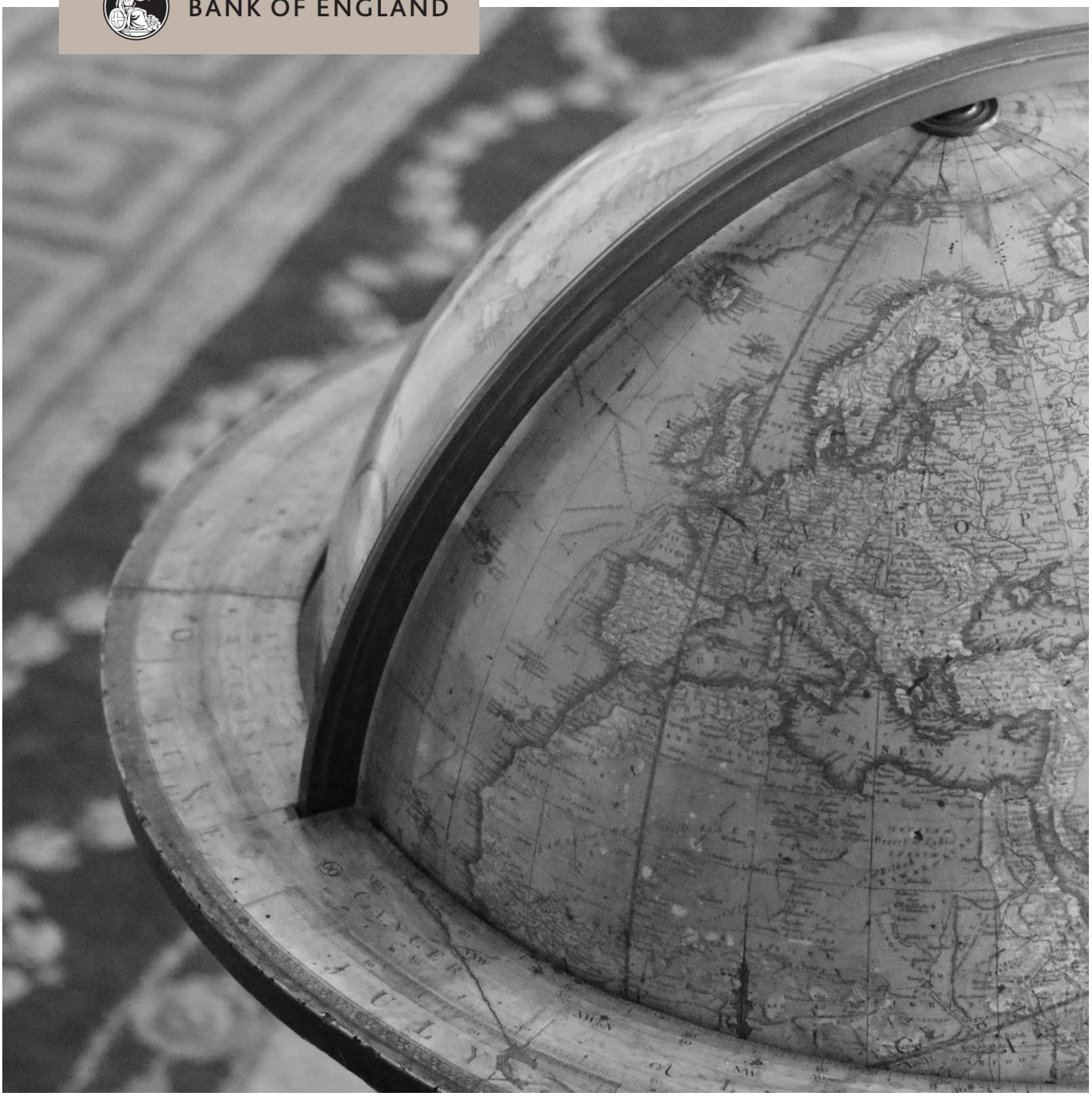
EU withdrawal scenarios and monetary and financial stability

A response to the House of Commons Treasury Committee

November 2018

BANK OF ENGLAND



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Executive Summary

The House of Commons Treasury Committee has requested that the Bank of England publish analysis of how leaving the European Union (EU) would affect its ability to deliver its objectives for monetary and financial stability.[1]

Brexit is unique. Large negative supply shocks are relatively rare, and there is no precedent of an advanced economy withdrawing from a trade agreement as deep and complex as the European Union.

As the United Kingdom's (UK) trading relationship with the EU changes, the reduction in openness will act to reduce the UK economy's productive capacity and in most scenarios its rate of growth in the short term. Leaving the EU abruptly, without a withdrawal agreement and implementation period, would amplify these effects.

The Bank will take all the necessary steps to achieve its objectives as the United Kingdom leaves the European Union, whatever form and path Brexit takes.

However, monetary and financial stability are necessary but not sufficient conditions for long term prosperity. The economic consequences of Brexit over the longer-term will depend on the nature of the UK's future trading relationships, other government policies, and ultimately the ingenuity and enterprise of the British people.

Analytical Foundations

As requested by the Treasury Committee, the report analyses the economic effects of the Withdrawal Agreement and the Political Declaration setting out the framework for the future relationship between the EU and the UK, as well as the consequences of leaving the EU without a Withdrawal Agreement.

This analysis includes scenarios not forecasts. The scenarios illustrate what could happen, not necessarily what is most likely to happen under a range of key assumptions.

Building the scenarios requires making key assumptions about the form of the new relationship between the UK and EU, the degree of preparedness across firms and critical infrastructure, and how macro policies respond.

The scenarios use established empirical economic relationships to quantify the impact of the assumptions and are constructed using the Bank's suite of macroeconomic models to ensure their coherence and plausibility.

The scenarios are only calculated for the policy relevant timelines of the committees - up to five years. As such, they are not assessments of the relative long-term merits of different trading relationships.

The degree of uncertainty around any forecast would be greater than the ranges provided in the report, given the usual uncertainty around other key influences on the outlook, such as shocks from the world economy, commodity prices, financial conditions and confidence.

However, the scenarios are informative about the *relative* economic impact of various economic relationships and transitions to them. The Monetary Policy Committee (MPC) and Financial Policy

[1] For more information: https://publications.parliament.uk/pa/cm201719/cmselect/cmtreasy/correspondence/chair-governor-boe-brexit-analysis-270618.pdf and https://www.parliament.uk/documents/commons-committees/treasury/Correspondence/181011-Chair-to-BoE-Brexit-Withdrawal-Agreement.pdf

Committee (FPC) have reviewed the relevant scenarios, and they will use them as inputs in their policy deliberations.

Key Economic Relationships

The impact of Brexit will depend on the direction, magnitude and speed of the effect of reduced openness on the UK economy.

Direction: The direction of the effects of a reduction in openness is clear: a weakening in both supply and demand, a lower exchange rate and higher inflation.

EU withdrawal has already had consequences for the economy, providing some evidence of the nature of the Brexit adjustment. Productivity growth has slowed, sterling has depreciated and the increase in inflation has squeezed real incomes. Early evidence from the forthcoming survey by the Bank's Agents[2] and from the next wave of the Decision Maker Panel surveys are consistent with these effects.

Magnitude: The magnitude of the economic impact of the underlying assumptions is modelled using established empirical economic relationships.

- Barriers that result in economies becoming less open result in lower trade and foreign direct investment.
- Reductions in trade and foreign direct investment tend to reduce productivity.
- Less open and less productive economies tend to have lower real exchange rates.
- Depreciations in the exchange rate tend to have large and protracted pass-through to consumer prices in the UK. Tax changes, such as tariffs, tend to be passed through to consumer prices more quickly.
- Slowdowns in the economy are often associated with tighter financial conditions and an increase in uncertainty. In turn, these weigh on demand.
- Weaker demand tends to increase the rate of unemployment and significant structural adjustment can increase the natural rate of unemployment.
- Weaker economic conditions tend to reduce net inward migration.

Speed of adjustment: Given the lack of precedents, there is uncertainty over the speed of adjustment to reduced openness. Empirical studies generally examine the effects of trade integration. The approach in this report assumes the magnitude of the effects of integration and de-integration on trade are symmetric. For the disruptive and the disorderly scenarios, "worst-case" assumptions that the effects of de-integration come through quickly are used. This approach is suggested by several cross-checks, including intelligence from the Bank's Agents:

- A range of evidence suggests that the impact of introducing frictions such as tariffs and customs checks at the border comes through quickly. A substantial number of firms have little experience with customs checks and, for many, business models and supply chain management could be significantly disrupted by delays at the border. Intelligence from the Bank's Agents suggests that uncertainty has deterred some companies from investing in preparatory actions, and it is likely that the corporate sector is generally not yet well equipped to cope were the UK to leave the EU without a transition period.

[2] The Bank's Agents are currently conducting a survey on business contacts' preparations for EU withdrawal. The survey results will be published on 4 December.

- The discrete nature of some non-tariff barriers means that they have the potential to have a rapid effect on trade. One example is in financial services where, if the relevant regulations do not allow for the service to be provided cross border, then the impact on the supply capacity of the economy may be immediate and coincident with the direct effect to demand.

- Sectoral evidence points to a need to reallocate capital and labour as patterns of production change in response to changes in the cost of trade. If resources are unable to move seamlessly this will quickly disrupt supply.

- The experience of New Zealand as it de-integrated from the UK following the loss of Commonwealth preferences in 1973.

The level of preparedness of businesses and infrastructure (such as ports, excise and customs systems and transport operations) will be important in determining how the economy adjusts to new barriers. The extent of any disruption at the border and to transport and financial services will depend on preparations made by firms, the authorities and on policy decisions yet to be taken by both sides. It is likely that the corporate sector is in general not yet well equipped to cope with a 'no deal' Brexit.

The speed of adjustment and the level of preparedness can have very significant effects on the overall economic impact of the move to a new trade regime. Allowing sufficient time for the authorities and firms to make the necessary adjustments reduces economic costs materially.

Scenarios

The Treasury Committee asked for the scenarios to be presented relative to the "present situation." This can be interpreted either: i) as the path the economy is currently on, represented by the MPC's most recent, November 2018, forecast; or ii) as the path the economy was on prior to the EU referendum, represented by the MPC's May 2016 forecast. Both are used as references for the various scenarios in the analysis that follows.

Economic Partnership under the Withdrawal Agreement and Political Declaration

These scenarios are most relevant for the MPC.

The Withdrawal Agreement and the Political Declaration could be consistent with different outcomes for the future relationship between the UK and EU. The two scenarios presented for the Economic Partnership differ in their underlying assumptions about trade barriers between the UK and the EU. Analysis of their economic effects is therefore based on various underlying trading assumptions with the EU, consistent with the broad terms of the agreed objectives and principles of the Economic Partnership.

In a scenario in which the UK retains a "Close Economic Partnership" with the EU including comprehensive arrangements for free trade in goods and some trade in business and financial services, there could be some recovery of output part of the way towards the May 2016 path over the five year period that is the focus of the Bank's statutory objectives. But in a scenario in which there is a "Less Close Economic Partnership" with the EU, customs checks and greater regulatory barriers to trade mean that output could fall below the November path and so further below the May 2016 path.

The estimated paths for GDP, CPI inflation and unemployment in the Economic Partnership scenarios are shown in **Charts A**, **B** and **C**. The range reflects the sensitivity to the key assumptions about the extent to which trade barriers rise, and how rapidly uncertainty declines. GDP is between 1¼% and 3¾% lower than the May 2016 trend by end-2023. Relative to the November 2018 *Inflation Report* projection, by end-2023 it is 1¾% higher in the Close scenario, and ¾% lower in the Less Close scenario. This is accompanied by a slightly lower level of unemployment relative to the *Inflation Report* in the Close scenario, and a slightly higher level in the Less Close scenario. In both the Close and Less Close scenarios, inflation is a little lower in

the near term reflecting the appreciation of sterling. Inflation then rises above the *Inflation Report* forecast in the Less Close scenario as customs barriers take effect from 2021.

No Deal No Transition Scenarios

These scenarios are most relevant for the FPC.

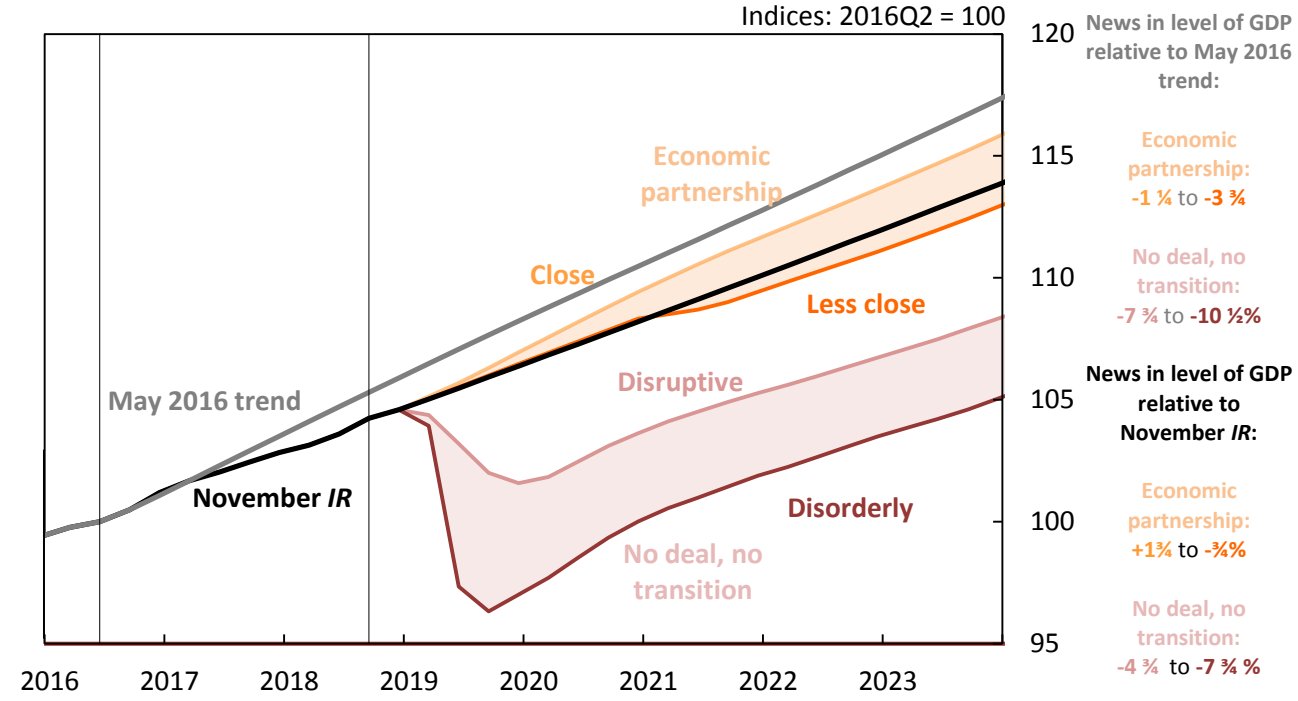
To assess the ability of the banking system to continue lending to households and businesses in the most adverse outcomes, the FPC has compared the scenario that banks were tested against in this year's annual stress test with a worst-case scenario that could be associated with a 'no deal no transition' Brexit. The "disruptive" and the "disorderly" Brexit scenarios are therefore not forecasts for the economy in the event that the UK leaves the EU with no deal and no transition period.

- In the disruptive scenario, tariffs and other barriers to trade between the UK and EU are introduced suddenly. No new trade deals are implemented within the five year period, but the UK replicates deals acquired by virtue of EU membership. While the UK recognises EU product standards, the EU does not reciprocate. The EU does not take action to address remaining risks of disruption to financial markets.

- In the disorderly scenario, on which the FPC has focussed given its remit for financial stability, the UK loses existing trade arrangements that it currently has with non-EU countries through membership of the EU. The UK's border infrastructure is assumed to be unable to cope smoothly with customs requirements. There is a pronounced increase in the return investors demand for holding sterling assets. There are spillovers across asset classes.

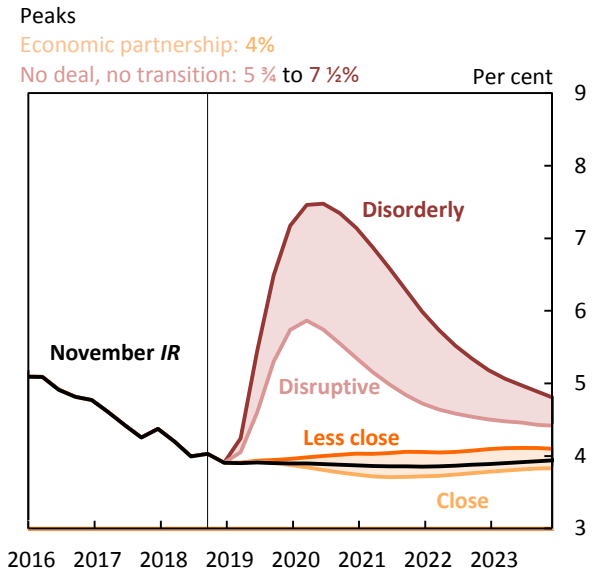
The estimated paths for GDP, CPI inflation and unemployment in the disruptive and disorderly scenarios are shown in **Charts A**, **B** and **C**. GDP is between 7¾% and 10½% lower than the May 2016 trend by end-2023. Relative to the November 2018 *Inflation Report* projection, GDP is between 4¾% and 7¾% lower by end-2023. This is accompanied by a rise in unemployment to between 5¾% and 7½%. Inflation in these scenarios then rises to between 4¼% and 6½%.

Chart A: GDP in EU withdrawal scenarios



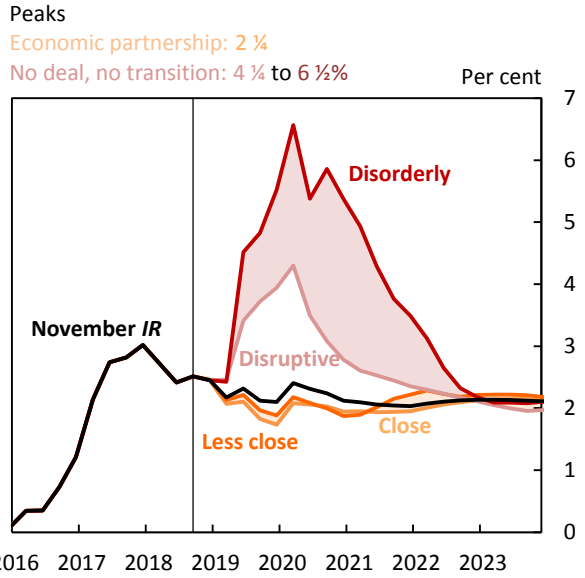
Sources: ONS and Bank calculations.

Chart B: Unemployment in EU withdrawal scenarios



Sources: ONS and Bank calculations.

Chart C: Inflation in EU withdrawal scenarios



Sources: ONS and Bank calculations.

Maintaining Monetary Stability

The outlook for inflation, growth and employment depends significantly on the nature of EU withdrawal, in particular: the form of new trading arrangements between the EU and UK; whether the transition to them is abrupt or smooth; and how households, businesses and financial markets respond.

There is little that monetary policy can do to offset supply shocks. Large negative supply shocks occur relatively rarely in advanced economies.

The implications of these developments for the appropriate path of monetary policy will depend on the balance of their effects on demand, supply and the exchange rate. The MPC judges that the monetary policy response to EU withdrawal, whatever form EU withdrawal takes, will not be automatic and could be in either direction.

Although the nature of EU withdrawal is not known at present, and its impact on the balance of demand, supply and the exchange rate cannot be determined in advance, under all circumstances, the MPC will respond to any material change in the outlook to bring inflation sustainably back to the 2% target while supporting jobs and activity.

Maintaining Financial Stability

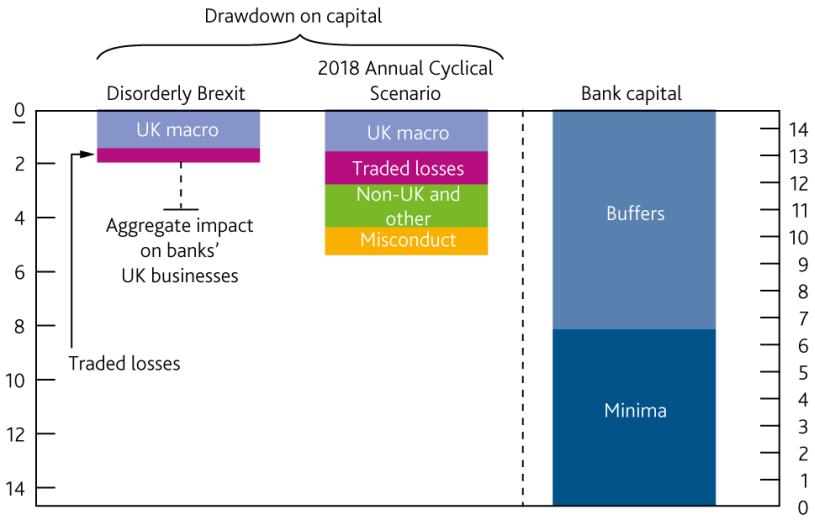
Securing an Implementation Period will minimise the near-term financial stability and economic risks of a disruptive withdrawal from the EU outlined above by providing time for authorities, infrastructure providers, financial and non-financial businesses time to address cliff edge risks.

The Bank of England - alongside other domestic authorities and financial companies themselves - has put extensive contingency plans in place to support institutional resilience and market functioning in the event that the UK leaves the EU without an implementation period.

The FPC judges that the UK banking system is strong enough to serve UK households and businesses even in a disorderly Brexit.

- The severity of the UK economic stress in the 2018 stress test which the major UK banks have passed is significantly greater than the economic scenario for Brexit based on ‘worst case’ assumptions (see **Chart D**).
- There is sufficient capital to absorb losses in a worst case Brexit.
- Major UK banks hold more than £1 trillion of high-quality liquid assets. In addition, banks have pre-positioned collateral at the Bank of England that would allow them to borrow a further £300 billion. The Bank is able to lend in all major currencies.

Chart D: Comparison of the impact of the disorderly Brexit scenario and 2018 ACS on major UK banks' capital ratios [(a)]



[(a)] See Section 5.2 for explanatory footnotes.
Sources: Participating banks' STDF data submissions, PRA regulatory returns, published accounts, Bank analysis and calculations.

Most risks of disruption to the financial services UK households and businesses use from the EU have been addressed, including through legislation by UK authorities that will allow EU firms to continue to serve customers in the UK.

Securing an implementation period will mitigate the near term financial stability risks. This Implementation Period should be as long as necessary to prepare properly for the new trading relationships. This will minimise impacts on financial stability, monetary stability and most importantly jobs and growth.

The UK is home to the world's leading international financial centre. At around ten times UK GDP by asset size, the scale, sophistication and degree of activity of the UK financial system is unmatched in other jurisdictions.

During the Implementation Period, current EU rules will apply in the UK as though the UK were still a member of the EU. On the basis of the legislation that is currently in the EU legislative process and the usually long lead times for new EU legislative proposals, the Bank assesses this risk to be manageable. The risk of legislation detrimental to the Bank's ability to meet its financial stability objective would however increase the longer the Implementation Period continues.

Looking beyond the Implementation Period, the UK Government plans to negotiate a relationship for financial services based on equivalence between the UK and EU. Equivalence would need to be expanded to cover a wider range of activities and to adopt a longer phase out period than is currently the case.

The financial stability impact of such a relationship will depend crucially on a number of key issues that will be the subject of future negotiations.

A deep level of supervisory cooperation would be commensurate with managing cross border financial stability risks, and allow an open financial system to flourish.

Irrespective of the particular form of the UK's future relationship with the EU, and consistent with its statutory responsibilities, the Bank of England will remain committed to the implementation of robust prudential standards in the UK. This will require maintaining a level of resilience that is at least as great as that currently planned, which itself exceeds that required by international baseline standards, as well as maintaining more generally the UK authorities' ability to manage UK financial stability risks.

Chapter 1 of this report sets out the Bank's objectives and how they relate to EU withdrawal. **Chapter 2** describes the analytical underpinnings of the economic analysis in this report, including the economic relationships and cross checks. **Chapter 3** describes scenarios based on the economic effects of the Withdrawal Agreement and Political Declaration, and of leaving the EU without a Withdrawal Agreement. **Chapter 4** describes the implications of EU withdrawal for monetary policy. **Chapter 5** describes the implications of EU withdrawal for financial stability. **Appendix A** contains analysis of a third scenario, requested by the Treasury Committee, in which the UK leaves the EU with no trade agreement at the end of a transition period. **Appendix B** contains a summary of external studies of the consequences of Brexit. **Appendix C** contains a summary of the assumptions used in the scenarios.

1 EU Withdrawal and the Bank of England's objectives

The House of Commons Treasury Committee has requested that the Bank publish analysis of how leaving the EU would affect its ability to deliver its objectives for monetary and financial stability.

1.1 Monetary stability

The Bank of England's monetary policy objectives are to maintain price stability, and, subject to that, support the economic policy of the Government. The Monetary Policy Committee (MPC) has responsibility within the Bank for formulating monetary policy.

The MPC's remit is to set monetary policy to achieve the Government's target of keeping inflation at 2%. The inflation target is symmetric and applies at all times. Subject to that, the remit also requires the MPC to support the economic policy of the Government, including its objectives for growth and employment.[3]

The remit for monetary policy recognises that the actual inflation rate may depart from its target from time to time. In exceptional circumstances, shocks to the economy may be particularly large or the effects of shocks may persist over an extended period. In such circumstances the MPC is likely to be faced with more significant trade-offs between the speed with which it aims to bring inflation back to the target and the consideration that should be placed on the variability of economic growth and employment. This most recently occurred in the period following the EU referendum when the MPC extended the horizon over which it returned inflation to target in order to provide support for the economy during a period of adjustment.

The outlook for inflation, growth and employment depends significantly on the nature of EU withdrawal, in particular: the form of new trading arrangements between the EU and UK; whether the transition to them is abrupt or smooth; and how households, businesses and financial markets respond.

As set out in Chapter 4 and in Box 4 of the November 2018 *Inflation Report*[4], the implications of these developments for the appropriate path of monetary policy will depend on the balance of their effects on demand, supply and the exchange rate. The MPC judges that the monetary policy response to EU withdrawal, whatever form EU withdrawal takes, will not be automatic and could be in either direction.

1.2 Financial stability

The Bank of England's financial stability objective is to 'protect and enhance the stability of the financial system of the United Kingdom'. By delivering this objective, the Bank ensures the UK financial system is able to serve UK households and businesses in bad times as well as good.

The Bank's overarching financial stability objective is implemented via:

- The Financial Policy Committee (FPC), which is the Bank's macroprudential authority. Its statutory responsibility is to identify, monitor, and take action to remove or reduce systemic risks with a view to protecting and enhancing the resilience of the UK financial system. Subject to achieving that, the FPC should act in a way that supports the economic policy of the Government, including its objectives for growth and employment.

[3] "Monetary policy remit: Budget 2018". Available here.
[4] "Box 4: The monetary policy response to Brexit", *Inflation Report November 2018,* p31-32. Available here.

- The Prudential Regulatory Authority (PRA), which is the Bank's microprudential authority. Its general objective is to promote the safety and soundness of the firms it regulates, including banks, building societies, credit unions, designated investment firms and insurers, and to secure an appropriate degree of protection for insurance policy holders. The Prudential Regulation Committee, as the decision-making body of the PRA, has a secondary objective to facilitate effective competition.

- The Bank's supervision of Financial Market Infrastructures (FMIs), executed via the FMI Board. The Bank undertakes supervision of FMIs with a view to protecting and enhancing the stability of the financial system.[5]

- The Bank's responsibility as the resolution authority for the United Kingdom. The Bank's role is to develop a strategy for how it would manage the failure of every bank, and enabling a failing bank's critical functions to continue when in resolution.[6]

Consistent with its statutory responsibilities, since the EU referendum in 2016 the Bank – and the FPC in particular – has worked to identify risks of disruption to the financial system that could arise from Brexit. This work has underpinned preparations, contingency planning, and actions being taken to mitigate those risks.

Identifying potential risks of disruption has required focusing on outcomes that would have greatest potential impact on financial stability, however unlikely they may be. In this context, the FPC in particular has considered the risks that could arise under a disorderly Brexit scenario, in which the UK's relationship with the EU moves abruptly to default World Trade Organisation (WTO) rules, without an implementation period.

As a result of this work, the FPC judges that the UK banking system would be strong enough to continue to serve UK households and businesses even in the event of a disorderly Brexit. The FPC judges that the UK economic scenario in the 2018 stress test was sufficiently severe to encompass the economic shock in the disorderly Brexit scenario (set out in Chapter 3).

Since November 2017, the FPC has published a checklist of actions that would mitigate risks of disruption to important financial services used by households and businesses to support their economic activity. Most risks of disruption to the financial services that EU firms provide to UK households and businesses have been addressed, including through legislation. Further UK legislation, currently in train, will need to be passed to ensure the legal framework for financial services is fully in place ahead of Brexit.

Irrespective of the particular form of the UK's future relationship with the EU, and consistent with its statutory responsibilities, the FPC will remain committed to the implementation of robust prudential standards in the UK. This will require maintaining a level of resilience that is at least as great as that currently planned, which itself exceeds that required by international baseline standards, as well as maintaining more generally the UK authorities' ability to manage UK financial stability risks.

[5] The Bank's approach to FMI supervision is set out here.
[6] The Bank's approach to resolution is set out here.

2 Analytical foundations

This chapter sets out the framework used in the report. It is described schematically in **Figure 2.A**. It separates the various assumptions made in each scenario from the established economic relationships used to process these assumptions. Supported by evidence from other sources, the assumptions and economic models are used in combination to produce the results for each scenario. Those results involve outcomes both for the macro-economy, in orange, and for the financial system, in red.

The main assumptions concern the detailed trading relationships involved in each scenario. The nature and extent of any increase in trade barriers will be a key determinant of the economic impact of EU withdrawal on the UK economy over the medium and longer term. There is a range of different trade barriers that might emerge in different scenarios – including tariffs, customs checks and other non-tariff barriers.

Over the shorter term another critical factor is the extent to which businesses and UK infrastructure are prepared for a sudden change in trading arrangements. In the face of such a change the extent of disruption at the border, and to transport and financial services, will depend on the state of readiness of the firms involved and of border infrastructure. Survey and other evidence suggests that many UK businesses are not well advanced in planning for a sudden transition to new trading rules or, where such plans exist, in their implementation. A transition or implementation period is required to allow firms to make the necessary changes consistent with the UK's new relationship with the EU in an orderly way.

This report makes a range of assumptions about key variables such as the extent of trade barriers and the level of preparedness to establish the scenarios requested by the Treasury Committee. It then uses established empirical relationships to trace out the economic impact of these assumptions.

The most relevant relationship is that between openness and productivity. This is well established in economic theory and in empirical studies. Openness to trade in goods and services affects productivity by facilitating competition, innovation and specialisation. Greater foreign direct investment also tends to boost productivity, partly because incoming firms tend to be more productive but also because they improve the productivity of existing domestic businesses in the same part of the economy.

There is no precedent of an advanced economy withdrawing from a trade agreement as deep and complex as that which the UK has with the EU. Given the lack of precedent there is uncertainty over the speed of adjustment to trade de-integration. The approach in this report assumes the magnitude of the effects of integration and de-integration are symmetric, but allows for the possibility that the effects of de-integration could take effect more quickly. This assumption is grounded by several cross checks, including intelligence from the Bank's Agents.

One of the channels through which a reduction in openness will affect productivity is through the need to reallocate capital and labour as production shifts away from the goods and services the UK has been exporting to the EU, and towards those it has been importing. Analysis of the sectors which are most exposed to a change in the UK's trading relationship with the EU, intelligence from the Bank's Agents, and sectoral models of the economy, have all been used to cross-check the aggregate impact of a change in openness on the economy.

Empirical relationships can also be used to model the way in which these changes in trading relationships flow through the economy. These channels include uncertainty, financial conditions, the exchange rate and migration.

2.1 Framework

The framework used in this report to analyse how a number of Brexit scenarios could affect the Bank of England's ability to deliver its objectives for monetary and financial stability is set out in **Figure 2.A**.

There remains uncertainty over the exact form of Brexit and, therefore, to model its effects requires a set of assumptions. The required assumptions cover the form of the future trading arrangements between the UK and EU; the degree of preparedness across firms and critical infrastructure; the negotiation of new trade deals; migration policy; the change in financial conditions; the change in uncertainty; and how other policies respond (green box in **Figure 2.A**). Important aspects of the future economic partnership – such as the extent of market access and the application of checks and controls at the border – are still to be negotiated. In scenarios in which the UK's trading relationship reverts to WTO terms, the extent of disruption at the border and to transport and financial services will depend on whether there is an implementation period, the extent to which that allows preparations by firms and critical infrastructure, and how other policies respond. There is a range of assumptions and, therefore, a swathe of outcomes for each scenario.

It is important to understand what these swathes represent. In practice, the evolution of the economy as the UK leaves the EU will depend not only on these assumptions, but also on other factors affecting the UK and the global economy at the time. The scenarios are not forecasts and the swathes do not represent the range of possible outcomes arising from the more usual uncertainties, unrelated to EU withdrawal, involved in economic forecasts. They are designed to illustrate the sensitivity of outcomes to the various assumptions made at the start. That said, these more commonplace factors – the strength of the global economy over the forecast period, for example – would affect the economic outcomes in each scenario in the same manner and to broadly the same extent. So even if there is more uncertainty than the swathes convey about absolute outcomes for the economy, the swathes are still useful to convey the differences between the various scenarios.

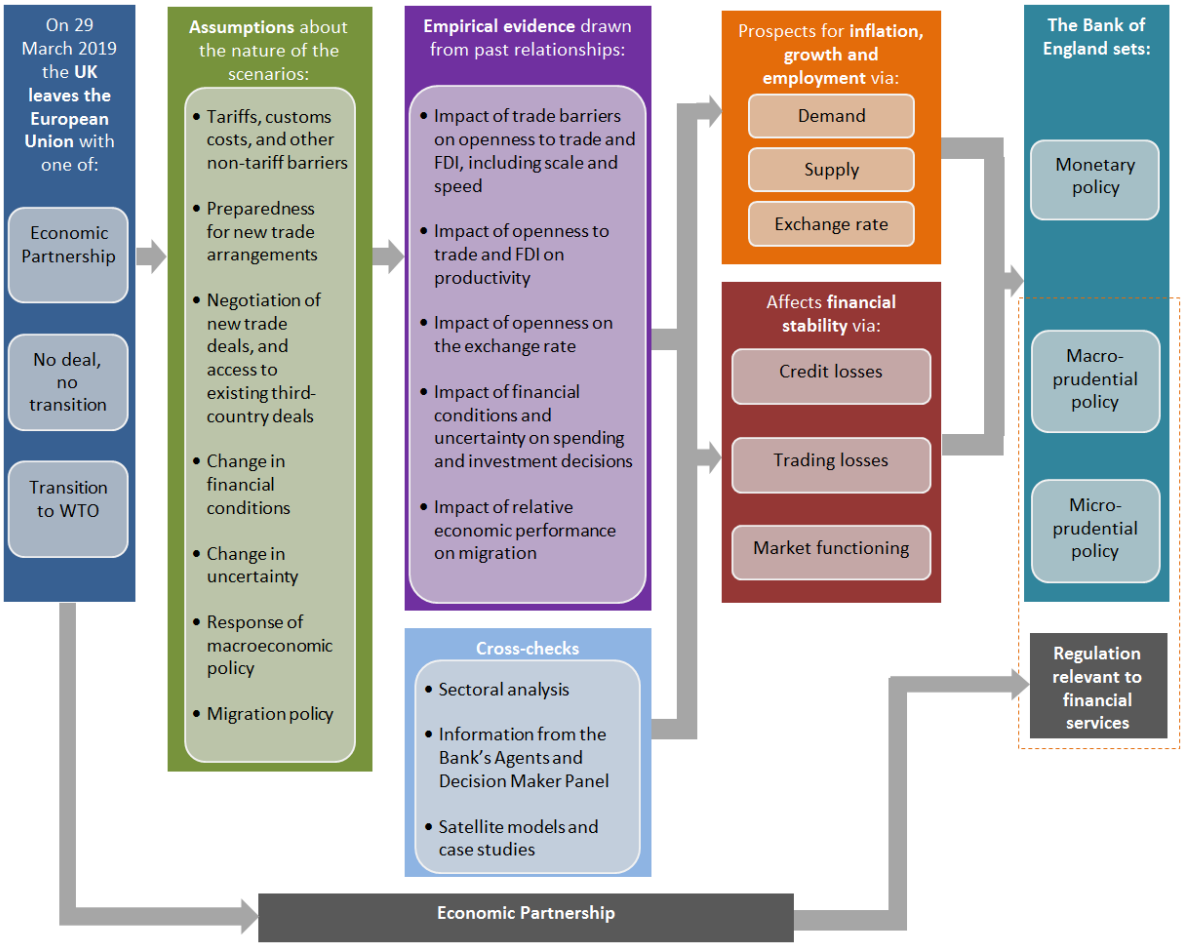
The economic consequences of different scenarios can be modelled using established empirical relationships (the purple box in **Figure 2.A**). Studies of decades of liberalisation document a strong, positive relationship between a country's openness to trade and foreign domestic investment and its productivity. The approach in this report assumes the magnitude of the effects of integration and de-integration are symmetric, but allows for the possibility that the effects of de-integration could take effect more quickly. Empirical relationships can also be used to model the impact of these changes in trading relationships as they flow through the economy. The channels include the impact of uncertainty, financial conditions, the exchange rate and migration.

A number of cross checks are used to inform the aggregate relationships (described in the light-blue box). One of the channels through which a reduction in openness will affect productivity is through the need to reallocate capital and labour as production shifts away from the goods and services the UK has been exporting to the EU, and towards those it has been importing. Analysis of the sectors which are most exposed to a change in the UK's trading relationship with the EU, intelligence from the Bank's Agents, sectoral models of the economy, and case studies can all be used to cross-check the aggregate impact of a change in openness on the economy and the speed with which it occurs.

Given the underlying assumptions and established economic relationships, outcomes for the economy are produced using the Bank of England's suite of macroeconomic models (the orange box). This ensures that the overall scenarios are coherent and respect general equilibrium relationships.

The underlying assumptions and outcomes will also have implications for financial stability through credit losses, trading losses and market functioning (the red box). The nature of the UK's relationship with the EU will also have implications for financial stability through the nature of market access and the degree of flexibility to set standards and undertake judgement-led supervision. This is shown in the black boxes.

Figure 2.A: The channels through which the future relationship between the UK and EU affects the achievement of the Bank of England's objectives



The remainder of this chapter proceeds as follows. Section 2.2 describes the assumptions that are used to characterise the scenarios and why these matter for economic outcomes. Section 2.3 then documents the empirical relationships that are drawn on to model the impact of these assumptions on the economy.

2.2 Assumptions needed to characterise Brexit

Assessing Brexit scenarios requires making assumptions about the future relationship between the UK and EU; the degree of preparedness across firms and critical infrastructure; the negotiation of new trade deals; the change in financial conditions; the change in uncertainty; how other policies respond; and migration policy (green box in **Figure 2.A**). The text below discusses each of these key assumptions in turn. The details of the assumptions used in each scenario are then described in Chapter 3.

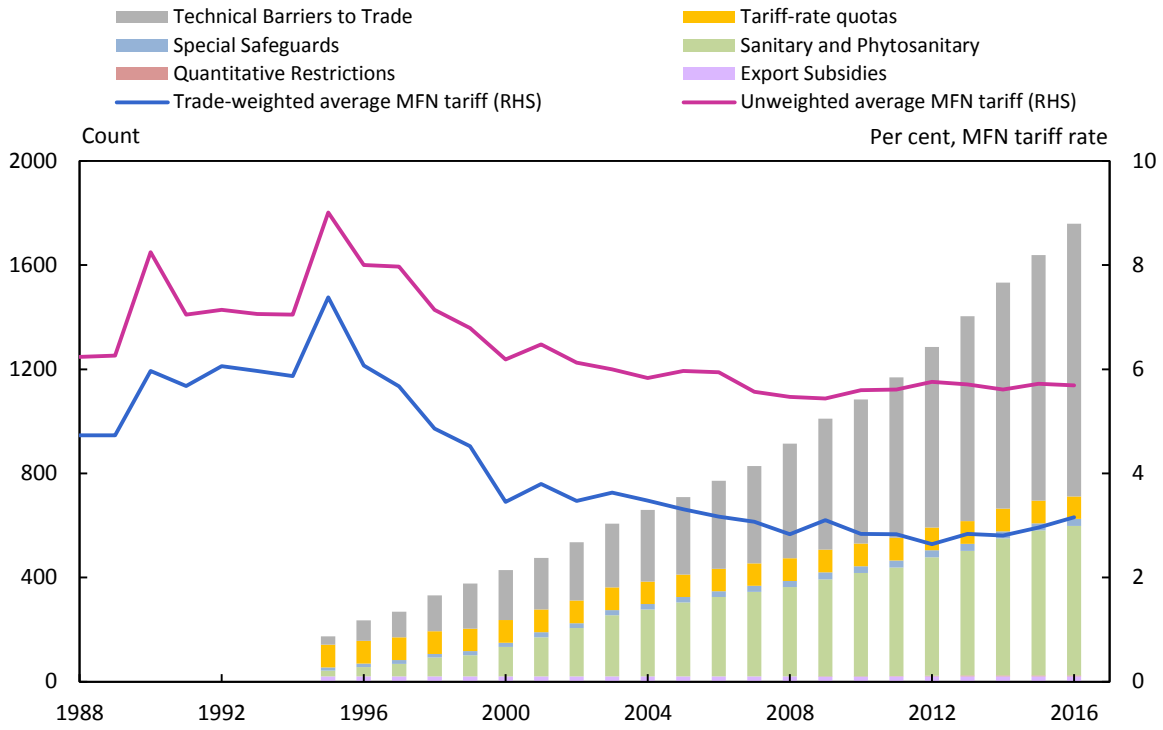
2.2.1 Trade barriers

The EU Single Market has substantially reduced trade costs between its members and other countries by removing tariffs on goods trade within the EU, reducing non-tariff barriers to trade within the EU, and

providing access to markets beyond the EU through common Free Trade Agreements (FTAs) with third countries.

The UK's withdrawal from the EU will reduce access to the EU market through higher trade barriers. **Chart 2.2.1** shows the evolution of EU tariffs and the number of non-tariff measures for the EU over time, indicating that whilst the former have dropped significantly, the latter have increased (similar to the pattern in other advanced economies, such as the United States).

Chart 2.2.1: EU trade barriers over time show the rising importance of non-tariff barriers



Sources: WTO I-TIP database, World Bank and Bank calculations.

Leaving the European Union has the potential to change both tariffs and non-tariff barriers to trade with the EU, as well as the potential to change trading arrangements with the rest of the world if the UK loses access to trade agreements that it had by virtue of being an EU member.

2.2.2 Tariffs

Tariff rates on UK imports and exports may change after leaving the EU. If the Withdrawal Agreement is signed and the UK agrees a new Economic Partnership with the EU, and if it rolls over existing trade agreements with third countries, tariffs would remain largely unchanged. If no Withdrawal Agreement is signed and the UK fails to replicate the EU's existing trade agreements, UK exports to the EU and to countries with which the EU currently has a trade agreement would then face the Most Favoured Nation (MFN) tariff rates that the EU and these countries apply.

For imports into the UK the UK Government will have to decide on its MFN tariff schedule. These will be the rates applied to imports from all countries that do not have a trade agreement with the UK. The UK submitted a draft schedule for its 'bound' tariff rates on 23 July 2018 – the upper limit on MFN rates than can be charged on imports from members of the WTO. These rates match current EU tariff rates. The UK Government has not yet decided the MFN tariff rates that will apply in practice within this upper limit. In scenarios where tariffs would be applied, the analysis adopts the status quo assumption that UK MFN tariff rates will match the current EU MFN tariff rates.

Tariff rates affect the economy by changing the prices of exports and imports. A simple unweighted average of EU MFN tariff rates was 5.7% in 2016. The trade-weighted-average MFN tariff rate, with weights given by the share of each good imported in overall imports, was lower – at 3.2 per cent, as shown in Chart 2.2.1.[7]

2.2.3 Non-tariff barriers

Under any of the Brexit scenarios set out in this report, the UK will face greater non-tariff barriers (NTBs) on its trade with the EU. NTBs are measures other than ordinary price-based customs tariffs that restrict international trade. NTBs include 'at the border' measures such as customs checks, including for compliance with rules of origin requirements. They also include 'behind the border' measures such as regulatory barriers and product standards. These include sanitary and phytosanitary rules (e.g. restrictions for substances, hygienic requirements, measures for preventing dissemination of disease and related to food safety), technical barriers to trade (e.g. labelling and certification), non-technical measures such as measures to protect intellectual property and rules on public procurement, and other measures aimed at creating a level playing field between imports and domestically-produced goods and services.

Quantifying NTBs is a challenge because of their heterogeneous nature and because of the difficulty of constructing comprehensive measures. Research on international trade has developed techniques to estimate an *ad-valorem* tariff equivalent (AVE) of NTBs. These can be interpreted as the tariff rate that would have an equally restrictive effect as the NTBs in question. This enables a comparison between the restrictiveness of NTBs and tariffs and their impact on trade.

Studies (e.g. Anderson and van Wincoop, 2004, Kee et al., 2009) suggest that many NTBs are at least as restrictive as tariffs and exert a higher drag on trade. That is in part, because tariffs have been gradually eroded over a long period of successive trade negotiations (Vandenbussche and Zanardi, 2008). Kee et al. (2009) find that the average AVE of NTBs can be as high as 48%, and find that existing NTBs almost double the level of trade restrictiveness imposed by tariffs. A report by UNCTAD (2012) argues that non-tariff measures contribute much more than tariffs to overall trade restrictiveness.

NTBs are particularly important because they have the potential to have a rapid effect on trade. This is because the discrete nature of some barriers means an exporter can either supply the goods or services, or they cannot. One example is financial services, where if the relevant regulations do not allow for the service to be provided across borders, then the NTB could impact on trade immediately and fully following the UK's exit from the EU. Similarly, under current regulations some services – such as broadcasting – cannot be exported to the EU without direct authorisation within member states. As discussed later, the speed at which some barriers may be introduced has implications for how fast these barriers affect the supply capacity of the economy.

2.2.4 Third country and new trade deals by virtue of EU membership

As a member of the EU, firms in the UK are able to export to third countries under the EU's negotiated trade deals. There are over 40 such agreements covering around 90 countries. Examples include FTAs with South Korea, Mexico and Canada, and the customs union with Turkey. Taken together, countries with which the EU has an FTA that has been fully implemented account for 10% of total UK goods trade. An

[7] Bank of England calculations on World Bank Data. In calculating the average MFN rate, specific duties are converted into ad-valorem equivalent rates by dividing the specific duty by the average unit price (calculated as import value divided by import volume). The unweighted average covers all products subject to tariffs calculated for all traded goods. Data are classified using the Harmonized System of trade at the six- or eight-digit level. Tariff line data were matched to Standard International Trade Classification revision 3 codes to define commodity groups.

additional 7% of UK goods trade is with countries with which the EU has partially implemented or pending trade agreements such as Japan and Singapore.

The UK Government is currently negotiating for these deals to be rolled over so that they continue to apply after the UK leaves the EU. It is unclear how long this will take. Typically trade deals are negotiated and implemented over several years. The US has taken an average of almost four years to negotiate and implement its trade deals;[8] the recent agreement between the EU and Japan required four years to negotiate and is expected to take two years to implement;[9] and the Comprehensive Economic and Trade Agreement (CETA) between the EU and Canada took more than eight years from the beginning of negotiations to the provisional start date, and two years to ratify and implement.[10] This case is different, because the UK Government is seeking to maintain terms that already exist by virtue of the UK's membership of the EU. However, some third countries have already raised concerns about being disadvantaged if these deals are rolled over on current terms, for example over the extent of tariff rate quotas (these are the quotas that allow firms to export up to the quota level at a tariff free rate). Discussions on the extension of these deals are ongoing.

2.2.5 Preparedness for EU withdrawal

A full adjustment to the change in the UK's trading relationship will inevitably take time. To one extent or another, the economy will be required to shift resources away from areas that export to the EU, and towards those where the UK imports from the EU or exports to non-EU countries. The resources and jobs involved will take time to move and are in many cases specialised.

There are also shorter-term considerations, involving the degree of preparedness for any sudden change in trading relationships, which will have an important bearing on how the economy behaves. The extent of disruption at the border and to transport and financial services will depend on the extent of preparations made in advance by firms and in critical infrastructure.[11] HMRC estimates that between 145,000 and 250,000 trading firms who have not previously completed a customs declaration will need to do so in the event of no deal. In September 2018, the Border Delivery Group reported that 11 of 12 major projects to replace or change key border systems were at risk of not being delivered on time and to acceptable quality by 29 March 2019.[12] To the extent that firms and infrastructure are not well prepared, at-the-border frictions could have a relatively rapid effect on economic activity.

In principle, if sufficient preparations are made for the UK leaving the EU, some of these effects on the economy could be mitigated. For example, with sufficient time, preparations could be made to:

- Upgrade customs infrastructure and introduce the systems required to efficiently complete the necessary checks and procedures on EU trade at the border;
- Restructure outstanding financial contracts, particularly derivatives, to resolve potential contractual continuity issues; and
- Allow firms to reapply for the necessary licenses, certifications of compliance with regulatory standards and changes to their organisational structure required for them to continue to sell goods and provide services to EU customers.

[8] See https://piie.com/blogs/trade-investment-policy-watch/how-long-does-it-take-conclude-trade-agreement-us
[9] See http://ec.europa.eu/trade/policy/in-focus/eu-japan-economic-partnership-agreement/
[10] See http://researchbriefings.files.parliament.uk/documents/CBP-7492/CBP-7492.pdf
[11] See https://publications.parliament.uk/pa/cm201719/cmselect/cmpubacc/1657/1657.pdf
[12] See the National Audit Office report, 'The UK border: preparedness for EU exit'.

Appendix A explores a 'Transition to WTO' scenario, as requested by the Treasury Committee, which highlights the economic benefits of preparedness, and conversely the costs of not being ready to leave the EU.

The Bank's Agents, who have regular contact with businesses across the UK, have been monitoring firms' preparedness for the UK's departure from the EU (**Box 2A**). Thus far, it is unclear how comprehensive contingency planning by companies for a 'no-deal' Brexit is. While a growing proportion of contacts say they have prepared plans, only some of those plans have begun to be implemented. It is likely that the corporate sector is in general not yet well equipped to cope with a 'no-deal' Brexit.

Other surveys reach similar conclusions, particularly among smaller businesses. A survey by the Chartered Institute of Procurement and Supply (CIPS) found that 22% of companies were working on implementing their Brexit plan. A Federation of Small Businesses (FSB) survey found that only 14% of small businesses had started planning for a no deal Brexit. A Confederation of British Industry (CBI) survey found that 41% of companies had carried out some of their contingency plans, but only 2% of businesses had carried out all of them.

The latest data from the Bank's Decision Maker Panel (DMP) indicate that senior management in companies are spending more time planning for Brexit than a year ago. Three quarters of firms reported that their CFO or CEO was spending some time on preparing for Brexit at the moment compared to 60% a year ago. The amount of time spent planning for Brexit was also reported to have increased, for example 37% of firms reported their CFO spending more than an hour a week planning for Brexit compared to 19% a year earlier.

Contingency plans often involve stockpiling of goods imported from the EU. A CBI survey suggests that nearly 44% of businesses are planning to stockpile goods in the future, while 15% have already done so. Consistent with this, the Bank's Agents report only limited stockbuilding so far, with many firms planning to do so through Q4 and in the New Year. A study by the Centre of Economics and Business Research (CEBR) estimated that three months' worth of stockpiled raw material and semi-manufactures usually imported from the EU, plus one month's worth of finished manufactures, would require £34bn in additional imports before 29 March.

The evidence on preparedness indicates strongly the desirability of a transition or implementation period, after the exit terms are determined, to allow firms and authorities to make the necessary preparations.

Box 2A: UK companies' preparedness for EU withdrawal: evidence from the Bank's Agents

The Bank's Agents are currently conducting a survey on business contacts' preparations for EU withdrawal. The full survey results will be published on 4 December. This box summarises the early results and recent intelligence.

In recent months, Agents' contacts have increasingly referenced Brexit as a source of uncertainty. Businesses report considerable uncertainty about both the likelihood and implications of a no-deal exit, and about the nature of the trading arrangements that might follow a more orderly transition to EU withdrawal.

While a growing proportion of contacts have said they have prepared contingency plans, only some of those plans have begun to be implemented. Other surveys have made similar findings.

In part, this reflects caution by contacts about committing cashflow to preparatory actions until it is absolutely necessary. And a number of contacts have said that they need more clarity on the potential Brexit outcome before taking concrete actions.

For those companies that are making preparations, plans can be grouped into three broad categories: legal and contractual preparations; plans relating to production and stocks; and financial preparations. These are explained in more detail below.

Legal and contractual preparations

These include actions such as establishing subsidiaries elsewhere in the EU in order to comply with regulations, for example on product registration or technical testing. A number of contacts are applying for Authorised Economic Operator status. However, contacts report that the approval process is lengthy and costly, so may only be helpful in the longer term.

Plans relating to production and stocks

Companies that are considering how to prepare for Brexit mostly expect to do so by building up stocks of goods. In large part, stockbuilding will be undertaken as a contingency for goods being delayed at the border.

In most cases, companies are considering building stocks of imported raw materials and components, including some goods sourced from outside the EU, which firms believe would also be delayed by any Brexit-related port disruption. Some companies are also planning to increase stocks of their own finished goods so that they can fulfil orders.

Many contacts have said they expect to start building stocks in early 2019, when more warehousing capacity is likely to be available – this is particularly the case for wholesalers and retailers.

Those companies that plan to increase stocks say they expect to do so by between 20% and 100%. In addition, the timing of some exports and imports could be brought forward to the end of this year or the first few months of next year, from 2019 Q2.

However, a variety of factors may limit the extent of stockbuilding. It is costly, and access to finance may constrain the ability of some companies – particularly smaller ones – to commit the cashflow to build inventory. A shortage of warehousing – especially in the run-up to Christmas – is reported to be an additional constraint. Capacity constraints are compounded by a shortage of drivers in the haulage industry.

Financial preparations

Some contacts have reported bringing forward scheduled debt refinancing to avoid the period around March next year. Some other corporate finance transactions have been brought forward to 2018 for the same reason.

Companies have also been repaying debt and looking to operate further below the headroom in their bank facilities, and many have increased their cash balances. A very small number of contacts have said they are increasing their cash buffers in case they need to build inventory, but most are doing it as a general contingency.

There have also been some reports of companies hedging foreign exchange exposure for longer periods than usual to cover the period around EU withdrawal.

2.2.6 Impact of Brexit on financial conditions

Financial conditions respond to, and have the potential to exacerbate, economic shocks.

Following the onset of the financial crisis in 2007, there was a sharp rise in the difference – or 'spread' – between the official interest rate (Bank Rate) and the interest rates faced by households and firms. Despite sharp cuts to Bank Rate in 2008 and 2009, the cost of finance remained elevated, weighing on the economic recovery.

This spread depends on bank funding costs, compensation for risk that firms or households may not repay their loans in full (i.e. credit risk), and other factors including banks' operating costs and mark-ups, as set out in Butt and Pugh (2014).

In the scenarios in this report, the paths for the spread between Bank Rate and the rates faced by households and businesses are calibrated using the framework set out in Butt and Pugh (2014), with the effects of financial market disruption and illiquidity on those spreads calibrated using a range of models, including Baranova et al. (2017 and forthcoming). An empirical relationship is used to estimate the impact of an increase in this spread on spending in the economy (Section 2.3.6).

2.2.7 Impact of Brexit on uncertainty and view of future prospects

Economic uncertainty is naturally cyclical – it tends to rise in downturns – but also depends on the degree of stress in financial markets, and on economic policies. It has important effects on the decision-making of households and firms. When uncertainty rises, households may reduce consumption spending and businesses may cut investment, particularly if that investment involves 'sunk' costs and cannot be easily reversed. It is already apparent that growth in business investment has been subdued by Brexit-related uncertainty. Since mid-2016 business investment has fallen relative to that in other developed economies and in 2018 Q3 was around 15% below the Bank's pre-referendum central forecast. In the Bank's Agents' recent survey of investment intentions, Brexit uncertainty was the largest reported headwind to investment. The lack of preparedness for certain Brexit outcomes (Section 2.2.5) is likely to have exacerbated the impact of that uncertainty.

Uncertainty tends to rise as households and firms become more unsure about their future prospects, both at an individual level and for the economy more generally. The precise extent to which uncertainty might increase is unknown. During the financial crisis measures of uncertainty picked up sharply. But the path of uncertainty after Brexit may well be different. On the one hand, the unfamiliarity of new barriers could lead uncertainty to rise, at least for a period of time. On the other hand, a resolution of the terms of withdrawal,

and of the future relationship, would reduce uncertainty. In addition to making an assumption about uncertainty, an empirical relationship is used to estimate the impact of uncertainty on spending in the economy (Section 2.3.6).

2.2.8 Response of macroeconomic and macroprudential policy

The path for the economy will be influenced by the response of macroeconomic and macroprudential policy.

Automatic fiscal stabilisers are assumed to operate, with the exception of tariffs in some scenarios, and no discretionary changes in spending or tax policy are assumed.

The response of monetary policy to EU withdrawal was discussed in the MPC's November 2018 Inflation Report and is covered in greater detail in Chapter 4 of this report. In the scenarios, monetary policy is assumed to respond mechanically to balance deviations of inflation from target and output relative to potential.

The FPC stands ready to move the UK Countercyclical Capital Buffer (CCyB) in either direction as the risk environment evolves. If an economic stress were to materialise, a cut in the CCyB rate would enable banks to use the released buffer to absorb losses which might otherwise lead them to restrict lending.

2.2.9 Migration policy

The level of net migration is an important contributor to the supply side of the economy.

In the scenarios in this report, net migration is assumed to decline in 2021 to a level consistent with annual net migration of 100,000, in line with the upper bound of the Government's stated migration policy.[13] Any movement below that level is determined by the relative economic attractiveness of living in the UK using an empirical relationship (Section 2.3.6).

2.3 Established empirical relationships

In order to map the assumptions discussed in the previous section to economic outcomes, the first step is to assess the impact of the change in trading arrangement. That assessment draws on a number of established empirical relationships: the impact of alternative trading arrangements identified by looking over a wide range of countries over past decades; the relationship between openness (both trade and FDI) and productivity; and how quickly trade responds to a reduction in openness (Sections 2.3.1-2.3.5). Empirical relationships can also be used to model the impact of these changes in trading relationship as they flow through the economy. The channels include: openness and the exchange rate; uncertainty and spending decisions; economic and financial conditions; house prices; and relative economic performance and migration (Section 2.3.6).

2.3.1 Estimating the impact on trade of alternative trade arrangements using a gravity model

Since the work of Tinbergen (1962), gravity models have been used extensively for analysing the determinants of bilateral trade flows (see Anderson (2011) for a review of the economic research in this area). These are rich models, using hundreds of thousands of observations from a wide range of countries over several decades.

The models bear out two clear empirical regularities that trade between two countries depends positively on their size and negatively on the distance between them. To take an example from a recent OBR

[13] The Conservative manifestos of 2010 and 2017 contained a commitment to reduce net migration to tens of thousands a year. The Home Office's business plan in 2010 also referred to reducing annual net migration to the tens of thousands.

Discussion Paper (OBR 2018), the UK's trade with India is almost six times as large as the UK's trade with Pakistan; while the two countries are both similar distances from the UK, Pakistan has a smaller economy than India. India's economy is of roughly similar size to that of Italy, but because Italy is much closer, the UK's trade with Italy is twice as large as that with India (trade between Italy and the UK will also have benefited from mutual membership of the EU).

Gravity models can be used to isolate the effect of different trading arrangements between economies, separating them from the basic drivers of size and distance and from other influences such as a common language and past historical links. This allows for the development of well-founded estimates of the impacts of possible future agreements on the eventual volume of UK trade with the EU and other countries. Note that, while gravity models allow for detailed comparisons of 'steady-state' outcomes, they cannot, in general, provide a guide to the changes that the economy will go through to reach those new steady-states (see **Box 2B** for discussion on the reallocation of resources across the economy).

The scenarios presented in Chapter 3 are based on gravity models for trade in goods and for trade in services developed by Bank staff. The model for goods trade is estimated on a dataset of bilateral trade flows between 170 countries over the period from 1950 to 2013.[14] By contrast, data for services trade are only available from 1985 to 2011 for some countries.[15] As a result, the goods model is estimated on many more observations (more than 600,000 compared with 51,000 in the services model). The shorter and narrower dataset on services may mean that the gravity model reflects all the impacts of integration to a lesser extent, potentially underestimating the effects of de-integration of services trade.

The gravity models used in this report are estimated in line with the most recent economic research. Since bilateral trade flows tend to zero as the distance between two countries increases.[16] This approach provides plausible counterfactuals for the loss of trade under the scenarios considered and takes into account the change in trade flows following episodes of trade integration.

A similar gravity model is used to estimate the impact of FDI flows under alternative trading relationships. Data limitations and potential measurement errors can affect FDI gravity models to a greater degree than gravity models of trade. In line with economic research,[17] specifications can be estimated that include country-pair fixed effects and capture economies' characteristics that do not change over time (such as distance), as well as other time-varying variables typically used in relation to gravity models, such as GDP and population.

Note that, appropriately, these models allow for both the *trade creation* and *trade diversion* components of any new relationship. When countries join a trade agreement, the reduction in trade costs will *create* new trade between them. But, because at the same time they become relatively more isolated from other countries outside the agreement, trade with such 'third countries' is likely to be *diverted* towards the members of the trading arrangement. In the current context, leaving the EU will decrease trade between the UK and EU members but, over time, it will also make the UK relatively less isolated from other countries, partially offsetting the reduction in trade from leaving the EU.

Having used the gravity model to calculate the impact on total trade and FDI separately in each case, these are then multiplied by the corresponding elasticity to productivity from Section 2.3.4 to obtain an overall impact on GDP under different possible trading arrangements.

[14] See the IMF Direction of Trade (DOTS) dataset for trade in goods.
[15] See the Trade in Services Database for trade in services.
[16] Trade data exhibit heteroscedasticity. For this reason, the approach taken to estimate gravity models uses a panel Poisson Pseudo-Maximum Likelihood (PPML) estimator. See Santos Silva and Tenreyro (2006).
[17] Clausing and Dorobantu (2005); Yegati et al (2003); Brenton et al (1998).

2.3.2 The economic relationship between trade openness and productivity

A key finding from the economic research on international trade is that openness supports productivity, raising economic output and improving living standards. This occurs in various ways:

(i) Increased innovation and adoption of new ideas and practices.
(ii) Greater specialisation, exploiting cross-country returns to scale and scope.
(iii) Better matching of capital and labour within an economy, improving the allocation of resources.

These effects can interact. International trade openness both increases competition and potential market size, allowing domestic companies to export as well as produce for the home market. That increases the incentive for firms to innovate (Grossman and Helpman, 1991, Aghion and Howitt, 1998), especially for more productive firms (Aghion et al., 2018). Openness also facilitates the flow of new ideas: both 'learning by exporting' through adapting *final goods* to foreign markets and 'learning by importing', through new technologies linked to the availability of new varieties and the research and development embodied in imported *intermediate goods* via international supply chains (Eaton and Kortum, 2002, Santacreu, 2015, Bøler et al., 2012, and Goldberg et al., 2010). Liao and Santacreu (2015) show that trade in different varieties of goods and services are associated with the international diffusion of technologies, which enables countries to benefit from each other's innovations.[18]

Access to a larger international market also allows individual firms to specialise and focus on what they are best at, achieving a greater scale of production with an associated increase in efficiency via a reduction in average costs.[19] For example, Mayer, Melitz and Ottaviano (2016) show how increases in demand from key foreign markets led French exporters to focus their export sales towards their best performing products and expand the range of products sold. A similar mechanism is likely to be at work for exporting firms in other countries.

The idea that trade allows a country to specialise in areas in which it has a natural 'comparative advantage' dates back over two centuries to the work of David Ricardo. He demonstrated in theory that specialisation of this sort, in which countries export goods and services in which they have a 'comparative advantage', is to their mutual benefit.[20]

2.3.3 The economic relationship between foreign direct investment and productivity

As well as trade, productivity is also positively related to foreign direct investment. For instance, foreign ownership of a firm is associated with higher labour productivity. Recent work by the ONS (2017) shows that the productivity of the average UK firm involved in FDI activities was around three times higher than that of firms not involved in FDI in 2015. Alfaro and Chen (2018), Helpman et al. (2004) and Griffith et al. (2004) also find evidence of a "foreign-ownership productivity premium".

As well as the boost to aggregate productivity from these foreign-owned firms, FDI has been associated with productivity *spillovers* to domestically-owned firms. FDI has the potential to increase productivity through channels such as knowledge spillovers, backward and forward linkages with local firms and technology transfers. Empirical evidence of such effects in the UK can be found in Haskel et al. (2007), who find that there are foreign investment 'spillovers' to domestically-owned firms in the same industry. Bloom

[18] See e.g. Broda, Greenfield, and Weinstein (2006); Goldberg, Khandelwal, Pavcnik, and Topalova (2010); Santacreu (2014).
[19] See Krugman, P R (1979), 'Increasing returns, monopolistic competition, and international trade', *Journal of International Economics,* Vol. 9, pages 469-79.
[20] See Heckscher, E F (1950), 'The effect of foreign trade on the distribution of income' in Ellis, H S and Metzler, L A (eds.) *Readings in the Theory of International Trade*, Homewood: Irwin; Ohlin, B (1933), *Interregional and international trade*, Cambridge, MA: Harvard University Press; Samuelson, P A (1949), 'International factor-price equalisation once again', *Economic Journal*, Vol. 59, pages 181–97; and Samuelson, P A (1953), 'Prices of goods and factors in general equilibrium', *Review of Economic Studies*, Vol. 21, pages 1–20.

et al (2012) find that multinationals boost productivity in UK establishments through enhanced technologies and management practices. Alfaro et al. (2004, 2010) stress the role of local financial markets in enabling FDI to promote growth and their results suggest that countries with well-developed financial markets (such as the UK) gain significantly from FDI.

2.3.4 Estimates of the impact of a reduction in trade openness and lower FDI on productivity

It is reasonable to expect these relationships between openness and productivity to operate in reverse. Though episodes of rising trade barriers are rare, what studies exist are consistent with that conclusion. For example, Barattieri, Cacciatore, and Ghironi (2018) show how tariffs reallocate production toward less efficient domestic producers, lowering aggregate productivity, as well as lowering investment in physical capital and the production of new varieties of products.

The scenarios in this report assume the magnitude of the effects of integration and de-integration on trade are symmetric, i.e. that the reduction in trade flows associated with leaving a trading arrangement is of the same size as the increase in trade flows of joining a trading arrangement.

A two stage process is used to estimate the impact of reduced openness on productivity and GDP. As discussed in Section 2.3.1, a gravity model is used to estimate the impact of the new trading relationship on trade and FDI. This is then converted into a GDP impact using an estimate of the elasticity between openness and productivity from economic research. These steps are done separately for trade and FDI and then aggregated into an overall impact.

The economic research that estimates the elasticity between trade and productivity is limited but the range of estimates is between 0.16 and 0.74%. Feyrer (2009a) exploits the difference in air and sea distances, and the changing share of goods trade that is transported by air and sea, and find that a 1% change in trade leads to a 0.42-0.59% change in GDP. Feyrer (2009b) uses the temporary closure of the Suez Canal between 1967 and 1975 as a natural experiment. That closure increased sea distances between countries, with a negative impact on trade; he estimated that a 1% change in trade leads to a 0.16 to 0.25% change in GDP. Studies using natural disasters in a country's trade partners (Felbermayr and Gröschl (2013)) find an elasticity of 0.74%. The elasticity between trade and productivity used in the scenarios in this report is 0.25% which is towards the bottom of the 0.16 to 0.74% range but higher than the minimum. That is in line with the estimate published by HMT in April 2016.

This elasticity covers only the effect of trade on productivity. To that one needs to add effects that come via changes in foreign direct investment.

Economic research estimating the elasticity between FDI and productivity is more limited than that for trade and GDP and estimates vary widely depending on the channels considered or data used in estimation, making it more difficult to specify a plausible range of estimates. Fons-Rosen et al. (2018) find that a 1% increase in the foreign ownership share increases the acquired firm's TFP by about 0.01%. Alfaro and Chen (2018) show that by being 23% more productive than domestic companies, multinational corporations increase the productivity of the whole economy by 3%. Pain and Young (2004) estimate significantly larger *long-run* effects, with a 1% increase in the stock of FDI increasing productivity by 0.32% in the UK manufacturing and distribution sector, and 0.13% in the financial services sector. Focusing on the *indirect* (spillover) effects from FDI in the UK, Haskel et al. (2007) find that a 1% increase in the share of total employment in an industry accounted for by foreign-owned plants raises output in each domestic plant in that industry by about 0.05%**.** The elasticity used between FDI and GDP in the scenarios in this report is 0.04. That is in line with the econometric results published by HMT in April 2016,[21] and an analytical report

[21] HMT's (2016) estimate of the elasticity of GDP to inward FDI comes from a panel regression of TFP on the stock of inward FDI covering eight sectors over the period 1998-2012.

from the Department for International Trade published in August 2018. Using data from a panel of OECD countries, De Mello (1999) finds similar effects.

Taking the trade and FDI effects together, the scenarios in this study are based on an estimate that a 1% fall in openness eventually reduces productivity by 0.3%.

2.3.5 The speed of impact from a reduction in openness

As discussed above, the scenarios in this report assume that the reduction in trade flows associated with leaving a trading arrangement, and their eventual impact on productivity, are similar in magnitude to the effects of lowering trade barriers. There is naturally a degree of uncertainty around the resulting estimates but they are well founded, given the extent of the empirical information and the wide range of existing studies on which they draw.

More uncertain is the timing of such effects. Where existing studies do have something to say about this, they tend to suggest that it takes several years for the benefits of greater integration to emerge. For example, Baier et al (2014) estimate that it takes around five years for half the impact on trade volumes of a new agreement to come through. But it is possible that this could be different in reverse.

There might be some reasons to expect a slower response. For example, sunk costs may encourage firms to continue trading for a period even if, over the long run, such activity is unprofitable. Whether such firms continue trading will depend in part on their business model and whether they can access other markets.

But there are probably more reasons to expect a somewhat faster response.

- Some of the benefits of greater integration rely on new investment, whether by multinational or domestic firms. This inevitably takes time. By contrast, some of the parallel effects in the case of de-integration involve changes in the value of existing resources, and could therefore come through fairly rapidly. If, for example, some services activity is no longer possible after the UK leaves the EU, and to the extent resources used for that activity are specialised, the impact on supply is more or less coincident with that on demand. Even when re-employed elsewhere, those resources would generate less output. The same could apply to goods trade related to complex supply chains. New barriers to trade could mean that some existing supply chains are no longer feasible, and to the extent the skills and resources involved are specialised, they too would be less productive when employed in other activities.

- While there are very few historical examples of advanced economies rapidly reducing their integration with a major trading partner, New Zealand provides one such case study. As discussed in **Box 2C**, Commonwealth countries lost their preferential access to UK markets in 1973, when the United Kingdom joined the European Economic Community (EEC). Despite the UK's intention to change its trading relationship being known for over a decade, there is limited evidence of a material change in trade flows ahead of the point when New Zealand lost access to UK markets. However, once new trade barriers came in, the level of exports fell very quickly, and this rapidly fed through to economic growth and investment.

- A wide range of survey evidence and intelligence from the Bank's Agents (**Box 2A**) suggests that many firms may not be very well prepared for a sudden departure from the EU, particularly in the event of a no deal. As observed in the case of New Zealand, it is likely that, since little or no adjustment has been made already, the impact of any sudden change in trading terms on frictions at the border could themselves be relatively abrupt. As explained earlier, these effects would be mitigated by a transition or implementation period sufficiently long to allow firms and authorities to make the necessary preparations.

Box 2B: The impact of EU withdrawal on sectors and supply capacity

A decline in openness will affect different sectors of the UK economy in varying ways and to different extents. Depending on the form that Brexit takes, any new export tariffs and non-tariff barriers imposed on UK exports to the EU may be higher for some sectors than others; those industries reliant on components or supply chains in the EU may face greater challenges than those that do not; and sectors that are most reliant on migrant labour from the EU may be more likely to face skills shortages than others. This dispersion across sectors is likely to be starkest in a no transition, no deal Brexit. This box focusses on that, but these effects are likely to be present under other outcomes, to a lesser extent.

Intelligence from the Bank's Agents, a range of other indicators, and structural economic modelling suggests some sectors are more exposed than others.

Table 2B.1 summarises different sectors' exposure to a no transition, no deal Brexit, through each of four main channels, which are combined to form an overall assessment of exposure. The colour-coding is based on a bottom-up sectoral analysis bringing together a wide range of vulnerability indicators and intelligence from the Bank's Agents (**Box 2A**). The results highlight the differences in sectoral vulnerabilities. Some – such as agriculture and food production – are vulnerable along several dimensions. Others – such as other utilities (water and waste) – might be less affected.

Table 2B.1: Sectors' direct exposure to no transition, no deal Brexit [(a)]

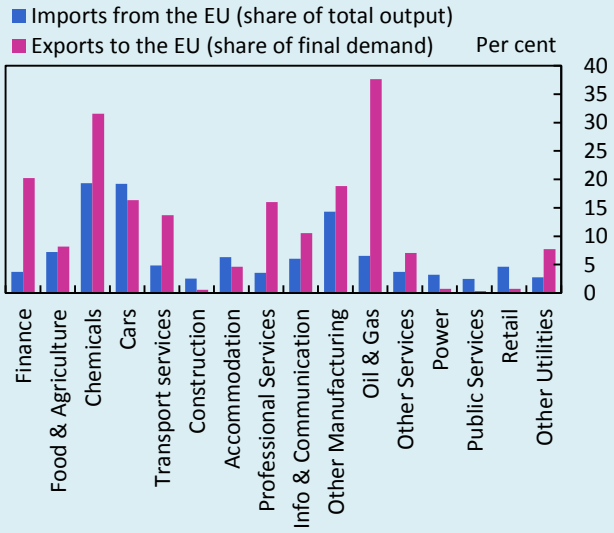
	At the Border	Behind the Border	Free Movement	EU Funding	Brexit Exposure
Food and Agriculture					
Chemicals and Pharmaceuticals					
Cars and Transport Goods					
Transport Services					
Construction & Real Estate					
Other Manufacturing					
Wholesale and Retail					
Other Services					
Professional & Technical Services					
Public Services					
Hotels and Restaurants					
Information and Communications					
Power					
Oil and Gas					
Other Utilities					

[(a)] The above table highlights the differences in sectoral vulnerabilities to risks from a 'no-deal' Brexit. Red, amber and green reflects the range from the most to least affected by these risks.

At-the-border barriers summarise sectors' vulnerability to tariffs and customs, taking into account their share of exports to the EU and share of intermediate imports from the EU, which are summarised in **Chart 2B.1**. Increased customs checks at the border, for example, may have disruptive effects on firms in the cars and transport goods sector, which has highly integrated cross-border just-in-time supply chains, with components crossing the UK-EU border multiple times in the course of production.

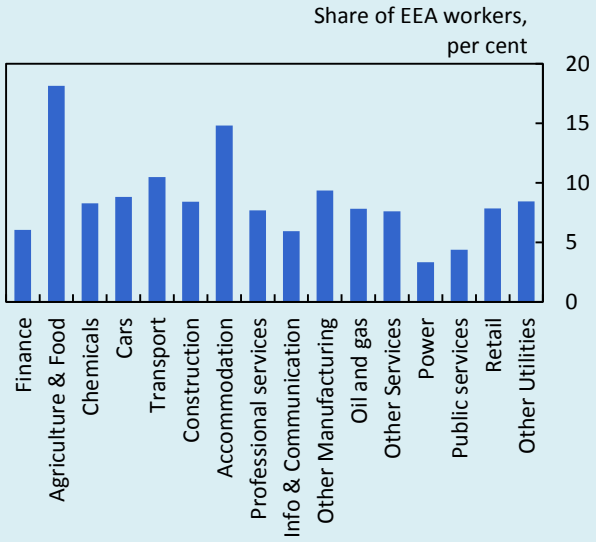
Behind-the-border barriers capture sectors' vulnerability to non-tariff barriers via the impact of product standards and regulatory compliance on sectors' shares of EU exports and intermediate imports to the EU. For example, the UK may no longer be part of the European Medicines Agency, so pharmaceutical companies may need to repeat batch testing in the EU in order to sell their products there.

Chart 2B.1: Sectors' reliance on EU trade[(a)]



Sources: Bank calculations, ONS.
[(a)] Data are from ONS Blue Book 2018, and refer to 2014.

Chart 2B.2: Sectors' reliance on EU labour[(a)] [22]



Sources: Bank calculations, ONS.
[(a)] Data are from the Labour Force Survey, and refer to 2017.

Free movement of labour combines measures of three things: the share of EU labour in a sector's workforce, the impact of skills shortages, and services provided in the EU and to EU residents in the UK. For example, agriculture and food production firms employ large numbers of seasonal, temporary, and permanent EU migrant labour (**Chart 2B.2**). The transport services sector, in particular haulage, is reliant on EU workers who have Community Driving Licences that grant them the right to operate throughout the EU.

EU Funding measures sectors' reliance on direct EU funding schemes and networks. For example, the removal of EU subsidies under the Common Agricultural Policy could have an impact on the income of some farms.

The overall direct *sector exposure to Brexit* combines at-the-border, behind-the-border and free movement vulnerabilities with 30% weight each and EU funding with 10% weight. In some cases, other factors are also taken into account. For example, the construction sector has low direct exposure through at-the-border, behind-the-border, and free movement restrictions but is highly exposed to the London property market and the risk of economic activity relocating outside the UK, so its overall exposure is judged to be high.

Structural economic modelling is an alternative way to assess the impact of Brexit on different sectors, although typically such models only capture the first two channels in **Table 2B.1**. Computable general equilibrium (CGE) modelling is the most common approach, and a number of studies have applied it to a range of possible Brexit scenarios. A summary of these studies can be found in the recent OBR discussion paper (OBR 2018). Those papers that publish results for individual sectors show that effects vary significantly across sectors, consistent with the assessment in **Table 2B.1**. For example, a recent IMF study (IMF 2018) suggests that in a WTO scenario there would be almost no change in output in the hotels and restaurants sector, while output in the chemicals sector is expected to be almost 35% lower.

A greater dispersion of sectoral impacts will result in a larger hit to supply, as more capital and labour will be stranded in the hardest hit sectors.

[22] Anecdotal evidence from firms in the agriculture sector suggests the share of migrants is higher than reported in the LFS. This could reflect the fact that the LFS does not sample multiple-occupancy dwellings, and many seasonal migrants working in agriculture live in shared accommodation provided by their employer.

As a result of the new barriers to trade with the EU, trade between the EU and UK will fall. The UK economy will need to pivot away from the goods and services the UK has been exporting to the EU and towards those that the country has tended to import and those it could export to new markets that have become more attractive in relative terms. As a result, the new most efficient allocation of productive resources – labour and capital – within the UK economy will be different after Brexit. Moreover, for the reasons discussed in Section 2.3.2, this new allocation is likely to be associated with a permanently lower level of productivity.

Relative to this new most efficient allocation of resources, in the short term some capital and labour is likely to be misallocated. In other words, the productive efficiency of the economy could be increased by moving these resources. But those shifts in production will neither be instant nor costless, as resources are often highly specialised in different sectors and even in different firms within those sectors. As part of the reallocation process, in some sectors and in some firms, jobs will be lost and plant and machinery may become stranded. During the period that this reallocation is taking place, aggregate output and productivity will be lower than it otherwise would be.

The size of this effect will depend on the flexibility of capital and labour between sectors and firms, something that is very difficult to quantify. That said, the hits to output in different sectors in the IMF study suggest that in a no transition, no deal Brexit the dispersion of impacts across sectors could be as wide as in the financial crisis – a period in which the economy experienced material misallocation for a number of years (e.g. Barnett et al (2014)).

The scale of turnover of capital and labour in the economy will be a crucial determinant of the speed at which the economy can adjust to this supply shock. Past experience (see Broadbent (2012) for analysis of the financial crisis) suggests that the UK labour market adjusts relatively rapidly. This reflects the presence of material labour market flows in normal times: around 2 million employees (7% of the total) move between sectors (at a 1-digit SIC level) every year; quarterly flows into and out of the UK labour force are equivalent to around 3% of the stock; and flows between employment and unemployment each quarter are equal to around 1-1.5% of employment. In the near term, disruption is likely, with more workers than usual needing to move between sectors.

Even if the labour market can adjust relatively quickly overall, there are likely to be pockets where reallocation is more difficult or slower to achieve, for example in sectors where workers are specialised or may need to retrain in order to move to another job. The fact that certain types of workers may encounter difficulties in transitioning to new forms of employment could raise their probability of becoming long-term unemployed. Protracted periods of unemployment are associated with hysteresis effects, potentially leading to the withdrawal of some labour force participants altogether (Krueger et al, 2014). For the labour market as a whole, even if many workers can move sector after Brexit, they may have to accept a lower wage and a job in which they are less productive. Displaced workers have been found to suffer earnings losses which persist long after re-employment (Jacobson et al, 1993; Autor et al, 2014). Such a situation could drag on aggregate productivity for many years.

On physical capital, according to ONS data, excluding dwellings, annual fixed investment in 2017 was worth 9% of the net capital stock, while consumption of fixed capital was 7%. This implies relatively slow 'passive' adjustment, since capital takes 15 years to depreciate on average. This is consistent with the experience after the crisis, (Broadbent, 2012), although the stronger banking system now could mean capital market impairment is a less material drag on reallocation.

Consistent with this, according to contacts of the Bank's Agents, reduced demand under a no transition, no deal scenario could lead to underutilisation of resources in the short term, with some risk of closures.

However, sunk costs in productive capacity mean that important strategic decisions, for example to relocate production or shut a plant, take one to two years. Other measures could be brought in more quickly, for example slowing the rate of production or mothballing capital. In many cases, contacts reported that there would be little scope to re-use redundant equipment, because so much is bespoke; and re-use of land could take years.

In summary, in a no transition, no deal Brexit, reduced openness is likely to have large and diverse effects on sectors and firms and could mean that the impact on the supply capacity of the economy is front-loaded.

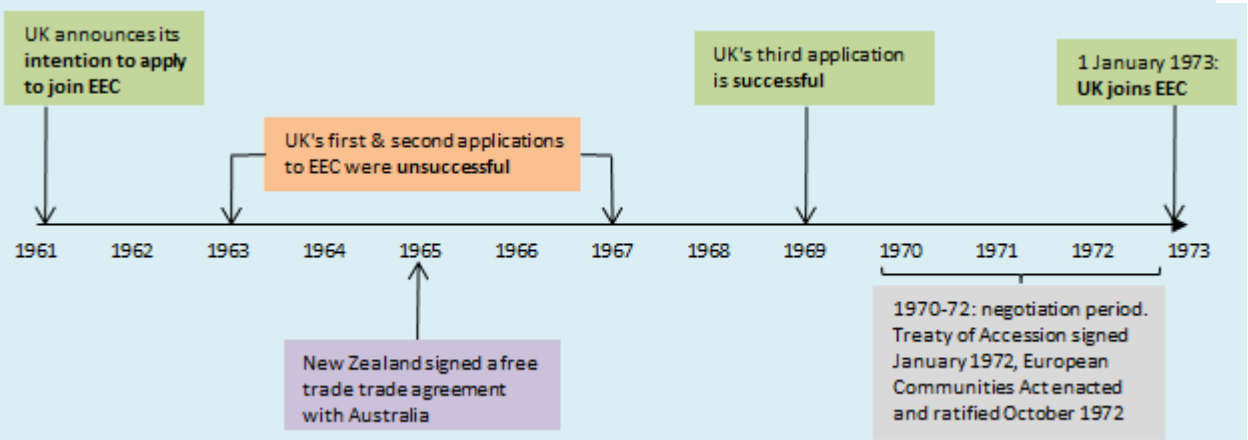
Box 2C: New Zealand trade after 1973: a case study of trade disruption

There are very few historical examples of advanced economies rapidly reducing their integration with a major trading partner. One set of examples is developed Commonwealth countries following their loss of preferential access to UK markets in 1973 when the United Kingdom joined the European Economic Community (EEC). This box considers the case study of New Zealand.

Historically, the United Kingdom was New Zealand's largest trade partner. At the time of the UK's accession to the EEC, it accounted for around 30% of New Zealand's exports (around 8% of GDP). Several agreements in the early 20th century ensured British and New Zealand goods received preferential access to each other's economies. New Zealand was one of the original 23 members of the General Agreement on Tariffs and Trade (GATT) in 1948. GATT ensured the removal of agricultural tariffs, a key sector for New Zealand exports.

In 1961, the UK first announced its intention to join the EEC (**Figure 2C.1**). After its third application was submitted in 1969, the European Communities Act 1972 was enacted and ratified in October 1972, letting the UK's membership come into effect on 1 January 1973. From this date, New Zealand no longer benefited from preferential access. In particular, New Zealand producers now faced a common external tariff on agricultural exports to the UK. They also faced greater competition from subsidised producers in the EEC.

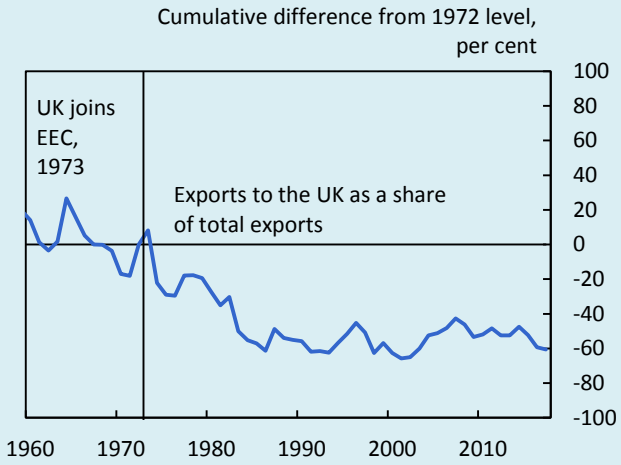
Figure 2C.1: Timeline of UK's application to EEC



In response to the news of the UK's intention to join the EEC, New Zealand pursued more open trading arrangements elsewhere. This included a free trade agreement with Australia in 1965.

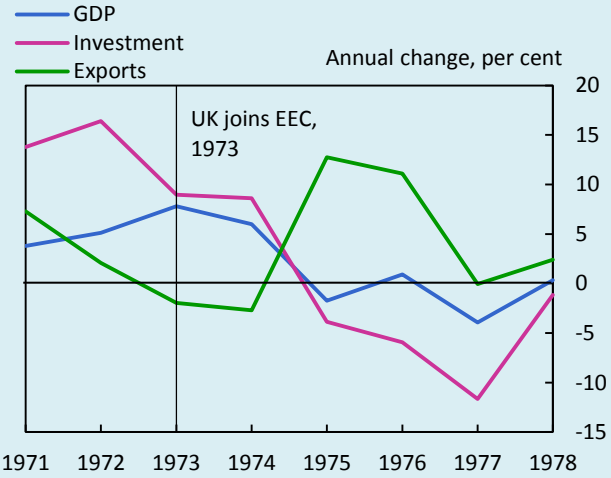
Despite this and despite the advance warning of the change in trading arrangements, New Zealand's total exports earnings fell sharply in 1973 and 1974 both to the UK and in aggregate. Exports recovered somewhat after that date, though even in 1983 those to the UK specifically were still only half their size a decade earlier (**Chart 2C.1**). But domestic demand also contracted, investment in particular (**Chart 2C.2**) and, because inflation rose sharply over the following three to four years (**Chart 2C.3**), domestic interest rates also rose (**Chart 2C.4**). The economy fell into recession in 1974 and overall economic growth did not return to its pre-1973 growth rate until the early 1980s.

Chart 2C.1: The level of New Zealand exports to the UK fell over time following 1973



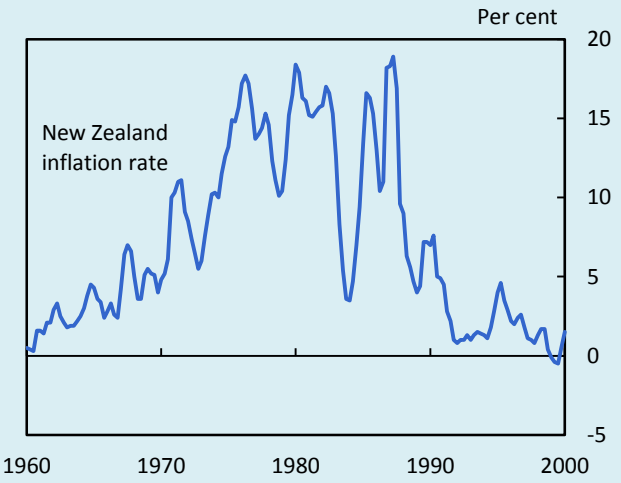
Sources: IMF Direction of Trade Statistics, and US Bureau of Economic Analysis.

Chart 2C.2: GDP and investment growth fell in the years following 1973, while exports rebounded



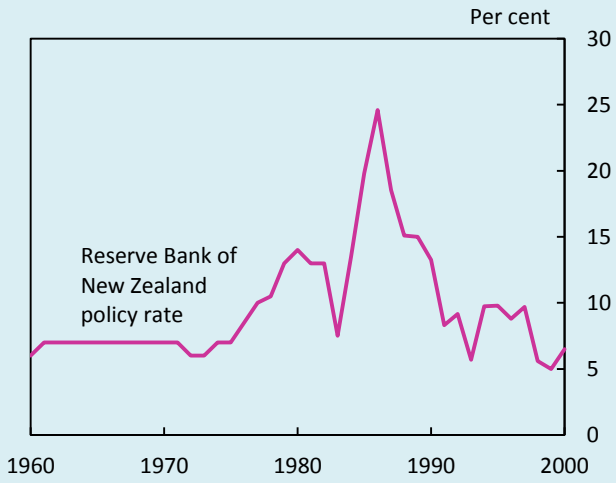
Sources: OECD and Bank calculations.

Chart 2C.3: Inflation picked up in the 1970s and 1980s



Source: Stats NZ.

Chart 2C.4: New Zealand interest rates rose after 1973



Source: Stats NZ.

An important caveat to this case study is the global oil price shock that occurred at the same time. One way to control for this is to compare New Zealand's economic performance with other countries. Norway and Austria required similar imports of energy to New Zealand and experienced the same rise in oil prices. But neither was exposed to the UK's accession to the EEC. GDP growth in these countries did not fall as far as in New Zealand, and recovered more quickly. And inflation peaked at lower levels in Norway (13%) and Austria (10%). The additional fall in growth and rise in inflation in New Zealand could therefore suggest the UK's accession to the EEC itself had a significant impact on the New Zealand economy.

Though New Zealand and the UK were not as closely integrated as the United Kingdom and European Union are today, this case study does point to some lessons relevant to the impact of Brexit on the UK. First, despite the UK's intention to change its trading relationship being known for over a decade, there is limited evidence of a material change in trade flows ahead of the point when New Zealand lost access to EU markets. However, once new trade barriers came in, the level of exports fell very quickly, and this rapidly fed through to economic growth and investment. Exports did recover, suggesting possible trade

diversion effects. Once the UK entered the EEC, New Zealand eventually diverted former trade with the UK towards other countries. As suggested by gravity models such as those set out in Section 2.3.1, it is easier for a country to trade with other countries that are closer in distance than farther, as New Zealand did. The UK, on the other hand, will likely have to divert trade to countries further away than the EU. In general, New Zealand's experience suggests that even for predictable changes in trading relationships, a substantial proportion of the macroeconomic consequences only become apparent after the change in trade barriers takes effect.

2.3.6 Using empirical relationships to model the further economic impact of these changes in trading relationships

Empirical relationships can also be used to model the further impact of these changes in trading relationships as they flow through the economy. The channels include openness and the exchange rate, uncertainty and spending decisions, economic and financial conditions, house prices, and relative economic performance and migration.

Openness and the exchange rate

The exchange rate is likely to respond to news about the UK's future economic trading relationship as well as the conditions that prevail in financial markets. Large current account surpluses or deficits are in principle not sustainable in the long run as the balance generated by the economy must be sufficient to pay for a country's outstanding external liabilities. Unsustainable current account positions can lead to exchange rate responses to rebalance external trade and investment flows.

The change in the long-run level of the exchange rate in the scenarios is calculated to offset changes in the sustainable current account position caused by the new trading arrangements. This is estimated using a fundamental equilibrium exchange rate approach, in two steps. First, the marginal effect of a change in the UK's new trading relationship on the sustainable level of the current account is estimated using a reduced-form empirical model relating the level of the current account to a range of macroeconomic variables, such as openness and investment. Second, the change in the exchange rate is calculated that offsets the gap between the current account and the sustainable current account position, including any depreciation needed to offset a persistent drag from a worsening in the terms of trade not captured in the reduced-form model.

In response to past large economic shocks, the initial reaction of the exchange rate has been larger than the long-run response around which it settles. For instance, during the financial crisis the exchange rate depreciated around 30% initially but settled to be around 25% below its pre-crisis peak in the following couple of years. This might reflect temporary fluctuations in risk premia or uncertainty about the long-term impact of the shock. Some of the scenarios outlined in Chapter 3 allow for such temporary overshooting.

Uncertainty and spending decisions

Periods of elevated uncertainty are likely to have an adverse effect on the economy by affecting the decision-making of household, companies, banks and financial markets. The Decision Maker Panel survey indicates the uncertainty over Brexit has already weighed on firms' investment decisions.[23] The estimates of the impact of uncertainty used in the scenarios in this report are derived from a structural vector autoregression model based on Haddow et al. (2013), which explicitly accounts for the fact that uncertainty and activity may depend on one another. It uses a measure of uncertainty constructed as the principal

[23] See Bloom et al (2017) and Box 3 in the February 2018 *Inflation Report*.

component of a range of proxies for uncertainty, including financial market volatility and household surveys. The current level of uncertainty has been augmented to include evidence of Brexit-related uncertainty from the Bank's Decision Maker Panel. Estimates from this model indicate that even a temporary rise in uncertainty can have a quantitatively significant impact on consumption and investment.

Economic and Financial conditions

The financial crisis demonstrated that changes in financial conditions and disruptions to the provision of financial services can have large and persistent effects on the economy. The effects of changes in a broad range of financial conditions, including credit spreads, interest rates and house prices, are estimated using the semi-sectoral model of the UK economy in Cloyne et al. (2015). This jointly models the impact of changes in credit conditions and financial yields on the behaviour of households, firms and the financial sector. The response of credit spreads in the scenarios is calibrateded using the framework set out in Butt and Pugh (2014), with the effects of financial market disruption and illiquidity on credit spreads calibrated using a range of models, including Baranova et al. (2017 and forthcoming).

House prices

The response of house prices to changes in income and credit conditions is estimated using a model based on those estimated in Meen (1990, 2009) and is similar to models used in other institutions including the OBR (Auterson, 2014). The model first estimates an equation for mortgage demand, and then relates this to the market price for housing with a household discount rate. The final equation is an error correction model, where house price growth is determined by growth in real income per household, lagged house price growth, and the change in the household discount rate, which itself is determined by the policy rate and credit spreads. The analysis allows for uncertainty, term premia and risk premia to affect the discount rate and, where there are large house price falls, for potential amplification effects from the buy-to let market.

Relative economic performance and migration

The ONS' latest principal population projection is based on an assumed path for net inward migration to the UK that declines from around +250k per year in 2016 to +165k per year from 2023. This population projection was used to construct the forecasts underlying the November *2018 Inflation Report.*

In the scenarios in this report, net migration is assumed to decline in 2021 to a level consistent with annual net migration of 100,000 in line with the upper bound of the Government's stated migration policy.[24] The scenarios also allow for further effects on migration on the basis of macroeconomic factors. The approach to modelling these effects is consistent with Lewis and Swannell (2018), in which heightened unemployment and lower expected GDP growth increase emigration from the UK and reduce immigration to the UK.

[24] The Conservative manifestos of 2010 and 2017 contained a commitment to reduce net migration to tens of thousands a year. The Home Office's business plan in 2010 also referred to reducing annual net migration to the tens of thousands.

Box 2D: Tariff and exchange rate effects by sector of the CPI basket

The scenarios presented in this report include different assumptions about the future trading relationship with the EU. In those scenarios where the UK's trading relationship with the EU is on WTO terms, it is assumed that the UK applies tariffs on EU imports in line with the EU's tariff schedule for trading with other countries on Most Favoured Nation (MFN) terms. In all scenarios, the exchange rate responds in line with established empirical relationships.

Rather than provide further details on these scenarios, this box sets out sensitivities of different components of the Consumer Price Index (CPI) basket to

1. the introduction of tariffs and
2. an illustrative 5% depreciation in the exchange rate

Importantly, the results reported in this box are simply the effects on prices from tariff and illustrative exchange rate changes. They do not take into account any price effects induced by the evolution of demand and supply discussed elsewhere in this report. Indeed, the price effects of developments in supply and demand could dominate the tariff and exchange rate effects discussed here.

Furthermore, depending on the nature of the UK's future trading relationship, non-tariff barriers may emerge, which could raise the level of the CPI by 0.3%.

Tariffs

As discussed in section 2.2.2, the UK could impose a schedule of tariffs on imports from the EU if the future trading relationship is on WTO MFN terms. Our estimates suggest that the level of UK consumer prices could rise by 1% in this case. **Table 2D.1** shows that food and non-alcoholic beverage (FNAB) prices are estimated to rise by 5%. This increase alone accounts for around half of the overall increase in consumer prices.

The price of new cars – a subset of the transport component – is estimated to increase by 4%, clothing and footwear to increase by 1.3% and food and drinks in pubs and restaurants to increase by 0.6%. These represent parts of the consumer basket that, after FNAB, are most likely to be the more significant contributors to the overall increase in the level of CPI due to the application of tariffs.

The estimates of tariff effects presented in this Box are slightly smaller than those assumed in Andy Haldane's letter to the Treasury Select Committee. These differences reflect the use of a broader set of import data to derive the estimates presented here.

As noted above, the analysis in this box has not accounted for the non-tariff barriers that could accompany a WTO trading relationship. These barriers are estimated to increase the overall level of consumer prices by 0.3%.

Exchange rate

As discussed above, news about the UK's future trading relationship with the EU may lead to movements in sterling. The MPC treats exchange rate pass-through to consumer prices symmetrically, such that an appreciation of a given magnitude is likely to feed through to prices at a similar speed and to the same extent as a depreciation of the same magnitude. **Table 2D.1** includes an illustrative example of how prices in different parts of the CPI basket may respond to a 5% depreciation in sterling, which would lead to a 0.9% long run increase in overall prices. Import-intensive products such as FNAB, household goods (e.g. furniture) and recreational goods (e.g. toys, garden items, laptops and TVs) are likely to be most affected.

Fuel prices and household energy bills are estimated to rise by around 2%.

Overall effects of tariffs and the exchange rate

Table 2D.1 reports the impact of tariffs and the illustrative exchange rate depreciation on prices within the CPI basket. These price movements will have different effects on the CPI depending on their shares within household consumption. **Table 2D.2** sets out how these price movements would contribute to the overall long run impact on the level of CPI. FNAB has the largest price increase when tariffs are applied and sterling depreciates. And because it also accounts for a large share of the CPI it also makes the largest contribution to changes in the CPI's level. Clothing and footwear prices are the second most affected by tariffs and exchange rate changes. But, given its larger share of the CPI, transport is estimated to provide the second largest contribution to the increase in the level of CPI.

Table 2D.1: The long-run effect on the level of CPI component prices, per cent change

Long-run impacts (percent change in prices)	**Tariffs under WTO MFN relationship**	**Effect of a 5% depreciation**
Component		
Food and non-alcoholic beverages	5.0	1.3
Alcohol & tobacco	0.8	0.3
Clothing & footwear	1.3	1.4
Housing, utilities	0.1	0.7
Furniture, household equipment	0.4	0.9
Health	0.1	1.0
Transport (incl. fuel)	1.0	1.0
Communication	0.0	0.9
Recreation & culture	0.5	1.0
Education	0.0	0.1
Restaurants & hotels	0.6	0.5
Misc goods & services	0.1	0.7
Package holidays	0.0	2.2
CPI	1.0	0.9

Table 2D.2: CPI component contributions to the long-run effect on the level of CPI, percentage points

Long-run impacts (contributions to CPI impact)	**Tariffs under WTO MFN relationship**	**Effect of a 5% depreciation**
Component		
Food and non-alcoholic beverages	0.5	0.1
Alcohol & tobacco	0.0	0.0
Clothing & footwear	0.1	0.1
Housing, utilities	0.0	0.1
Furniture, household equipment	0.0	0.1
Health	0.0	0.0
Transport (incl. fuel)	0.2	0.2
Communication	0.0	0.0
Recreation & culture	0.1	0.1
Education	0.0	0.0
Restaurants & hotels	0.1	0.1
Misc goods & services	0.0	0.1
Package holidays	0.0	0.1
CPI	1.0	0.9

Note: component contributions may not sum to total CPI effect due to rounding.

3 Scenarios

The outlook for inflation, growth and employment and financial stability depends significantly on the path of EU withdrawal and the new relationship between the EU and the UK.

EU withdrawal has already had consequences for the economy. Sterling fell sharply immediately following the referendum, and remains 18% below its 2015 peak before the referendum was called. This has pushed inflation above target, and squeezed household incomes as a result. At the same time, Brexit-related uncertainty has depressed investment and held back productivity growth. As a result, the level of GDP in 2018 Q3 was 1% lower than the MPC had projected in May 2016, a forecast that was conditioned on the government's policy of the UK remaining in the EU, despite support from stronger-than anticipated global growth, and more supportive domestic financial conditions than the MPC had expected at that time.[25]

In response to the Treasury Committee's request, this chapter provides scenarios setting out the potential impact of the Economic Partnership between the EU and the UK on the economy. These are based on a continuation of current trading arrangements applying during an Implementation Period, as set out in the Withdrawal Agreement, from 30th March 2019 to 31st December 2020. It is assumed that the Economic Partnership starts immediately after that. Scenarios in which the Northern Ireland 'backstop' is activated are not included. As requested, this chapter also provides scenarios in which the UK leaves the EU with no Withdrawal Agreement and no Implementation Period, which are also set out in the November 2018 *Financial Stability Report*. The scenario requested in which the UK leaves the EU with no trade agreement at the end of a transition period is set out in Appendix A.

The scenarios presented are based on assumptions about: the key details of the new relationship between the UK and the EU; the degree of preparedness across firms and critical infrastructure (such as transportation including air carriers, road hauliers and rail services; customs infrastructure including IT systems for declarations and tracking goods, and space and facilities to examine goods; and power facilities, including arrangements for nuclear fuel imports); and how other policies respond. The economic impact of a Brexit based on these assumptions is modelled using established empirical relationships, based on analysis of decades of trade liberalisation, as described in Chapter 2. As noted in that Chapter, in modelling the consequences of a decline in openness, the analysis assumes that relationships based on trade liberalisation hold in reverse, but allows for the likelihood that this economic impact would come through more quickly when trade barriers are introduced than when they are removed.

It is important to understand what these swathes represent. The scenarios are not forecasts and the swathes do not represent the range of possible outcomes arising from the more commonplace uncertainties, unrelated to EU withdrawal, involved in economic forecasts. They are instead designed to illustrate the sensitivity of outcomes to the various assumptions made about the terms of the UK's departure and the eventual trading relationship between the two economies.

The UK economy will still be influenced by stronger or weaker growth in the world economy, to take just one example, whatever the nature of its withdrawal from the EU. It will still be influenced by conditions in global financial markets, which are also subject to unpredictable movements. There are many other factors – things that give rise to the 'fan charts' around the MPC's economic projections in the *Inflation Report* – that could affect the economy along these projected paths. The swathes do not allow for these usual forecasting uncertainties.

[25] This is within the range of external estimates. For example, UBS estimates that GDP is 2.1% lower as a result of the referendum by September 2018, GDP was 1.6% lower than the IMF's pre-referendum forecast by the end of 2017, and JP Morgan estimates that GDP was 1.1% lower as a result of the referendum by the end of 2017. The estimate of news in the level of GDP relative to the May 2016 *Inflation Report* is based on the Bank's backcast for the final estimate of GDP.

However, it should be noted that we can be more confident about the relative positions of the swathes. That is because these unpredictable factors would move the different swathes in the same direction, whatever the nature of the UK's withdrawal from the EU. For example, if the world economy proved stronger than expected over the next few years, that would provide a tailwind for the UK economy in all the scenarios. The differences between them would remain.

The Bank was asked to provide an assessment of the consequences of leaving the EU, by comparing these scenarios to a baseline of "the present situation".[26] To meet this request, comparisons are given relative to a continuation of growth along the path for potential output embodied in the MPC's May 2016 forecast – 'the May 2016 trend' hereafter. The November 2018 *Inflation Report* projections are also included on all charts to provide an additional point of comparison. These have been extended to end-2023 to enable comparison with the scenarios.

3.1 Scenarios in which the UK and EU implement the Economic Partnership

The *Political Declaration setting out the framework for the future relationship between the European Union and the United Kingdom*[27] provides an outline of the Economic Partnership. With regard to goods, it outlines that "Comprehensive arrangements that will create a free trade area, combining deep regulatory and customs cooperation, underpinned by provisions ensuring a level playing field for open and fair competition". It also states that it "should ensure no tariffs, fees, charges or quantitative restrictions across all sectors, with ambitious customs arrangements that build and improve on the single customs territory provided for in the Withdrawal Agreement which obviates the need for checks on rules of origin." With regard to regulation, the Political Declaration states that "While preserving regulatory autonomy, the Parties will put in place provisions to promote regulatory approaches that are transparent, efficient, promote avoidance of unnecessary barriers to trade in goods and are compatible to the extent possible" and "the United Kingdom will consider aligning with Union rules in relevant areas".

With regard to services, the Political Declaration states, "The Parties should conclude ambitious, comprehensive and balanced arrangements on trade in services and investment in services and non-services sectors, respecting each Party's right to regulate. The Parties should aim to deliver a level of liberalisation in trade in services well beyond the Parties' World Trade Organization (WTO) commitments and building on recent Union Free Trade Agreements (FTAs)". For financial services in particular, it proposes cross-border trade based on autonomous 'equivalence' decisions by each side's authorities, and calls for the Parties to "start assessing equivalence" with respect to each other's frameworks "as soon as possible after the United Kingdom's withdrawal from the Union, endeavouring to conclude these assessments before the end of June 2020".

Many details of the Economic Partnership are still to be negotiated, however, including the extent of non-tariff barriers across different sectors, and provisions on labour mobility. This analysis therefore constructs two variants of the Economic Partnership, labelled as 'Close Economic Partnership' and 'Less Close Economic Partnership', which form the top and bottom of a range of possible characteristics of the Economic Partnership.

Scenarios in which the Northern Ireland 'Backstop' is activated after the transition are not included, even though that is a possibility, as this was not requested by the Treasury Committee and the Political Declaration notes that "The Parties recall their determination to replace the backstop solution on Northern

[26] The Rt Hon. Nicky Morgan's letter to Governor Mark Carney, 11 October 2018: https://www.parliament.uk/documents/commons-committees/treasury/Correspondence/181011-Chair-to-BoE-Brexit-Withdrawal-Agreement.pdf
[27] https://www.consilium.europa.eu/media/37059/20181121-cover-political-declaration.pdf

Ireland by a subsequent agreement that establishes alternative arrangements for ensuring the absence of a hard border on the island of Ireland on a permanent footing".[28] The Less Close variant of the Economic Partnership scenario assumes that customs checks can be erected between the UK and the EU without introducing a hard border between Northern Ireland and the Republic of Ireland.

3.1.1 Assumptions underpinning the Economic Partnership scenarios

The two scenarios are underpinned by different assumptions about the extent of trade barriers and the degree of uncertainty. They share assumptions on migration and the way in which policy is set.

Assumptions

- **Trade barriers are minimised for goods, but increase for services:**
    - **Comprehensive arrangements for free trade in goods are implemented**

      No tariffs, fees, charges or quantitative restrictions are introduced across all goods sectors. In the Close scenario, no customs checks or new regulatory checks are introduced between the UK and EU. In the Less Close scenario, customs checks and more onerous regulatory checks between the UK and EU are introduced immediately in January 2021, leading to border delays and higher administrative costs for firms engaging in cross-border trade with the EU.
    - **Non-financial services regulatory trade barriers with the EU increase gradually**

      Provisions are included that facilitate services trade, consistent with the ambition of the Political Declaration. Residual barriers arise over time. In the Less Close Partnership, while services provisions are included, they are less extensive than in the Close Economic Partnership, resulting in higher barriers.
    - **Equivalence provides market access for a material proportion of financial services currently using passporting.**

      UK financial firms no longer have the ability to 'passport' into the EU, but the granting of equivalence by EU authorities allows for continued market access in some sectors. In the Close scenario, equivalence is assumed to mitigate half the impact on financial sector activity from a loss of market access. In the Less Close scenario, only one quarter of the loss is mitigated.
    - **Trade barriers are applied symmetrically in both cases**
    - **The UK does not implement any new independent deals with third countries.**
- **Uncertainty declines following the agreement**

  In the close scenario, having risen sharply around the time of the referendum, uncertainty declines following the agreement of the Withdrawal Agreement, falling back to its long-run average over 2019. In the Less Close scenario, uncertainty remains elevated over the transition period, before falling back to its long-run average over 2021.
- **Net migration**

  Net migration is assumed to follow the path set out in the ONS' principal population projection until the end of 2020, then decline to 100,000 a year over the course of 2021, consistent with the Government's current policy.

[28] Ibid.

- **Preparedness**

  The transition period until the end of 2020 is assumed to be sufficient for all sectors' regulatory authorities and infrastructure to prepare for the new trading arrangements. The transition period is not extended.

- **Macroeconomic policy**

  Automatic fiscal stabilisers are assumed to operate, but no discretionary changes in spending or tax policy are assumed.

  In the scenario, monetary policy is assumed to react mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates are gently rising.

Table 3.1.1: Key assumptions

Economic Partnership			
Assumption		**Close**	**Less Close**
Trading arrangements	Tariffs	None.	None.
	Customs barriers	No customs checks on UK-EU trade.	Customs checks on UK-EU trade introduced from 2021.
	Other goods barriers	No new regulatory barriers	Additional regulatory checks required for new product lines. (Previous recognitions grand-fathered).
	Services barriers	Barriers to non-financial services trade emerge. System of mutual recognition in professional qualifications is put in place. Financial services lose passporting rights but one half of the loss is mitigated by equivalence on some financial services.	Services provisions less extensive. Barriers to non-financial services trade emerge. System of mutual recognition in professional qualifications is put in place. Financial services lose passporting rights but one quarter of the loss is mitigated by equivalence on some financial services.
	Trade deals	No new trade deals with third countries implemented before 2023. UK retains access to existing trade agreements between EU and third countries.	
Preparedness for new trading arrangements		The transition period until the end of 2020 is assumed to be sufficient for all sectors' regulatory authorities and infrastructure to be able to prepare for the new trading arrangements.	
Macroeconomic policy		In these as in all the scenarios monetary policy is assumed to react mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates rise gently. No discretionary changes in spending or tax policy are assumed. Automatic stabilisers operate. No change in the countercyclical capital buffer.	
Financial conditions		No additional effects	No additional effects
Macroeconomic uncertainty		Uncertainty falls back to average by the end of 2019. No anticipation effects.	Uncertainty falls back to average by the end of 2021. No anticipation effects.

3.1.2 Modelling the effects of these assumptions on the economy

The effects of these assumptions on the economy are modelled using empirical relationships that have held in the past (as set out in Chapter 2). The primary relationships on which the variants of the scenario are constructed are shown in **Table 3.1.2**.

Table 3.1.2: Key economic relationships

Economic Partnership			
		Results	
Relationship	Analytical Foundation (See Chapter 2 for more details)	Close	Less Close
Trade barriers and trade volumes	Empirical studies are used to calibrate the extent to which higher trade barriers reduce trade. Speed of adjustment depends on the type of barrier. A judgement has been taken that the introduction of new barriers of particular types affects trade faster than the removal of barriers.	Trade barriers reduce UK trade by 2% relative to the May 2016 trend by end-2023.	Trade barriers reduce UK trade by 9% relative to the May 2016 trend by end-2023.
Openness to trade, FDI, and productivity	Empirical estimates on the impact of openness on trade, FDI and productivity.	These factors reduce output per hour by 1¼% by end-2023 relative to the May 2016 trend.	These factors reduce output per hour by 3½% by end-2023 relative to the May 2016 trend.
Openness and the exchange rate	Sterling has depreciated by 18% since *its 2015 peak*. The response of the exchange rate in the scenarios is calculated to broadly offset changes in the sustainable current account position caused by the new trading arrangements. No overshooting is assumed.	Sterling appreciates by 5% in 2019 Q1 relative to its current level.	Sterling appreciates by 2% in 2019 Q1 relative to its current level.
Economic conditions and migration	The ONS's principal projection is used until end-2020. After that net inward migration is consistent with economic conditions, constrained not to exceed 100,000 a year in line with the government's current policy.	Net immigration declines to 100,000 a year by the end of 2021, and remains at 100,000 a year thereafter in both variants.	
Economic prospects, uncertainty, financial conditions, and consumption, & investment	Households and firms respond to expectations of lower incomes based on empirical estimates. Empirical studies are used to map from an index of uncertainty, and from financial conditions, to investment and consumption.	Lower productivity growth feeds into lower incomes and consumption. Investment, which has been subdued by uncertainty, recovers somewhat following the agreement, though it remains below the May 2016 trend.	

3.1.3 Overall impact

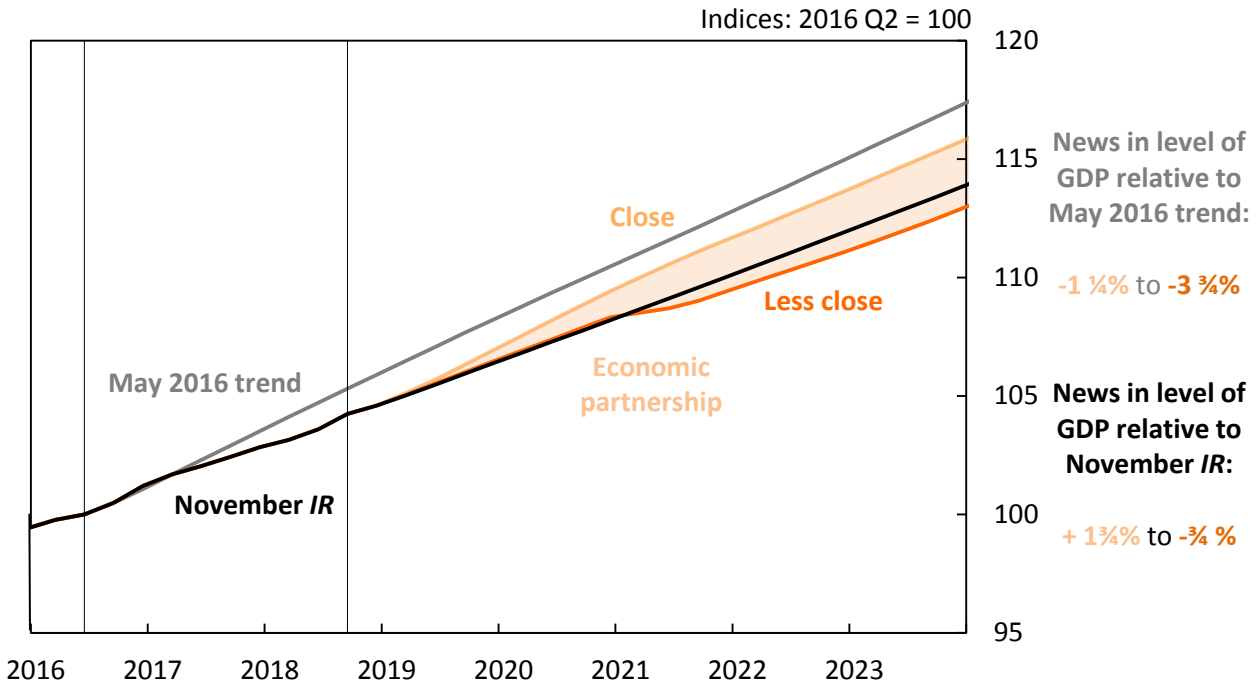
The estimated paths for GDP in the Economic Partnership under the assumptions in Table 3.1.1 are shown in Chart 3.1.1. The range reflects the sensitivity to the key assumptions about the extent to which trade barriers increase, and how rapidly uncertainty declines. The level of GDP is between 1¼% and 3¾% lower than the May 2016 trend by end-2023. Relative to the November 2018 *Inflation Report* projection, by end-2023 it is 1¾% higher in the Close scenario, and ¾% lower in the Less Close scenario. These

scenarios are not forecasts: the range does not cover every possible assumption, or every possible impact of the Economic Partnership, nor does it capture generalised uncertainty about prospects for the economy.

This is accompanied by a slightly lower level of unemployment relative to the *Inflation Report* in the Close scenario, and a slightly higher level in the Less Close scenario (**Chart 3.1.2**).

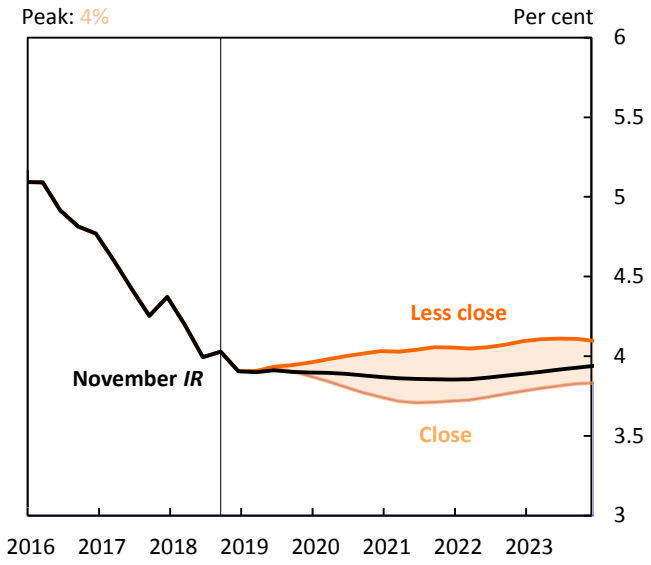
Inflation is lower in the near term in the Close scenario than in the November *Inflation Report*, largely due to the appreciation of sterling. Towards the end of the scenario, it is closer to the Inflation Report profile, as the effect of the appreciation fades. In the Less Close scenario, inflation again is lower than in the *Inflation Report,* but not by as much as in the Close scenario due to the smaller appreciation of sterling. It then rises above the *Inflation Report* after the transition period*,* in part due to the customs barriers which take effect from 2021 (**Chart 3.1.3**).

Chart 3.1.1: Range of GDP outcomes in Economic Partnership scenarios



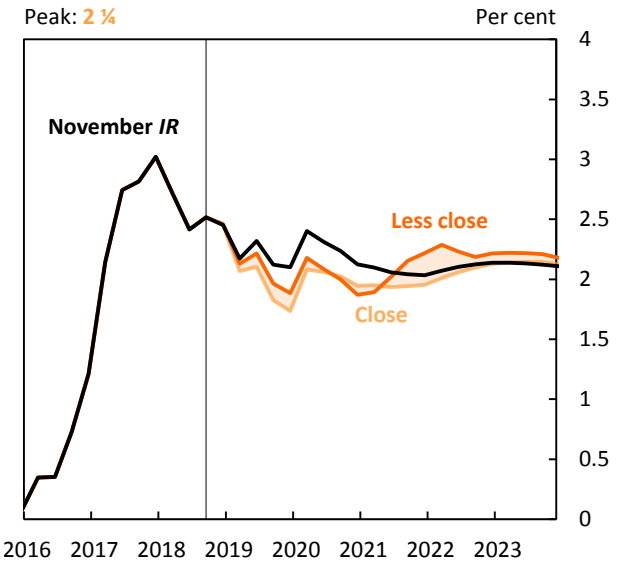
Sources: ONS and Bank calculations.

Chart 3.1.2: Range of unemployment outcomes in Economic Partnership scenarios



Sources: ONS and Bank calculations.

Chart 3.1.3: Range of inflation outcomes in Economic Partnership scenarios



Sources: ONS and Bank calculations.

3.2 Worst case macroeconomic scenarios for assessing UK financial system resilience

In the scenarios described in Section 3.1, the transition period allows the UK to avoid a cliff edge, and provides time to prepare for the new Economic Partnership. Given the time for adjustment during the transition period and the propsect of some equivalence arrangements, financial stability risks would be less likely to crystallise in those scenarios (see Chapter 5). A more testing scenario would be a Brexit scenario with a cliff-edge in March 2019 – a "no deal with no transition" outcome.

Consistent with its statutory duties, the FPC has identified risks of disruption to the financial system that could arise from Brexit so that preparations can be made and actions taken to mitigate them.

The FPC is focused on outcomes that would have the greatest potential impact on financial stability. In that context, the FPC has considered the particular risks that could arise if the UK's relationship with the EU were to move abruptly to default World Trade Organisation (WTO) rules without an implementation period.

Chapter 5 describes in more detail the financial stability risks which could emerge in such a scenario. This section sets out the worst case assumptions underpinning the macroeconomic scenario, and the outcomes for key macroeconomic variables.

3.2.1 Macroeconomic scenarios for a Brexit with no deal and no transition

The challenges the economy could face in the event the UK leaves the EU with no agreement and no transition period would depend crucially on political decisions by the EU and UK authorities and on the degree of preparation by firms and critical infrastructure before Brexit.

Consistent with its remit to protect and enhance the resilience of the financial system to major shocks, however unlikely they may be, the disorderly scenario used by the FPC is underpinned by 'worst case' assumptions about the challenges the UK economy could face in this scenario. The disorderly Brexit scenario is therefore not a forecast for the economy in the event that the UK leaves the EU with no deal and no transition period.

The assumptions underpinning the disorderly Brexit scenario are summarised in **Table 3.2.1**. A variant of the scenario - labelled 'Disruptive Brexit' - is also described. This variant excludes four of the most severe assumptions in order to illustrate the magnitude of their effects.

Table 3.2.1: Summary of assumptions made in "No deal, no transition" scenario

No deal, no transition			
Assumption		**Disruptive**	**Disorderly**
Trading arrangements	Tariffs	EU applies Common Customs Tariff. UK applies symmetric tariffs.	
	Customs barriers	Customs checks on UK-EU trade introduced.	
	Other goods barriers	UK recognises EU standards. EU does not reciprocate. Regulatory checks required for new and existing product lines.	
	Services barriers	Revert to WTO terms. Financial services lose passporting rights. Broadcasting rights lost. Increased costs	

		for transport services as firms require EU license.	
	Trade deals	No new trade deals implemented before 2023. UK retains access to existing trade agreements between EU and third countries.	No new trade deals implemented before 2023. UK loses access to existing trade agreements between EU and third countries.
Preparedness for new trading arrangements		Some delays at the border associated with re-certification of products.	Severe disruption at the border reflecting customs checks.
Macroeconomic policy		Monetary policy responds mechanically to balance deviations of inflation from target and output relative to potential. Bank Rate rises to 1.8%.	Monetary policy responds mechanically to balance deviations of inflation from target and output relative to potential. Bank Rate rises to 5.5%.
		Automatic fiscal stabilisers operate. No discretionary changes in tax or spending policy. Countercyclical capital buffer cut from 1% to 0%.	
Financial conditions		Financial conditions tighten due to weaker and more uncertain economic conditions. EU does not take action to address remaining risks in derivative markets. Overall, interest rates on loans to households and businesses rise by 150bps more than Bank Rate. There is a 50bps increase in the term premium on gilts.	Financial conditions tighten due to weaker and more uncertain economic conditions. EU does not take action to address remaining risks in derivative markets. Negative spillovers to other UK markets. Overall, interest rates on loans to households and businesses rise by 250bps more than Bank Rate. Uncertainty about institutional credibility leads to a pronounced increase in risk premia on sterling assets, including a 100bps increase in the term premium on gilts.
Macroeconomic uncertainty		Index rises by 1½ standard deviations from current levels, a similar rise to that seen around the EU referendum.	Index rises by 2 standard deviations to levels only exceeded in the financial crisis.

3.2.2 Assumptions in no transition no deal scenarios

- **Tariffs and other barriers to trade between the UK and EU are introduced suddenly from 2019Q2 onwards**

  The EU applies its Common Customs Tariff (CCT) to goods imported from the UK. The UK Government has stated that, if the UK leaves the EU with no agreement or transition period, the UK will apply its own duty rates to imports from the EU and that these will be published before Brexit. The scenario assumes that the UK establishes tariffs equivalent to the EU's CCT.

New customs checks, including checks on compliance with rules of origin requirements, also raise the costs of trade. Trade in services reverts to WTO terms, mutual recognitions of professional qualifications are lost and the financial sector loses 'passporting' rights.

- **While the UK recognises EU product standards, the EU does not reciprocate.**

  UK exports are further reduced in the near term because existing products made in the UK need go through the process to be recertified for sale in the EU.

  In line with recent Government announcements, the UK is assumed to recognise existing product standards for EU imports.[29] However, the EU is not assumed to reciprocate because only 15% of imports to EU countries originate from the UK, compared to 52% of the UK's imports that originate from the EU.

- **No new trade deals are implemented within a five year period.**

- **The EU does not take action to address remaining risks of disruption to financial derivative markets.**

  This results in challenges for UK and EU banks in managing risks using derivatives (see the November *Financial Stability Report*). They are unable to adjust terms on uncleared derivatives and the market for cleared derivatives fragments. Banks respond by raising the cost of providing finance in the EU and the UK, reinforcing the tightening of financial conditions in the scenario.

- **Economic prospects, uncertainty and consumer and business spending**

  Expectations of lower future incomes, in particular the risk of future job losses, are assumed to lower consumer spending and business investment.

  Macroeconomic uncertainty is also assumed to rise sharply and this leads to consumers and businesses delaying spending.

- **Economic conditions and financial conditions**

  There is also assumed to be a tightening in financial conditions (**Table 3.2.1**). This occurs for three reasons: because economic downturns typically result in some tightening of credit conditions by making lending riskier; because the term premium component of government bond yields is assumed to rise in response to lower output and higher economic uncertainty; and because of the challenges banks face in derivatives markets (see above).

- **Macroeconomic policy responds consistent with its objectives.**

  The assumptions for fiscal and monetary policy are consistent with those used in Section 3.1. The automatic fiscal stabilisers are allowed to operate and monetary policy is assumed to react mechanically to balance deviations of inflation from target and output relative to potential. However, the monetary policy response is more pronounced in the "no transition, no deal" scenario, reflecting the larger shocks affecting the economy. In these more severe scenarios, the FPC is assumed to cut the CCyB from 1% to 0%."

3.2.3 Additional assumptions for the disorderly Brexit scenario

The following additional assumptions underpin the disorderly scenario but are not included in the disruptive variant:

[29] See https://www.gov.uk/government/publications/trading-goods-regulated-under-the-new-approach-if-theres-no-brexit-deal/trading-goods-regulated-under-the-new-approach-if-theres-no-brexit-deal.

- **The UK loses existing trade agreements that it currently has with non-EU countries through membership of the EU.**

  These agreements would not automatically apply to the UK after a no deal Brexit and would require bilateral negotiation by governments.

  In the disorderly Brexit scenario, it is assumed that bilateral agreements are not reached. This reduces trade with these jurisdictions. Around 10% of total UK exports are sent to countries covered by such free trade agreements. These include European Free Trade Area (EFTA) countries and a range of other important export destinations, such as South Korea and Turkey.

- **The UK's border infrastructure is assumed to be unable to cope smoothly with new customs requirements for some time.**

  This assumption results in very severe disruption to trade. UK trade falls initially by an additional 15% in the short run, until new border infrastructure and processes are established. This assumption is consistent with UK-EU trade falling by around a third. Delays at the border are also associated with some disruption to transport services.

  This disruption at the border results in a sharp fall in productivity. Supply chains are disrupted and economic activity falls. Potential output per employee falls by nearly 5% in the short term.

- **There is a pronounced increase in the return investors demand for holding sterling assets given a rise in perceived risks.**

  Normal empirical relationships suggest that the increase in economic uncertainty in the scenario would be associated with an increase in the term premium on UK government bond yields.

  In addition, the scenario assumes that uncertainty about the UK's macroeconomic framework and institutional credibility results in a further fall in investor appetite for sterling assets.

  The UK is reliant on inflows of foreign capital to finance its current account deficit – the gap between investment and domestic saving. This currently stands at 3.9% of GDP. To continue to finance this deficit, the returns to investors are assumed to have to rise.

  In the disorderly Brexit scenario, the term premium on UK government bond yields rises by 100bp. And as the sterling risk premium increases, sterling falls by 25%, in addition to the 9% it has already fallen since the May 2016 *Inflation Report*. Consistent with the worst case assumptions underpinning the scenario, this reflects a combination of a shift in the equilibrium level of the sterling exchange rate and some overshooting beyond that new lower level.

- **There are spillovers to other financial markets resulting in fire sales of some assets.**

  Investors are assumed to respond to rising corporate bond yields (falling prices) and falling property prices by selling these assets, putting further downward pressure on prices.

  These effects could be more severe than in the past, reflecting the increased importance in bond markets of open-ended funds offering short-term redemptions, and the higher share of buy-to-let properties in the stock of housing.
  The result is a further tightening of credit conditions for those borrowers who rely on corporate debt markets or who use property as collateral to secure lending.

  Overall, borrowing costs facing households and firms rise by 250bps more than Bank Rate in the disorderly scenario.

3.2.4 Impact of this scenario on the economy

The impact of these assumptions on the economy is calibrated using empirical relationships that have held over the past and are described in more detail in Chapter 2. The primary relationships on which the variants of the scenario are constructed are shown in **Table 3.2.2**.

Table 3.2.2: Key economic relationships which generate the economic outcomes

"No deal, no transition"			
		Results	
Relationship	**Analytical Foundation** **(See Chapter 2 for more details)**	**Disruptive**	**Disorderly**
Trade barriers and trade volumes	Empirical studies are used to calibrate the extent to which higher trade barriers would reduce trade. Speed of adjustment depends on the type of barrier. A judgement has been taken that new barriers of particular types affect trade faster than the removal of barriers.	Trade barriers reduce UK trade by around 15% by 2023. Around a fifth of this arises from tariffs and the remainder from non-tariff barriers, including customs checks and rules of origin which raise the cost of exporting. Trade barriers also make the UK a less attractive destination for foreign direct investment. The relationship means that new inflows of FDI are nearly 20% weaker by 2023.	
Openness to trade, FDI, and productivity	Empirical estimates on the impact of openness on trade, FDI and productivity.	Output per hour is reduced by around 5% relative to its May 2016 trend as a result of lower trade openness.	
Openness and the exchange rate	Sterling has depreciated by 18% since *its 2015 peak*. The response of the exchange rate in the scenarios is calculated to offset changes in the sustainable current account position caused by the new trading arrangements. There is also some near-term overshooting.	Sterling depreciates by around a further 15% at its trough.	Sterling depreciates by around a further 25% at its trough. Part of the larger move reflects the increase in risk premia on sterling assets.
Economic conditions and migration	Net migration follows a model-based relationship reflecting relative economic performance	Net migration declines to around 30,000 per year.	Net migration declines to around minus 100,000 per year (i.e. a net outflow).

Economic prospects, uncertainty, financial conditions and consumption & investment	Households and firms respond to expectations of lower incomes based on empirical estimates. Empirical studies are used to map from an index of uncertainty, and from tighter financial conditions, to investment and consumption. Tighter financial conditions also further reduce potential supply.

Source: Bank of England.

Given the underpinning assumptions explained in Sections 3.2.2 and 3.2.3 and the established economic relationships listed in **Table 3.2.2**, **outcomes for the economy are produced using the Bank of England's suite of macroeconomic models**. This ensures that the paths for output, employment, interest rates and property prices in the scenario are both internally consistent and consistent with the underpinning assumptions and empirical relationships.

In the disorderly Brexit scenario on which the FPC has focussed, UK trade declines sharply, as trade barriers are introduced, the EU does not recognise UK product standards and there is disruption at the border.

Weak current and future income growth, higher uncertainty and tighter financial conditions, all weigh on consumer spending and business investment. Overall, GDP falls by 8% from its level in 2019 Q1 (**see Table 3.2.3 and Chart 3.2.1**).

The fall in economic activity is reflected in a mix of higher unemployment, lower labour supply and lower productivity. Border disruption affects the supply capacity of the economy, reducing productivity in the near term and dampening the effect of lower output on employment.

As economic conditions deteriorate, net migration falls from a net inflow of 250,000 per year to a net outflow of 100,000 people per year. This reduces labour supply.

The supply-driven nature of the downturn means that, although output falls by more than it did in the financial crisis, unemployment rises by less than it did then, peaking at a rate of 7 ½ %.

The composition of UK output shifts towards the production of goods and services that are currently imported. This results in a degree of mismatch between the skills of the available supply of labour and the skills demanded by employers. As a result, the structural level of unemployment – the level that in the long run is consistent with steady wage growth – rises by a further ½pp than the usual hysteresis mechanisms would imply, taking the overall rise in structural unemployment to 1pp.

This means that the margin of domestic slack widens by much less than the fall in output, mitigating downward pressure on domestically-generated inflation. The sharp fall in sterling, alongside the imposition of tariffs on EU imports, pushes up costs of imports and overall CPI inflation picks up to peak at 6 ½%.

Trade barriers mean that imports also fall. The reduction in UK imports affects the EU economy, reducing activity there. That further spills back to demand for UK exports.

In addition, the fall in trade weighs on productivity growth and therefore real household incomes. Reflecting the weak trade position, increased risk premia on sterling assets, and an overshoot, the exchange rate depreciates by 25% to less than parity against the US dollar and the euro.

Although the fall in the exchange rate dampens some of the fall in net exports, by pushing up prices of imported goods and services it reinforces the squeeze on real incomes and consumer spending.

Weak current and future income growth, higher uncertainty and tighter financial conditions all weigh on consumer spending and business investment.

Table 3.2.3: Comparison of Brexit scenarios with no agreement and no implementation period with other stress episodes

	GDP[1]	Unemployment rate[2]	Inflation[2]	House prices[1]	Commercial property prices[1]	Bank Rate	
						Average over years 1-3	Peak level
Disruptive	- 3%	5 ¾%	4 ¼%	-14%	-27%	1 ½%	1 ¾%
Disorderly	-8%	7 ½%	6 ½%	-30%	-48%	4%	5 ½%
Bank of England 2018 stress test	-4 ¾ %	9 ½%	5%	-33%	-40%	3 ¼%	4%
Global financial crisis[3]	-6 ¼%	8%	4 ¾%	-17%	-42%	2%	5 ¼%

[1] Maximum fall from starting point
[2] Peak
[3] Defined to start in 2008 Q1
Source: Bank of England calculations.

This creates a challenging trade-off between economic activity and inflation. In order to bring inflation back to the 2% target, Bank Rate rises sharply, peaking at 5 ½ % and averaging 4% over the first three years of the scenario.

The weakness of output and incomes, alongside rising interest rates and a pronounced tightening of financial conditions, results in sharp falls in some asset prices. Residential property prices fall by 30%, and commercial property prices fall by 48%.

In the disruptive Brexit variant of the scenario, the absence of border disruption and financial market disruption mean output falls by somewhat less than in the disorderly Brexit. It falls by 3% from its level in 2019 Q1.

Productivity growth slows. Consistent with relative economic performance, net inward migration falls to 30,000 per year. And structural unemployment rises. But the erosion of potential supply is much smaller than in the disorderly Brexit scenario.

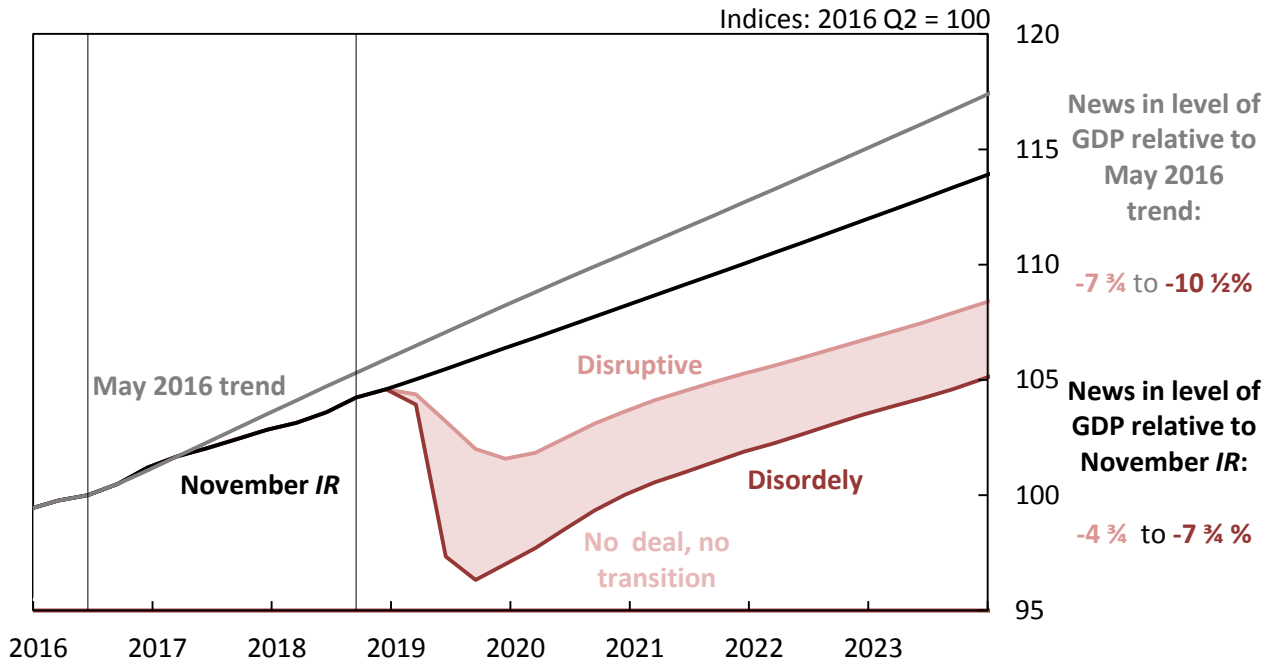
The exchange rate depreciates by 15% to around $1.10 against the dollar. Imported inflation rises by less than in the disorderly Brexit scenario and inflation peaks at 4 ¼ %. Faced with a less challenging trade-off between activity and inflation, Bank Rate averages only 1 ½ % over the first three years.

Financial conditions tighten, albeit by somewhat less than in the disorderly Brexit scenario. The effects of this tightening, along with the reduction in activity and incomes, are falls in residential property prices of 14% and in commercial property prices of 27%.

The disruptive and disorderly variants of the overarching 'no deal, no transition' Brexit scenario are shown in **Charts 3.2.1, 3.2.2 and 3.2.3.**

Chart 3.2.1: Range of GDP outcomes in no transition no deal scenarios

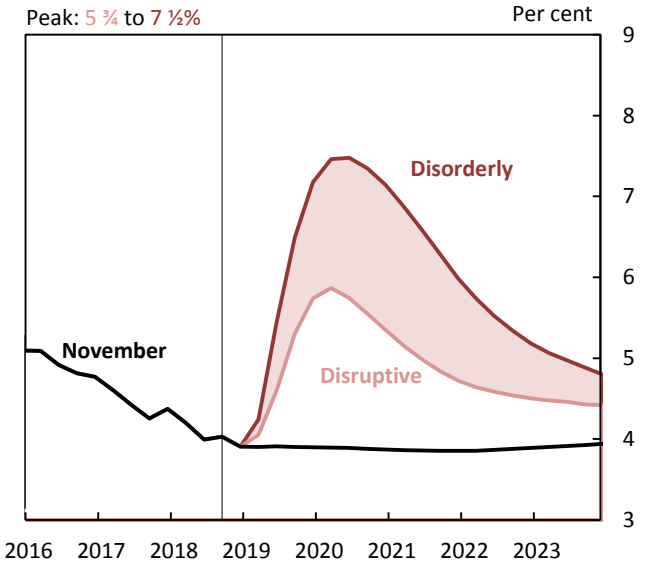
Level of UK GDP



The level of GDP is based on the Bank's backcast for the final estimate of GDP.
Sources: ONS and Bank calculations.

Chart 3.2.1: Range of unemployment outcomes in no transition no deal scenarios

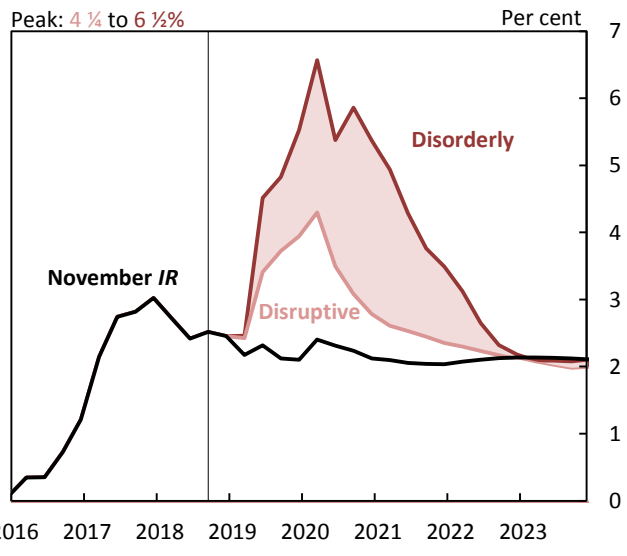
Unemployment rate



Sources: ONS and Bank calculations.

Chart 3.2.2: Range of inflation outcomes in no transition no deal scenarios

Annual UK CPI inflation



Sources: ONS and Bank calculations.

4 Maintaining monetary stability

The Monetary Policy Committee's (MPC) remit is to set monetary policy to achieve the Government's target of keeping inflation at 2%. The inflation target is symmetric and applies at all times. Subject to that, the remit also requires the MPC to support the economic policy of the Government, including its objectives for growth and employment.[30]

The outlook for inflation, growth and employment depends significantly on the nature of EU withdrawal, in particular: the form of new trading arrangements between the EU and UK; whether the transition to them is abrupt or smooth; and how households, businesses and financial markets respond.

As set out in the November 2018 *Inflation Report*,[31] the implications of these developments for the appropriate path of monetary policy will depend on the balance of their effects on demand, supply and the exchange rate. The MPC judges that the monetary policy response to EU withdrawal, whatever form EU withdrawal takes, will not be automatic and could be in either direction. It will not necessarily follow the same mechanical rule that the scenarios in Chapter 3 are based on.

4.1 Demand

Withdrawal from the EU will affect the demand for goods and services produced in the UK. Any reduction in the ease with which UK companies can trade will lower UK exports. Business investment will respond to changes in uncertainty and financial conditions. UK households and companies are likely to adjust their spending in light of changes to their expected future earnings and income as well as the uncertainty around those expectations. Those effects on demand over the MPC's policy horizon are likely to be more negative the greater the disruption to the economic relationship between the EU and UK.

4.2 Supply

The extent to which changes in demand affect inflationary pressures will depend on how the supply capacity of the economy evolves. Reductions in openness as the UK's trading relationship with the EU changes are likely to reduce the economy's productive capacity for a period of time. The supply capacity of the economy could be affected as mismatches in the labour market increase and as companies shift production away from the goods and services the UK has been exporting to the EU — for which demand from abroad will fall — and towards those that the country has tended to import or could export to new markets that have become more attractive in relative terms. Those shifts in production will neither be seamless nor costless, as resources in different sectors are often highly specialised. This will drag on supply as the adjustment process unfolds.

Usually, changes in supply are gradual, so have less bearing on monetary policy in the short term than changes in demand. If the future economic relationship between the EU and UK changes only gradually, supply losses too would emerge relatively slowly.

In some Brexit scenarios, however, it is possible that the UK's supply capacity could fall sharply. For example, an abrupt and disorderly withdrawal could result in delays at borders, disruptions to supply chains, and more rapid and costly shifts in patterns of production, severely impairing the productive capacity of UK businesses.

[30] "Monetary policy remit: Budget 2018" available here .
[31] "Box 4: The monetary policy response to Brexit", *Inflation Report November 2018,* p31-32. Available here.

4.3 Exchange rate and tariffs

The prospects for inflation will also depend on how the exchange rate reacts and on any tariffs that result from the new trading arrangements. Sterling fell sharply around the time of the referendum. This reflected the judgement by financial markets that leaving the EU would lower UK real incomes, for example through raising costs or reducing productivity in the tradable sector. In the case of a smooth transition to a relationship that is judged to have a relatively small long-term economic impact, financial market participants might expect a smaller reduction in UK real incomes than currently, causing the exchange rate to appreciate. In contrast, a disruptive withdrawal from the EU could result in a more pessimistic view and some further depreciation. Tariffs, if imposed by the UK on imports of EU goods and services, would add to inflationary pressures in the short term.

4.4 Implications for monetary policy

The appropriate response of monetary policy to any particular Brexit scenario will depend on the balance of the effects on demand, supply and the exchange rate.

In the case of a smooth transition to a relatively close economic relationship, the extent to which domestic inflationary pressures increase would depend on the balance between an expected rebound in demand as uncertainty fades, any further impacts on supply over the MPC's policy horizon, and the likely appreciation of sterling.

In contrast, a disruptive withdrawal from the EU would probably result in a further decline in the exchange rate and a large, immediate reduction in supply. Tariffs might also be extended. Each of these developments would tend to increase inflation. Set against that, it is likely that demand too would weaken, reflecting lost trade access, heightened uncertainty and tighter financial conditions. The overall extent of inflationary pressures would depend on the balance of these forces, as well as the evolution of inflation expectations.

Three other considerations will be important to the conduct of monetary policy.

First, current circumstances differ materially from those immediately following the referendum. At that time, the economy was operating with a material degree of excess capacity and inflation was below the target. As Article 50 had not yet been triggered, Brexit was at least two years away and its nature was highly uncertain. Therefore many of the supply-side effects were distant. At present, inflation is above the target and the MPC judges that demand and supply in the economy are broadly in balance. In some scenarios, the UK's trading relationships with the EU could change abruptly with a material negative impact on the supply capacity of the economy over the monetary policy horizon.

Second, there is little that monetary policy can do to offset supply shocks. Large negative supply shocks occur relatively rarely in advanced economies. In such circumstances, the appropriate monetary response will depend on whether the hit to demand is more than that to supply, and the extent of any exchange rate effects on inflation.

Third, in exceptional circumstances, the MPC's remit allows the Committee to extend the horizon over which it returns inflation to the target in support of its objectives for growth and employment. Given the starting position, this flexibility would only become relevant if the shock to demand were greater than that to supply. In that event, as it did following the referendum, the Committee would explain clearly its approach to managing any trade-off between inflation and output variability, including the horizon over which it is seeking to return inflation to the target.

Although the nature of EU withdrawal is not known at present, and its impact on the balance of demand, supply and the exchange rate cannot be determined in advance, under all circumstances, the MPC will respond to any material change in the outlook to bring inflation sustainably back to the 2% target while supporting jobs and activity.

5 Managing the Ongoing Risks to Financial Stability

5.1 The UK is Home to the World's Leading International Financial Centre

The UK is home to the world's leading international financial centre. At around ten times UK GDP by asset size; the scale, sophistication and degree of activity of the UK financial system is unmatched. Financial services represent around 7% of GDP, 11% of tax revenues, and over one million jobs across the UK. The UK is host to all thirty globally systemically important banks (G-SIBs) and the home jurisdiction of four. The UK has the largest share of cross-border bank lending, foreign exchange trading and interest rate OTC derivatives clearing. Firms incorporated in the UK are estimated to be involved in over half of debt and equity issuance by EU (excluding UK) borrowers. The UK's insurance industry is the world's fourth largest and the UK is a leading global hub for wholesale insurance in particular. The UK's asset management industry is the second largest in the world.

Ensuring financial stability is ultimately a national responsibility. UK taxpayers act as the ultimate backstop to the UK financial system, in the event that an orderly resolution of a systemically-important financial institution was not possible and recourse to public funds was required. This means it is vital, in any scenario, that the UK. authorities continue to have the ability to manage financial stability risks to the UK. They need to be able to apply the highest standards and have the ability to take action to ensure the safety and soundness of individual firms, as well as addressing risks to the financial system as a whole.

In a globally integrated financial sector, however, risks cannot be entirely managed domestically. This is especially true for the UK., which is also the world's most open financial centre. Being open enhances the efficiency and risk sharing of the financial system, but it also necessitates the management of cross-border risks. It is subject to cross-border risks from institutions domiciled in a very wide range of jurisdictions. The most effective way to manage those is through a combination of internationally agreed high prudential standards, a high degree of supervisory cooperation internationally, and a shared assessment of global systemic risks.

International prudential standards and regulation have been fundamentally reformed and strengthened by the international community in the light of the global financial crisis. These reforms, which have so far been effectively implemented in the EU (and hence the UK), set high global standards and strengthened the mechanisms for international surveillance of global systemic risks. The UK's post-crisis response has gone beyond both international and EU standards, for example in implementing the Senior Managers Regime and 'ring-fencing' of certain core retail banking- services. Overall, these reforms have substantially raised the level of resilience and risk assessment in both the UK and EU financial systems, reducing both the likely frequency and likely severity of a financial crisis.

Supervisory cooperation with jurisdictions whose banking, insurance and financial infrastructure firms operate in the UK. is at the heart of the UK's approach to managing cross border risks. It is central to the PRA's policy on the establishment of foreign financial firms in the UK, whether through branches or subsidiaries, and to the Bank's approach to the risks from cross border financial infrastructure firms such as CCPs, central securities depositories or payment and payment messaging systems.

As a member of the EU, much of the UK's financial regulation has been set at the EU level. The UK. has played a major role in shaping this body of regulation and the international standards which it implements.

In the same way, supervisory cooperation in relation to firms domiciled in EU jurisdictions has predominantly taken place through EU structures in which the UK. has exerted a major influence. Looking forward, the UK authorities intend for the UK financial system to remain open. Whatever the scenario for the new relationship between the UK and the EU, it will need to allow for the Bank of England and other authorities to continue to have the ability to manage financial stability risks effectively in what is the world's largest and most complex international financial centre.

5.2 Managing risks of a No deal and No Implementation Period scenario

No deal and no implementation period would, in the disruptive and disorderly scenarios set out in Chapter 3, mean an abrupt shift to WTO terms for the economy and, within that, for the financial services sector.

The financial stability risks of such a shift, both generally through the economic impact and specifically through the loss of cross border access for the financial sector, has been set out in detail in successive *Financial Stability Reports*. The 2018 stress test (ACS) shows that the UK banking system is resilient to deep simultaneous recessions in the UK and global economies that are more severe overall than the global financial crisis, large falls in asset prices and a separate stress of misconduct costs. Because they are resilient to the more severe annual stress test ACS, the FPC judges that major banks would also be resilient to the disorderly Brexit scenario.

In the ACS, UK GDP falls by 4 ¾ %, the UK unemployment rate rises to 9 ½ %, UK residential property prices fall by 33% and UK commercial real estate prices fall by 40%. The scenario also includes a sudden loss of overseas investor appetite for UK assets, a 27% fall in the sterling exchange rate index and Bank Rate rising to 4% (**Table 3.2.3**).

The FPC developed the disorderly scenario set out in Chapter 3 to assess whether the financial system was resilient to such an event. The outcomes of the scenario are compared to the 2018 ACS in **Table 5.2.1**. The large reductions in productivity and labour supply in the disorderly Brexit scenario mean that, although output in that scenario falls by more than in the ACS stress test, the rise in unemployment is smaller. The differences between the disorderly scenario and the ACS would be broadly offsetting in terms of their impact on banks.

Table 3.2.3: Outcomes in disorderly 'no transition no deal' scenario and 2018 ACS stress test

	GDP[1]	Unemployment rate[2]	Inflation[2]	House prices[1]	Commercial property prices[1]	Bank Rate	
						Average over years 1-3	Peak level
Disorderly	-8%	7 ½%	6 ½%	-30%	-48%	4%	5 ½%
Bank of England 2018 ACS stress test	-4¾%	9 ½%	5%	-33%	-40%	3 ¼%	4%

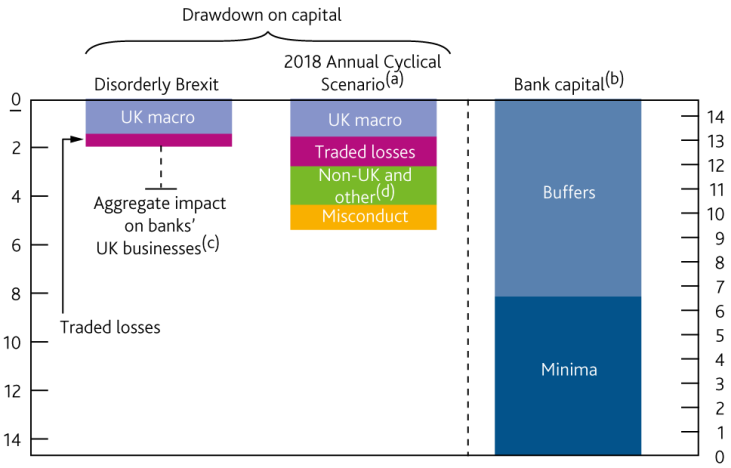
[1] Maximum fall from starting point

[2] Peak

[3] Defined to start in 2008 Q1

Chart 5.2.1 compares the impact on banks' capital ratios of the disorderly Brexit scenario and the ACS. The total impact of the disorderly Brexit macroeconomic scenario on major UK banks' aggregate CET1 capital ratio is around 1.5 percentage points. That is in line with the aggregate impact of the UK macroeconomic shock in the stress test.

Chart 5.2.1: Comparison of the impact of the disorderly Brexit scenario and 2018 ACS on major UK banks' capital ratios



Sources: Participating banks' STDF data submissions, PRA regulatory returns, published accounts, Bank analysis and calculations.

(a) The CET1 impact for the ACS is before the conversion of AT1 instruments.

(b) Defined as total aggregate CET1 capital as a proportion of risk-weighted assets.

(c) Average impact on banks' UK businesses calculated by scaling the aggregate impact of the disorderly Brexit scenario based on groups' aggregate ratio of global to UK business. This estimates the impact of the scenario as a proportion of groups' aggregate UK RWAs.

(d) Non-UK is computed as a residual in this chart. It includes global elements in the same category as the UK macro-economic impact.

In addition, the disorderly Brexit scenario also includes sharp adjustments in UK financial markets. Term premia on gilts rise by 100 basis points and UK equity prices fall by 23%, with bigger falls for UK-focused companies. Investment grade corporate bond spreads rise by almost 300 basis points. Losses on trading books add a further 0.5 percentage points to the impact on major UK banks' aggregate CET1 ratio (**Chart 5.2.1**).

The annual stress test also included a severe UK financial market stress with sterling investment grade corporate bond spreads widening by 280 basis points and UK equity prices falling by up to 45%. In addition, it included a severe global market stress so that, overall, losses on trading books in the stress test reduced major banks' aggregate CET1 capital ratio by 1.2 percentage points, relative to the start of the stress.

The FPC judges that the UK economic and market stress scenario in the 2018 stress test of major UK banks was sufficiently severe to encompass the disorderly Brexit scenario.

The aggregate impact of the disorderly Brexit scenario and of the UK macroeconomic element of the ACS stress test on the banking systems aggregate capital is limited. In part that reflects the geographic diversification of major UK banks. In aggregate, only around half of their exposures are to the UK.

This diversification increases the resilience of the system as a whole to country-specific shocks, such as that in the disorderly Brexit scenario. It means that a large proportion of the capital UK banks hold is to absorb losses incurred in other jurisdictions. As a result, the impact of losses incurred only in the UK is relatively small when compared to the overall level of capital.

For UK-focused banks, the impact on capital ratios of the disorderly Brexit scenario would be greater than the aggregate. For example, the average effect of the disorderly Brexit scenario on banks' UK businesses in isolation would be to reduce aggregate CET1 capital ratios by about 4pp. This is also shown in **Chart 5.2.1**.

The same holds for the impact of the UK economic shock in the stress test. However, unlike the disorderly Brexit scenario, the stress test also included a severe global recession and global market shock. So differences in the geographic composition of banks' exposures mattered less for their relative performance. The aggregate impact on banks' capital of the UK and global macroeconomic and market shocks in the stress test was 4.4 percentage points.

The stress test also included a separate stress of misconduct redress costs. Taken together, this brings the total impact of the ACS to be 5.4 percentage points.

With an aggregate Tier 1 capital ratio of 17.3% of risk-weighted assets and an aggregate common equity Tier 1 ratio of 14.7%, banks have buffers of capital above their minimum requirements well in excess of the impact of the stress test scenario and further in excess of the disorderly Brexit scenario (**Chart 5.1.1**).

As a result, the FPC judges that the impact of the disorderly Brexit scenario on the core banking system's aggregate capital ratio would be smaller than the impact of the ACS stress test.

Major UK banks also have sufficient liquidity to withstand a significant disruption in financial markets. Any disruption in financial markets in a disorderly Brexit could place pressure on funding conditions for the banks', and hence on their ability to provide financial services to the UK real economy. The FPC has therefore reviewed the resilience of banks' funding and liquidity positions.

At a group level, major UK banks hold more than £1 trillion of high-quality liquid assets. On a like for like basis, this is more than four times the level they held before the financial crisis. This means they more than meet the Liquidity Coverage Ratio (LCR) standard, which measures a bank's liquid assets as a proportion of the net outflows it might face over a severe 30-day stress. In aggregate, major UK banking groups have 50% more liquid assets than needed to meet this standard. UK banks have also pre-positioned collateral at the Bank of England such that they could access around £300bn of additional funding through the Bank's regular facilities.

The Bank is able to provide substantial liquidity in all major currencies. As an additional precaution against a severe dislocation in financial markets, the PRA has been working with major UK banking groups to ensure they have sufficient liquidity, both in aggregate and in individual major currencies, to survive the closure of important funding markets, including foreign exchange markets. Because of this and their own risk management major UK banking groups can now survive many months of such disruption.

The largest life insurers have an aggregate surplus of capital above their regulatory requirements of £44.5bn, 62% more than their regulatory requirements. Sharp falls in asset prices like those in the disorderly Brexit scenario would cause life insurers' aggregate capital positions to deteriorate materially, but they would remain well above regulatory requirements.

In November 2017, the FPC published a checklist of actions that would mitigate risks of disruption to important financial services used by households and businesses to support their economic activity. It has since updated its judgements of progress against this checklist on a quarterly basis.

In the UK, significant progress continues to be made towards mitigating the risks of disruption to cross-border financial services. However, EU authorities have taken few mitigating actions, relying instead on actions by the private sector. A full analysis of these risks is contained in the Bank's November *Financial Stability Report*.

In a disorderly Brexit, some market volatility would be expected. As demonstrated after the EU referendum in 2016, sterling markets are able to function effectively through markedly volatile periods. The strength of the core financial system, including banks, dealers and insurance companies supports the markets on which the economy relies.

5.3 Financial Stability Implications of an Implementation Period

Cliff-edge risks, both in the financial sector and more broadly across the economy, arise because of the lack of preparation time in moving to new EU-UK trading relations. The scenarios described in Chapter 3 of this document illustrate how material an absence of preparedness would be for the UK economy. The information in Chapter 2 documents the as yet limited level of preparedness of UK businesses and infrastructure.

Securing an Implementation Period will mitigate the near-term financial stability risks arising from general economic impact of a disorderly withdrawal from the EU. This Implementation Period should be as long as necessary to prepare properly for the new trading relationships. It would also allow for more time for adjustment of the financial sector. A description of the level of preparedness across sectors is contained in Chapter 2 of this paper.

During the implementation period, current EU rules will apply in the UK as though the UK were still a member of the EU. EU rules currently in force or coming into force before the end of the Implementation Period would apply in the UK as if the UK was a member of the EU.

Maintaining the current body of EU regulation throughout the Implementation Period should have no impact on financial stability. As set out in the Bank of England's 2015 report on EU membership, the current body of EU regulation has substantially raised the quality of regulation in the EU overall and implements effectively internationally agreed standards.[32] The Bank of England has influenced this regulation through a number of channels. As regulator for the largest financial sector in the EU, the Bank of England has advised and supported the UK Government in the EU legislative processes and influenced the EU authorities in the development of binding technical standards. The Bank has played an active role in the European Systemic Risk Board (ESRB).

During the Implementation Period, the UK will not be a member of, or have a regular voice in, the main supervisory cooperation structures - the European Supervisory Authorities - although it can be invited as an observer if the discussion concerns legal acts addressed to the UK or if it is necessary and in the interests of the EU for the UK to be present. The UK authorities will, however, remain members of the EU colleges of supervisors for UK subsidiaries, UK branches of insurers and banks which operate significantly in the EU, and branches of EU insurers and banks that operate significantly in the UK The UK authorities will also remain members of EU college of supervisors for CCPs and continue to chair these colleges for UK CCPs. These arrangements, while a diminution of UK influence in the supervisory sphere, are not at present judged to pose material risks to the Bank's financial stability objective.

During the implementation period, the UK will be a 'rule-taker': new EU rules on which the UK will not have had any vote will also apply in the UK as though the UK were still an EU member.

It is possible of course that without the UK at the EU's decision-making table, new rules that are either not well-suited for the UK, or that limit the Bank's flexibility and supervisory discretion could be agreed in this period. These would need to be applied in the UK. Such rule changes could impact on the Bank's ability to discharge its objectives relating to financial stability. On the basis of the EU legislation that is currently in the pipeline of the EU legislative process in which the UK has been involved and the usually long lead times

[32] EU Membership and the Bank of England, October 2016, page 84.

for new EU legislative proposals, the Bank of England currently expects this risk to be manageable. The Withdrawal Agreement includes the option for the UK and EU to extend the Implementation Period by mutual agreement via the Joint Committee, by a "period for up to one or two years"[33]. The risk of EU legislation detrimental to the Bank's ability to meet its financial stability objective would be adopted increase the longer the Implementation Period continues. Whether such risks materialised would depend on what action the EU took during the Implementation Period to bring new legislation or amend current legislation. And such risks need to be assessed against the broader financial stability benefit of allowing sufficient time for the economy to prepare or the new regime.

5.4 Declaration on the Economic Partnership

5.4.1 Equivalence as the basis of the future partnership on financial services

At the end of the Implementation Period, under the Withdrawal Agreement, the UK and EU would either agree to move to an Economic Partnership or the Northern Ireland backstop would come into play. Economic Scenarios for the Economic Partnership are set out in Chapter 3.

The Northern Ireland backstop incorporates no provision for the regulation of financial services. The position after the Implementation Period will therefore depend on whether any specific arrangements on financial services have been agreed. Absent such an agreement, WTO rules for financial services would apply.

The Political Declaration makes clear that both the EU and UK aim for cross-border trade in financial services to be based on autonomous decisions by each jurisdiction on the equivalence of the other jurisdiction's regulatory regime. They aim to conclude their respective equivalence assessments by June 2020.

Equivalence does not replicate the EU 'passport' that currently provides for cross-border market access for all financial services between EU Member States. Rather, equivalence can facilitate cross-border activity and preferential supervisory treatments for some financial activities. There is no single regime or standard form of equivalence for non-EU countries in the EU law. Rather, equivalence provisions are a set of diverse arrangements within EU sectoral legislation. Equivalence arrangements for non-EU countries currently exist in some parts of the EU legislation and cover a limited set of financial activities. Equivalence decisions that facilitate cross-border activity are unilaterally made by the Commission, and can be withdrawn with very little notice. The Commission has made a number of proposed amendments to reform equivalence provisions in certain sectoral legislation. The outcome of these proposals and therefore the impact on the current EU equivalence regime remains uncertain.

The Political Declaration contains few details of what future equivalence arrangements might comprise. The White Paper 'The future relationship between the United Kingdom and the European Union' ("the White Paper") set out in more detail the UK Government's intentions for such arrangements. The EU has not responded to this aspect of the White Paper. It is however in the process of revising substantially its main equivalence regimes for financial services – in part in the light of Brexit. Proposed changes have generally been designed to strengthen the EU's influence in its relations with non-EU jurisdictions.

In the White Paper, the UK Government set out an objective of an equivalence arrangement with the EU of broader scope and greater stability and transparency than the regime currently in force in the EU. Under the White Paper the scope of existing autonomous equivalence frameworks would be expanded to encompass a broader range of cross-border activities, those that generate the greatest economies of scale

[33] Agreement on the withdrawal of the United Kingdom of Great Britain and Northern Ireland from the European Union and the European Atomic Energy Community, Article 132.

and scope, to maintain the economic benefits of integrated financial sectors while preserving financial stability.[34] Autonomous equivalence decisions on each side would be based on an "evidence-based judgement of the equivalence of outcomes achieved by the respective regulatory and supervisory regimes".[35] Autonomous equivalence decisions would be accompanied by bilateral commitments on common principles for the governance of relationship, a regulatory dialogue and extensive supervisory cooperation, as well as structured and transparent processes – in particular for the withdrawal of equivalence.[36]

In the Bank of England's view, the ability for financial firms to branch into or operate in other countries, particularly to undertake wholesale business, can, provided it is done safely, be an important component of an open world economy, which in turn benefits the UK economy. To achieve this international authorities must work together to manage cross-border challenges. For example, for branches of banks, the PRA requires firms to meet minimum prudential standards, and to be capable of effective supervision by the PRA, and for the Bank of England to have appropriate assurance over the resolution arrangements for the firm and its UK operations. This includes an open dialogue and prompt engagement and support from the home state supervisors and regulatory authorities. The more important an international firm is to UK financial stability, the higher the degree of supervisory and resolution cooperation that is required.

In the Political Declaration the UK and EU agreed to "close and structured cooperation on regulatory and supervisory matters". As the UK leaves the EU and to ensure continuity and effective cooperation, it is important for the UK and EU regulators to make tailored, reciprocal and comprehensive commitments in relation to supervisory cooperation and crisis management, including resolution. It may be possible to go beyond existing arrangements EU in certain areas. However, cooperation should not interfere with the Bank of England's ability to respond effectively to emerging or crystallising risks.

The alternative to deep and comprehensive cooperation is to attempt to manage risks by turning towards closed markets. That would, in turn, restrict cross-border investment, fragment pools of funding and liquidity, and reduce competition. The result would be higher costs of financing for households and business, less reliable access to finance and less resilient finance.

Negotiations between the UK and the EU on equivalence have not yet begun and it is therefore difficult to be precise about the implications of any equivalence arrangements for the Bank's ability to deliver its financial stability objective. These will need to be assessed at the time and in the round looking at a range of factors including the extent to which equivalence is based on outcomes rather than textual alignment of rules, the transparency of the equivalence process and, related, the stability of equivalence decisions.

In the equivalence-based relationship proposed in the Political Declaration, equivalence decisions are an autonomous matter for both Parties. Regulatory and decision-making autonomy will mean the UK and EU would be able to develop their rulebooks independently over time. However, maintaining cross-border activity through equivalence provisions would require the UK and EU regulatory regimes to produce sufficiently similar outcomes on an ongoing basis. There could, over time, be pressure for the UK to maintain a closer alignment to the EU than it would otherwise choose in order to maintain equivalence. At one extreme this could result in the UK becoming a de facto rule-taker. These associated risks could build over time as regulatory systems diverged. Changes to equivalence regimes that jeopardised supervisory autonomy in relation to UK firms would likewise have implications for the Bank's financial stability objective.

Any arrangement based solely on autonomous decisions by each side, without any overarching common agreement for a framework between the Parties (e.g. on mechanisms to resolve disputes), must therefore

[34] The future relationship between the United Kingdom and the European Union, July 2018, pages 29-30.
[35] Ibid, page 30.
[36] Ibid, page 30-32.

deliver effective autonomy through time, both in principles and in practice, for both Parties. Such an arrangement would need to be assessed on a regular basis to ensure it was not detrimental to the management of UK financial stability risk.

Irrespective of the particular form of the UK's future relationship with the EU, and consistent with its statutory responsibilities, the Bank of England will remain committed to the implementation of robust prudential standards in the UK. This will require maintaining a level of resilience that is at least as great as that currently planned, which itself exceeds that required by international baseline standards, as well as maintaining more generally the UK authorities' ability to manage UK financial stability risks.

Appendix A Impact on the UK economy of a transition to WTO

As part of its request, the Treasury Committee asked that this report consider the impact of the UK leaving the EU with no trade agreement at the end of a transition period. This section covers that scenario.

In the event of the UK leaving the EU without a trade agreement, the default outcome for the UK would be for trade to revert to World Trade Organization (WTO) trading arrangements. This would result in the introduction of tariffs, quotas, customs and other non-tariff barriers to trade.

In the scenario described below, the UK leaves the EU in March 2019 with a transition period that lasts until the end of 2020, and trades on WTO terms from 2021. The analysis presents a range of outcomes for GDP under this scenario. The key sensitivities for the impact on GDP are the speed with which new barriers reduce trade and productivity and, most importantly, how prepared authorities and firms are for trading on WTO terms.

The 21-month transition may not give sufficient time to adjust to this unprecedented change in trading arrangements. And the cost of not making necessary adjustments would be high. Without necessary infrastructure at borders, customs checks may not be possible without costly delays, and without proper contingency plans firms may not be able to export as easily. The lower part of the range of outcomes incorporates disruption at the border, to capture the key risk that firms and authorities have not completed the required adjustments by 2021.

There is considerable uncertainty around the impact on the UK economy of a transition to trading on WTO terms. This section considers two variants: a 'Prepared' and an 'Unprepared' outcome which form the top and bottom of a range of impacts.

These scenarios are not forecasts. The ranges shown for each scenario reflect different assumptions. Forecasts would not usually incorporate so many conditioning assumptions. In contrast to the fan charts presented in the *Inflation Report*, these ranges do not contain error bands reflecting uncertainty over the evolution of GDP growth in the future. The degree of uncertainty around any forecast would be greater than the ranges provided in the report, to allow for alternative paths for other key influences, such as the world economy and the response of macroeconomic policy. The rank ordering of the scenarios, however, is clear.

The Bank was asked to provide an assessment of the consequences of leaving the EU, by comparing these scenarios to a baseline of 'the present situation'.[37] To meet this request, comparisons are given relative to a continuation of growth along the path for potential output embodied in the MPC's May 2016 forecast, the MPC's last pre-referendum set of projections – the 'May 2016 trend' hereafter. The November 2018 *Inflation Report* projections are also included on all charts to provide an additional point of comparison.

A.1 Assumptions underpinning the transition to WTO scenarios

- **Significant trade barriers are introduced**
    - **Trade in goods and services with the EU face new barriers**

[37] The Rt Hon. Nicky Morgan's letter to Governor Mark Carney, 11 October 2018.

Under WTO terms, UK trade with the EU will be subject to tariffs, quotas and quantitative restrictions across all goods sectors. Assuming the UK maintains the same tariff schedule as the EU, UK exporters and importers would face tariffs of around 3¼% on trade with the EU. Customs checks and procedures are introduced and regulatory checks become onerous. Residual barriers arise over time**.** All barriers are applied symmetrically.

- **Financial services barriers with the EU rise immediately**

UK firms no longer have the ability to 'passport' into the EU, leading to a loss of market access. Equivalence is not granted by EU authorities.

- **The UK does not implement any new independent deals with third countries**

- **Uncertainty**

The significant change in trading arrangements from the present situation is assumed to have a material impact on uncertainty. In the Prepared variant, there is a marginal increase in the uncertainty index described in **Chapter 2**, relative to current conditions, of ½ a standard deviation. In the Unprepared variant, uncertainty increases by 1 standard deviation.

- **Macroeconomic policy responds**

Automatic fiscal stabilisers are assumed to operate, but no discretionary reductions in spending or changes in tax rates are assumed.

In this as in all the scenarios, monetary policy is assumed to react mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates rise gently.

In the Prepared scenario, the CCyB remains at 1%. In the Unprepared scenario it is cut to 0%.

- **The variants make different assumptions about preparedness for WTO arrangements**

To avoid significant disruption to the economy, it will be crucial for authorities and firms to take mitigating actions to adjust to new trading arrangements during the 21-month transition period.

In the Prepared variant, authorities and firms are assumed to take sufficient action to prevent significant disruption at the border once the transition period ends. In the Unprepared variant the UK's border infrastructure is assumed to be unable to cope smoothly with new customs requirements for some time. This results in disruption to trade, which falls by an additional 6% until new border infrastructure and processes are established.

The disruption at the border results in a sharp fall in productivity. Supply chains are disrupted and economic activity falls. Output per employee falls by an additional 1¾% in the short term.

Table A.1: Key assumptions in the Prepared and Unprepared variants

Transition to WTO			
Assumption		**Prepared**	**Unprepared**
Trading arrangements	Tariffs	From the start of 2021 the EU applies Common Customs Tariff. UK applies symmetric tariffs.	

	Customs barriers	Customs checks on UK-EU trade introduced from 2021.	
	Other goods barriers	Regulatory checks required for new and existing products.	
	Services barriers	Revert to WTO terms from 2021. Financial services lose passporting rights. Broadcasting rights lost. Increased costs for transport services as firms require EU license.	
	Trade deals	No new trade deals with third countries implemented before 2023. UK retains access to existing trade agreements between EU and third countries.	
Preparedness for new trading arrangements		UK fully prepared for change in trade arrangements when the transition period ends in 2020.	UK not fully prepared for change in trade arrangements when the transition period ends in 2020; some disruption at border. Disruption at the borders is assumed to reduce trade volumes and productivity further in the short term
Macroeconomic policy		Relative to the *IR*, monetary policy reacts mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates are rising gently. No discretionary changes in spending or tax policy are assumed. Automatic stabilisers operate. No change in countercyclical capital buffer.	Relative to the *IR*, monetary policy reacts mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates are rising gently. No discretionary changes in spending or tax policy are assumed. Automatic stabilisers operate. Countercyclical capital buffer cut from 1% to 0%.
Financial conditions		Interest rates on loans to households and businesses rise by 20bps more than Bank Rate. There is a 12.5bps increase in gilt premia.	Interest rates on loans to households and businesses rise by 80bps more than Bank Rate. There is a 25bps increase in gilt premia.
Macroeconomic uncertainty		Uncertainty index increases from current levels by ½ standard deviations. Households and firms anticipate some weakness in future incomes.	Uncertainty index increases from current levels by 1 standard deviation. Households and firms anticipate some weakness in future incomes.

A.2 Modelling the effects of these assumptions on the economy

The effects of these assumptions on the economy are modelled using empirical relationships that have held in the past (**Chapter 2**). The primary relationships on which the variants of the scenario are constructed are shown in **Table A.2.**

Table A.2: Key economic relationships

Transition to WTO			
		Results	
Relationship	Analytical Foundation (See Chapter 2 for more details)	Implication for Prepared	Implication for Unprepared
Trade barriers and trade volumes	Empirical studies are used to calibrate the extent to which higher trade barriers reduce trade. Speed of adjustment depends on the type of barrier. A judgement has been taken that new barriers of particular types affect trade faster than the removal of barriers.	Trade is 13% lower than the May 2016 trend by end-2023.	Trade is 13% lower than the May 2016 trend by end-2023 as a result of new trade barriers. There is an additional fall in the near-term, due to disruption at the border, before businesses adapt and new border checks can be properly introduced (**Table A.1**).
Openness to trade, FDI, and productivity	Empirical estimates on the impact of openness on trade, FDI and productivity.	Output per hour falls by 4% by end-2023 relative to the May 2016 trend.	Output per hour falls by 5% by end-2023 relative to the May 2016 trend. As discussed in Chapter 2, it is possible that lower openness drags on productivity more quickly than estimates based on periods of trade integration would suggest. This variant also allows for the lack of preparedness and disruption of supply chains to accelerate the impact on productivity.
Openness and the exchange rate	Sterling has depreciated by 18% since its 2015 peak. The response of the exchange rate in the scenarios is calculated to broadly offset changes in the sustainable current account position caused by the new trading arrangements.	Sterling depreciates by a further 8½% in 2019 relative to the November 2018 Inflation Report.	
Economic conditions and	The ONS's principal projection is used until end-2020. After	Net migration declines to	Net migration declines to

migration	that net inward migration is consistent with economic conditions, constrained not to exceed 100,000 a year in line with the government's current policy.	85,000 by 2023.	30,000 by 2023.
Economic prospects, uncertainty, financial conditions, and consumption & investment	Households and firms respond to expectations of lower incomes based on empirical estimates. Empirical studies are used to map from an index of uncertainty, and from financial conditions, to investment and consumption.	Lower productivity growth feeds into lower incomes and consumption. Households and businesses respond to the increase in uncertainty by delaying spending. That reduces GDP by a peak of ½% relative to the May 2016 trend.	Lower productivity growth feeds into lower incomes and consumption. Households and businesses respond to the increase in uncertainty by delaying spending. That reduces GDP a peak of around 1% relative to the May 2016 trend.

A.3 Overall impact

The estimated paths for GDP in the Transition to WTO scenario under the assumptions in Table A.1 are shown in Chart A.1. Relative to the May 2016 trend, in 2021 GDP is between 4¼% and 7½% lower. By end 2023, GDP is between 5¼% and 8¼% lower. Relative to the November 2018 *Inflation Report* projection, by end-2023 it is between 2½% and 5½% lower. These scenarios are not forecasts: the range does not cover every possible assumption, or every possible impact of moving to WTO trading arrangements, nor does it capture generalised uncertainty about prospects for the economy.

The range for the impact on UK GDP reflects the sensitivity to a few key assumptions (**Table A.1**). For example the speed at which higher trade barriers affect productivity and, importantly, whether firms and authorities are sufficiently prepared to prevent disruption at the border after the transition period.

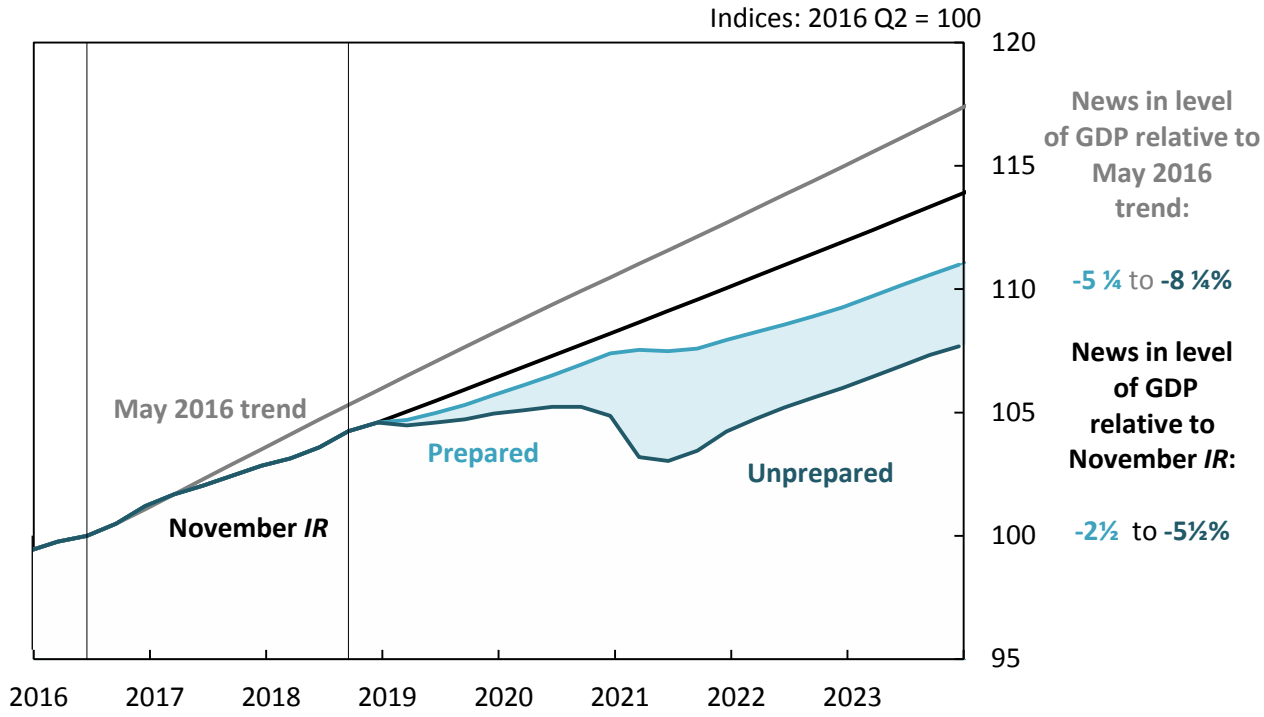
As discussed above, outcomes towards the upper end of the swathe are consistent with: a smaller drag on UK productivity from trade barriers over the scenario horizon; a smaller fall in net migration; and a smaller drag on consumption and investment from uncertainty and anticipation of future productivity and incomes. Importantly the upper end of the swathe assumes no disruption at the border, as firms and authorities are fully prepared at the end of the transition period.

Larger falls in GDP are associated with a larger, more immediate fall in productivity as trade barriers are introduced; a larger fall in net migration; and a larger drag on consumption and investment from uncertainty and anticipation of future productivity and incomes. In particular, outcomes towards the bottom of the swathe incorporate some disruption at the border, to capture the risk that firms and authorities have not completed the adjustment to new trading arrangements. This results in a significant reduction in trade and productivity as the transition period ends.

This fall in GDP is accompanied by a rise in unemployment in both variants. In the Prepared variant, it peaks at 4½%. In the Unprepared variant it peaks at 5½% (**Chart A.2**).

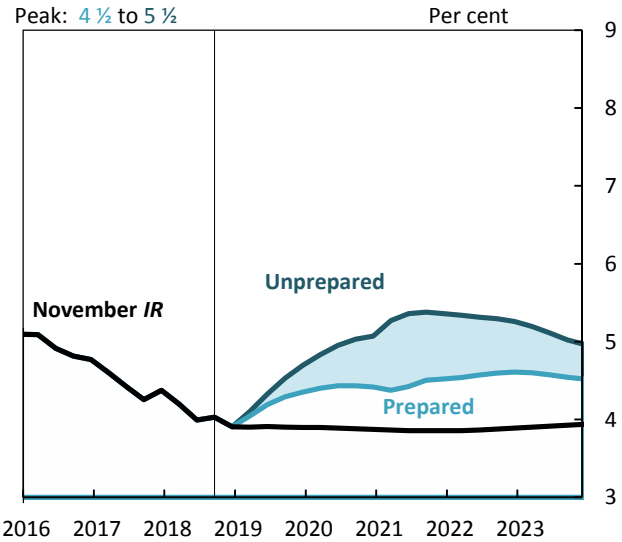
In both scenarios, inflation picks up sharply after the move to WTO trading arrangements (**Chart A.3**), driven by the introduction of tariffs, which increase the cost of imported goods and services. In the Prepared variant, inflation peaks at 3% in 2021. In the Unprepared variant the increase in inflation is exacerbated by significant disruption at the border, peaking at 3¼% in 2021.

Chart A.1 Range of GDP outcomes in Transition to WTO scenarios



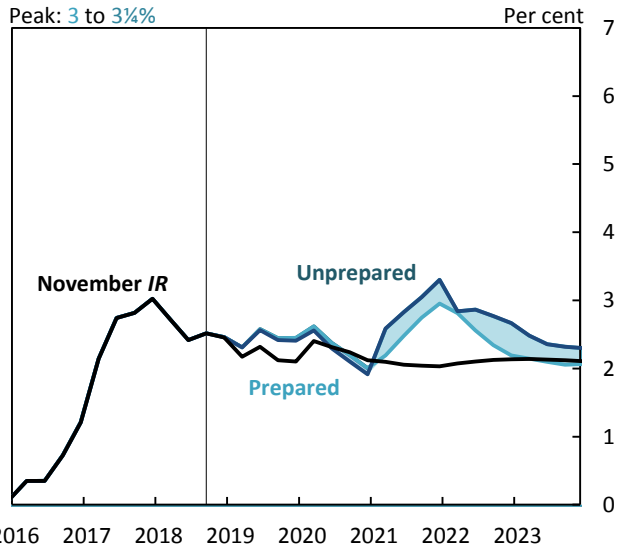
Sources: ONS and Bank calculations.

Chart A.2 Range of unemployment outcomes in Transition to WTO scenarios



Sources: ONS and Bank calculations.

Chart A.3 Range of inflation outcomes in Transition to WTO scenarios



Sources: ONS and Bank calculations.

Appendix B External studies of the impact of Brexit

There have been many studies published estimating the impact of Brexit, as set out in Tetlow and Stojanovic (2018). Almost all judge that the UK's withdrawal from the EU has weakened GDP growth to date, and will weigh on output in the coming years. There is a range of views about the magnitude of that effect.

B.1 The impact of Brexit on the UK economy to date

On average, studies assessing the impact of Brexit to date estimate that GDP is currently around 2% lower than it would have been had the UK remained in the EU. Some studies (e.g. Nomura, Centre for European Reform, UBS) estimate the impact of Brexit by comparing UK growth since the referendum to other similar countries. Other studies (e.g. IMF, JPMorgan) compare projections for UK GDP made before the referendum with subsequent data outturns. For reference, the level of GDP in 2018 Q3 was 1% lower than the MPC had projected in May 2016, a forecast that was conditioned on the government's policy of the UK remaining in the EU, despite support from stronger-than anticipated global growth, and more supportive domestic financial conditions than the MPC had expected at that time (Chapter 3).

Weak real income growth associated with the referendum-related depreciation of sterling has been cited by many studies as a factor weighing on GDP growth. A study by academics at the London School of Economics estimated that the depreciation of sterling increased inflation by 1.7 percentage points in the 12 months following the referendum.

Most studies also cite weaker business investment, related to an increase in uncertainty among businesses about the eventual trading arrangements between the UK and the EU, as a cause of weaker GDP growth since the referendum. Capital Economics, for example, estimate that investment would have grown by about 5% a year had the UK voted to remain in the EU, whereas it has been broadly flat.

B.2 Estimates of the long-run impact of Brexit

When economists estimate the long-run impact of Brexit, the main channels through which Brexit is expected to affect GDP is through changes to trade costs, the amount of foreign direct investment (FDI), and the extent of EU migration.

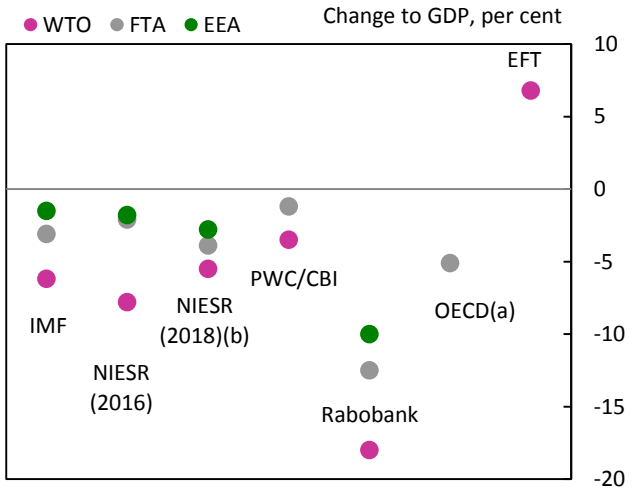
Most studies conclude that Brexit will reduce output in the long-run (**Chart B.1**). That is because most studies predict that Brexit will increase trade barriers between the UK and other countries on average, and reduce FDI and EU migration. There is an extensive body of economic evidence which demonstrates that openness to trade and investment is associated with faster economic growth.

The one study that predicts that Brexit will provide a significant boost to the UK economy is by the Economists for Free Trade (EFT). Those estimates are based on the assumption of 'unilateral free trade' with non-EU countries whereby the UK abolishes its trade barriers, and it does not increase barriers to trade with the EU. That means that openness to trade increases. These strong assumptions contrast with all other studies.

Among the studies that estimate a negative long-run impact, the magnitude of the effect varies markedly. The most pessimistic scenario is one where the UK and EU trade with each other on World Trade Organisation (WTO) terms – the red dots in **Chart B.1** – the impact ranges from a 3.5% to 18% reduction in output by 2030. The largest negative effects are in those studies where lower trade, investment and migration have a permanent effect on UK productivity growth. Under scenarios where the UK signs a Free

Trade Agreement (FTA) with the EU, or remains in the European Economic Area (EEA), the hit to GDP is smaller. The most recent study by NIESR analyses the long-run economic impact of the Government's proposed deal. That results in GDP being around 4% lower relative to a scenario where the UK remains in the EU.

Chart B.1: Long-run estimates of the impact associated with Brexit, relative to remaining in the EU



(a) OECD central scenario assumes a reversion to WTO terms before a free trade agreement is reached after a few years.
(b) NIESR (2018) scenario includes the government's proposed deal where the UK leaves the EU in March 2019, enters a transition period lasting until end 2020 and then moves to a FTA.
(c) Sources: External economists

Appendix C Scenario assumptions

Economic Partnership			
Assumption		**Close**	**Less Close**
Trading arrangements	Tariffs	None.	None.
	Customs barriers	No customs checks on UK-EU trade.	Customs checks on UK-EU trade introduced from 2021.
	Other goods barriers	No new regulatory barriers.	Additional regulatory checks required for new product lines. (Previous recognitions grand-fathered).
	Services barriers	Barriers to non-financial services trade emerge. System of mutual recognition in professional qualifications is put in place. Financial services lose passporting rights but one half of the loss is mitigated by equivalence on some financial services.	Services provisions less extensive. Barriers to non-financial services trade emerge. System of mutual recognition in professional qualifications is put in place. Financial services lose passporting rights but one quarter of the loss is mitigated by equivalence on some financial services.
	Trade deals	No new trade deals with third countries implemented before 2023. UK retains access to existing trade agreements between EU and third countries.	
Preparedness for new trading arrangements		The transition period until the end of 2020 is assumed to be sufficient for all sectors' regulatory authorities and infrastructure to be able to prepare for the new trading arrangements.	
Macroeconomic policy		Relative to the *IR*, monetary policy reacts mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates are rising gently. No discretionary changes in spending or tax policy are assumed. Automatic stabilisers operate. No change in the countercyclical capital buffer.	
Financial conditions		No additional effects	No additional effects
Macroeconomic uncertainty		Uncertainty falls back to average by the end of 2019. No anticipation effects.	Uncertainty falls back to average by the end of 2021. No anticipation effects.

No transition, No deal			
Assumption		**Disruptive**	**Disorderly**
Trading arrangements	Tariffs	EU applies Common Customs Tariff. UK applies symmetric tariffs.	
	Customs barriers	Customs checks on UK-EU trade introduced.	
	Other goods barriers	UK recognises EU standards. EU does not reciprocate. Regulatory checks required for new and existing product lines.	
	Services barriers	Revert to WTO terms. Financial services lose passporting rights. Broadcasting rights lost. Increased costs for transport services as firms require EU license.	
	Trade deals	No new trade deals implemented before 2023. UK retains access to existing trade agreements between EU and third countries.	No new trade deals implemented before 2023. UK loses access to existing trade agreements between EU and third countries.
Preparedness for new trading arrangements		Some delays at the border associated with re-certification of products.	Severe disruption at the border reflecting customs checks.
Macroeconomic policy		Monetary policy responds mechanically to balance deviations of inflation from target and output relative to potential. Bank Rate rises to 1.8%.	Monetary policy responds mechanically to balance deviations of inflation from target and output relative to potential. Bank Rate rises to 5.5%.
		Automatic fiscal stabilisers operate. No discretionary changes in tax or spending policy. Countercyclical capital buffer cut from 1% to 0%.	
Financial conditions		Financial conditions tighten due to weaker and more uncertain economic conditions. EU does not take action to address remaining risks in derivative markets. Overall, interest rates on loans to households and businesses rise by 150bps more than Bank Rate. There is a 50bps increase in the term premium on gilts.	Financial conditions tighten due to weaker and more uncertain economic conditions. EU does not take action to address remaining risks in derivative markets. Negative spillovers to other UK markets. Overall, interest rates on loans to households and businesses rise by 250bps more than Bank Rate. Uncertainty about institutional credibility leads to a pronounced increase in risk premia on sterling assets, including a 100bps increase in the term premium on

			gilts.
Macroeconomic uncertainty		Index rises by 1½ standard deviations from current levels, a similar rise to that seen around the EU referendum.	Index rises by 2 standard deviations to levels only exceeded in the financial crisis.
Transition to WTO			
Assumption		**Prepared**	**Unprepared**
Trading arrangements	Tariffs	From the start of 2021 the EU applies Common Customs Tariff. UK applies symmetric tariffs.	
	Customs barriers	Customs checks on UK-EU trade introduced from 2021.	
	Other goods barriers	Regulatory checks required for new and existing products.	
	Services barriers	Revert to WTO terms from 2021. Financial services lose passporting rights. Broadcasting rights lost. Increased costs for transport services as firms require EU license.	
	Trade deals	No new trade deals with third countries implemented before 2023. UK retains access to existing trade agreements between EU and third countries.	
Preparedness for new trading arrangements		UK fully prepared for change in trade arrangements when the transition period ends in 2020.	UK not fully prepared for change in trade arrangements when the transition period ends in 2020; some disruption at border. Disruption at the borders is assumed to reduce trade volumes and productivity further in the short term.
Macroeconomic policy		Relative to the *IR*, monetary policy reacts mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates are rising gently. No discretionary changes in spending or tax policy are assumed. Automatic stabilisers operate. No change in countercyclical capital buffer.	Relative to the *IR*, monetary policy reacts mechanically to balance deviations of inflation from target and output relative to potential. In both variants, interest rates are rising gently. No discretionary changes in spending or tax policy are assumed. Automatic stabilisers operate. Countercyclical capital buffer cut from 1% to 0%.
Financial conditions		Interest rates on loans to households and businesses rise by 20bps more than Bank Rate. There is a 12.5bps increase in gilt premia.	Interest rates on loans to households and businesses rise by 80bps more than Bank Rate. There is a 25bps increase in gilt premia.

Macroeconomic uncertainty	Uncertainty index increases from current levels by ½ standard deviations. Households and firms anticipate some weakness in future incomes.	Uncertainty index increases from current levels by 1 standard deviation. Households and firms anticipate some weakness in future incomes.

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