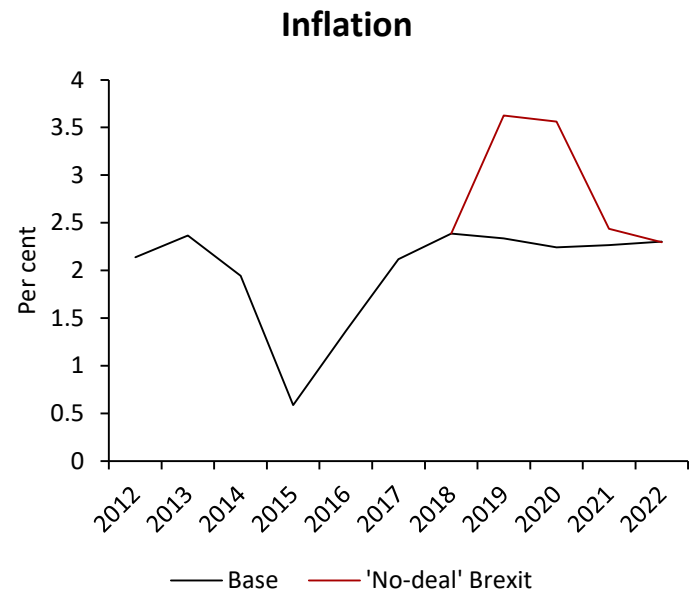
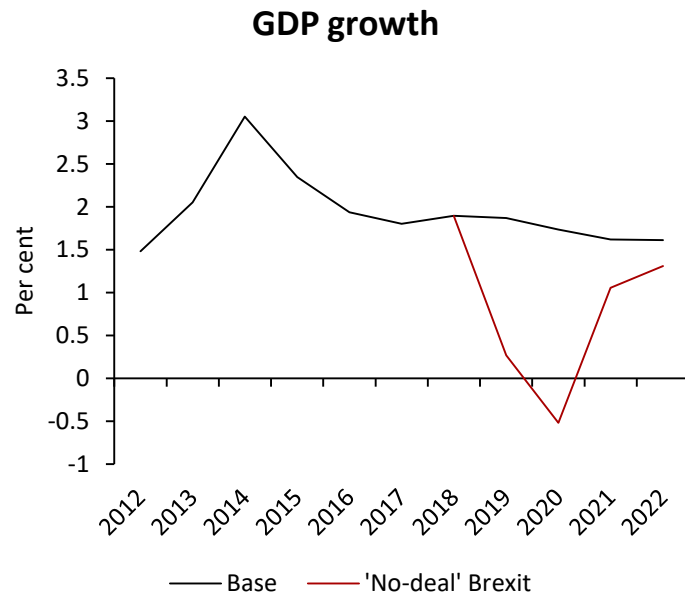
Long-term economic impact: supply components

Impact on components of supply, % difference

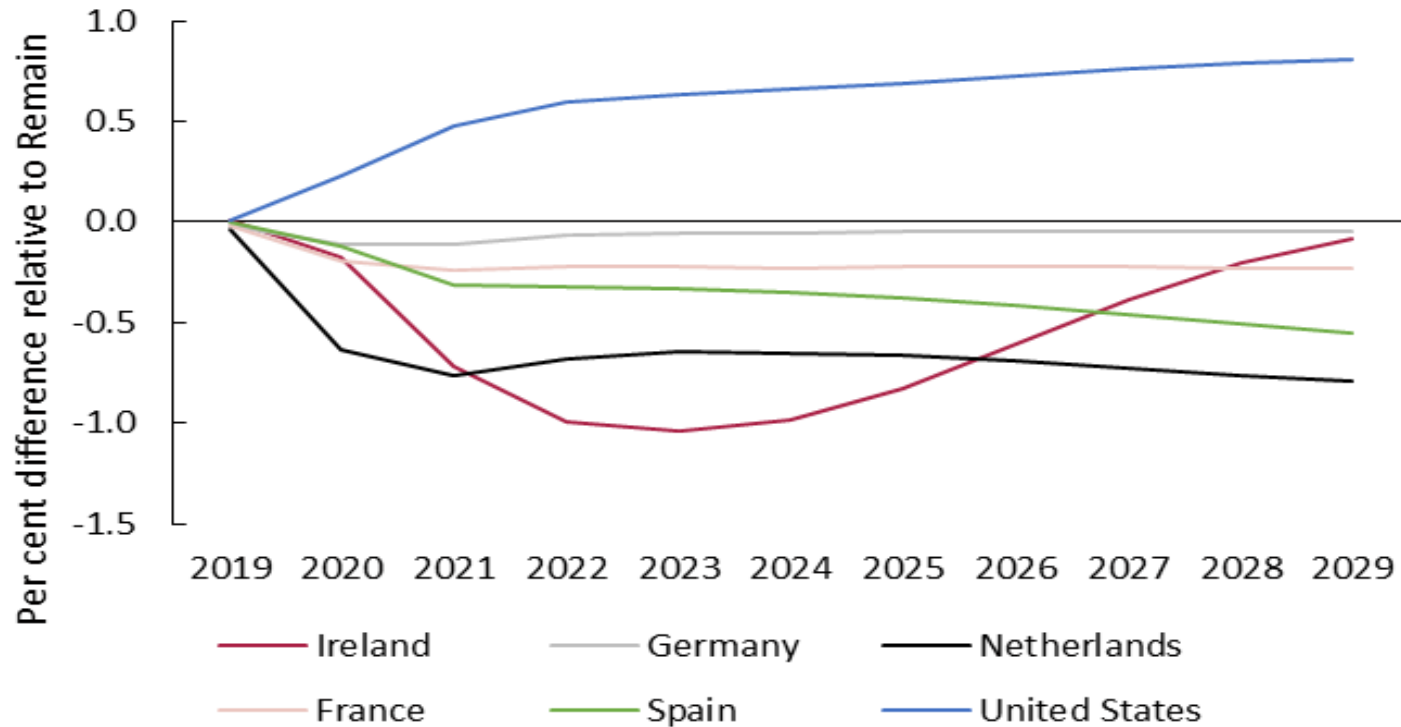


Short-term impact of 'orderly' hard Brexit

- 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



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?

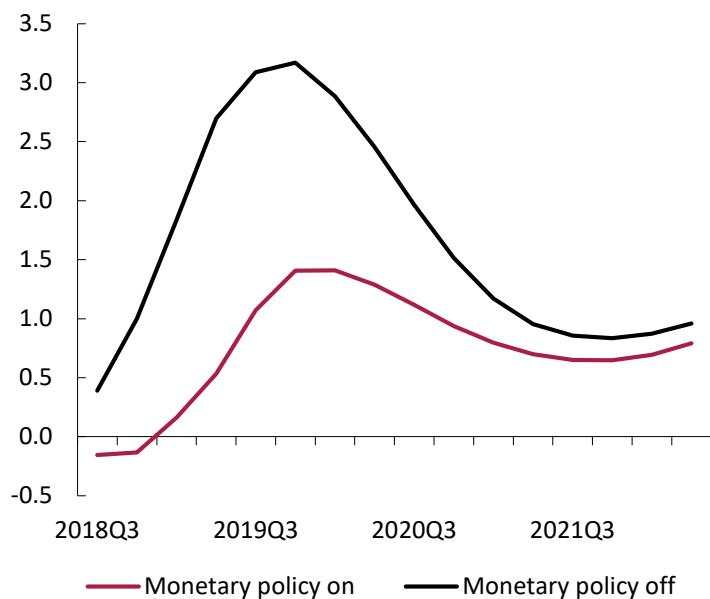
- A key property of the model, and our view of the world, is that **inflation is determined by monetary policy**.
- This means that inflation would result from either deliberate policy or failure to respond adequately to shocks (Bullard-Mitra conditions not met).
- We look at a combination of demand 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

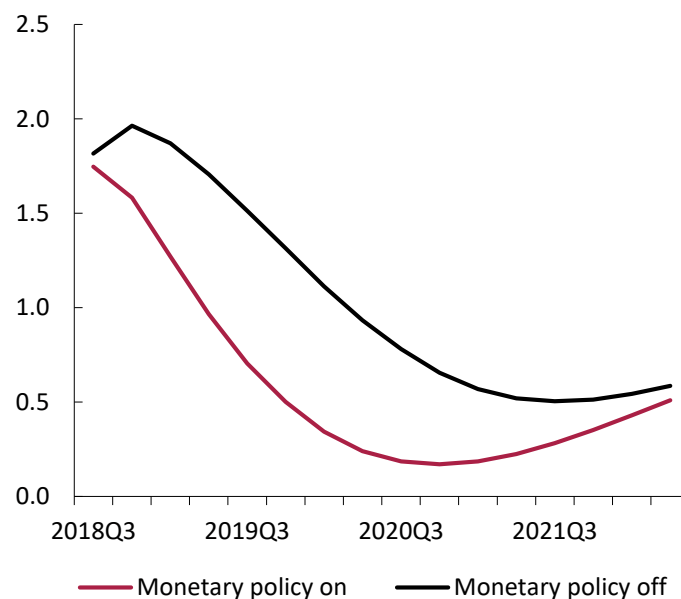
Inflation

Percentage point difference from base



Output

Per cent difference from base



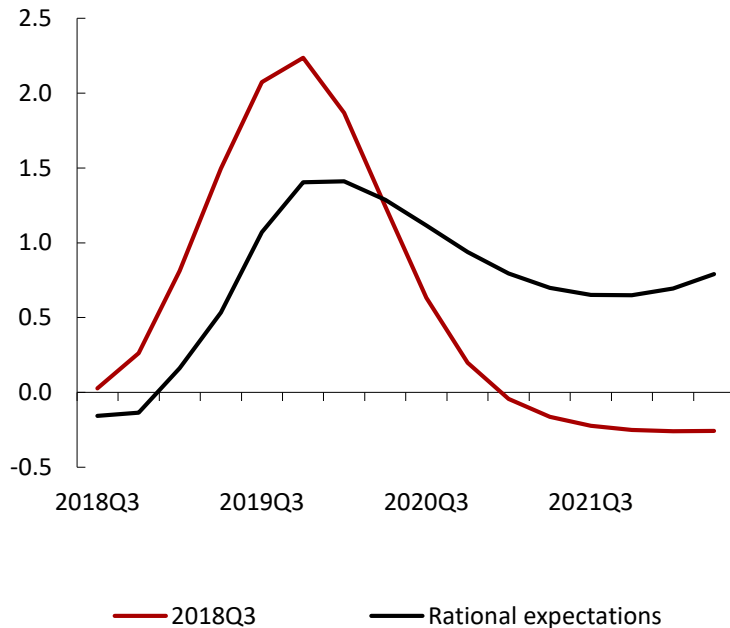
Note: Taylor rule is assumed to operate beyond simulation period



The impact on inflation and growth when shocks are expected to be temporary

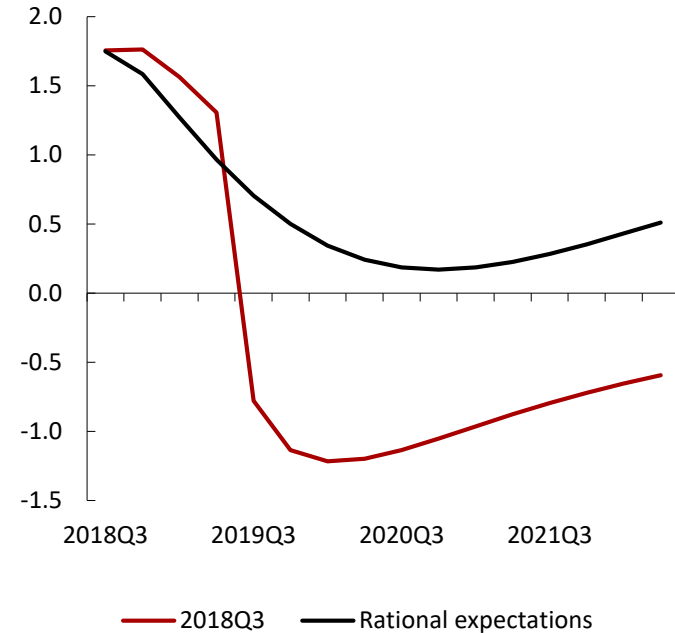
Inflation

Percentage point difference from base



Output

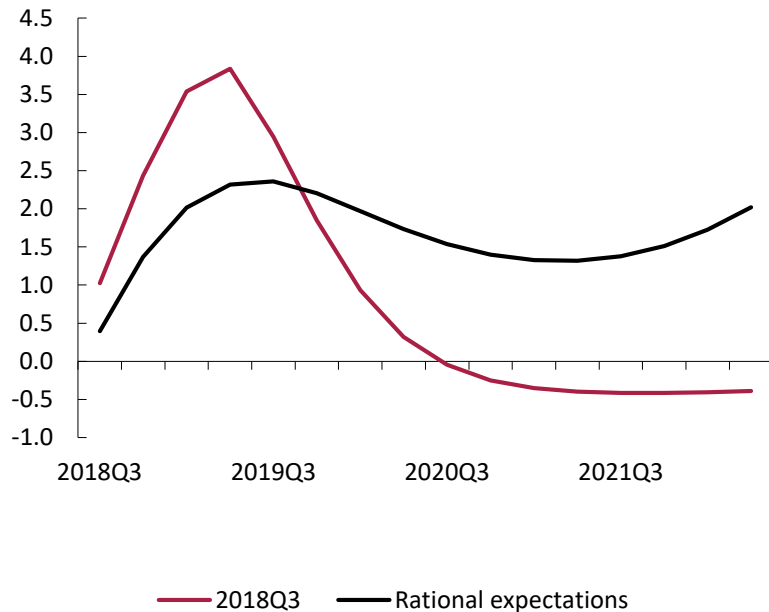
Per cent difference from base



The impact on short-term and long-term interest rates when shocks are expected to be temporary

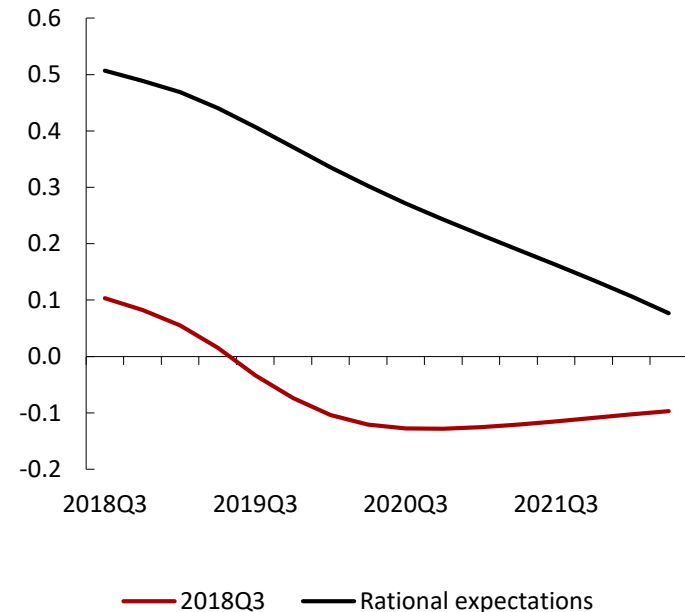
Short rate

Percentage point difference from base



Long rate

Percentage point difference from base



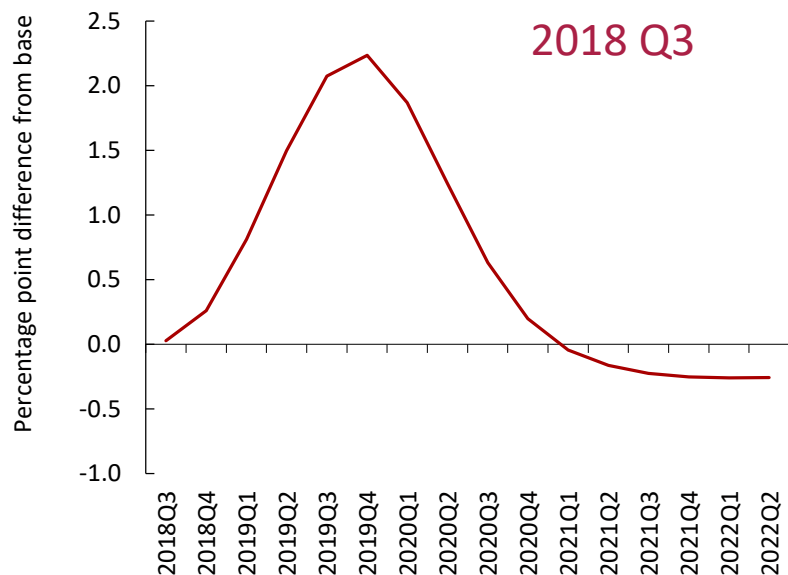
Note: Taylor rule is assumed to operate beyond simulation period



What if combined shock is thought to be temporary but turns out to be persistent?

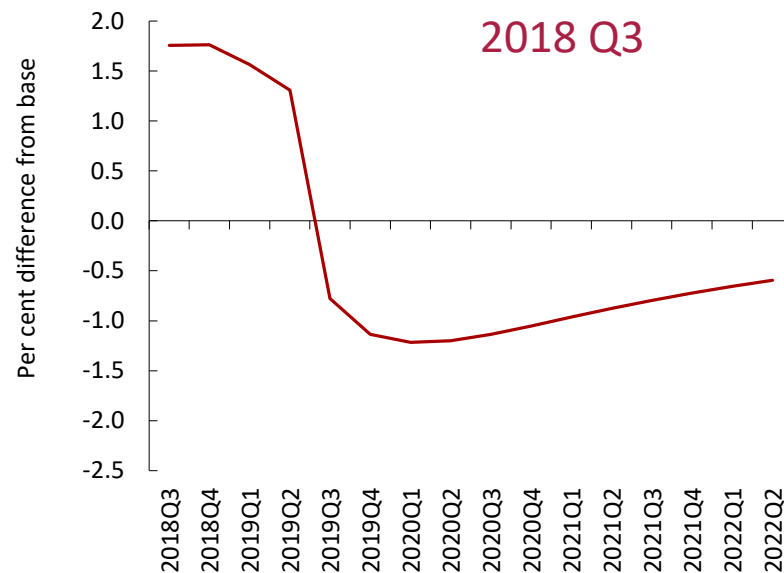
Inflation

Figure 12. Response of US inflation to more persistent shock



Output

Figure 13. Response of US output to more persistent shock



Dates show timing of new temporary shocks.

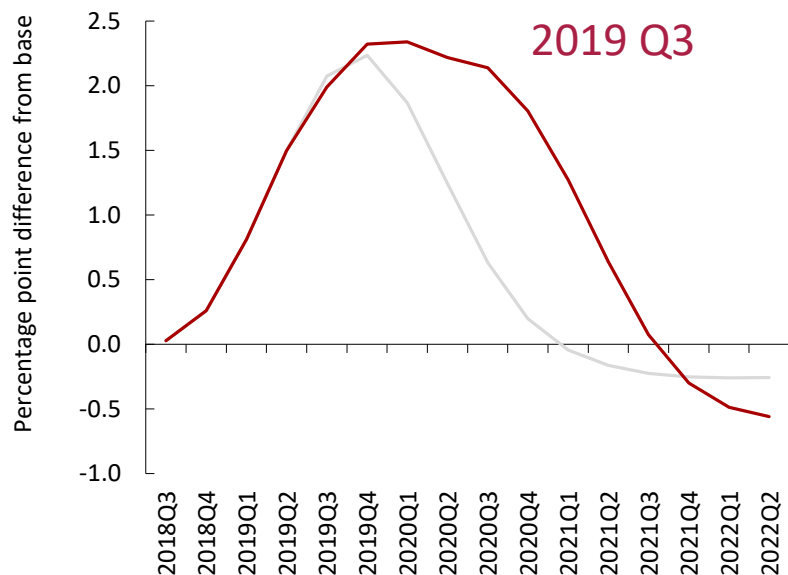
Succession of temporary shocks keep inflation elevated for longer.



What if combined shock is thought to be temporary but turns out to be persistent?

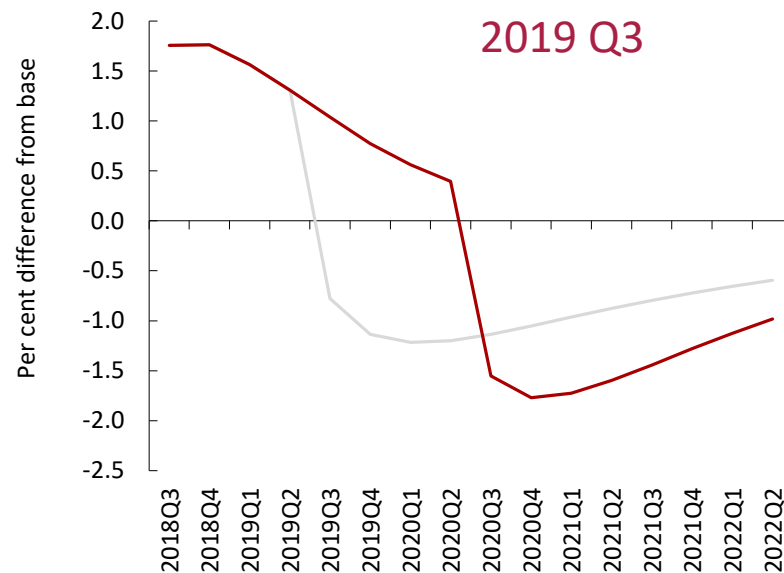
Inflation

Figure 12. Response of US inflation to more persistent shock



Output

Figure 13. Response of US output to more persistent shock



Dates show timing of new temporary shocks.

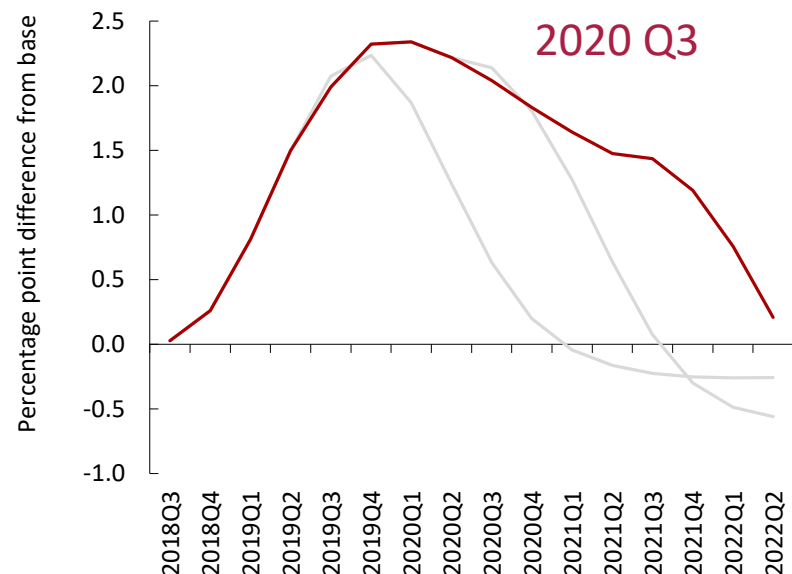
Succession of temporary shocks keep inflation elevated for longer.



What if combined shock is thought to be temporary but turns out to be persistent?

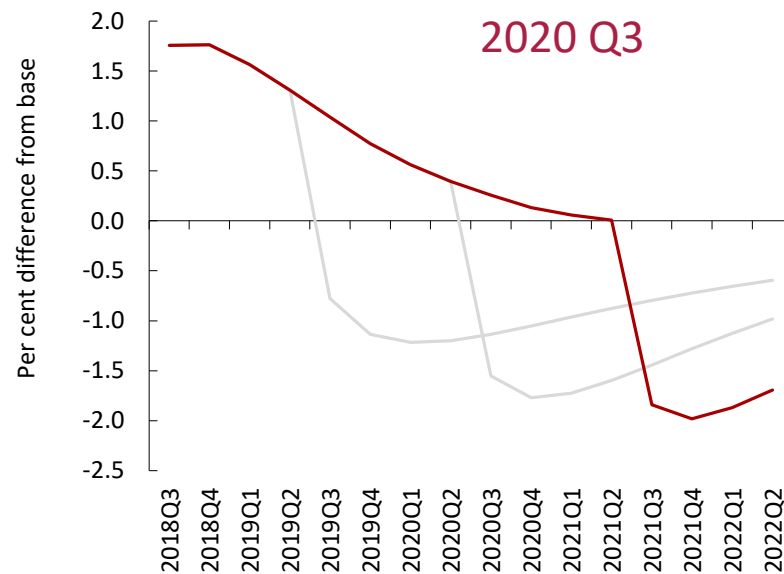
Inflation

Figure 12. Response of US inflation to more persistent shock



Output

Figure 13. Response of US output to more persistent shock



Dates show timing of new temporary shocks.

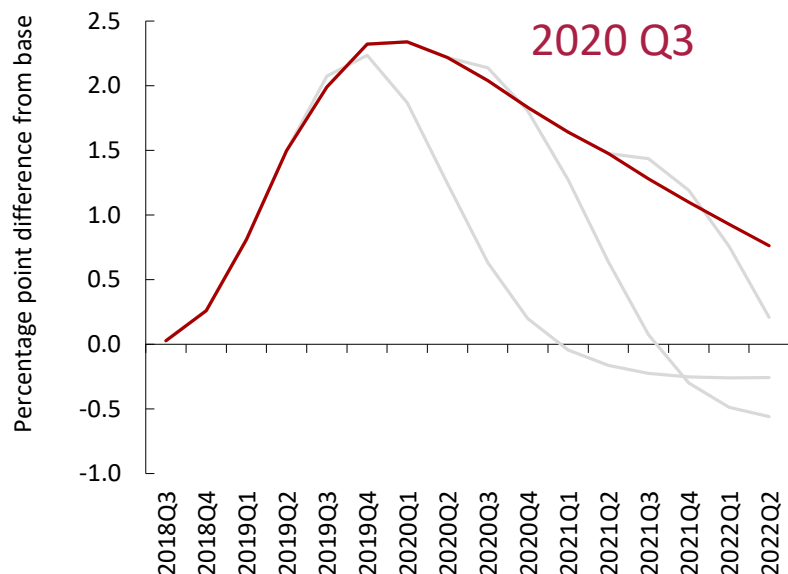
Succession of temporary shocks keep inflation elevated for longer.



What if combined shock is thought to be temporary but turns out to be persistent?

Inflation

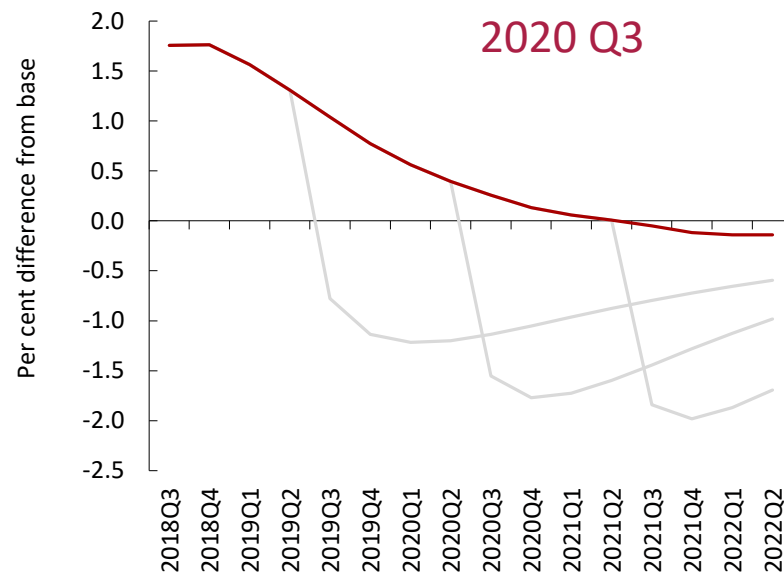
Figure 12. Response of US inflation to more persistent shock



Dates show timing of new temporary shocks.

Output

Figure 13. Response of US output to more persistent shock



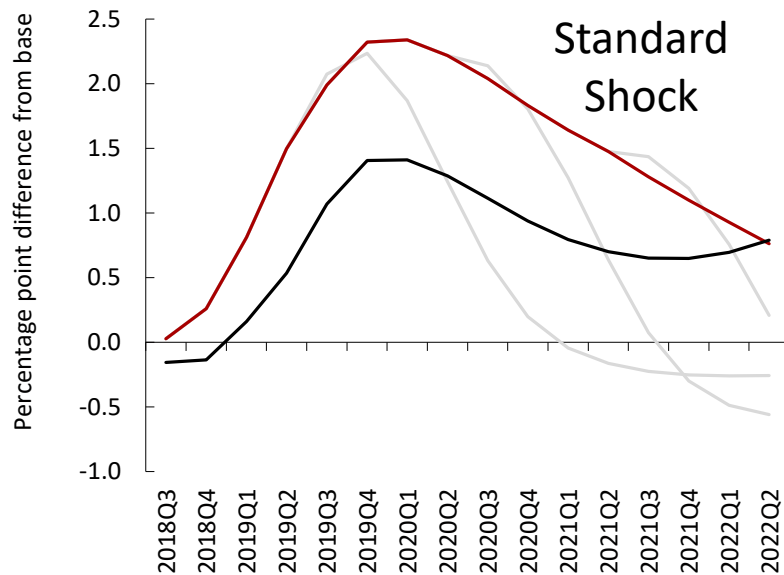
Succession of temporary shocks keep inflation elevated for longer.



What if combined shock is thought to be temporary but turns out to be persistent?

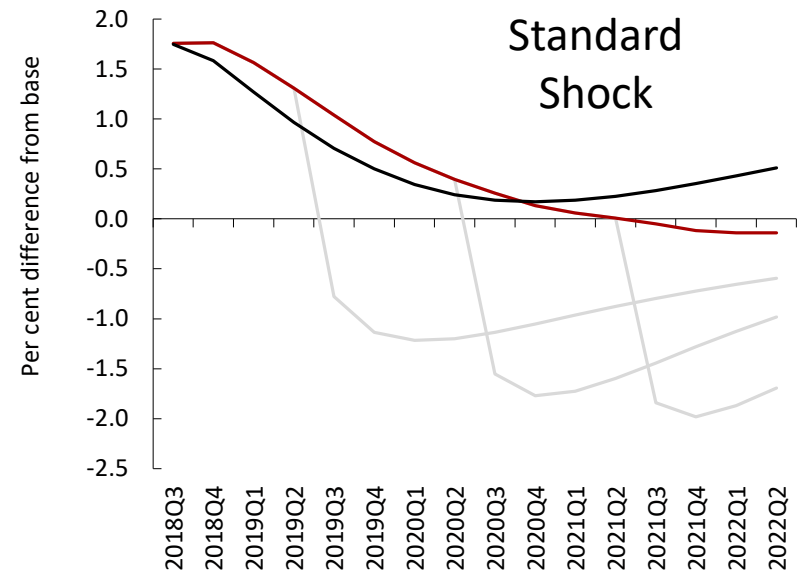
Inflation

Figure 12. Response of US inflation to more persistent shock



Output

Figure 13. Response of US output to more persistent shock



Dates show timing of new temporary shocks.

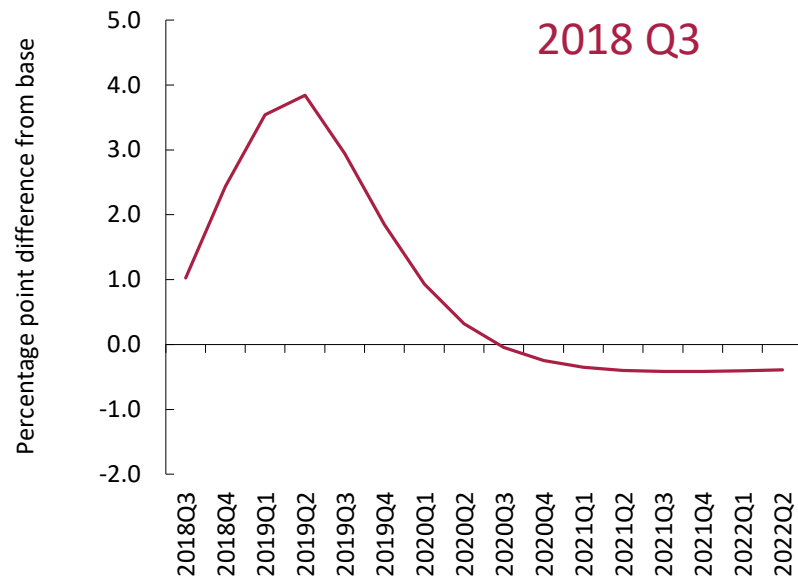
Succession of temporary shocks keep inflation elevated for longer.



What if combined shock is thought to be temporary but turns out to be persistent?

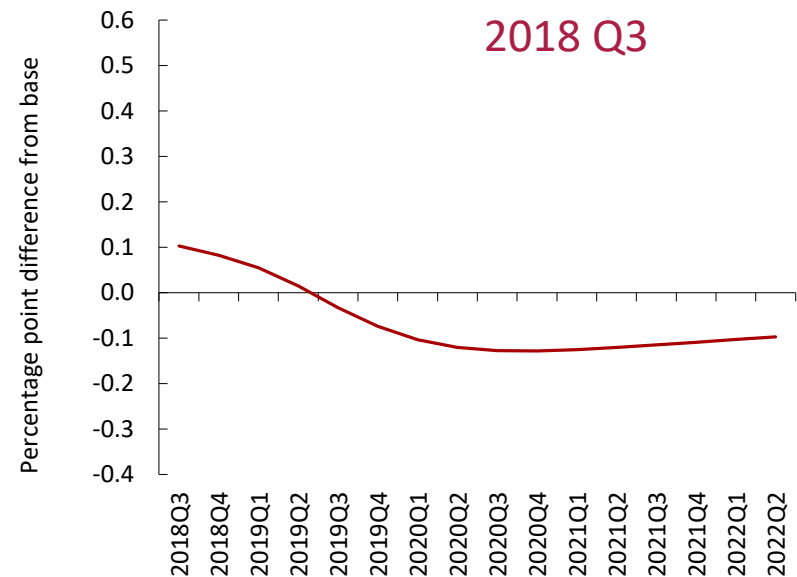
Short rate

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



Long rate

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



Dates show timing of new temporary shocks.

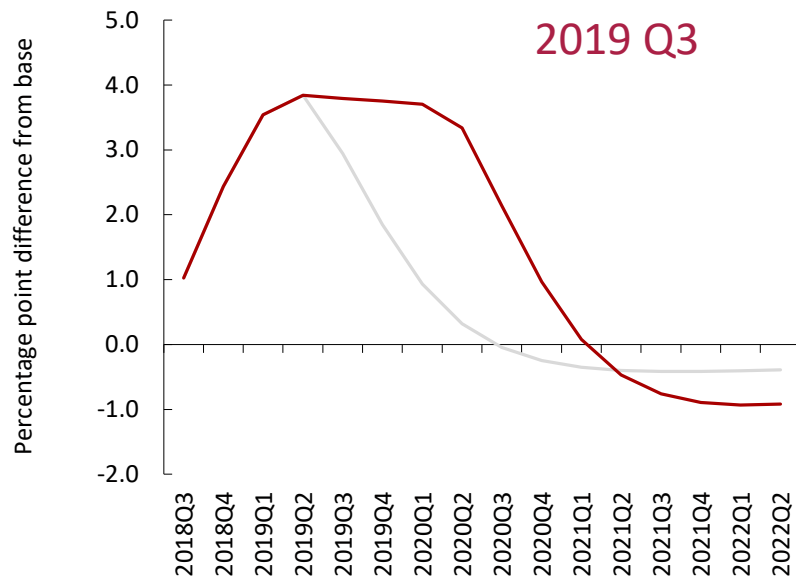
Succession of temporary shocks mean rise in short rates persists, but never reflected in long rates and so prevent transmission mechanism working effectively.



What if combined shock is thought to be temporary but turns out to be persistent?

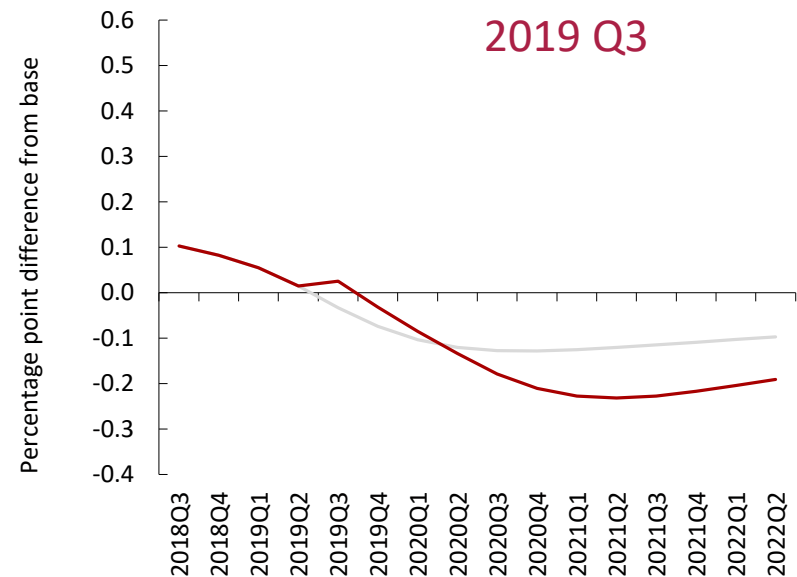
Short rate

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



Long rate

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



Dates show timing of new temporary shocks.

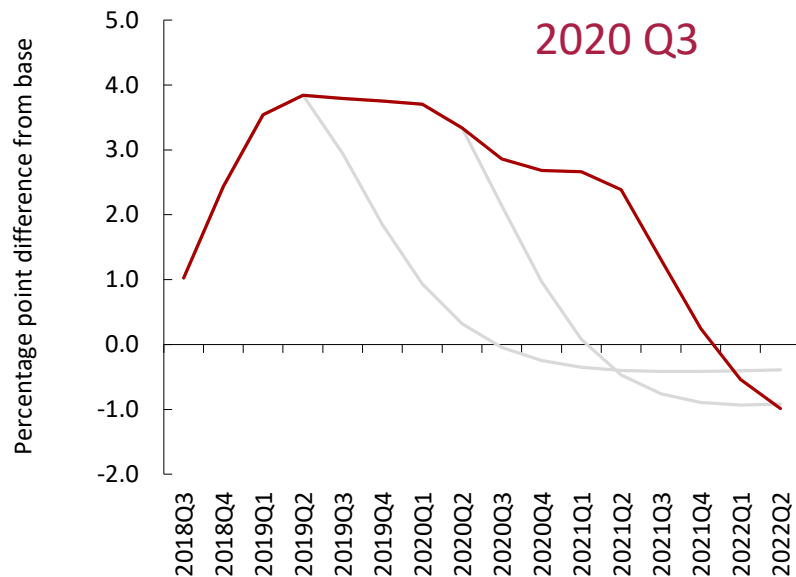
Succession of temporary shocks mean rise in short rates persists, but never reflected in long rates and so prevent transmission mechanism working effectively.



What if combined shock is thought to be temporary but turns out to be persistent?

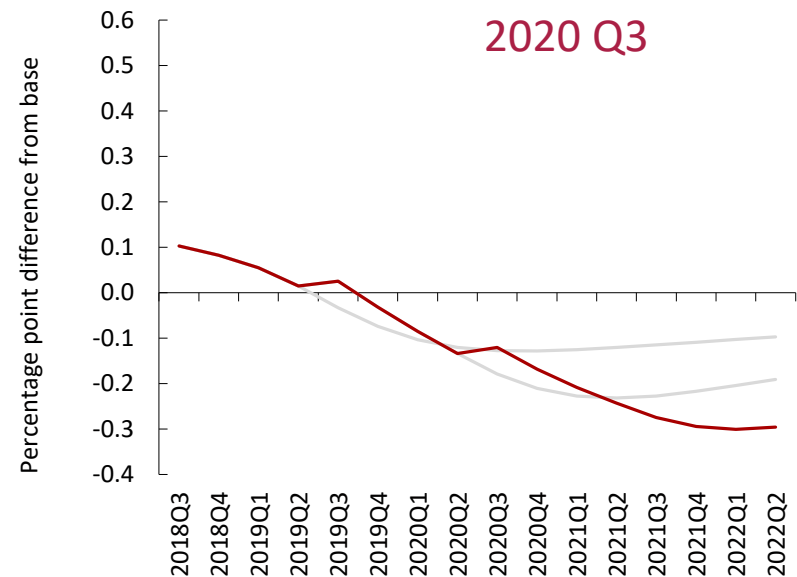
Short rate

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



Long rate

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



Dates show timing of new temporary shocks.

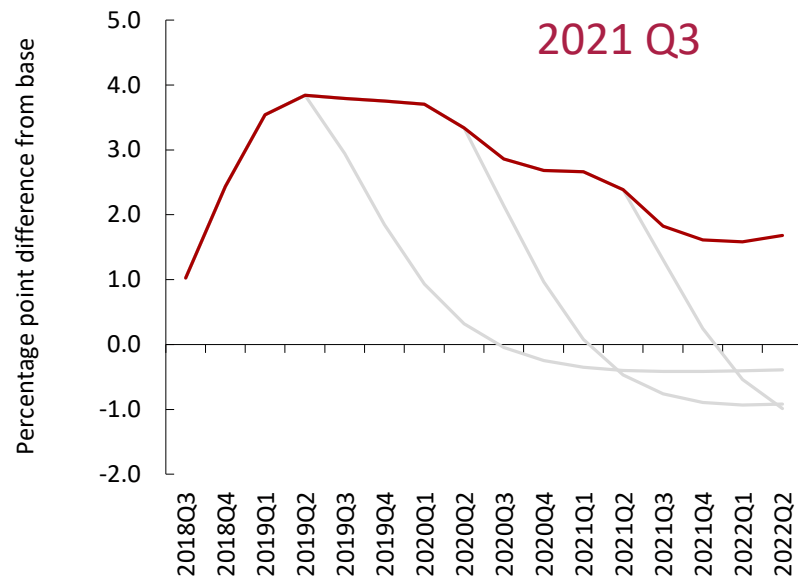
Succession of temporary shocks mean rise in short rates persists, but never reflected in long rates and so prevent transmission mechanism working effectively.



What if combined shock is thought to be temporary but turns out to be persistent?

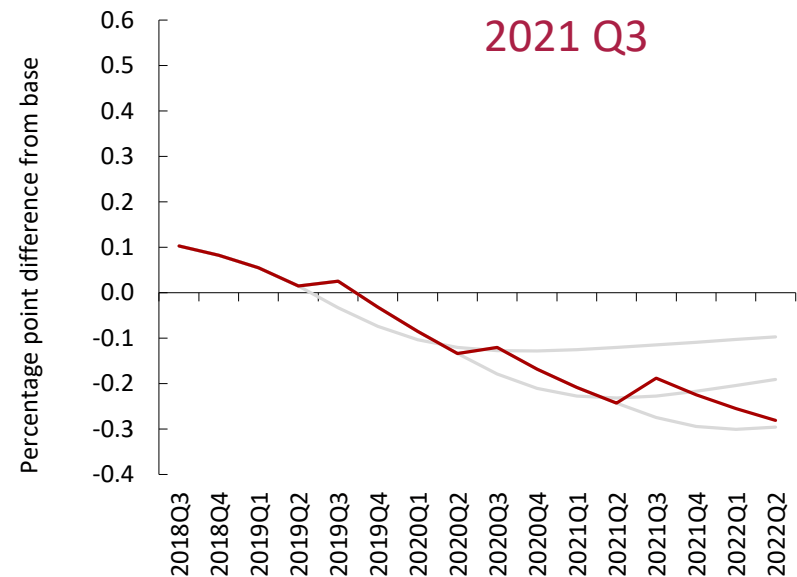
Short rate

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



Long rate

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



Dates show timing of new temporary shocks.

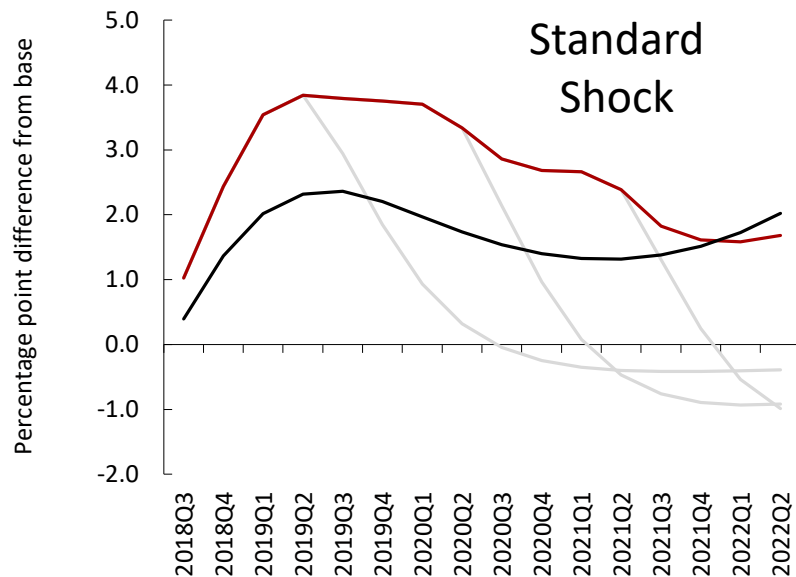
Succession of temporary shocks mean rise in short rates persists, but never reflected in long rates and so prevent transmission mechanism working effectively.



What if combined shock is thought to be temporary but turns out to be persistent?

Short rate

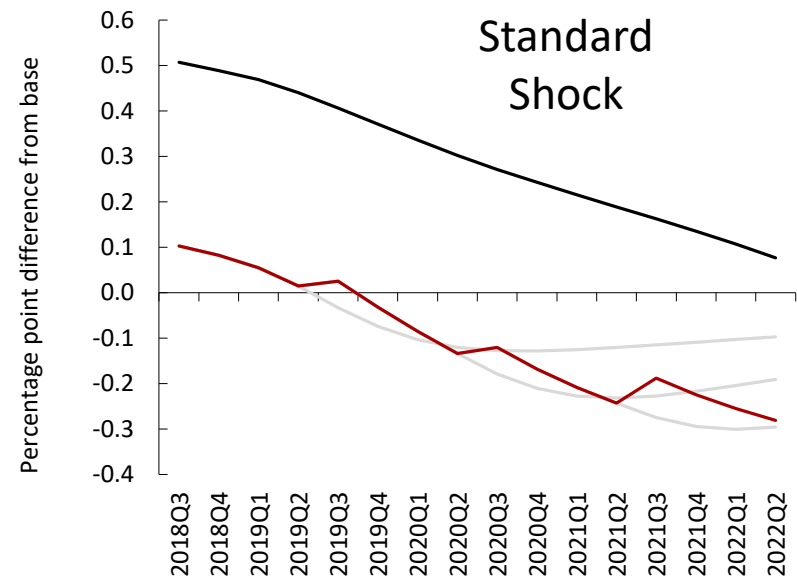
Figure 14. Response of US short rate to more persistent shock



Dates show timing of new temporary shocks.

Long rate

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



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



What might cause inflation to go up?

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



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.

