



HM Government

# HM Treasury analysis: the immediate economic impact of leaving the EU





# HM Treasury analysis: the immediate economic impact of leaving the EU

Presented to Parliament by the  
Chancellor of the Exchequer  
by Command of Her Majesty

May 2016

Cm 9292

This document has benefitted from a review by Professor Sir Charles Bean, former Deputy Governor of the Bank of England, acting in a personal capacity as an academic consultant to HM Treasury. All content and conclusions in this study are, however, the responsibility of HM Treasury.

Commenting on the work, Professor Bean said: “While there are inevitably many uncertainties – including the prospective trading regime with the EU – this comprehensive analysis by HM Treasury, which employs best-practice techniques, provides reasonable estimates of the likely size of the short-term impact of a vote to leave on the UK economy.”



© Crown copyright 2016

This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit [nationalarchives.gov.uk/doc/open-government-licence/version/3](http://nationalarchives.gov.uk/doc/open-government-licence/version/3) or write to the Information Policy Team, The National Archives, Kew, London TW9 4DU, or email [psi@nationalarchives.gsi.gov.uk](mailto:psi@nationalarchives.gsi.gov.uk)

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

This publication is available at [www.gov.uk/government/publications](http://www.gov.uk/government/publications)

Any enquiries regarding this publication should be sent to us at [public.enquiries@hmtreasury.gsi.gov.uk](mailto:public.enquiries@hmtreasury.gsi.gov.uk)

Print ISBN 9781474132633

Web ISBN 9781474132640

PU1948

ID 10051605 05/16

Printed on paper containing 75% recycled fibre content minimum

Printed in the UK by the Williams Lea Group on behalf of the Controller of Her Majesty's Stationery Office

# Contents

Foreword	3
Executive summary	5
Section 1    Uncertainty, disruption and costs of leaving the EU	11
Section 2    Macroeconomic analysis of the immediate impact of leaving the EU on the UK economy	35
Annex A     Macroeconomic and fiscal modelling of the immediate impact of the UK leaving the EU	59
Annex B     Article 50 of the Treaty on European Union	79
Glossary of key terms	80
List of tables	82
List of figures	82
List of charts	83



# Foreword

The decision that the British people will make in exactly one month's time – whether to remain in the European Union or to leave it – will affect families, jobs and the future of our country for decades to come.

I promised to set out a serious and sober assessment of the economic facts, to inform this vital decision for our country.

The Treasury document published five weeks ago set out a rigorous analysis of the long-term impact of leaving. It showed that under any alternative relationship with Europe, we would trade less, do less business and receive less investment. Its central estimate was that Britain would be permanently poorer by the equivalent of £4,300 per household by 2030 and every year thereafter. Depending on the new relationship with the EU, these long-term costs could be even larger.

This paper focuses on the immediate economic impact of a vote to leave and the two years that follow. Such a vote would change fundamentally not just the UK's relationship with the EU, our largest trading partner, but also our relationship with the rest of the world. The instability and uncertainty that would trigger is assessed.

The Treasury analysis in this document uses a widely-accepted modelling approach that looks at the impact of this uncertainty and instability on financial markets, households and businesses, as our economy transitions to a worse trading arrangement with the EU.

I am grateful to Professor Sir Charles Bean, one of our country's foremost economists and a former Deputy Governor of the Bank of England, who has reviewed this analysis and says that it “provides reasonable estimates of the likely size of the short-term impact of a vote to leave on the UK economy”.

The analysis in this document comes to a clear central conclusion: a vote to leave would represent an immediate and profound shock to our economy. That shock would push our economy into a recession and lead to an increase in unemployment of around 500,000, GDP would be 3.6% smaller, average real wages would be lower, inflation higher, sterling weaker, house prices would be hit and public borrowing would rise compared with a vote to remain.

These findings sit within the range of what is now an overwhelming weight of published estimates for this short-term impact, which all find that UK GDP would be lower following a vote to leave.

The analysis also presents a downside scenario, finding that the shock could be much more profound, meaning the effect on the economy would be worse still. The rise in uncertainty could be amplified, the volatility in financial markets more tumultuous, and the extent of the impact to living standards more acute. In this severe scenario, GDP would be 6% smaller, there would be a deeper recession, and the number of people made unemployed would rise by around 800,000 compared with a vote to remain. The hit to wages, inflation, house prices and borrowing would be larger. There is a credible risk that this more acute scenario could materialise.

My first duty as Chancellor is to seek to deliver economic security and higher living standards for the people of Britain. We already know the long-term effects of a vote to leave: Britain would be permanently poorer. Now we know the short-term shock too: an economy in recession, major job losses and a self-inflicted blow to living standards and aspirations of the British people.

A vote to remain in the EU, however, would be the best way to ensure continued growth and safeguard jobs, providing security for working people now and opportunity for the next generation.

This document provides the facts that I hope the people of Britain will consider when they make this historic decision one month from today.



**George Osborne**  
**Chancellor of the Exchequer**

May 2016

# Executive summary

To inform the decision that the British people will make on whether the United Kingdom (UK) should remain a member of the European Union (EU), this document provides a comprehensive, rigorous and objective analysis of the immediate impact of a vote to leave.

An earlier HM Government document (*HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*) considered the long-term economic impact of a vote to leave the EU by comparing continued membership with the alternatives described in the HM Government document (*Alternatives to membership: possible models for the United Kingdom outside the European Union*).<sup>1</sup> It focused on a period of 15 years following the referendum, by which point the nature of the UK's future relationship with the EU would be clear and the economy would have adjusted to the new economic reality. That document concluded that **the UK would be permanently poorer if it left the EU and adopted any of these alternative relationships.**

That document did not consider the disruptive, short-term adjustment that would follow a vote to leave.

The analysis in this HM Treasury document quantifies the impact of that adjustment over the immediate period of two years following a vote to leave. Such a vote would trigger a redefinition not only of the UK's economic relationship with the EU and the rest of the world, but also of much of the UK's domestic economic policy, regulatory and legislative framework. **A vote to leave would cause an immediate and profound economic shock creating instability and uncertainty which would be compounded by the complex and interdependent negotiations that would follow.**

**The central conclusion of the analysis is that the effect of this profound shock would be to push the UK into recession and lead to a sharp rise in unemployment.**

The scale and impact of this uncertainty and instability is analysed drawing on a widely-accepted modelling approach, used by the Bank of England and other leading institutions and economists. A vector autoregression (VAR) model is employed to identify the impact of increased uncertainty on overall economic activity. This is combined with analysis of the

---

<sup>1</sup> *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, HM Government (April 2016). *Alternatives to membership: possible models for the United Kingdom outside the European Union*, HM Government (March 2016). The models considered are European Economic Area (EEA) membership, a negotiated bilateral agreement with the EU, and World Trade Organization (WTO) membership.

effect of the initial transition to the new long-term relationship with the EU, as set out in the Treasury's assessment,<sup>2</sup> and the large downward movement in asset prices that would ensue. The impact of these effects on the economy is then quantified using a global macroeconomic model. This document has benefitted from a review by Professor Sir Charles Bean, former Deputy Governor of the Bank of England, acting in a personal capacity as an academic consultant to HM Treasury.

## The economic impact of a vote to leave the EU

The immediate economic impact would be driven by three key factors:

- 1 the **'transition effect'**: the emerging impact of the UK becoming less open to trade and investment under any alternative to EU membership
- 2 the **'uncertainty effect'**: the rise in uncertainty following the referendum and the impact that has on economic decisions
- 3 the **'financial conditions effect'**: the extent of financial market volatility

### The transition effect

*HM Treasury analysis: the long-term economic impact of EU membership and the alternatives* demonstrated that the UK would become less open, less productive and poorer as a country in the long term following a vote to leave the EU.

The effect of this would start to be felt immediately. Businesses would start to reduce investment spending and cut jobs in the short term, consistent with lower external demand and investment in the future. This transition effect would also lead to lower incomes, reducing household spending.

The scale of the initial impact of this transition to a permanent reduction in trade, foreign direct investment and productivity in the long term would depend crucially on the sort of relationship the UK would seek with the EU. **The analysis in the long-term document sets out a range for each alternative, with a central estimate that gross domestic product (GDP) would be £4,300 lower in 2015 terms for each household after 15 years and every year thereafter.**<sup>3</sup> However, the impact of the transition effect would be considerably larger if the UK did not seek participation in the Single Market, as would be the case if it fell back on World Trade Organization (WTO) membership.

### The uncertainty effect

While the referendum would settle the issue of EU membership once and for all, many aspects of the UK's international and domestic economic policy framework would be put in doubt, leading to a significant rise in uncertainty. Businesses and households would respond to this by putting off spending decisions until the nature of new arrangements with the EU became clearer. This uncertainty effect would also lower overall demand in the economy in the immediate aftermath of a vote to leave.

A large number of academic studies show a clear link between a range of uncertainty measures and economic activity. For this document's analysis, a comprehensive UK uncertainty indicator was constructed. The Bank of England has also used a similar indicator to evaluate movements in uncertainty.

---

<sup>2</sup> *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, HM Government (April 2016).

<sup>3</sup> *Ibid.*

The extent and duration of the uncertainty created would depend on the progress made in negotiations with the EU and other international partners which would be inherently uncertain. Four processes would need to be completed:

- Process 1: agreeing the UK's terms of withdrawal from the EU under Article 50 of the Treaty on European Union
- Process 2: agreeing the UK's new trading relationship with the EU
- Process 3: agreeing the UK's new trading relationships with the rest of the world including over 50 countries with which the UK would need to negotiate new trade arrangements
- Process 4: changing the UK's domestic regulatory and legislative framework

**Each of these four processes would be complicated in their own right, but conducting them all at the same time, on any terms that would be acceptable to the UK and within the specified two-year period for leaving the EU would almost certainly be impossible.** If these processes were more protracted, the uncertainty would be larger and, as set out in a previous HM Government document, could last up to a decade or more.<sup>4</sup>

Moreover, there would be a trade-off between securing a deal as quickly as possible to reduce uncertainty in the short-term, and securing the best possible deal for the UK to minimise the economic costs of exit over the long term. Even then, it would not be possible to provide the clarity required to address uncertainty in the short term, as that would require anticipating the outcomes of negotiations with other nations and Parliamentary votes that would be inherently uncertain up to the point they were concluded, and over which the UK would not have full control. A period of persistent uncertainty about the UK's economic policy, regulatory and legislative regime in the event of a decision to leave the EU would therefore be unavoidable.

### The financial conditions effect

Both the uncertainty effect and the transition effect would in turn weigh on financial markets, increasing volatility. Asset price falls would lead to this financial conditions effect amplifying the uncertainty and transition effects.

In the immediate aftermath of a vote to leave, financial markets would start to reassess the UK's economic prospects. The UK would be viewed as a bigger risk to overseas investors, which would immediately lead to an increase in the premium for lending to UK businesses and households. The value of UK personal investments would also decline, and the fall in the value of the pound would put upward pressure on the prices paid by consumers. This would add to the transition and uncertainty effects and influence a wide range of financial conditions facing businesses and households.

**Through a combination of these three effects, a vote to leave the EU would have a damaging effect on both the demand side and supply side of the economy.** Two scenarios have been modelled to provide analysis of the adverse impact on the economy: a 'shock' to the economy and a 'severe shock'.

### The impact in advance of the referendum

**Evidence for these effects is already clear in advance of the referendum.** In financial markets, the value of the pound has fallen and the price financial market

---

<sup>4</sup> *The process for withdrawing from the European Union*, HM Government (February 2016).

participants are prepared to pay for insurance against default on UK government debt has increased markedly.

For the wider economy, recent survey data shows weaker expectations for business investment, and there has been a sharp fall in commercial real estate transactions. Consistent with this, the Purchasing Managers Indices for services, manufacturing and construction output are all at their lowest levels for three years.

The Bank of England's Monetary Policy Committee (MPC) expects growth to slow in 2016 Q2. At its May 2016 meeting, the MPC noted that "there are increasing signs that uncertainty associated with the EU referendum has begun to weigh on activity".<sup>5</sup>

### **The impact of a vote to leave the EU: shock scenario**

In the shock scenario, many of the assumptions underlying the interaction of the three effects of a vote to leave the EU are cautious. The size of the transition effect is linked to the central estimate of the negotiated bilateral agreement alternative, as set out in the long-term document. The shock scenario assumes that a vote to leave would generate a rise in uncertainty from current levels, in line with historical experience, to just below the peak of uncertainty experienced during the early 1990s recession; and it assumes a financial conditions effect similar in scale.

**In the shock scenario, a vote to leave would result in a recession, a spike in inflation and a rise in unemployment. The analysis shows that the economy would fall into recession with four quarters of negative growth. After two years, GDP would be around 3.6% lower in the shock scenario compared with a vote to remain. In this scenario, the analysis shows that the fall in the value of the pound would be around 12%, and unemployment would increase by around 500,000, with all regions experiencing a rise in the number of people out of work. The exchange-rate-driven increase in the price of imports would lead to a material increase in prices, with the CPI inflation rate higher by 2.3 percentage points after a year.**

The Bank of England and International Monetary Fund (IMF) have both reported the possibility of such a recession following a vote to leave. As the Governor of the Bank of England said, "there's a range of possible scenarios [...] which could possibly include a technical recession";<sup>6</sup> and Christine Lagarde, Managing Director of the IMF, noted that she shared the Bank of England's view that a vote to leave the EU "could lead to a recession".<sup>7</sup>

### **The impact of a vote to leave the EU: severe shock scenario**

The 'severe shock' scenario explores the risk that the rise in uncertainty, the effect on financial conditions and the transition effects are larger. The rise in both uncertainty and financial market volatility is around 50% larger than in the shock scenario, but still only half of that seen during the financial crisis in 2008 and 2009. The size of the transition effect is linked to the estimate of leaving the Single Market and defaulting to WTO membership. **In the severe shock scenario, the analysis shows that after two years the level of GDP would be 6% lower, the number of people unemployed would**

---

<sup>5</sup> *Minutes of the Monetary Policy Committee meeting ending on 13 May 2016*, Bank of England (May 2016).

<sup>6</sup> Mark Carney, Governor of the Bank of England, *Inflation Report Press Conference* (May 2016).

<sup>7</sup> Christine Lagarde, IMF Managing Director, *Press conference for the IMF UK Article IV concluding statement* (May 2016).

**rise by around 800,000, sterling would depreciate by 15% and CPI inflation would increase by 2.7 percentage points after a year.**

While more severe, this scenario represents a credible risk. The larger uncertainty effect could reflect a more protracted process for exit; while the larger transition effect linked to WTO membership could reflect a decision to be outside the Single Market as has been suggested in recent weeks.

**There are significant downside risks which imply that the impact could be even larger.** First, these scenarios do not allow for so-called ‘tipping points’, such as the crystallisation of financial stability risks. Nor do they incorporate the risk of a ‘sudden stop’ in financial inflows, reflecting concerns about the size of the current account deficit.

Nor has the impact of a sharp tightening of fiscal and monetary policy to restore credibility been modelled. In both scenarios monetary policy is held fixed. Fiscal policy is assumed to support the economy through the operation of the ‘automatic stabilisers’. The analysis does not make any assumption about what policy decisions might be taken to contain the resulting increase in borrowing, but these would need to be significant as net government borrowing would increase by around £24 billion in the shock scenario, and by around £39 billion in the severe shock scenario, compared with a vote to remain.

Moreover, if negotiations took longer than two years to conclude, or if the outcome were to be less favourable than expected, the UK economy could be subject to repeated and persistent rises in uncertainty which would depress further economic prospects.

Immediate impact of a vote to leave the EU on the UK (% difference from base level unless specified otherwise)

	Shock scenario <sup>a</sup>	Severe shock scenario <sup>a</sup>
GDP	-3.6%	-6.0%
CPI inflation rate (percentage points)	+2.3	+2.7
Unemployment rate (percentage points)	+1.6	+2.4
Unemployment (level)	+520,000	+820,000
Average real wages	-2.8%	-4.0%
House prices	-10%	-18%
Sterling exchange rate index	-12%	-15%
Public sector net borrowing (£ billion) <sup>b</sup>	+£24 billion	+£39 billion

<sup>a</sup> Peak impact over two years. Unemployment level rounded to the nearest 10,000. <sup>b</sup> Fiscal year 2017-18.

**In conclusion, the analysis in this document shows that a vote to leave the EU would result in a marked deterioration in economic prosperity and security.** This is based on a widely-accepted approach, and is supported by the effects of uncertainty already evident in financial markets and the real economy. A recession would be expected to follow even in the more cautious scenario with a significant risk that the outcome could be far worse.

In contrast, a vote to remain in the EU would see uncertainty fall back rapidly with little lasting impact on the economy. Indeed, conditioned on a vote to remain, the MPC expect growth to start to recover in the second half of 2016.<sup>8</sup> This would be consistent

<sup>8</sup> *Inflation Report May 2016*, Bank of England (2016).

with the pickup in GDP seen following large uncertainty shocks, such as during the financial crisis in 2008 and 2009.

# Section 1

## Uncertainty, disruption and costs of leaving the EU

### Part 1: Introduction

1.1 A previous government paper *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives* (“the long-term document”) looked at the impact of leaving the European Union (EU) on the United Kingdom (UK) economy after 15 years.<sup>1</sup> It considered the alternative models and concluded that in all of them the UK economy would be less open and productive.<sup>2</sup> It set out a range for each alternative and a central estimate that UK Gross Domestic Product (GDP) would be £4,300 lower in 2015 terms for each household after 15 years.

1.2 The long-term document did not consider the immediate economic shock of a vote to leave the EU. This document looks at the immediate effect from the point of a decision to two years later, as this is the period in which to negotiate a withdrawal agreement to leave the EU as set out in the Treaties.

1.3 There are three main effects on the economy which would follow a vote to leave the EU. These effects would have a negative impact on the economy, both in terms of supply and demand.

1.4 **The first effect of a vote to leave the EU would be that businesses and households would start to make decisions consistent with the transition to becoming permanently poorer in the long term.** This would be defined by the UK’s new long-term trading relationship with the EU and non-EU countries, and the prospects of lower future incomes and living standards that leaving the EU would mean for the UK, as set out in the long-term document. This effect would be larger if the UK were not to seek participation in the Single Market, as businesses and households would expect an even poorer economic future.

---

<sup>1</sup> *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, HM Government (April 2016).

<sup>2</sup> *Alternatives to membership: possible models for the United Kingdom outside the European Union*, HM Government (March 2016). The models considered are European Economic Area (EEA) membership, a negotiated bilateral agreement with the EU, and World Trade Organization (WTO) membership.

1.5 Businesses and households would start to adjust immediately following a vote to leave the EU. Businesses would reduce investment spending, such as the purchase of new machinery and moving to new premises. They would also cut jobs, consistent with lower expectations of external demand and financial investment, including from overseas, in the future. Individuals would adjust their purchases of major items, particularly where they involved extra borrowing, on the basis of lower future incomes.

1.6 **The second effect would be from immediate and ongoing uncertainty about what the UK's new relationships would mean in practice and how that would affect businesses and households.**<sup>3</sup> Many of the UK's relationships with the EU and non-EU countries, along with large parts of the UK's domestic regulatory framework would be put in doubt. As the impact of the process of leaving the EU would begin straight away following a vote to leave, this uncertainty effect would follow from the result of the referendum. The process is set out in detail in Part 3.

1.7 Businesses would delay making decisions on some projects, such as the development and launch of products, or entry into new markets where the costs of doing business may be unclear. Individuals would postpone or scale back their spending as they waited for conditions to become clearer, lowering overall demand in the economy.<sup>4</sup> The negative economic reaction to uncertainty has been set out in the work of Professor Nicholas Bloom and others.<sup>5</sup>

1.8 **The third effect would be seen in financial conditions where markets would reassess the UK's economic prospects immediately.** This would start straight after a vote to leave the EU was known and add to the transition and uncertainty effects.

1.9 This effect would weigh on financial markets, increasing volatility and adding to the fall in asset prices.<sup>6</sup> The Bank of England has said that, following a vote to leave the EU, "it is likely that sterling would depreciate further, perhaps sharply."<sup>7</sup> The UK would be viewed as a bigger risk to overseas investors, who would immediately increase the premium they charge for lending to UK businesses and households. Financial markets (for example the corporate bond market that many larger companies rely on for funding) may become less liquid as investors seek safer places for their money.

1.10 The deterioration in financial conditions would have a negative impact on businesses and households. Asset prices, including house and equity prices, would fall as investors would probably require higher rates of return as compensation for increased uncertainty and the worse economic outlook. The greater risk premia required by investors would increase the cost of raising finance, which would be passed on through higher interest rates on borrowing by businesses and households. The value of UK personal investments would also decline, and the fall in the value of the pound

---

<sup>3</sup> Elevated uncertainty restrained economic growth in the UK during its recovery from the 2008 financial crisis. *Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?* Haddow, Hare, Hooley and Shakir (2013). *The impact of uncertainty shocks on the UK economy*, Denis and Kannan (2013).

<sup>4</sup> Increased risks to income levels are associated with higher rates of saving, lowering consumption. *Financial Expectations, Consumption and Saving: A Microeconomic analysis*, Brown and Taylor (2006).

<sup>5</sup> *The impact of uncertainty shocks*, Bloom (2009).

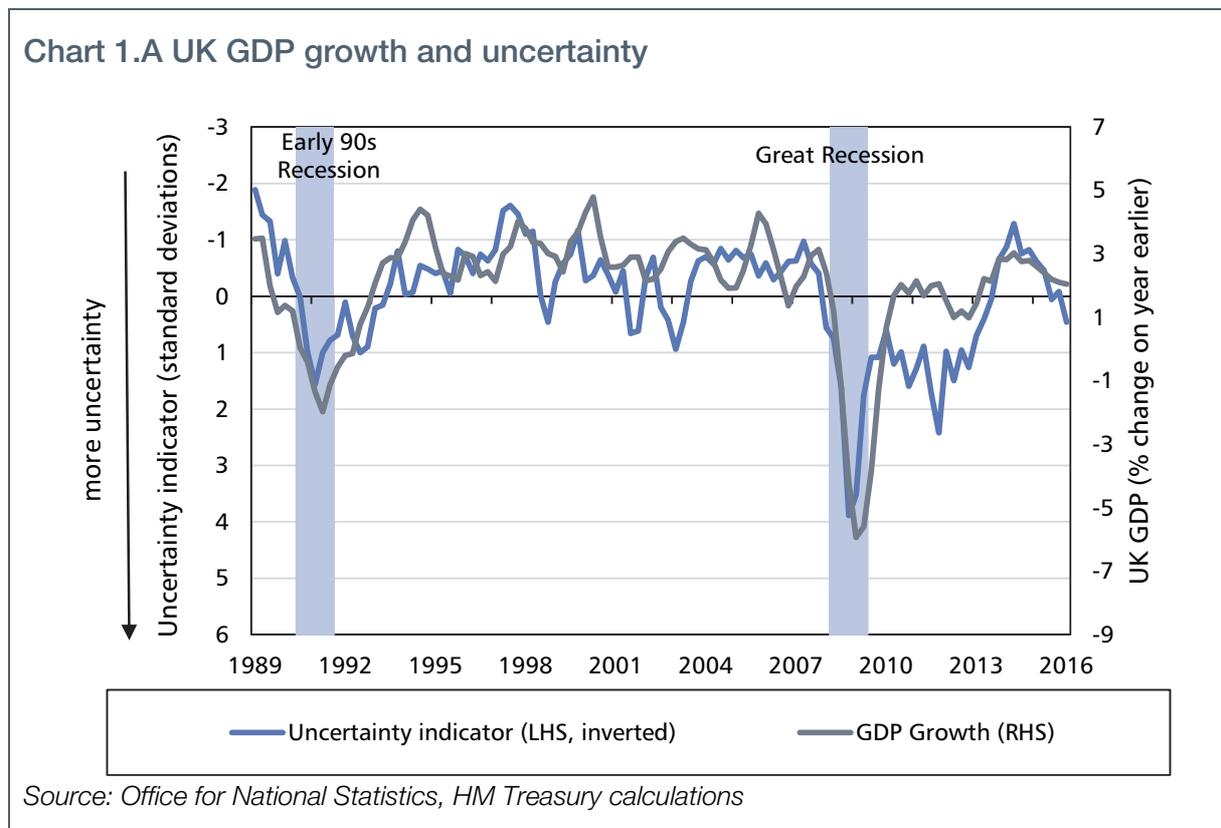
<sup>6</sup> Policy uncertainty is associated with higher risk premia and more correlated and more volatile stock prices. *Political uncertainty and risk premia*, Pastor and Veronesi (2011).

<sup>7</sup> *Inflation Report May 2016*, Bank of England (2016).

would put upward pressure on the prices paid by consumers. Larger asset price falls would amplify the uncertainty and transition effects described above.

1.11 The effects of uncertainty on spending decisions can be long-lasting even after the uncertainty recedes. The Bank of England has said “it can take time for companies and households to reassess their spending decisions and restart spending projects after a period of increased uncertainty.”<sup>8</sup>

1.12 HM Treasury has compiled a composite measure of uncertainty that brings together measures of policy, business and consumer uncertainty, equity market and exchange rate volatility, and labour market expectations. This approach is consistent with those used by the Bank of England and other leading institutions and economists.<sup>9</sup> Chart 1.A shows that **periods of increased uncertainty have been associated with lower GDP growth.**<sup>10</sup>



1.13 There are signs that these effects are already being seen in the economy on the basis of the possibility of a vote to leave the EU. These effects are set out in Part 2 of this section.

1.14 The disruption to economic activity following a vote to leave the EU could be prolonged, as the UK’s new economic reality would depend on the outcome of negotiations with the EU and other international partners. As set out in the HM Government paper, *The process for withdrawing from the European Union*, **a vote to**

<sup>8</sup> *Inflation Report May 2016*, Bank of England (2016).

<sup>9</sup> *Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?* Haddow, Hare, Hooley and Shakir (2013).

<sup>10</sup> The chart uses the HM Treasury derived indicator of uncertainty, which is inverted to show the relationship with GDP growth. The uncertainty indicator is the mean of a number of direct measures of uncertainty. Further detail is set out in Annex A.

**leave would be the start of protracted and complex negotiations that could take up to a decade or more to conclude.<sup>11</sup>**

1.15 In the case of a decision to leave the EU, households and businesses would see the impact of uncertainty in many different ways which would have immediate and persistent adverse economic consequences. For example:

- all businesses would be affected by the shock of leaving the EU and the general downturn in economic conditions that would follow that decision - they would be unsure of the continued demand for their products and services and all could face higher borrowing costs if credit markets became constrained
- those businesses which are part of international supply chains would be particularly hit by uncertainty over their ability to move products across borders and the increased costs they could face for being part of international supply chains - this would reduce the competitiveness or profitability of UK businesses in the global market place
- businesses that trade with the EU would be uncertain about the UK's access to the Single Market, not knowing what restrictions could be put on their ability to trade, including tariffs, customs costs or non-tariff barriers such as different product standards. Providers of services would not know whether they would have guaranteed non-discriminatory access to the Single Market
- businesses that import from the EU and over 50 non-EU countries would be uncertain about the potential for changes in UK tariffs and other rules to increase the price of imports
- businesses that trade with non-EU countries would not know if and when they would again benefit from the preferential trade deals that UK businesses enjoy as a result of the EU's trade agreements with non-EU countries
- foreign investors in the UK would be uncertain over their access to the European market, a significant driver of foreign investment in the UK,<sup>12</sup> leading them to delay, relocate or cancel investment that otherwise would have come to the UK
- the 1.2 million individuals born in the UK living in other EU member states<sup>13</sup> and others wishing to work, live or travel in other EU member states would not know whether they would continue to have the right to do so
- those that currently benefit from EU funding would not know what support if any they would receive after the UK left the EU. This includes businesses, farmers, fishermen, universities and regions

1.16 None of these uncertainties could be resolved easily. They would all involve difficult individual choices.

1.17 The uncertainty caused by these processes would affect different sectors of the economy in different ways. Box 1.A sets out the impact on agriculture. Box 1.B sets out the impact on aviation and maritime sectors. Box 1.C sets out the impact on selected advanced manufacturers. Box 1.D sets out the impact on financial services.

---

<sup>11</sup> *The process for withdrawing from the European Union*, HM Government (February 2016).

<sup>12</sup> *UK attractiveness survey*, Ernst and Young (2015).

<sup>13</sup> *International migrant stock by destination and origin*, United Nations Global Migration Database (2015).

### **Box 1.A Impact of a decision to leave the EU on the agricultural sector**

A vote to leave the EU would affect the agricultural sector through a number of channels.

There would be major uncertainty about the future levels of agricultural subsidies and whether they would be maintained at their current levels once the UK left the EU. Indeed, the Department for Environment, Food and Rural Affairs has seen significant real terms cuts in each of its last three spending settlements.

There would also be uncertainty over the level of trade barriers between the UK and foreign agricultural markets. The EU accounts for over 60% of UK agri-food exports,<sup>14</sup> so the significant risk of higher trade barriers into the EU would be a serious concern for the sector. At the same time, the level at which the UK decides to set import tariffs would affect the degree of protection for UK farmers from global competition compared to the level of protection in the EU. The livestock sector, where tariffs are generally much higher than the arable sector (equivalent to over 70% on some sorts of meat<sup>15</sup>), would expect to be affected most by changes to trade policy.

This uncertainty could have a depressing impact on agricultural rents and land prices. Farmers and landowners could be expected to delay purchases of machinery and other forms of investment, until there is greater clarity on the levels of subsidy and tariffs.

The National Farmers Union Council have resolved that “the interests of farmers are best served by our continuing membership of the European Union.”<sup>16</sup>

<sup>14</sup> Department for Environment, Food and Rural Affairs (Defra) calculations based on HM Revenue and Customs data (2014).

<sup>15</sup> Defra calculations of effective tariff rates based on HMRC trade data.

<sup>16</sup> *EU Referendum Where do WE stand*, National Farmers' Union (2016).

## Part 2: The economic impact in advance of the referendum

**1.18 The evidence for the negative economic effects described in Part 1 is already clear in advance of the referendum.** Sterling has weakened and business expectations and investment intentions have declined.<sup>17</sup> The Bank of England's Monetary Policy Committee (MPC) has said that "there are increasing signs that uncertainty associated with the EU referendum has begun to weigh on activity."<sup>18</sup> The International Monetary Fund (IMF) has said that uncertainty and implications of a potential vote to leave "already appears to be having an impact on investment and hiring decisions."<sup>19</sup> The Organisation for Economic Co-operation and Development (OECD) has said that "uncertainty about the referendum has begun to hold back UK growth."<sup>20</sup>

**1.19** The negative impact of uncertainty that is currently affecting the economy reflects the assessment of the possibility of a vote to leave. There would be a profound economic shock if leaving the EU became a certainty when the referendum decision was known.

**1.20** This Part sets out the recent developments in a series of financial and non-financial indicators. These are mainly UK measures and are likely to capture concerns driven by the uncertainty over the potential for a vote to leave the EU more than wider concerns about the global economy.

### Impact of a possible vote to leave the EU on financial indicators

**1.21** As financial markets are forward looking and are affected by the full distribution of outcomes, they have started to put some weight on, or 'price-in', a vote to leave in determining asset prices in advance of the referendum.

**1.22** Sterling depreciated by around 7% from its peak in November 2015 on a trade-weighted basis.<sup>21</sup> The Bank of England has estimated that, by mid-May, "roughly half of that decline reflects perceived risks associated with the referendum on UK membership of the European Union."<sup>22</sup> Exchange rates should move in line with changes in the difference between interest rates which can be earned in different currencies. This is known as the 'uncovered interest rate parity condition'. Sterling has depreciated by more than changes in UK interest rates relative to other countries would imply (Chart 1.B). This suggests an additional risk premium in sterling has become evident, which may reflect referendum uncertainty. The chart shows the trade-weighted sterling exchange rate and a weighted average of relative interest rates between the UK and its main trading partners.

---

<sup>17</sup> *UK Purchasing Managers Index*, Markit/Chartered Institute of Procurement and Supply (CIPS) (May 2016); *Agents' summary of business conditions*, Bank of England (May 2016); and *Manufacturing Outlook Quarter 1*, EEF (2016).

<sup>18</sup> *Monetary Policy Summary and minutes of the Monetary Policy Committee meeting ending on 11 May 2016*, Bank of England (2016).

<sup>19</sup> *United Kingdom – 2016 Article IV Consultation Concluding Statement of the Mission*, IMF (2016).

<sup>20</sup> *The Economic Consequences of Brexit: A Taxing Decision*, OECD (2016).

<sup>21</sup> Sterling trade-weighted exchange rate index (ERI), Bank of England (as at 20 May 2016).

<sup>22</sup> *Inflation Report May 2016*, Bank of England (2016).

**Chart 1.B – Sterling trade-weighted exchange rate index (ERI) and weighted relative interest rates**



Source: Bank of England, Bloomberg, HM Treasury calculations

\*The weighted relative interest rate is the difference between UK 2-year interest rates and a weighted average of other countries' 2-year interest rates, with the weights equal to each currency's weight in the sterling ERI

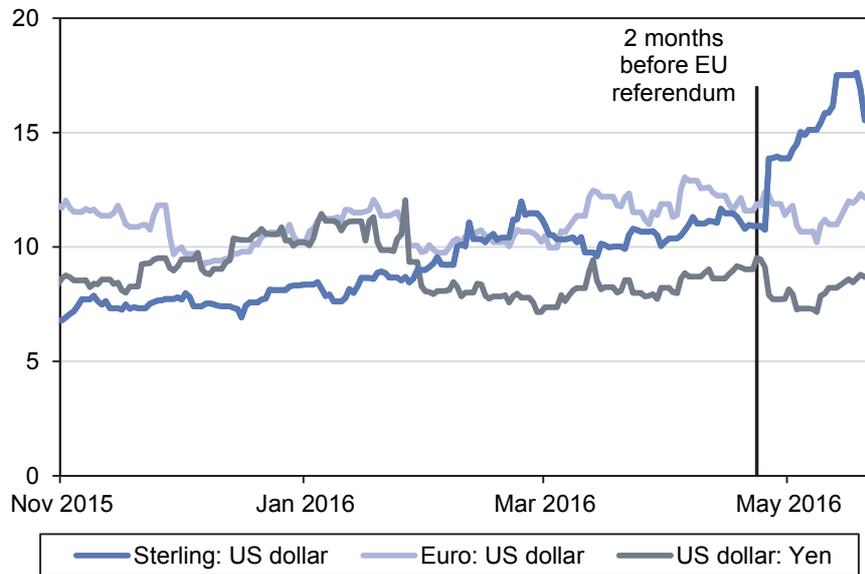
1.23 Consistent with a rise in perceived risk, sterling exchange rate volatility has increased significantly in recent months. Implied exchange rate volatility reflects the price financial market participants are prepared to pay to insure against future movements in foreign exchange prices. An increase in volatility reflects greater uncertainty over the future value of sterling. The volatility implied from options to buy or sell sterling in two months' time, therefore settling after the referendum date, rose significantly after 23 April, the date two months before the referendum. It reached its highest level since March 2009 on 16 May 2016 (Chart 1.C).<sup>23</sup>

1.24 There have been signs of heightened volatility in UK equity markets, which may also reflect uncertainty over the referendum. The implied volatility of the FTSE 100 index reflects the cost to market participants of insuring against moves in the index and is implied from options to buy or sell the stocks and shares which make up the index. Implied volatility for the FTSE 100 has risen by more than for the US S&P 500 stock market index for options that expire around the date of the referendum, with the difference reaching its highest level since the series began in 2010.<sup>24</sup>

<sup>23</sup> 2-month sterling-dollar option implied volatility data series, Bloomberg (as at 20 May 2016).

<sup>24</sup> 2-month FTSE 100 and S&P 500 at-the-money option implied volatility data series, Bloomberg (as at 20 May 2016).

**Chart 1.C: 2-month ahead Sterling, Euro and Yen implied volatility against the US dollar (%)**

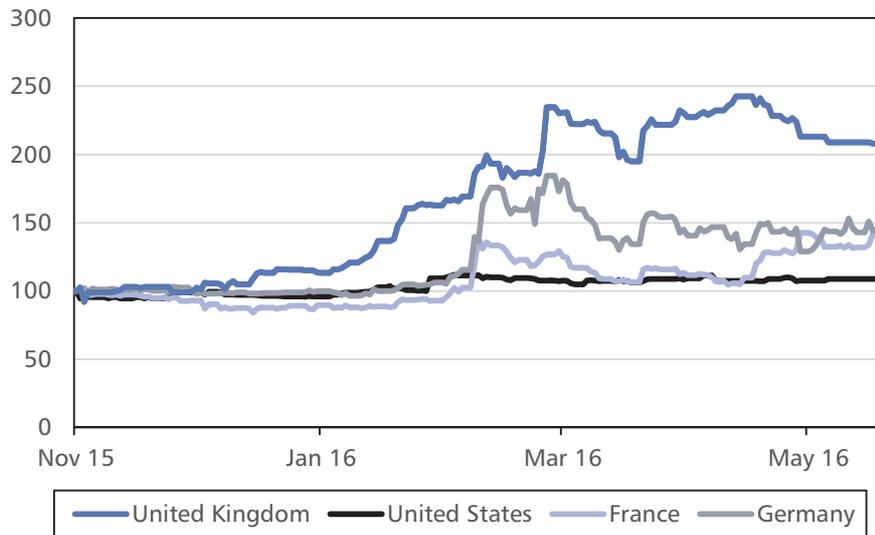


Source: Bloomberg

1.25 UK sovereign credit default swaps (CDS) are financial instruments that provide insurance against the government failing to make payments on gilts. Movements in UK CDS have in recent years been aligned with the US and Germany. The cost of protection against UK risks has been rising since November 2015, more so than for the US and Germany, (Chart 1.D). As the OECD has noted, this rise reflects investors' fears of the macroeconomic risks and uncertainty that would be associated with a vote to leave the EU.<sup>25</sup>

<sup>25</sup> *The economic consequences of Brexit*, OECD (2016).

**Chart 1.D: Sovereign credit default swap spreads (index, 1 November 2015=100)**



Source: Bloomberg

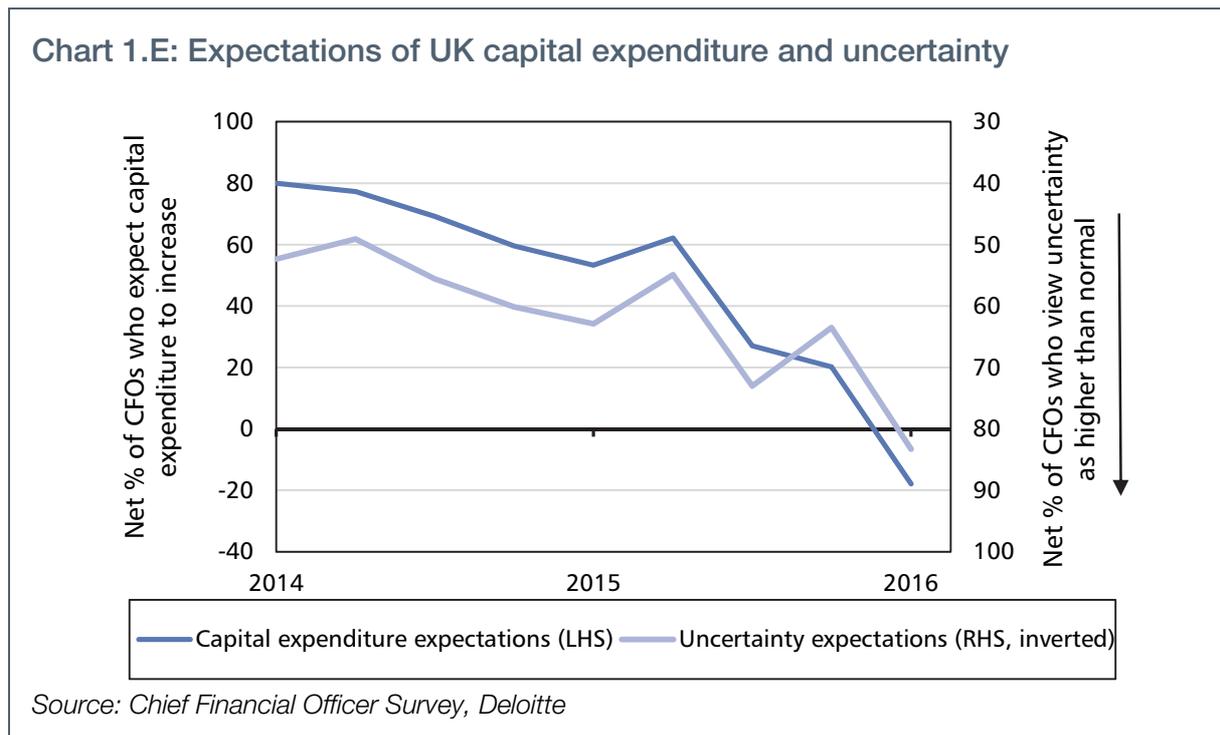
### Impact on non-financial indicators

1.26 Uncertainty is having an impact on investment decisions. The Deloitte survey of Chief Financial Officers (CFO) in April (Chart 1.E) showed a sharp increase in the number of CFOs who rate the level of external financial and economic uncertainty facing their business as above normal, high or very high.<sup>26</sup> Survey participants cited the possibility of a vote to leave the EU as the biggest risk to their business.

1.27 CFOs expect capital expenditure to fall in the next 12 months (Chart 1.E).<sup>27</sup> Risk appetite has also suffered from the rising uncertainty with the proportion of CFOs saying that now is a good time to take risk dropping from 51% to 25% in the past year.

<sup>26</sup> *Brexit tops CFO risk list: Deloitte CFO Survey: 2016 Q1*, Deloitte (2016).

<sup>27</sup> *Ibid.*



1.28 Other indicators of investment intentions have weakened. The May 2016 Bank of England Agents' summary of business conditions showed that "there was some evidence of businesses delaying investment expenditure decisions on account of uncertainty around the outcome of the EU referendum."<sup>28</sup> The latest survey from EEF, the manufacturers' organisation, showed a decline in investment intentions among manufacturers.<sup>29</sup> The survey found that firms have muted appetite to increase investment and jobs. Chart 1.F shows the recent weakness in investment intentions in both surveys.

1.29 UK GDP growth fell from 0.6% in 2015 Q4 to 0.4% in 2016 Q1.<sup>30</sup> The key driver of the slowing of GDP growth was Business and Finance services, which grew by 0.3% in 2016 Q1, less than half of the 0.7% growth in 2015 Q4.<sup>31</sup> Business and Finance services account for over 30% of GDP. The Bank of England has noted that some of the slowdown in business services growth may have reflected uncertainty surrounding a possible vote to leave the EU.<sup>32</sup>

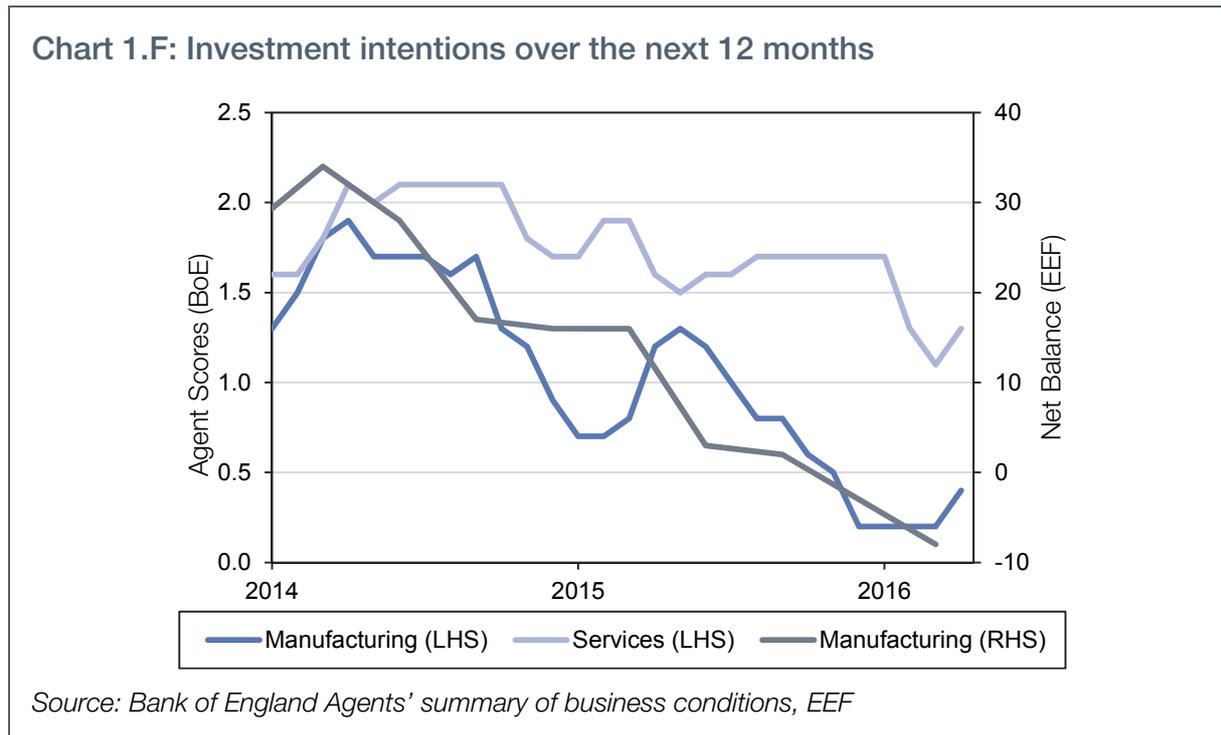
<sup>28</sup> *Agents' summary of business conditions*, Bank of England (May 2016).

<sup>29</sup> *Manufacturing Outlook Quarter 1*, EEF (2016).

<sup>30</sup> *Gross domestic product preliminary estimate: January to March 2016*, Office for National Statistics (2016).

<sup>31</sup> *Ibid.*

<sup>32</sup> *Inflation Report May 2016*, Bank of England (2016).

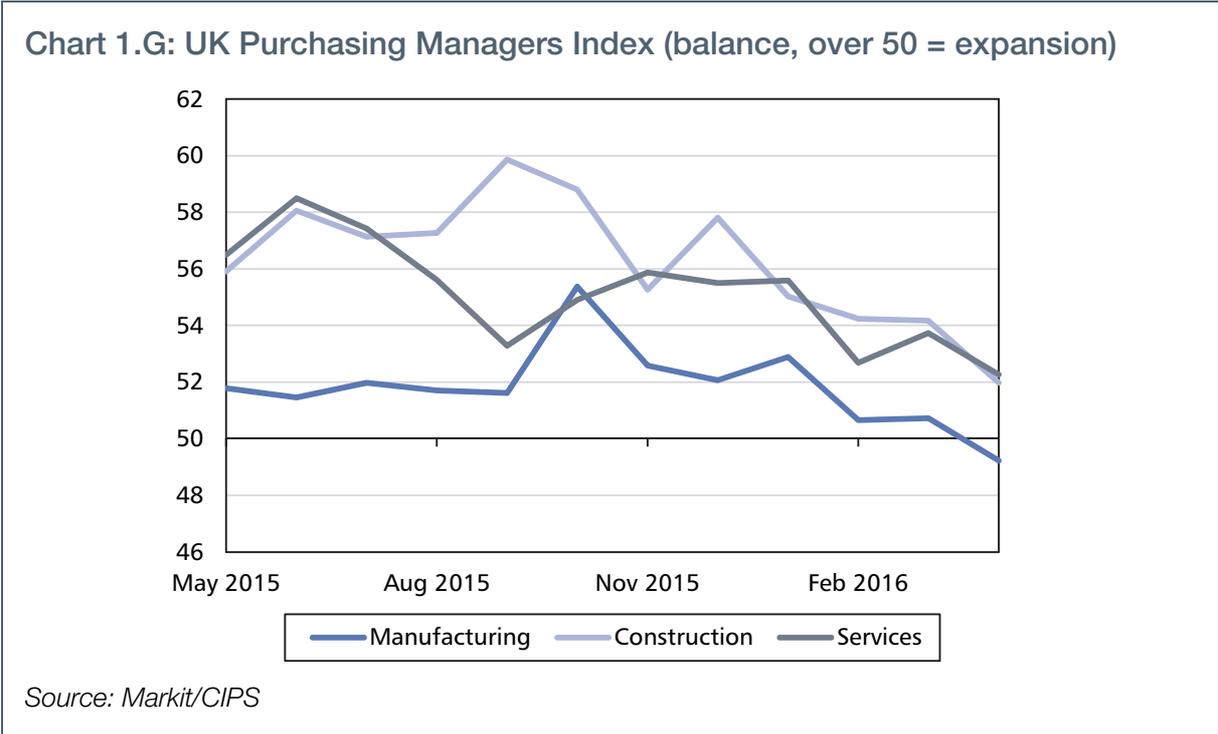


1.30 The risk of leaving the EU is also having an effect on other economic indicators. The latest Purchasing Managers Indices (PMI) for April 2016 suggest a worsening outlook for businesses across the economy in recent months, (Chart 1.G, where a score below 50 indicates a contraction).<sup>33</sup> Respondents reporting a slowdown in new orders cited increased uncertainty from the potential vote to leave in the referendum. Growth in the construction sector eased, with a sharp slowing in new orders linked to uncertainty, as respondents cited a general unwillingness to commit to new projects.

1.31 The PMIs provide a good guide to economic activity. If the weaker PMI scores were to persist, they could be associated with lower GDP growth. The Bank of England projects that GDP growth will slow to 0.3% in 2016 Q2, compared with 0.4% in 2016 Q1.<sup>34</sup>

<sup>33</sup> UK Services PMI, UK Construction PMI, and UK Manufacturing PMI, all Markit/CIPS (May 2016).

<sup>34</sup> Inflation Report May 2016, Bank of England (2016).

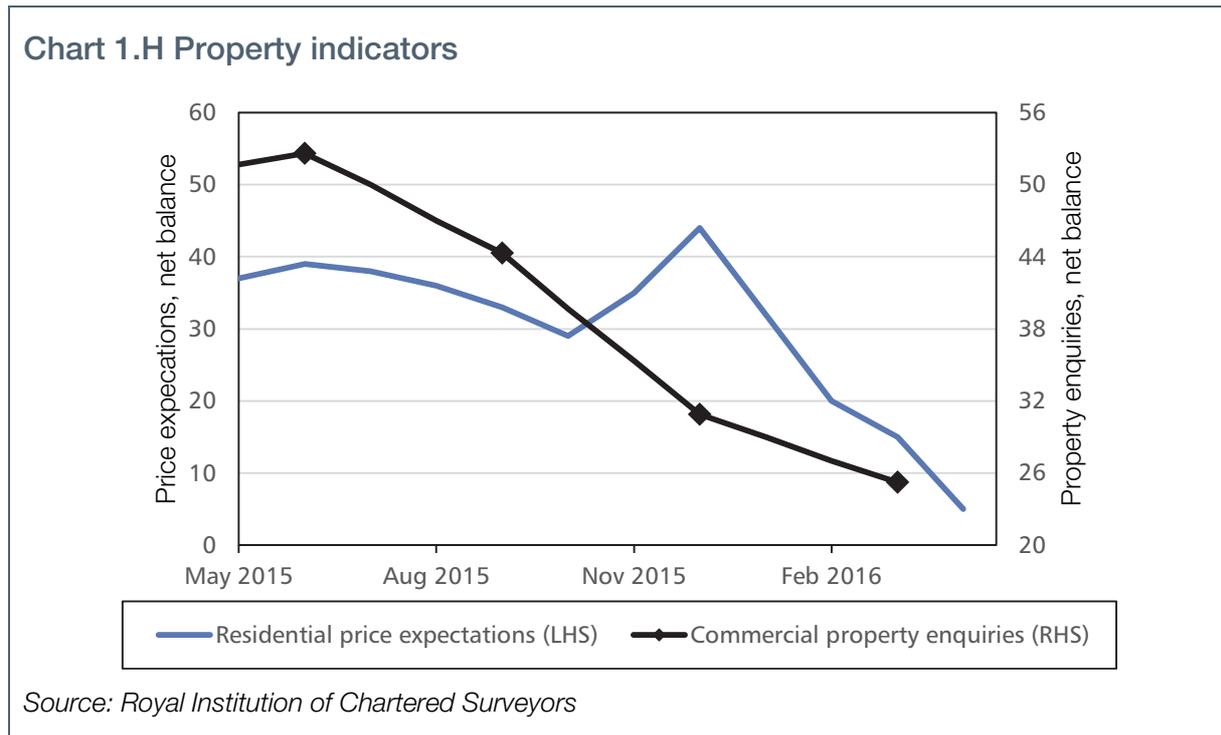


1.32 There are signs that the risk of leaving the EU is affecting the labour market. The Recruitment and Employment Confederation have reported that “employers are turning to temps and contractors to provide a flexible resource, as a way of hedging any possible change to the UK’s relationship with Europe, and the implications this would have for the economy.”<sup>35</sup>

1.33 Uncertainty also appears to be having a negative effect on commercial property. The MPC has noted that transactions in commercial real estate had fallen by nearly 40% in 2016 Q1.<sup>36</sup> Latest figures from the 2016 Q1 UK Commercial Property Market Survey from the Royal Institution of Chartered Surveyors (RICS) show that demand for UK commercial property among international investors is starting to slow (Chart 1.H).<sup>37</sup> A large number of respondents felt uncertainty about the possible vote to leave the EU was reducing investment in the commercial property market, particularly in London, where 80% felt that doubt over the UK’s future position in the EU was weighing on investment. In addition, 43% of respondents considered a vote to leave the EU would carry negative consequences for commercial real estate, while only 6% felt it would be positive in the long term.

1.34 Short-term expectations for growth in house prices have been declining steadily in 2016. RICS have highlighted this may reflect the uncertainty that the possibility of a vote to leave the EU is having on the housing market. Its latest survey shows only 5% more surveyors expect prices to increase rather than fall in the next three months. This is a significant reduction in expectations since December 2015, when 44% more surveyors expected prices to increase rather than fall (Chart 1.H).<sup>38</sup>

<sup>35</sup> *Report on Jobs*, Recruitment and Employment Confederation (May 2016).  
<sup>36</sup> *Monetary Policy Summary and minutes of the Monetary Policy Committee meeting ending on 11 May 2016*, Bank of England (2016).  
<sup>37</sup> *2016 Q1: UK Commercial Property Market Survey*, RICS (2016).  
<sup>38</sup> *UK Residential Market Survey*, RICS (April 2016).



1.35 **The Bank of England has noted that if the UK votes to remain in the EU, the recent weakness in GDP is “projected to unwind over subsequent quarters.”**<sup>39</sup> This would be consistent with previous periods in which uncertainty rose sharply, such as the financial crisis in 2008 and 2009. Business expectations of future growth have been linked to a number of factors including a vote to remain in the EU.<sup>40</sup> The IMF has also said “in the event of a vote to remain in the EU, growth is expected to rebound during the second half of the year.”<sup>41</sup>

1.36 **A vote to leave the EU would, however, lead to a sharp further increase in uncertainty and instability, and have negative effects on investment as well as business and consumer confidence.** This is likely to happen because the effects that have already been observed are those only in response to the possibility of a vote to leave the EU. Section 2 analyses the expected economic impact of an actual vote to leave.

<sup>39</sup> *Inflation Report, May 2016*, Bank of England (May 2016).

<sup>40</sup> “Where companies predicted growth of output over the forthcoming outlook period, this was linked to business expansion, marketing, new product launches, demand from the construction sector and a ‘remain’ vote in the forthcoming EU referendum”, *UK Services PMI*, Markit/CIPS (May 2016).

<sup>41</sup> *United Kingdom – 2016 Article IV Consultation Concluding Statement of the Mission*, IMF (2016).

## Part 3: Sources of instability following a vote to leave the EU

1.37 The transition effect described in Part 1 for businesses and households to adjust to the new, lower long-term level of GDP would be exacerbated by the uncertainty of the process of leaving the EU. No member state has ever left the EU, so the process would be unprecedented.

1.38 There are four complex and interdependent processes which would need to be completed in order to resolve fundamental questions about the UK's long-term economic policies:

- Process 1: agreeing the UK's terms of withdrawal from the EU under Article 50 of the Treaty on European Union (TEU) – the full text of Article 50 can be found at Annex B
- Process 2: agreeing the UK's new trading relationship with the EU
- Process 3: agreeing the UK's new trading relationships with the rest of the world, including over 50 countries with which the EU has an existing trade arrangement
- Process 4: changing the UK's domestic economic policy, regulatory and legislative framework

1.39 As set out in a previous HM Government document, *The process for withdrawing from the European Union*, it is probable that it would take an extended period to complete these processes on any terms that would be acceptable. **A vote to leave the EU therefore would be the start, not the end of these processes. These could exacerbate and extend the uncertainty effect described above, and lead to up to a decade or more of uncertainty.**<sup>42</sup>

1.40 As the Managing Director of the IMF has said, “Negotiations on new arrangements with the European Union and other trading partners could in our view take years, leading to a protracted period of uncertainty, and the longer this uncertainty goes on the more heavily it will weigh on investment and growth.”<sup>43</sup>

### Process 1: Agreeing the UK's terms of withdrawal from the EU

1.41 The rules for exit are set out in Article 50 of the TEU. This is the only lawful way to withdraw from the EU. It would be a breach of international and EU law to withdraw unilaterally from the EU (for example, by simply repealing the domestic legislation that gives the EU law effect in the UK). Article 50 has never been tested and there is uncertainty about how it would work. It would be a complex negotiation requiring the involvement of all remaining 27 EU member states and the European Commission. It would mean unravelling all the rights and obligations that the UK has acquired during its accession to the EU and over 40 years of membership. Figure 1.A sets out the process.

---

<sup>42</sup> *The process for withdrawing from the European Union*, HM Government (February 2016).

<sup>43</sup> Christine Lagarde, IMF Managing Director, *Press conference for the IMF Article IV concluding statement* (May 2016).

1.42 The Prime Minister has said that if the UK votes to leave the EU, the British people would expect the Article 50 process to start straight away.<sup>44</sup> **Article 50 provides for a two-year negotiation to agree a withdrawal agreement that would require enhanced qualified majority approval from the remaining 27 member states and the support of the European Parliament.**<sup>45</sup> An extension to the two-year deadline would require the unanimous agreement of all 27 remaining member states. Without such an extension, if after two years no deal were reached, exit from the EU would take place automatically.

## Process 2: Agreeing the UK's new trading relationship with the EU

1.43 **Article 50 is unclear about how far the arrangements for the UK's new relationship with the EU would be included in a withdrawal agreement.** It is likely however that the scope of those arrangements would require the negotiation of a separate agreement with the EU.

1.44 The precise process for negotiating that agreement would depend on its content, but an ambitious agreement could need the unanimous agreement of all 27 member states in the Council. Any such process would clearly add to the complexity, and hence, very probably, to the length of the overall negotiations. If the agreement needed unanimous support in the Council, it would be open to any member state to seek to block it, or to extract a price for agreeing any element of the agreement.<sup>46</sup>

1.45 The HM Government paper *Alternatives to membership: possible models for the UK outside the EU*, set out the existing alternative relationships with the EU: membership of the European Economic Area (EEA); a negotiated bilateral agreement; or World Trade Organization (WTO) membership without any form of special agreement with the EU.<sup>47</sup> The long-term document demonstrated that these alternatives would leave the UK permanently poorer compared to remaining a member of the EU. It found that **alternatives that involve retaining significant access to the Single Market for trade would require accepting EU regulations, the free movement of people and financial contributions to the EU, without any say over EU decision making. The long-term document also showed that relying on WTO membership would be the worst economic alternative for the UK.**

---

<sup>44</sup> *Prime Minister's Statement on the European Council*, Hansard (22 February 2016).

<sup>45</sup> Article 50 of the Treaty on European Union stipulates that the voting rule to be used is that set out in Article 238(3)(b) of the Treaty on the Functioning of the European Union, which requires 72% of member states (i.e. 20 out of the remaining 27 member states) comprising 65% of the EU population.

<sup>46</sup> *The process for withdrawing from the European Union*, HM Government (February 2016).

<sup>47</sup> *Alternatives to membership: possible models for the United Kingdom outside the European Union*, HM Government (March 2016).

Figure 1.A: Process 1 for withdrawal from the EU and Process 2 for the new trading relationship with the EU



Source: *The process for withdrawing from the European Union*, HM Government, (February 2016)

**Box 1.B Impact of a decision to leave the EU on the aviation and maritime sectors**

A vote to leave the EU would cause significant disruption to the UK's aviation and maritime sectors. 125,000 jobs are directly supported by the UK's aviation sector,<sup>48</sup> and 113,000 people work in the maritime industry.<sup>49</sup>

EU initiatives to open up markets to competition and common regulation across the Single Market have reduced costs for businesses.<sup>50</sup> Following a vote to leave, there would be uncertainty over businesses' access to the Single Market and the rules with which they would need to comply.

The Single Market for aviation has opened up the EU's aviation market to competition and allowed UK-based airlines to operate any intra-EU route, bringing greater choice and lower prices. Following a vote to leave the EU there would be uncertainty over airlines' access to other EU countries. If UK-based airlines lost routes into the EU then UK passengers would face reduced choice over destinations. The number of intra-EU routes has more than doubled since 1993.<sup>51</sup>

Even if not bound by EU legislation in the UK, the inherently cross-border nature of the sector means UK-based businesses would need to comply with EU rules when flying to EU destinations, for example by ensuring they were sufficiently equipped to operate in other states' airspace. In practice, implementing different regulations in the UK would create extra costs for the airline industry, putting pressure on fares.

The cross-border nature of shipping means differences in regulation would also directly raise costs for businesses. Leaving the EU would create uncertainty over the extent to which EU rules would apply to UK shipping. The nature of the sector means it would be heavily exposed to the negative impact on trade that leaving the EU would imply.

In order to continue trading across the Single Market, businesses would have to weigh up the costs of continuing their current business models, or restructure themselves, including by locating in the remaining EU. Given the high proportion of their business that is focussed on the EU, the incentive to relocate activities and jobs to the remaining EU would be strong.

### Process 3: Agreeing the UK's new trading relationships with the rest of the world

1.46 On leaving the EU, in addition to losing its current access to the EU Single Market, the UK would no longer benefit from the EU's free trade agreements with the rest of the world. The UK currently benefits from such agreements with over 50 countries, and would benefit from the successful conclusion of agreements with a further 67 countries currently under negotiation, including the US, Japan and India.<sup>52</sup> **The UK would need to decide how to go about replacing these trading relationships.**

1.47 The UK would also need to update the terms of its WTO membership where the commitments have previously applied to the EU as a whole. This would mean negotiating and agreeing updated UK schedules of commitments with all 161 other WTO members. Until the UK's schedule of commitments was updated, there could be questions surrounding the UK's rights to access WTO members' markets, and the UK's ability to enforce those rights.

1.48 The UK would want to start negotiations as soon as possible with non-EU trade partners in particular, in order to preserve any existing level of preferential access UK businesses currently get to those markets. However, many of the UK's non-EU trading partners are already negotiating with the EU, and before they were to begin negotiations with the UK they would be likely to want those deals with the EU to conclude. **It would therefore be hard to negotiate the new trading relationship with the EU in parallel with negotiating a new set of trade deals with the countries outside the EU.**

1.49 There would be significant uncertainty about whether it would be possible for the UK to reach agreements that replace the benefits to UK businesses of the EU's trade agreements and how long it would take to reach all of these agreements. This could have a prolonged effect on businesses who would be unsure of their ability to trade on existing terms. As set out in the long-term document, **the UK is unlikely to secure access to wider global markets as good as it has through the EU.** Against a trend towards regional deals such as the Transatlantic Trade and Investment Partnership<sup>53</sup> and the Trans-Pacific Partnership, the UK would have less ability to negotiate beneficial deals than it currently does as part of a large bloc (the EU's economic weight is five times that of the UK).<sup>54</sup> As Pascal Lamy, the former Director General of the WTO, has said, "to fall back on WTO rules...would be a terrible replacement for access to the EU Single Market."<sup>55</sup>

---

<sup>48</sup> *Annual business survey*, Office for National Statistics (2014).

<sup>49</sup> *Maritime Growth Study*, Department for Transport (2015).

<sup>50</sup> *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, HM Government (April 2016).

<sup>51</sup> *20 years of the single market*, European Commission (2012).

<sup>52</sup> European Commission (2016).

<sup>53</sup> The Transatlantic Trade and Investment Partnership is currently being negotiated between the US and the 28 EU member states. The Trans-Pacific Partnership comprises 12 countries of the Pacific Rim, including the US, Japan, Canada and Australia.

<sup>54</sup> *World Economic Outlook*, IMF (April 2016).

<sup>55</sup> *Britain won't get better trade deals if it leaves Europe*, The Times (3 May 2016).

## **Box 1.C Impact of a decision to leave the EU on selected advanced manufacturing sectors**

### **Aerospace**

The UK is a world leader in civil aerospace – number one in Europe and second only to the US globally<sup>56</sup> – employing 110,000 people<sup>57</sup> and supporting a further 113,000 jobs.<sup>58</sup> It relies heavily on EU supply chains, both as a buyer and a seller, and even companies that do not directly export produce parts for other exporters. In the UK, Airbus designs and manufactures wings and Rolls-Royce make engines, but many of the aircraft that end-users buy are assembled in continental Europe. Aerospace is an international industry.

A vote to leave the EU would result in uncertainty over continued access to these supply chains. Businesses would want to ensure supply chains could continue to deliver after UK exit from the EU, but the uncertainty could lead businesses to make decisions to invest and source components away from the UK immediately following a vote to leave.

Reflecting these risks, 76% of aerospace members of ADS (the trade association which covers Aerospace, Defence, Security and Space sectors) believe remaining in the EU is best for their business.<sup>59</sup> Indeed, Airbus Group UK recently warned that their investment would be less certain if the UK votes to leave.<sup>60</sup> This would eventually undermine the UK's manufacturing capability and make it less likely the UK attracts future work when new aircraft models are launched.

There would also be some uncertainty over the rules under which UK-based businesses would need to operate. That said, many decisions affecting the UK aerospace sector would still be made outside the UK. Regulations negotiated through the EU (for example, on emissions and noise) would in practice still be applied by UK businesses that wanted to continue trading internationally, but the UK would have less influence over Europe-wide negotiating positions.

Aerospace is a rapidly developing industry and sustained investment in technology, design and production is critical for the high productivity of the sector. A temporary decline in investment could permanently affect the continued competitiveness of the sector.

### **Automotive**

The UK is the fourth largest vehicle manufacturer in Europe, making 1.6 million vehicles a year,<sup>61</sup> and is particularly international – nearly four in every five UK-made vehicles are exported, with almost 60% of those going to the EU.<sup>62</sup> The sector directly supports 147,000 jobs, with another 300,000 in the supply chain.<sup>63</sup> It relies heavily on international supply chains, both through selling UK goods abroad and through using overseas components in UK products.

A vote to leave the EU would create uncertainty about the UK's continued access to the Single Market. These international supply chains would look vulnerable. Highlighting these concerns, 77% of the members of the Society of Motor Manufacturers and Traders (SMMT), which covers the automotive sector, say the best outcome for their business is a vote to remain.<sup>64</sup> These worries reduce businesses' confidence to make UK investment and supply decisions.

The automotive sector is fast-moving and maintaining high levels of investment in technology, design, and production is critical to keep it competitive. Many major car firms operating in the UK have plants across Europe,<sup>65</sup> with each competing for investment and production. Currently, the UK automotive industry attracts substantial inward investment due to its productivity.<sup>66</sup> Even a temporary decline in investment and connectivity in the UK automotive industry would therefore be a risk to the competitiveness and jobs in the sector. This is highlighted by GKN, a leading UK automotive and aerospace parts supplier, who warn that “over time a UK outside the EU will be disadvantaged and will lose the investment it needs to maintain our industries.”<sup>67</sup>

#### Process 4: Changing the UK’s domestic regulatory and legislative framework

1.50 The UK’s economic policy, regulatory and legislative framework would need to reflect the outcome of all of the processes discussed above. Withdrawal from the EU would involve considerable implications for UK domestic legislation. **The UK Parliament and devolved administrations would need to consider how to replace EU laws, including how to maintain a robust legal and regulatory framework where that had previously depended on EU laws.**

1.51 A recent House of Lords European Union Committee report on the process for withdrawing from the EU concluded this would be a lengthy process: “Domestic disentanglement from EU law would require a review of the entire corpus of EU law as it applies nationally and in the devolved nations. Such a review would take years to complete.”<sup>68</sup>

<sup>56</sup> *Facts and Figures 2016*, ADS (16 May 2016).

<sup>57</sup> *2014 Annual Business Survey*, Office for National Statistics (2015).

<sup>58</sup> Department for Business, Innovation & Skills (BIS) estimate for 2014 based on *Workforce Jobs*, Office for National Statistics (2015).

<sup>59</sup> ‘*ADS members are clear: remaining part of the EU is better for business*’, ADS (3 April 2016).

<sup>60</sup> ‘*Airbus warns workers on consequences of Brexit*’, Financial Times (4 April 2016).

<sup>61</sup> *2015 Production Statistics*, International Organisation of Motor Vehicle Manufacturers (OICA) (2016).  
<sup>62</sup> SMMT (2016).

<sup>63</sup> BIS estimate for 2014 based on *Workforce Jobs*, Office for National Statistics (2015).

<sup>64</sup> SMMT (2016).

<sup>65</sup> Many UK producers have factories across Europe – for details see *Automobile Assembly and Engine Production Plants in Europe*, European Automobile Manufacturers Association (ACEA).

<sup>66</sup> *UK Automotive International Competitiveness Report 2015*, Automotive Council UK (2015).

<sup>67</sup> *Remaining in Europe best for our business, SMMT members reveal in new survey*, SMMT (2016).

<sup>68</sup> *The process of withdrawing from the European Union*, House of Lords European Union Committee (2016).

### Box 1.D Impact of a decision to leave the EU on the financial services sector

UK financial services firms would face costly upheaval in the event of a vote to leave the EU. Over 5,000 UK firms, including banks, investment firms and insurance companies, hold passports which enable them to provide their financial services and establish branches in other EU member states.<sup>69</sup>

No existing alternative to EU membership, apart from EEA membership, preserves access to the passport, and EEA membership requires accepting the free movement of people and making contributions to the EU. Cross-border business would therefore be subject to decisions by individual member state regulators or EU institutions.

In order to continue trading across the Single Market firms could have to restructure themselves. This could include creating or reconfiguring subsidiaries in EU member states which, by being located in the remaining EU, would have access to the passport. Such actions would involve relocating activities and jobs to the remaining EU. Restructuring businesses and relocating staff would take a considerable time. Securing a banking licence in some member states can take six months to a year, and the further tasks associated with relocating operations can take much longer than this.<sup>70</sup>

It would be rational for firms to plan their response, soon after a vote to leave, to ensure they could continue to provide services to their EU clients. Firms would need to put their plans into effect before the final deal on the UK's new trading relationship with the EU was known.

The relocation of financial services activities and staff outside of the UK would have an immediate negative impact on jobs, exports and tax revenue. It could also damage the UK's successful financial services clusters, which rely on the concentration of financial services firms in cities including Belfast, Birmingham, Cardiff, Edinburgh, Leeds, London and Manchester. The relocation of some financial services activities could also have wider negative consequences for other firms and activities, such as professional and business services, that are associated with the UK's financial centres.

There are over one million jobs within the financial services sector.<sup>71</sup> Around two-thirds of jobs in the sector are based outside London, including 85,000 people in Scotland and 98,000 people in the North West.<sup>72</sup> Around 285,000 jobs are linked to financial and insurance services exports to the EU.<sup>73</sup> If the UK left the EU then tens of thousands of jobs in the sector would be at risk.<sup>74</sup>

<sup>69</sup> Tracey McDermott, Financial Conduct Authority Acting Chief Executive, at *The economic and financial costs and benefits of UK's EU membership* hearing, Treasury Select Committee (3 February 2016).

<sup>70</sup> In the euro area an application for a licence is jointly assessed by the European Central Bank and national supervisors.

<sup>71</sup> *Workforce jobs by region and industry, 2015 Q4*, Office for National Statistics (March 2016).

<sup>72</sup> *ibid.*

## Interdependencies of the four processes

1.52 Each of these four processes would be complicated in their own right, but conducting them all at the same time, on any terms that would be acceptable to the UK and within the specified two-year period for leaving the EU would almost certainly be impossible.

1.53 As set out above there is no requirement for the process to agree any new arrangement with the EU to be concluded at the same time as leaving the EU. Indeed, the remaining EU member states could insist that the terms of the UK's withdrawal are agreed before starting negotiations on the new relationship.

1.54 **There would be a trade-off between securing a deal as quickly as possible to reduce uncertainty in the short term and securing the best possible deal for the UK to minimise the economic costs of exit over the long term.** Figure 1.B sets out the interactions between the four processes. Case 1 of Figure 1.B shows completing the withdrawal agreement and agreeing the new EU relationship before the end of the two-year period.

1.55 **In the circumstances where it was not possible to conclude a new agreement with the EU within the two-year period, the UK would have to decide whether to seek to extend UK membership of the EU until a new agreement had been reached, or to accept exit at that point.**

1.56 Extending the Article 50 process would require the unanimous approval of the European Council. One or more of the remaining member states might expect the UK to offer concessions in return, such as that the UK's rebate would cease automatically to apply. Case 2 of Figure 1.B shows what would happen if the Article 50 process were to be extended beyond the two-year period.

1.57 **UK withdrawal from the EU without an extension would mean entering a period of limbo, where the UK's relationship with the EU would default to WTO rules.** That period could last a number of years, with uncertainty over how long it would last and what the final relationship would turn out to be. Case 3 of Figure 1.B shows what would happen if the UK exited at the end of the two-year period without a new relationship agreed with the EU.

1.58 In these circumstances, there would be a difficult trade-off for the UK over the level to set import tariffs. If tariffs were kept at zero with EU countries, the UK would have to lower tariffs unilaterally with all other WTO members where it did not have a preferential trade agreement. As a result, the UK would give up a key bargaining position in negotiating new trade arrangements. The alternative would be to raise tariffs

---

<sup>73</sup> HM Treasury analysis using the methodology behind Box 1.J of *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, HM Government (April 2016). *Number of regional jobs linked to EU exports*, HM Treasury (March 2016).

<sup>74</sup> 3.4% of workforce jobs are in financial services, including insurance services. If it is assumed that the sector maintains a constant share of UK workforce jobs then, as a share of the increase in unemployment relative to a vote to remain in the EU, this would suggest there would be around 18,000 fewer jobs in the sector in the shock scenario and around 28,000 fewer jobs in the sector in the severe shock scenario. However, these scenarios do not explicitly consider the impact of international financial services activity relocating away from the UK. Taking account of the likelihood of financial services firms relocating jobs away from the UK, the total number of jobs at risk in the sector would be larger than the figures above. *Workforce jobs by region and industry, 2015 Q4*, Office for National Statistics (March 2016).

on imports from the EU, with increased prices for consumers from more expensive imports from the EU including cars, clothing and foodstuffs.

**1.59 An extension of the processes to leave the EU and agree any new arrangement would also delay new trade deals with non-EU countries given that, as set out above, non-EU countries are likely to want to see the terms of the UK's future relationship with the EU before negotiating any new trade agreements with the UK.**<sup>75</sup>

1.60 The UK would also need to ensure a comprehensive economic policy, regulatory and legislative framework was in place throughout the period of the negotiations and that a revised framework was in place which reflected any new agreement at the point at which it was concluded. If it did not, there would be large gaps in the UK's regulatory framework including on financial stability, competition rules, and consumer protection. A protracted process would add to the complexity and uncertainty, particularly if the UK left the EU before concluding any new agreement with it. This period would mean the UK's previous regulatory regime based on EU membership would cease, but a new regime based on any new agreement would not be in place.

1.61 In any event, **uncertainty about the future of the UK's regulatory regime would have an immediate impact from the point the UK voted to leave the EU. However, it would not be possible to provide clarity as that would require anticipating the outcome of negotiations that would be inherently uncertain up until they were concluded, and over which the UK did not have full control.** A prolonged period of uncertainty about the UK's economic policy, regulatory and legislative regime in the event of a decision to leave the EU would therefore be unavoidable.

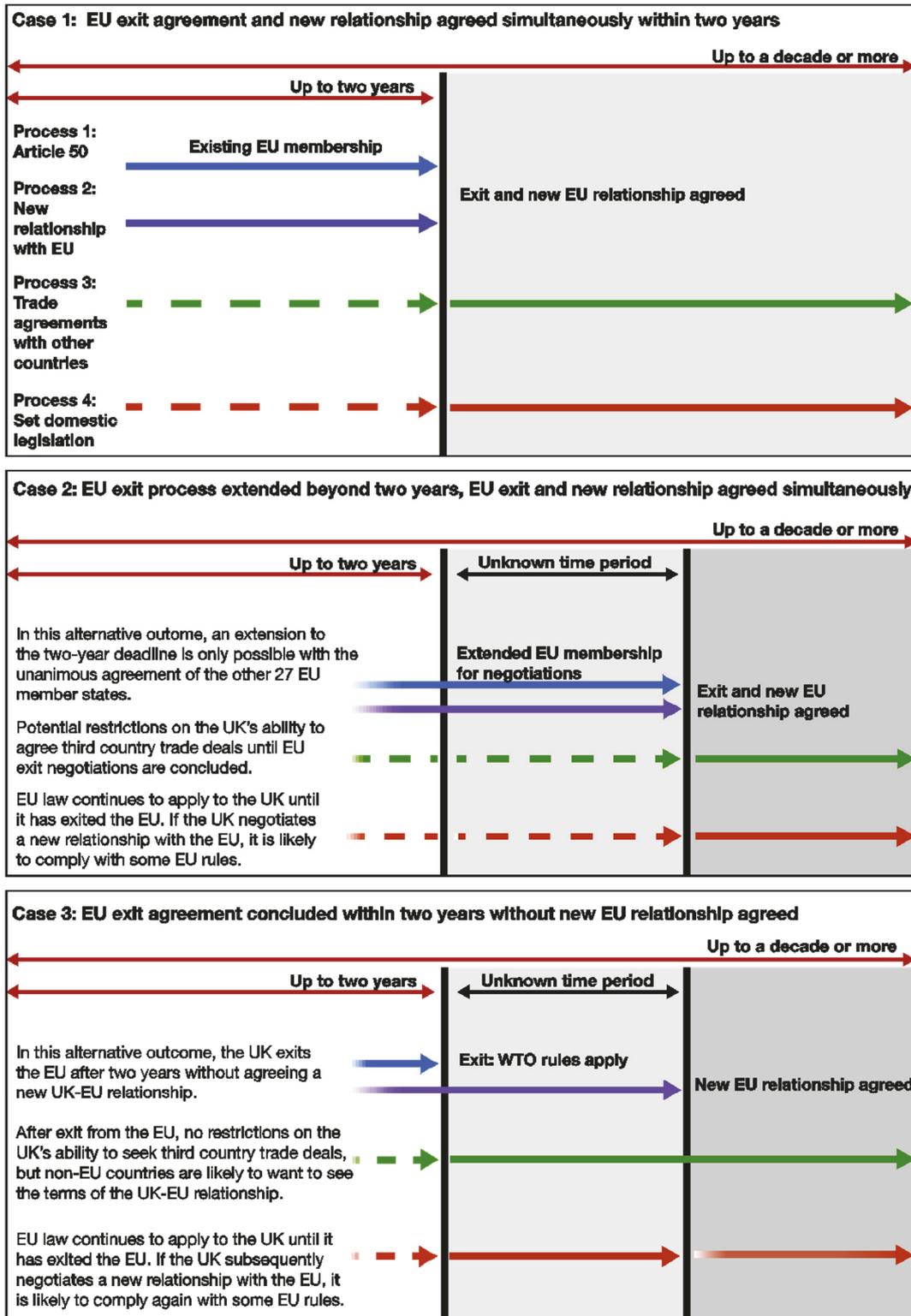
1.62 A decision to leave the EU would in itself create considerable uncertainty which would cause economic disruption and costs. However, **the complex and interdependent processes to resolve fundamental questions about the UK's long-term economic policies suggests this period of uncertainty could be both exacerbated and extended, with the potential for multiple economic shocks.**

1.63 This document does not predict how these negotiations would happen and the specific details of any agreements, as this would depend on future decisions by the UK government, the EU and other international partners. Instead, Section 2 sets out a quantitative analysis of the likely economic impact in the first two years that could follow a vote to leave the EU. Given a vote to leave could lead to a decade or more of uncertainty, the UK economy could face further disruptive economic shocks and Section 2 provides a description of these risks beyond the initial two-year period.

---

<sup>75</sup> "Many of the Japanese companies set up their operations in the UK precisely because the UK is a gateway to the EU. A vote to leave would make [the] UK less attractive as a destination for Japanese investment." Prime Minister of Japan, Shinzo Abe, at joint Press Conference with UK Prime Minister, David Cameron (5 May 2016).

Figure 1.B: The interdependencies of the four processes triggered by a vote to leave the EU



Source: HM Treasury

## Section 2

# Macroeconomic analysis of the immediate impact of leaving the EU on the UK economy

## Part 1: Introduction

2.1 **A vote to leave the European Union (EU) would be an immediate and profound shock.** There would be a sharp rise in uncertainty, households and businesses would start to make spending decisions to reflect their expectations of lower incomes in the future, and financial conditions would tighten.

2.2 The modelling approach to assess the impact of leaving the EU reflects three key effects, as described in Section 1. It analyses the implications of the United Kingdom (UK) starting to transition to a less open, less productive and permanently poorer economy (the ‘transition effect’), as discussed in HM Government’s document, *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives* (“the long-term document”).<sup>1</sup> It also analyses the impact of the sharp increase in uncertainty (the ‘uncertainty effect’) following the shock of a vote to leave the EU through a widely-accepted approach, building on methods used by Bank of England and other leading economic researchers. Finally, it analyses how these effects and the ensuing weakness of the economy are amplified by financial markets (the ‘financial conditions effect’).

2.3 The comprehensive and rigorous modelling is informed by empirical analysis, external studies, and the evidence on the impact that these effects are already having, in order to estimate the impact on a range of key economic variables. This document has benefitted from a review by Professor Sir Charles Bean, former Deputy Governor of the Bank of England, acting in a personal capacity as an academic consultant to HM Treasury.

2.4 The analysis in this document estimates the impact of this adjustment on a range of key variables within the two years following a vote to leave the EU. This time frame covers the initial period available to complete the Article 50 withdrawal process (the left-hand side of Figure 1.B). The evolution of economic instability and disruption would be determined by the outcomes of complex and interdependent negotiations and policy

---

<sup>1</sup> *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, HM Government (April 2016).

decisions. The modelling approach is set out in Part 2 and discussed in more detail in Annex A.

**2.5 The analytical approach uses scenarios relative to a baseline of staying in the EU. In doing so, the analysis of the immediate impact of a vote to leave can be isolated from the many future complex and interdependent policy choices and negotiations which would follow a vote to leave the EU.** This is consistent with the explicit focus in this document of modelling the impact of heightened instability and disruption in the two years following the shock of a vote to leave, rather than trying to produce a forecast of the UK economy by attempting to anticipate the outcome of numerous policy decisions and negotiations.<sup>2</sup> Beyond this point, the degree of instability would depend heavily on the outcomes of these processes and negotiations.

2.6 The analysis in Part 3 presents two quantitative scenarios: a ‘shock scenario’ and a ‘severe shock scenario’. The shock scenario makes a number of cautious assumptions about the size of each of the main effects. The severe shock scenario acts as a sensitivity analysis, to test the cautious assumptions made in the shock scenario. In both the shock and severe shock scenarios, it is assumed that uncertainty would be elevated throughout the two-year period examined in this analysis. In the shock scenario there is a rise in uncertainty, tightening in financial conditions, and a fall in business and household spending reflecting lower future productivity and incomes, using many cautious assumptions.

2.7 There is a plausible risk that the immediate economic impact from a vote to leave the EU could be significantly worse. Therefore, a severe shock scenario is also presented in which the process for leaving the EU and redefining its economic relationship exacerbates and extends the uncertainty and financial stresses, and so worsens expectations for the UK’s long-term economic outlook. This could reflect a decision not to seek participation in the Single Market.

**2.8 There are a number of downside risks that are not reflected in either scenario.** Part 3, therefore, also discusses how more adverse developments might result in significantly worse economic outcomes, through triggering ‘tipping points’ such as the crystallisation of financial stability risks, a ‘sudden stop’ to the external financing of the UK current-account deficit, or a tightening in monetary or fiscal policy in response to a loss in the credibility of the UK authorities.

**2.9 As noted in Section 1, each of the four processes that would need to be completed to leave the EU would be complicated in their own right. But conducting them all at the same time, on any terms that would be acceptable to the UK and within the specified two-year period for leaving the EU, would almost certainly be impossible.** Part 3 then sets out how multiple shocks could result in more persistent disruption and instability that continues to impact the economy beyond the two years examined in the scenarios.

---

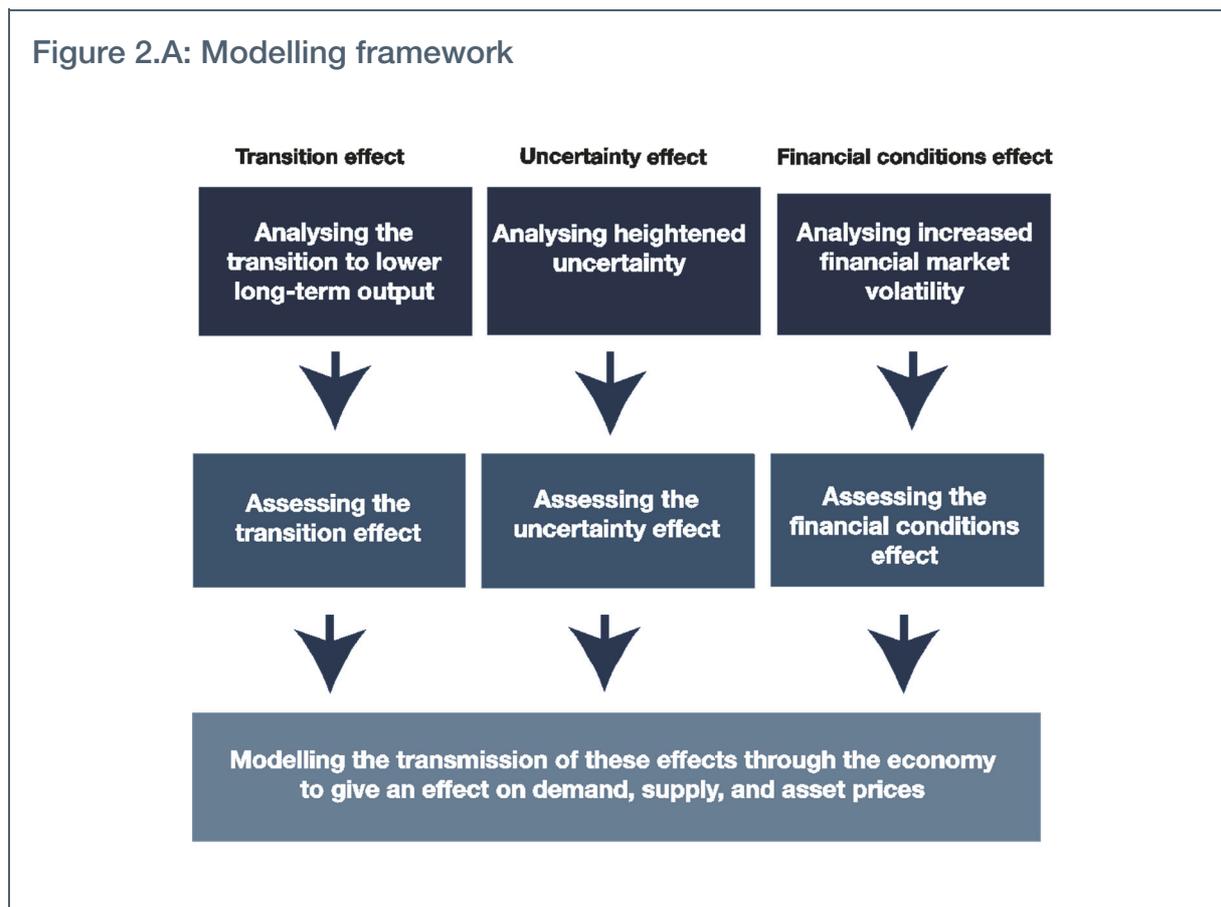
<sup>2</sup> A scenario approach is taken by the OECD and National Institute of Economic and Social Research to analyse the economic impact on the UK of a vote to leave the EU. *The Economic Consequences of Brexit: A Taxing Decision*, OECD (2016). *The short-term economic impact of leaving the EU*, National Institute of Economic and Social Research (2016). HM Treasury took this approach to analysing scenarios for a change of regime in its assessment of joining the euro. *UK membership of the single currency: An assessment of the five tests*, HM Treasury (2003).

## Part 2: Modelling approach

2.10 To model the impact on the UK economy of the instability created by a vote to leave, the analytical steps taken by this document are:

- **assessing the transition effect:** analysing the short-term effects of expectations of reduced trade, foreign direct investment (FDI), and productivity in the long term
- **assessing the uncertainty effect:** constructing an indicator of uncertainty, and then estimating the relationship between uncertainty and a set of economic variables. Using this estimated relationship, a set of economic outcomes are calibrated to reflect heightened uncertainty
- **assessing the financial conditions effect:** analysing how the uncertainty, transition shocks and ensuing weakness of the economy are amplified by financial market volatility and asset price falls
- **modelling the overall impact:** using a general equilibrium economic model to estimate the transmission of the transition, uncertainty and financial conditions effects on demand, supply and asset prices

2.11 These steps are summarised in Figure 2.A.



### Assessing the transition effect

2.12 The Bank of England has said that following a vote to leave, “activity may also be affected by concerns that the outcome might reduce the openness of the UK economy

and its long-run potential supply”.<sup>3</sup> A proportion of the long-term impacts of the reduced openness described in the long-term document would emerge in the short term. This effect is a key input to this analysis to ensure it is comprehensive.

2.13 As set out in the analysis in the long-term document and Table 2.A, the UK would be permanently poorer if it left the EU and adopted any of the models discussed. The long-term economic impact would reflect lower productivity due to reduced trade and financial openness and a small persistent effect from the short-term economic disruption.

Table 2.A: Annual impact of leaving the EU on the UK after 15 years (difference from being in the EU)

	EEA	Negotiated bilateral agreement	WTO
GDP level (%) – central	-3.8	-6.2	-7.5
GDP level (%)	-3.4 to -4.3	-4.6 to -7.8	-5.4 to -9.5

Source: HM Treasury analysis: the long-term economic impact of EU membership, HM Government (April 2016).

2.14 **The scale of the short-term impact of this transition to a permanent reduction in trade, FDI and productivity would depend crucially on the sort of relationship the UK seeks with the EU.**

2.15 Reflecting the shock of a vote to leave, there are likely to be immediate consequences to reflect the adjustment to becoming permanently poorer in the long term, particularly in financial markets. Businesses and households would start to adjust to being permanently poorer in the future by reducing spending immediately. For some businesses and households, this effect may only take hold over time as the difficult negotiations begin and it becomes evident that the outcome will lead to a UK economy that is less open to trade and investment.

2.16 **The modelling of both scenarios assumes that these impacts would build up over 15 years from the time of a vote to leave the EU.** The analysis in the long-term document was modelled over a period of 15 years, which is considered to be a sufficient time horizon for the UK’s future relationship with the EU to be clear and the economy to have adjusted to a new ‘steady-state’ outside of the EU.

2.17 The size of these effects on trade, FDI and productivity in the shock scenario reflect the transition to the central estimate of the negotiated bilateral agreement alternative. As set out in the long-term document, leaving the EU under this alternative would result in Gross Domestic Product (GDP) per household being £4,300 lower every year after 15 years, than if the UK remained in the EU.

2.18 The severe shock scenario is characterised by larger effects on trade, FDI and productivity to reflect the transition to the central estimate of an external relationship based on WTO membership. This could reflect a decision to be outside the Single Market.

## Assessing the uncertainty effect

2.19 A large number of existing empirical studies on the impact of uncertainty evaluate the economic response to select uncertainty measures, including implied volatility in

<sup>3</sup> *Inflation Report May 2016*, Bank of England (2016).

financial markets, consumer and business survey data and forecast dispersion.<sup>4</sup> However, no single uncertainty measure is likely to capture effectively uncertainty across the economy and over different economic episodes. For the purpose of this analysis, a comprehensive UK uncertainty indicator is constructed by averaging six measures of uncertainty in order to estimate the size of uncertainty shocks in past episodes.<sup>5</sup> The Bank of England has also used a similar composite uncertainty indicator in their May 2016 Inflation Report to evaluate movements in uncertainty.<sup>6</sup>

**2.20 The economic impact of uncertainty shocks is then modelled through a widely-accepted vector autoregression (VAR) modelling approach.** This approach builds on the method used by the Bank of England to empirically link measures of uncertainty to economic outcomes, based on a growing number of studies by leading economic researchers.<sup>7</sup> Using over 25 years of data, the approach estimates the relationship between the uncertainty indicator, overall economic activity and financial market conditions. This approach makes it possible to isolate the impact of an uncertainty shock on other economic and financial variables.

**2.21** To estimate the impact of uncertainty on the economy, an estimate is required for the size of the uncertainty shock generated from a vote to leave the EU. Chart 2.A illustrates the level of the UK uncertainty indicator estimated over recent economic episodes and the size of the uncertainty shock assumed in the shock and severe shock scenarios.

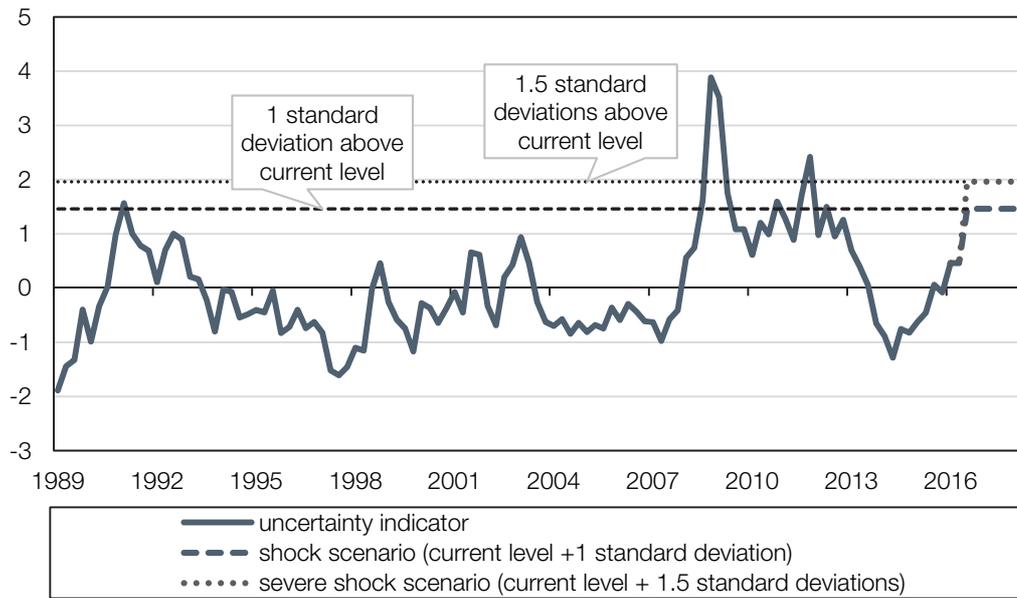
---

<sup>4</sup> For example: *The impact of uncertainty shocks on the UK economy*, Denis and Kannan (2013); *Measuring economic policy uncertainty*, Baker, Bloom and Davis (2015); and *The short-term economic impact of leaving the EU*, National Institute of Economic and Social Research (2016).

<sup>5</sup> The uncertainty indicator is constructed by averaging the following normalised measures: Baker, Bloom, and Davis policy-related uncertainty; FTSE 100 implied volatility; sterling implied volatility; CBI Industrial Trends uncertainty measure; European Commission consumer uncertainty measure and GfK unemployment expectations. See Annex A for more details.

<sup>6</sup> *Inflation Report May 2016*, Bank of England (2016).

<sup>7</sup> *The Impact of Uncertainty Shocks*, Bloom (2009). *Macroeconomic uncertainty: what is it, how can we measure it and why does it matter*, Haddow, Hare, Hooley and Shakir, Bank of England (2013). *Measuring economic policy uncertainty*, Baker, Bloom and Davis (2015). *The impact of Uncertainty Shocks on the UK Economy*, Denis and Kannan (2013). *The Macroeconomic Impact of Financial and Uncertainty Shocks*, Caldara, Fuentes-Albero, Gilchrist and Zakrajsek (2016).

**Chart 2.A: Uncertainty indicator (standard deviations)**

Source: HM Treasury calculations

**2.22 The shock scenario assumes that a vote to leave would generate a rise in uncertainty from current levels equivalent to 1 standard deviation based on data from the past 25 years.** Since 1989, the uncertainty indicator has been above the levels assumed in the shock scenario for 7% of the time. Chart 2.A illustrates that this increase would bring the level of uncertainty to just below the peak of uncertainty experienced during the early 1990s recession. This assumption is cautious as the increase in uncertainty falls well below the peak of uncertainty seen during the financial crisis of 2008 and 2009. The overall impact of the shock scenario on UK GDP would be different to those episodes, however, as this event would depend on factors other than just the uncertainty affecting the economy at the time, including the transition effect and financial conditions effect.

**2.23** A larger uncertainty effect than assumed in the shock scenario would be easily plausible if households, businesses, and financial markets were to react to a vote to leave the EU with worse expectations about the orderliness of the complex and challenging Article 50 withdrawal process and its outcomes. To test the cautious assumption in the shock scenario, the severe shock scenario assumes that a vote to leave the EU results in an increase in uncertainty from current levels equivalent to 1.5 standard deviations from the historical average. This means it reaches a level only half that seen at the peak of the financial crisis in 2008 and 2009.

**2.24** As the pattern of uncertainty over time in Chart 2.A suggests, the level of uncertainty over the coming years would likely fluctuate in the event of a vote to leave in response to economic and policy developments. For the purpose of the scenarios, however, the shock to uncertainty remains constant throughout the two-year period.

## Assessing the financial conditions effect

**2.25** Both the transition and uncertainty effect would weigh on financial markets, increasing volatility, leading to a fall in asset prices. **The financial conditions effect would lead to larger asset price falls amplifying the uncertainty and transition effects, and bringing forward the economic impact from lower future incomes.**

2.26 Following a rise in uncertainty and the realisation of a permanent deterioration in the prospects for the UK economy triggered by a vote to leave the EU, asset prices would fall. This is because lower GDP implies lower returns on assets and higher uncertainty would lead to an additional return – or risk premium – being required by investors to hold UK assets. As discussed in Section 1, some asset prices are already being affected and a wider range would likely fall in price following a vote to leave the EU. An important part of the modelling, therefore, is to take account of the higher cost of borrowing caused by this risk premium.

2.27 The return that investors would demand for holding longer-term UK government debt – or the term premium – would rise. The term premium is unobservable but can be estimated by decomposing long-term bond yields and estimating the additional expected return investors in long-term bonds require relative to rolling over a series of short-term bonds.

2.28 Given that UK government bond yields have fallen since the financial crisis,<sup>8</sup> it is assumed that the term premia on UK government debt would be less responsive to the economic shock than historical movements would suggest. Therefore, while uncertainty is assumed to increase by 1 standard deviation in the shock scenario, the increase in 10-year government bond term premium is only assumed to increase by half a standard deviation, the equivalent of 40 basis points. The severe shock scenario is characterised by more uncertainty and more upwards pressure on debt dynamics. Therefore, in that scenario, the term premium is assumed to increase by 1.25 standard deviations, equivalent to 100 basis points. This remains a cautious assumption. Even a 100 basis point increase from current levels would leave the UK government debt term premium over 50 basis points below the level of the term premium during the financial crisis of 2008 and 2009.

2.29 Uncertainty, disruption and economic instability would also be expected to increase the cost for UK banks of raising funding in wholesale markets and for UK companies of raising funding through bond or equity issuance. This would translate into a higher cost of credit for UK households and businesses and represent a tightening of UK financial conditions, including higher mortgage rates. For this reason in the modelling of the shock scenario, UK financial variables – including corporate and household borrowing premia and the equity risk premium – are assumed to increase from their current level by 1 standard deviation. In the severe shock scenario these financial risk premia increase by 1.5 standard deviations. How these movements translate into basis point changes in risk premia is set out in Table 2.B.

2.30 The assumed increase in financial risk premia is higher than the estimated relationship between uncertainty and financial market variables estimated in the VAR approach. This is because, in these circumstances, the financial variables would respond to more than just the heightened uncertainty, as they would also respond to the deterioration in UK economic prospects.

2.31 In the event of a vote to leave the EU, a sterling depreciation would be driven by both a deterioration in UK economic prospects and the additional risk associated with holding sterling, the exchange rate risk premium. For the modelling, the exchange rate risk premium is calibrated to generate an overall sterling depreciation of 12% in the shock scenario, and 15% in the severe shock scenario. The average sterling

---

<sup>8</sup> Historical statistics on the gilt portfolio, Debt Management Office (April 2016).

depreciation across a range of external studies in response to a vote to leave the EU was estimated to be around 12%.<sup>9</sup>

**2.32 The shock and severe shock scenarios assume that financial stability risks do not crystallise into a financial crisis, reflecting the increased resilience of the UK financial system.** For the banking system this means there is no acute liquidity stress and that no new policy interventions by the government or the Bank of England are required. However, outcomes could prove worse than assumed as adverse financial episodes are inherently difficult to predict and could be unexpectedly triggered through a number of amplification channels. For example, if a fall in the value of sterling combined with heightened uncertainty made it difficult or expensive for UK banks to access foreign currency funding. Part 3 discusses how more adverse developments than those presented in the scenarios might impact the financial system.

## Modelling the overall impact

### Monetary policy

**2.33** The Bank of England's Monetary Policy Committee (MPC) has noted that it would be likely to face a trade-off following a vote to leave. In particular, the MPC set out that it "would face a trade-off between stabilising inflation on the one hand and stabilising output and employment on the other. The implications for the direction of monetary policy would depend on the relative magnitude of the demand, supply and exchange rate effects".<sup>10</sup>

**2.34** As there are two opposing forces on domestic inflationary pressure, the direction of the policy response would not be clear. **Rather than attempt to anticipate how the MPC would react, the shock and severe shock scenario assume for the purposes of the model that the MPC holds Bank Rate unchanged although market rates tighten.** The impact on GDP could be worse under an alternative assumption. In reality, the MPC would operate consistent with its remit.<sup>11</sup>

### Fiscal policy

**2.35** **In the shock and severe shock scenario it is assumed for the purposes of the model that in response to the impact of a vote to leave the EU, fiscal policy would support the economy in the short term via operation of the 'automatic stabilisers' and the deficit would be higher.** These are the non-discretionary response of tax receipts, welfare and interest payments to changes in the economic cycle. For example, higher unemployment would result in greater welfare spending, through benefits such as Jobseeker's Allowance.

**2.36** The automatic stabilisers support the economy in a cyclical downturn but would lead to higher borrowing and debt. The analysis does not assume what policy decisions might be taken to contain borrowing. Departmental spending which is not part of the

<sup>9</sup> The average sterling depreciation of 12% reflects the views of Citi, Commerzbank, Credit Suisse, Deutsche Bank, Nomura, Oxford Economics, HSBC, JP Morgan, NIESR and the OECD.

<sup>10</sup> Open letter from Governor of the Bank of England, Mark Carney, to the Chancellor of the Exchequer, George Osborne (May 2016).

<sup>11</sup> *Remit for the Monetary Policy Committee*, Letter from Chancellor of the Exchequer, George Osborne, to Bank of England Governor, Mark Carney (2016).

automatic stabilisers is assumed to stay fixed in nominal terms as set out in HM Treasury’s Budget 2016<sup>12</sup>, and tax and welfare policy remains unchanged.

**Global economic assumptions**

**2.37 A vote to leave the EU could have knock-on effects for the global economy.**

A weaker UK economy would have implications for the UK’s closest EU trading partners, including Ireland. An economic deterioration in foreign economies would mean the UK’s trade with them would suffer even more, which would, in turn, weigh on UK growth. To err on the side of caution, the shock scenario does not make any allowances for economic contagion from a UK vote to leave the EU impacting on other countries, beyond the reduction in trade.

2.38 In practice, the impact of UK economic instability and disruption would, at least in part, extend beyond UK borders – both directly through lower spending, and also through increased financial risk premia. To test this assumption, the severe shock scenario assumes an element of financial contagion with EU economies. This has been modelled by assuming EU term premia for government debt and the corporate borrowing premium increase according to the historical relationships with UK financial conditions. The equity risk premium in EU countries is assumed to increase by the same level as in the UK. After two years, modelling these foreign financial stresses leads to a reduction in euro area GDP of around 1% relative to a UK vote to remain in the EU. This would weaken external demand for UK exports and weigh on UK growth.

**General equilibrium model**

2.39 Estimates of the effects from the transition, uncertainty and shocks to asset prices and credit spreads are input into NiGEM,<sup>13</sup> the National Institute of Economic and Social Research’s global macroeconomic model used to different extents by the IMF, the OECD and others. NiGEM is a general equilibrium model that assesses the overall macroeconomic impact of economic shocks and the dynamic path of the UK economy. Using a macroeconomic model in this way allows the impact of different economic channels, such as consumption, investment, net trade, labour market, and policy reactions to be considered in a consistent framework. The modelling inputs are summarised in Table 2.B.

Table 2.B: Summary of modelling inputs

	Shock scenario	Severe shock scenario
<b>Transition effect</b>	Central estimate of the negotiated bilateral agreement alternative phased in over 15 years	Central estimate of the WTO alternative phased in over 15 years
<b>Uncertainty effect</b>	+1 standard deviation	+1.5 standard deviations
<b>Financial conditions effect</b>		
Corporate borrowing rates	+130 basis points	+200 basis points

<sup>12</sup> *Budget 2016*, HM Treasury (2016).

<sup>13</sup> NiGEM is developed and maintained by the National Institute of Economic and Social Research. NiGEM is used, to different degrees, by over 40 organisations including the IMF, the OECD, the Bank of England and the European Central Bank.

	<b>Shock scenario</b>	<b>Severe shock scenario</b>
Household borrowing rates	+70 basis points	+110 basis points
Equity risk premium	+120 basis points	+180 basis points
Government debt term premium	+40 basis points	+100 basis points
<b>EU economic spillovers</b>	None assumed	Increase in EU financial risk premia

## Part 3: The immediate impact of a vote to leave the EU

2.40 The shocks to the UK economy from a permanent deterioration in economic prospects, higher uncertainty, and tighter financial conditions would impact the UK economy in a number of ways.

2.41 The analysis examines these impacts from 2016 Q3 to 2018 Q2. The baseline against which the scenarios are presented is the Office for Budget Responsibility's (OBR) March 2016 economic forecast, which is conditioned on the UK remaining in the EU.<sup>14</sup>

2.42 The analysis in the long-term document focused on the supply-side effects of leaving the EU. **The results of this document's analysis are driven by both demand and supply impacts.** Demand would be lower because uncertainty and financial conditions would impact on investment and consumption. Supply would also be negatively affected by the impact on productivity from an economy transitioning to be less open to trade and investment. Productivity would be impacted as the UK economy became less integrated in European supply chains in the long term, and in the short term resources were reallocated due to changing trade and investment patterns.

### GDP

2.43 The Bank of England and IMF have both reported the possibility of a recession following a vote to leave. As the Governor of the Bank of England said, "there's a range of possible scenarios [...] which could possibly include a technical recession";<sup>15</sup> and Managing Director of the IMF, Christine Lagarde, noted that she shared the Bank of England's view that a vote to leave the EU "could lead to a recession".<sup>16</sup>

2.44 **In both scenarios, a vote to leave the EU would result in a recession.** Setting the shock scenario against the OBR's Budget 2016 forecast, the analysis shows that immediately following a vote to leave the EU, the economy would be pushed into recession with four quarters of negative growth. Two years after a vote to leave the EU, GDP would be around 3.6% lower in the shock scenario than following a vote to remain (see Chart 2.B). This is within the range of published estimates for the short-term impact, which without exception find that UK GDP is lower following a vote to leave (see Box 3.D in the long-term document).<sup>17</sup>

2.45 In the severe shock scenario the analysis shows that the economy would fall into recession which would persist for four quarters, and GDP would be 6.0% lower in two years time compared with a vote to remain (see Chart 2.C). Table 2.C sets out the quarter-on-quarter growth rates based on the analysis for both scenarios set against the OBR's 2016 Budget forecast.

---

<sup>14</sup> *Economic and fiscal outlook*, Office for Budget Responsibility (March 2016).

<sup>15</sup> Mark Carney, Governor of the Bank of England, *Inflation Report Press Conference* (May 2016).

<sup>16</sup> Christine Lagarde, IMF Managing Director, *Press conference for the IMF UK Article IV concluding statement* (May 2016).

<sup>17</sup> *HM Treasury analysis: the long-term economic impact of EU membership*, HM Government (April 2016).

Table 2.C: Quarter-on-quarter GDP growth (%)

	2016 Q3	2016 Q4	2017 Q1	2017 Q2	2017 Q3	2017 Q4	2018 Q1	2018 Q2
OBR Budget 2016	0.5	0.5	0.6	0.6	0.6	0.5	0.5	0.5
Shock scenario	-0.1	-0.1	-0.1	-0.1	0.2	0.2	0.2	0.2
Severe shock scenario	-1.0	-0.4	-0.4	-0.4	0.0	0.0	0.1	0.1

## Components of GDP

2.46 In both scenarios, lower domestic demand would be the key driver of the weaker outlook for GDP (Charts 2.B and 2.C).

2.47 Following a vote to leave the EU, both consumption and investment would fall quickly. Businesses would likely respond to the uncertainty and disruption to their business models by postponing investment projects. As UK businesses adjust their expectations to permanently lower incomes outside the EU, they would eventually cancel a portion of these investment decisions. Higher financial risk premia would also increase the cost of capital, reducing investment.

Chart 2.B: Shock scenario – GDP level (contributions to % difference from base level)

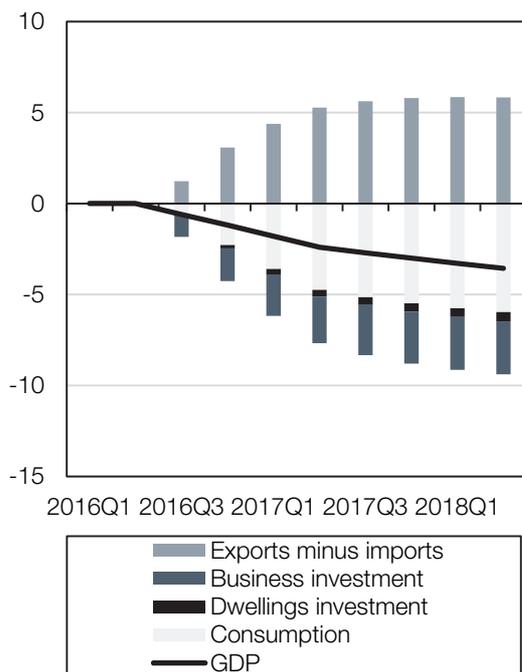
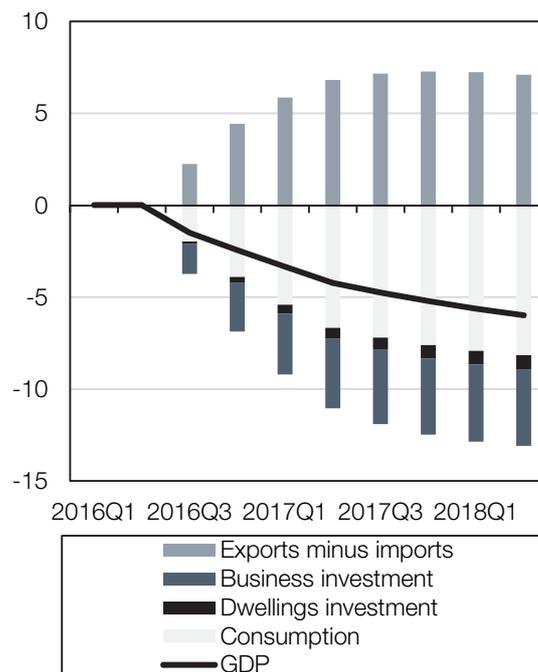


Chart 2.C: Severe shock scenario – GDP level (contributions to % difference from base level)



Source: HM Treasury calculations

2.48 Households would also be less likely to make major purchases given risks to employment and wealth. The fall in the value of sterling would increase inflation, lowering spending power. Together, these factors would reduce consumption. The impact on investment is larger than the impact to consumption. This is consistent with economic theory and past episodes where investment is more responsive to uncertainty and changes in demand.

2.49 After a period, exports would then begin to fall, reflecting the weaker outlook for productivity, driven by the transition effect, which would more than offset the impact of the fall in sterling. Domestic purchasing power would be eroded by the fall in the value of the pound, which along with weaker domestic demand, would reduce imports. Moreover, the impact of the fall in sterling on net trade could be weaker than estimated given the limited relationship between net trade and the exchange rate recorded during the large sterling depreciation that occurred over the financial crisis of 2008 and 2009.<sup>18</sup>

2.50 In both scenarios the UK is able to continue borrowing from abroad in the short term, allowing the overall current account – the combination of net trade and net income flows from abroad – to close gradually in response to the drop in domestic demand and the depreciation of sterling. There is, however, a risk that foreign investors lose confidence in funding the UK deficit and the adjustment would be more abrupt (see Box 2.B). This would amplify the negative economic impacts of a vote to leave the EU.

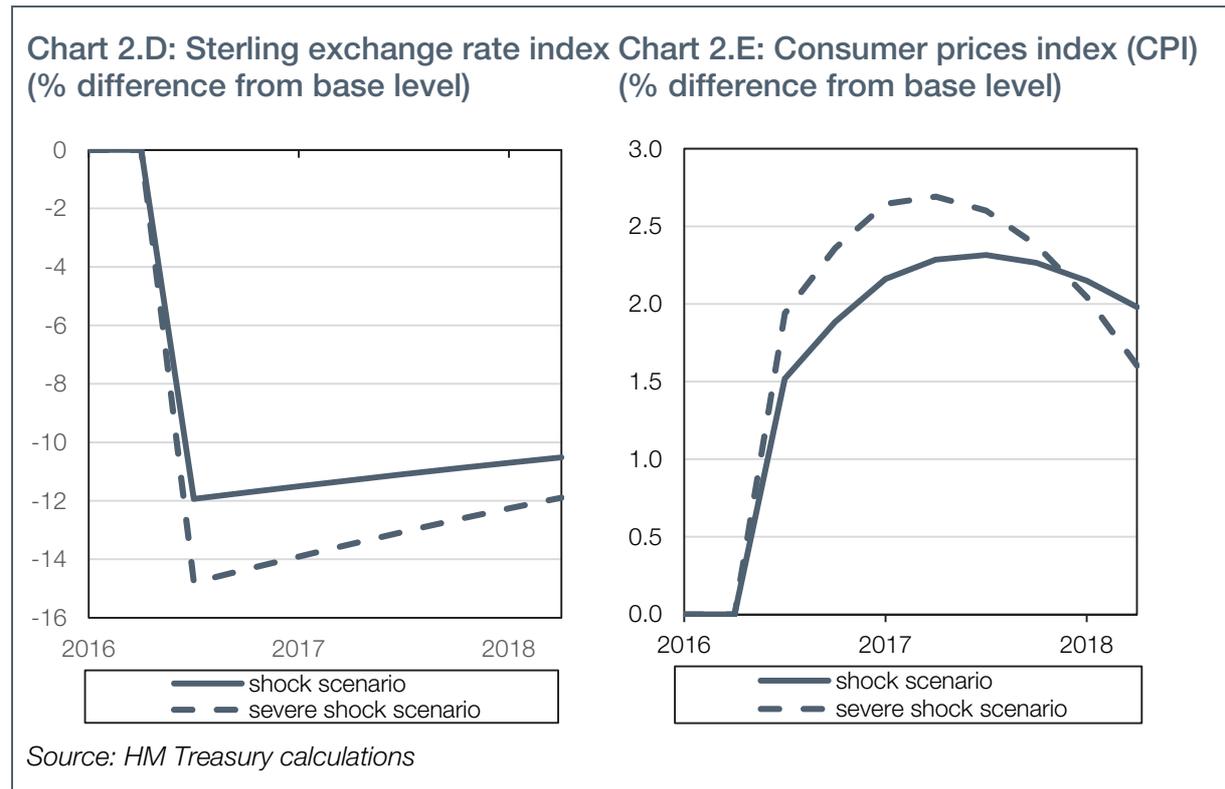
### Exchange rate and consumer price inflation

**2.51 Following a vote to leave the EU, sterling would depreciate both due to the deterioration in UK economic prospects and the additional risk from holding sterling from heightened economic uncertainty – the exchange rate risk premium.** The former effect is estimated from the general equilibrium model and the latter effect is a modelling assumption set out in Table 2.B. **The analysis shows the combination of these two effects would see sterling depreciate by around 12% in the shock scenario and 15% in the severe shock scenario (see Chart 2.D).**

2.52 The depreciation in the exchange rate would lead to an increase in the price of imports that would quickly be passed on to the prices consumers face (see Chart 2.E). **At its peak impact after a year, relative to a vote to remain in the EU, CPI inflation would be 2.3 percentage points higher in the shock scenario and 2.7 percentage points higher in the severe shock scenario.**

---

<sup>18</sup> *Forecast evaluation report*, Office for Budget Responsibility (2015).



## Unemployment and wages

2.53 All these economic impacts would lead to weaker growth and a fall in demand for labour. The modelling of the impact of the scenarios on the labour market reflects that a small share of the workers losing jobs would leave the labour force. The rise in unemployment would be tempered with subdued real and nominal wage growth (see Charts 2.F and 2.G). If wages did not fall as much, then the increase in unemployment would be higher.

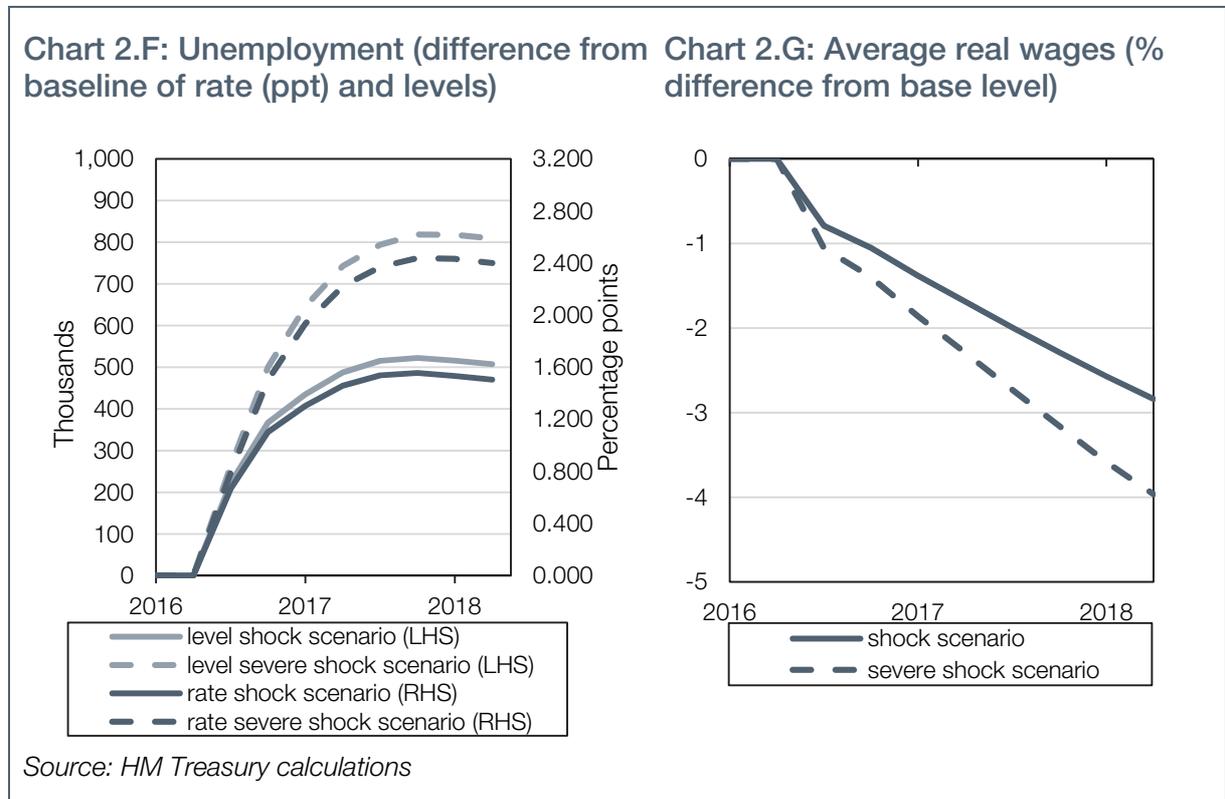
2.54 In the shock scenario, real average wages would be around 2.8% lower after two years than under a vote to remain. That is equivalent to a fall in wages of more than £780 per year for an individual working full time, based on 2015 average wages.<sup>19</sup> The analysis shows that the peak impact on unemployment in the shock scenario would see the unemployment rate increase to around 1.6 percentage points above the rate in the event of a vote to remain – equating to an increase of around 500,000 unemployed.

2.55 In the severe shock scenario, real average wages would be around 4.0% lower than under a vote to remain within two years. The peak impact on the unemployment rate in the severe shock scenario would be around 2.4 percentage points higher than two years after a vote to remain – equating to an increase of around 800,000 unemployed. The relative change in unemployment to the loss in GDP in both scenarios is in line with their past historical relationship.

2.56 The analysis shows that if these job losses proportionally impacted those between 16 to 24 years of age by their share of the labour force, then youth unemployment would increase by around 70,000 in the shock scenario and around 100,000 in the severe shock scenario. However, this very much provides a lower bound for the impact on those between 16 and 24 years of age, as

<sup>19</sup> Annual Survey of Hours and Earnings, Office for National Statistics (2015).

**increases in unemployment are rarely evenly spread over society<sup>20</sup> and tend to affect young people disproportionately.** The OECD finds that the youth unemployment rate rises by twice as much in an economic downturn as the unemployment rate for older workers.<sup>21</sup> An estimate of how total unemployment and youth unemployment would be distributed across the regions and countries of the UK is set out in Box 2.A.



**2.57 As productivity slows in response to the transition to a less open economy, nominal wages would fall relative to their level in a vote to remain in the EU. The exchange-rate-driven increase in consumer prices would further erode real wages.** While not assumed in the modelling, where uncertainty leads individuals to be less willing to search for more productive jobs and employers less willing to post vacancies, this would create less ‘churn’ in the labour market, which in turn would affect productivity through less efficient matching of skills to jobs.<sup>22</sup>

<sup>20</sup> Small and medium enterprises (SMEs) often shoulder a disproportionate burden of the adjustment. *Uncertainty and the Employment Dynamics of Small and Large Businesses*, Ghosal and Ye (2015).

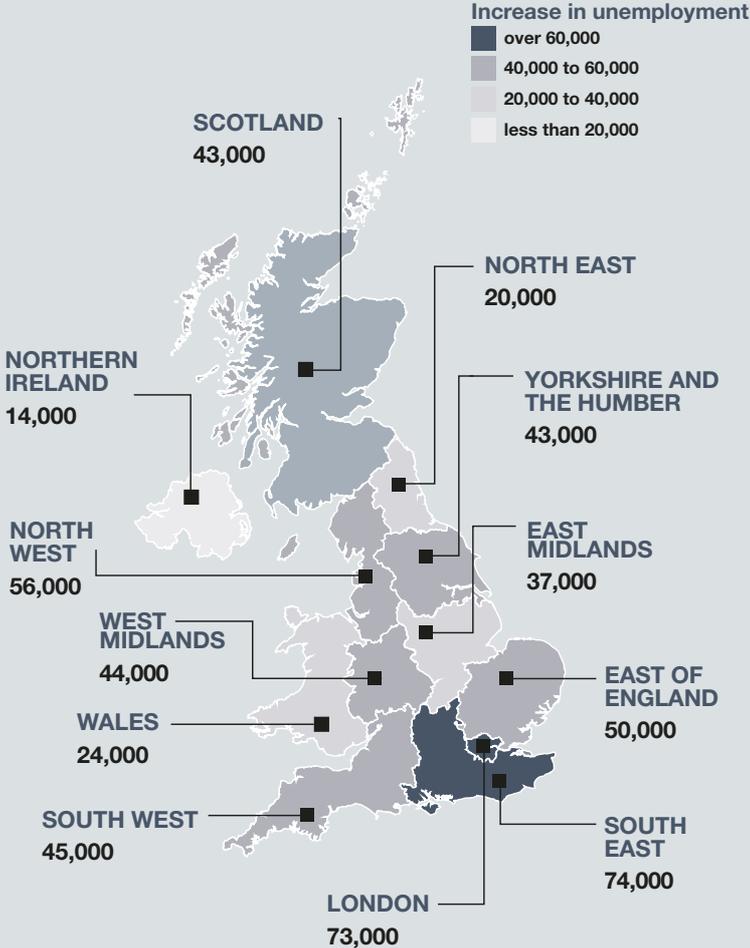
<sup>21</sup> *Employment Outlook 2008*, OECD (2008).

<sup>22</sup> *The United States Labor Market: Status Quo or A New Normal?*, Lazear and Spletzer (2011).

### Box 2.A: Regional implications for the labour market

In the event of a vote to leave the EU, the shock scenario estimates that unemployment would rise by around 500,000. Figure 2.B and Table 2.D illustrate how unemployment and youth unemployment, respectively, might increase at a regional level, assuming that the increase in unemployment in each region and country is proportionate to its share of total UK employment.<sup>23</sup> Exactly how these job losses would be distributed across the UK would depend on how the shock impacted different sectors, and the demand for labour in each region.

Figure 2.B: Impact on unemployment of the shock scenario by region



Other factors would also influence how the impact on the labour market was distributed. For instance, some regions that feature industries which are relatively more reliant on exports to the EU, like the automotive industry, might be disproportionately impacted. Some regional labour markets may also be less flexible than others, which would result in a more painful labour market adjustment.

Table 2.D: Regional impact on youth unemployment of the shock scenario by region

	Youth unemployment (levels)
North East	3,000
North West	7,000
Yorkshire and The Humber	6,000
East Midlands	5,000
West Midlands	5,000
East	6,000
London	8,000
South East	9,000
South West	6,000
Wales	3,000
Scotland	6,000
Northern Ireland	2,000
North East	3,000

## Asset prices

2.58 Increasing uncertainty in the UK would raise the return needed to compensate for the additional risk from a vote to leave the EU. As UK prospects become more uncertain, the term premia would increase on government debt, steepening the government yield curve and raising bank funding costs. Corporate borrowing spreads would increase due to the shock to uncertainty and the steepening government yield curve. **Even while assuming no change to monetary policy, the uncertainty shock would lead to tighter financial conditions, a reduction in real economy lending and higher mortgage rates.** This, in turn, would reduce consumption and investment and weigh on asset prices. These effects would act as amplifiers to the economic shock. A fall in asset prices would have a wealth effect, making holders of assets poorer. For households this would further reduce spending and for businesses it would further increase the cost of capital.

2.59 The higher borrowing costs and lower incomes would weigh on house and equity prices. House prices and transactions have been modelled outside of the general equilibrium model to reflect the likely immediate effect relative to the long-run asset pricing in NiGEM. The effect on house prices is estimated using the OBR house price model and values in the scenarios for incomes, inflation, and mortgage rates.<sup>24</sup> **The analysis shows that demand for housing would fall due to the higher cost of lending, and at the end of the two years, house prices in the shock scenario**

<sup>23</sup> The regional share of UK employment is calculated using the 12-month average for 2015. *Annual Population Survey*, Office for National Statistics (2016).

<sup>24</sup> *Working paper No.6: Forecasting house prices*, Office for Budget Responsibility (2014).

would be around 10% lower relative to a vote to remain in the EU. In the severe shock scenario, house prices would be around 18% lower.

2.60 Due to the responsiveness of financial markets to economic developments, immediately after a vote to leave the EU, the price of equities is estimated to fall by around 20% relative to the baseline in the shock scenario, and 29% in the severe shock scenario.

### Summary of immediate economic impacts

2.61 Table 2.E sets out the key economic impacts for each scenario. In both the shock and severe shock scenarios the adjustment to a less open economy significantly reduces prosperity and poses risks to the UK's economic security. **A vote to leave the EU would push the UK into recession, lead to a spike in inflation and a rise in unemployment.**

2.62 Under the shock scenario, a vote to leave the EU would push the UK into recession, increase unemployment, and increase prices faced by consumers. Under the severe shock scenario, the instability and economic hit would be considerably worse.

Table 2.E: Immediate impact of a vote to leave the EU on the UK (% difference from base level unless specified otherwise) <sup>a</sup>

	Shock scenario	Severe shock scenario
GDP	-3.6%	-6.0%
CPI inflation rate (percentage points)	+2.3	+2.7
Unemployment rate (percentage points)	+1.6	+2.4
Unemployment level	+520,000	+820,000
Average real wages	-2.8%	-4.0%
House prices	-10%	-18%
Sterling exchange rate index	-12%	-15%

<sup>a</sup> Peak impact over two years. Unemployment level rounded to the nearest 10,000.

### Immediate impact on the public finances from a vote to leave the EU

2.63 If the UK voted to leave the EU, the resulting recession would reduce tax receipts and increase welfare spending. This, in turn, would increase Public Sector Net Borrowing (PSNB) – the deficit – and Public Sector Net Debt. **The additional borrowing in both scenarios would be driven by lower wages, consumption, house prices and profits weighing on tax revenues, and increases in welfare spending and higher debt interest.**

2.64 These fiscal impacts are set out in Table 2.F. In the shock scenario, net borrowing in 2017-18 would be around £24 billion higher and debt would be around £34 billion higher than under a vote to remain. In the severe shock scenario, net borrowing in 2017-18 would be around £39 billion higher and debt would be around £54 billion higher than under a vote to remain. The deficit and debt impacts set out as a share of GDP would reflect both the fiscal deterioration and the lower level of nominal GDP.

2.65 **This fiscal deterioration would put at risk the government’s fiscal deficit reduction plan and the aim for debt as a share of GDP to be falling in each year until 2019-20.** The approach to modelling the fiscal impact is detailed in Annex A.

Table 2.F: Net impact on public sector finances of a vote to leave the EU (positive numbers imply higher deficit/debt)

Shock scenario	2016-17	2017-18
Public sector net borrowing (£ billion)	+12.2	+24.2
Public sector net borrowing (% of GDP)	+0.7	+1.3
Public sector net debt (£ billion)	+11.3	+34.4
Public sector net debt (% of GDP)	+2.7	+4.5

Severe shock scenario	2016-17	2017-18
Public sector net borrowing (£ billion)	+19.0	+38.5
Public sector net borrowing (% of GDP)	+1.1	+2.1
Public sector net debt (£ billion)	+17.3	+53.5
Public sector net debt (% of GDP)	+4.5	+8.1

2.66 The OBR’s average absolute revision to the underlying PSNB forecast over the five years of the forecast period at each fiscal event is 0.5% of GDP.<sup>25</sup> Therefore the impact of a vote to leave the EU on PSNB of 1.3% of GDP in 2017-18 in the shock scenario is over double the size of the average absolute revision to PSNB.

2.67 These public finance impacts are estimated using elasticities that provide an indicative estimate as to how an element of spending or taxation varies given a change in the economy. These elasticities themselves are estimated using recent economic experience. However, these elasticities may be larger in the case of a vote to leave the EU. For instance, a reduction in the presence of financial services in the UK could lead to a larger reduction in tax receipts for a given change in GDP, due to the relatively high wages in the sector. Therefore the fiscal impact of a vote to leave the EU could well be more severe than the estimates suggest.

## Downside risks to the scenarios

2.68 The shock and severe shock scenarios quantify the impact on the UK economy of a vote to leave under differing levels of severity. **There are still downside risks that are not reflected, even in the severe shock scenario, which suggest the economic impact of a vote to leave the EU could be worse.**

2.69 The scenarios do not reflect the realisation of any ‘tipping point’ effects. These can occur when an unobserved threshold is reached, resulting in severe economic consequences. Tipping points are, for example, often associated with financial stability risks and losses of policy confidence that are difficult to estimate but can have significant and persistent effects. Managing these risks is an important consideration for policymakers during periods of economic stress but they are not included in the modelled scenarios.

<sup>25</sup> *Economic and fiscal outlook*, Office for Budget Responsibility (March 2016).

**2.70 A large uncertainty shock could put stresses on the financial system that would result in an amplification of the disruption from a vote to leave the EU.**<sup>26</sup> The Bank of England’s Financial Policy Committee (FPC) “assessed the risks around the referendum to be the most significant near-term domestic risks to financial stability”.<sup>27</sup> Risks to financial stability could materialise if heightened uncertainty were to trigger a sharp increase in risk premia. Whilst banks are significantly less reliant on short-term wholesale funding than they were before the financial crisis of 2008 and 2009,<sup>28</sup> the FPC recently noted that heightened uncertainty could test the capacity of core funding markets at a time when the liquidity of these markets had shown signs of fragility across advanced economies.<sup>29</sup>

2.71 For example, a shock to sterling could cause a sudden contraction in foreign currency lending to UK banks or increase the cost of swapping sterling into other currencies. Around half of banks’ short-term wholesale funding is in foreign currency,<sup>30</sup> so reduced access to foreign currency funding combined with an increase in the cost of accessing swap markets for an extended period could, under severe developments, pose risks to financial stability.

2.72 The Bank of England has primary responsibility for identifying and responding to threats to financial stability. In line with this, it is undertaking contingency planning for risks that could materialise. This includes announcing extra liquidity auctions<sup>31</sup> and the Prudential Regulation Authority reviewing UK financial institutions’ own contingency plans.<sup>32</sup> HM Treasury is also contingency planning, working with the Bank of England and the Financial Conduct Authority under existing arrangements to ensure a fully coordinated response across the financial authorities.<sup>33</sup>

2.73 The UK’s large current account deficit is a particular economic vulnerability (see Box 2.B). In both quantitative scenarios the UK is able to continue borrowing from abroad in the short term, allowing the current account to close gradually. However, were foreign investors to judge the current account deficit unsustainable, a sudden stop of financial inflows as highlighted by the IMF in May 2016,<sup>34</sup> would amplify the adverse economic impacts of the modelled scenarios.

**2.74 If the economic shock from a vote to leave the EU were to induce a period of heightened uncertainty, foreign investors would become more risk averse, which could be a trigger for the reversal of financial flows to the UK. Were these inflows to decline sharply, UK domestic demand would also have to fall sharply as overseas lenders would be no longer willing to finance current levels of expenditure.** There are a number of ways this could materialise, for example, credit conditions in financial markets could tighten sharply, pushing up borrowing costs, and

---

<sup>26</sup> *Inflation Report May 2016*, Bank of England (2016).

<sup>27</sup> *Record of the Financial Policy Committee meeting- 23 March 2016*, Bank of England (2016).

<sup>28</sup> *Financial Policy Committee core indicators*, Bank of England (March 2016).

<sup>29</sup> *Record of the Financial Policy Committee meeting- 23 March 2016*, Bank of England (2016).

<sup>30</sup> *Inflation Report May 2016*, Bank of England (2016).

<sup>31</sup> *Market Notice: Additional Indexed Long-Term Repo Operations*, Bank of England (March 2016).

<sup>32</sup> Bank of England Governor, Mark Carney, and Deputy Governor, Sir Jon Cunliffe, at *The economic and financial costs and benefits of UK’s EU membership* hearing, Treasury Select Committee (8 March 2016).

<sup>33</sup> Chancellor of the Exchequer, George Osborne, at *The economic and financial costs and benefits of UK’s EU membership* hearing, Treasury Select Committee (11 May 2016).

<sup>34</sup> *United Kingdom – 2016 Article IV consultation concluding statement of the mission*, IMF (2016).

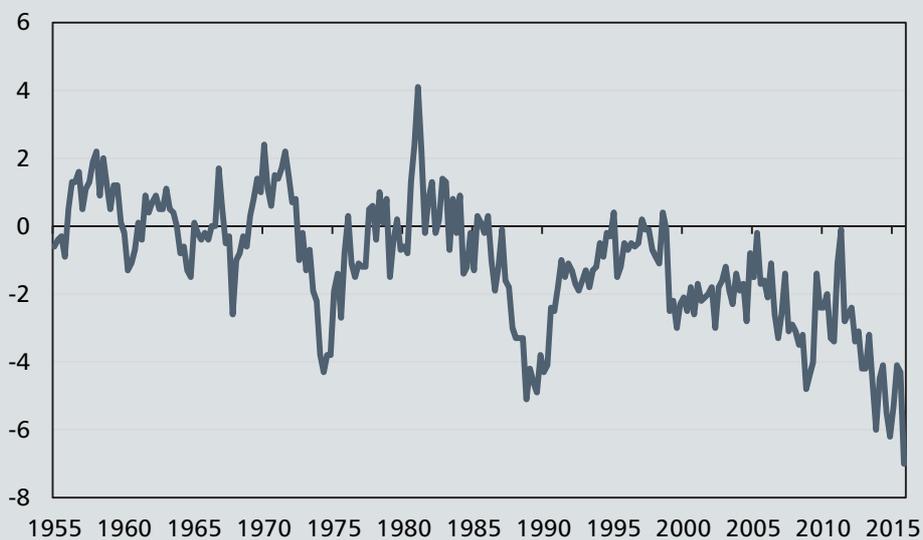
sterling could depreciate even more rapidly than in either of the scenarios, which would lead to higher costs of imported goods and lower real incomes.

### Box 2.B: UK current account as a vulnerability

The UK current account deficit of 7.0% of GDP in 2015 Q4 is high by historical and international standards.<sup>35</sup> In recent years the deficit has been driven by a deterioration in the UK's net investment income. This likely reflects the relatively stronger performance of the UK economy compared to its trading partners, which has meant that the income earned on the UK's overseas assets has been relatively weaker.

However, the UK's current account deficit remains reliant on inflows of capital from abroad. Some of these inflows are linked to business related to the UK's access to the Single Market, including financial services.

Chart 2.H: UK current account (% of GDP)



Source: Office for National Statistics

The extent to which a large current account deficit can be sustained, and the pace at which it adjusts to a more sustainable level, depends on the willingness of foreign investors to hold assets in that country. This in turn would depend on a broad range of factors, including the structural features of the economy (such as how open an economy is), the size and composition of its external liabilities and other external variables.

2.75 If the rise in import prices led to significant upward pressure on inflation, there is a risk that inflation expectations could become less well anchored. In such an event, **the MPC might need to tighten monetary policy in order to stabilise inflation and combat capital outflows.** This would exacerbate the immediate impact on GDP, increase the cost of borrowing, and further reduce the price of assets.

2.76 Both modelled scenarios assume that fiscal policy remains unchanged and that the automatic stabilisers help cushion the economic downturn. Table 2.F sets out that

<sup>35</sup> Balance of Payments (MEI) MPM: Current account balance as a % of GDP, OECD (2016).

the assumption of no fiscal policy change leads to an increase in government borrowing and debt. There is a risk that the instability and fiscal deterioration would risk a loss in policy credibility.

2.77 The instability following a vote to leave the EU would lead to an increase in the term premium on government debt. A combination of the term premium pushing up government bond yields, the increase in government debt from falling into recession, and the lower productivity prospects, could risk triggering a loss in fiscal credibility where the debt dynamics are judged by investors to be unsustainable. In the presence of such a risk, **fiscal policy would need to be tightened to retain policy credibility and investor confidence.** While this policy reaction would ensure fiscal sustainability by shoring up investor confidence in government debt, it could also have an additional immediate impact on the economy.

2.78 **Finally, a vote to leave the EU could have more significant knock-on effects for the global economy than considered in the severe shock scenario.** A weaker UK economy would have implications for global growth, as highlighted by the IMF and others who have described a vote to leave the EU as one of the key risks this year.<sup>36</sup> Economic contagion of this sort would weigh on UK output through lower demand for UK exports.

2.79 Overall, there are material downside risks that could lead to a more adverse impact on the UK economy following a vote to leave the EU.

### **Adjustment from the immediate shock to the long term**

2.80 As set out in the long-term document, external studies have found evidence that economic shocks can have persistent effects on the level of output. Bank of England analysis suggests that increased macroeconomic uncertainty might lead businesses to postpone profitable investment projects in both physical and intangible capital.<sup>37</sup> Their analysis estimated that at the end of 2013 between a fifth and a third of the weakness in productivity could be explained by low levels of investment.

2.81 **Given the evidence of the impact of previous economic shocks, a slowdown caused by the uncertainty generated by leaving the EU is likely to have a persistent negative impact, in particular through the effect on the capital stock.**

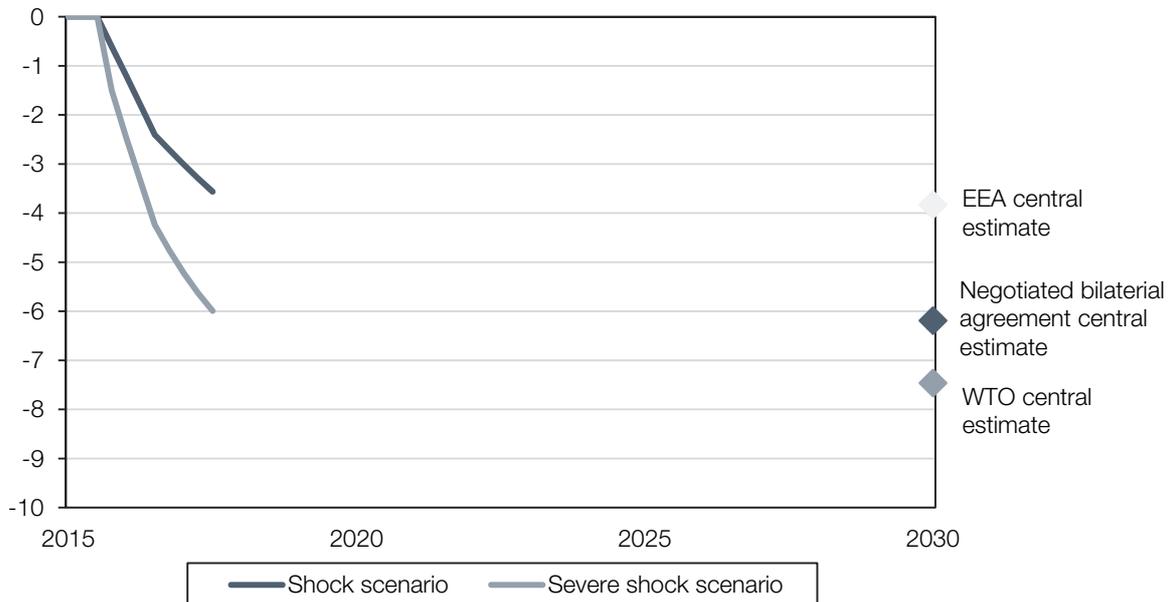
2.82 Beyond the short term, the economy would be weighed upon by a persistent impact from the downturn and the transition to one of the trade arrangement scenarios set out in the long-term document. Under each of these long-term alternatives to EU membership, incomes would be permanently lower than in the event of a vote to remain in the EU. However, the adjustment between the immediate and long-term impacts would depend on a wide variety of factors including the policy response, and the extent to which the UK is hit by further uncertainty shocks (see Figure 2.C).

---

<sup>36</sup> *World Economic Outlook: Too Slow for Too Long*, IMF (April 2016).

<sup>37</sup> *The UK productivity puzzle*, Barnett, Batten, Chiu, Franklin and Sebastián-Barriel, Bank of England (2014).

**Figure 2.C: Comparison between the scenarios and the long term (GDP % difference from base level)**



Source: HM Treasury calculations

2.83 In the shock scenario, the analysis shows that two years after a vote to leave the EU, the hit to supply lowers the UK's potential GDP by 2.7% relative to a vote to remain; under the severe shock scenario, the effect on supply is even greater, with potential GDP 4.1% lower after two years relative to vote to remain in the EU. This reflects the combination of influences from the transition, uncertainty and financial conditions effects.

### Risk of persistent instability from a vote to leave the EU

2.84 In presenting the economic impact of the shock and severe shock scenarios over the two-year period, the quantitative analysis in this document does not take account of the significant risk of further increases in uncertainty and instability beyond two years (the scenarios focus on the two-year period shown on the left-hand side of Figure 1.B). **As noted in Section 1, each of the four processes that would need to be completed to leave the EU would be complicated in their own right. But conducting them all at the same time, on any terms that would be acceptable to the UK and within the specified two-year period for leaving the EU, would almost certainly be impossible.**

2.85 **The economic impact of a vote to leave the EU could also be larger still if the uncertainty persists, or even intensifies beyond the two-year period examined in these scenarios.** This could be the case if the UK were unable to finalise its withdrawal from the EU during the specified two-year period and defaulted to WTO membership. The risk from this more protracted instability is not reflected in the modelling of the shock and severe shock scenarios, but such developments would lead to significantly worse economic outcomes.



# Annex A

## Macroeconomic and fiscal modelling of the immediate impact of the UK leaving the EU

A.1 This Annex sets out the modelling framework that underlies Section 2. There are three Parts to the Annex:

- assessing the immediate effects of a vote to leave the European Union (EU)
- modelling the immediate macroeconomic impact of a vote to leave the EU
- modelling the immediate impact on the public finances of a vote to leave the EU

A.2 A vote to leave the EU would have three main effects in the short term:

- a ‘transition effect’, reflecting the expected reduction in trade and financial openness as the United Kingdom’s (UK) economy transitions to its new long-term arrangements with the EU and the rest of the world, leading to lower UK productivity and output
- an ‘uncertainty effect’, which reduces household consumption and business investment, as well as leading to increases in risk premia in financial markets
- a ‘financial conditions effect’, which amplifies the uncertainty and transition effects, leading to increased financial market volatility with further increases in risk premia and falls in asset prices

A.3 The analysis examines these effects over the two years immediately following a vote to leave (between 2016 Q3 and 2018 Q2).

A.4 A previous government paper *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives* (“the long-term document”) concluded that the long-term effect of a vote to leave the EU would be to lower UK output under all existing alternatives considered.<sup>1</sup> A proportion of the long-term impacts of the reduced openness described in the long-term document would emerge in the short term. These transition effects would be expected to begin to feed through quickly as firms and households respond to falls in asset prices and start to reduce investment and consumption spending.

A.5 To model the impacts of an increase in uncertainty, an indicator of uncertainty, based on empirical data and in line with external studies on uncertainty, is constructed.

---

<sup>1</sup> *HM Treasury analysis: the long-term economic impact of EU membership and the alternatives*, HM Government (April 2016).

This indicator is then used to assess the impact of uncertainty on a number of economic variables including households, businesses and interest rates, building on the approach used by the Bank of England.<sup>2</sup> The magnitude of the uncertainty shock is based on standard deviations of the uncertainty indicator. The impacts of this shock on the wider economy are estimated in a vector autoregression (VAR) model.

A.6 Financial conditions would also deteriorate. In addition to the uncertainty impacts on financial risk premia, there would be additional impacts to reflect increased financial market volatility and downward pressure on asset prices. Shocks to the household borrowing spread, corporate borrowing spread, equity risk premium and term premium are calibrated based on historical fluctuations. The effect on sterling is calibrated based on external estimates.

A.7 These effects are then input into NiGEM, the global macroeconomic model developed and maintained by the National Institute of Economic and Social Research (NIESR). NiGEM is used to model the transmission of these effects through the economy and quantifies the effects on demand, supply and asset prices.

A.8 The analysis quantifies these effects in two scenarios: a 'shock' scenario and a 'severe shock' scenario. The shock scenario makes a number of cautious assumptions about the size of each of the main effects. The severe shock scenario acts as a sensitivity analysis, to test the cautious assumptions made in the shock scenario.

A.9 Part 1 of this Annex discusses the measurement and quantification of the effects above in more detail. Part 2 discusses how NiGEM is used to model the immediate economic impact of a UK vote to leave the EU. Part 3 of this Annex provides details of the methodology used to estimate the immediate fiscal implications of a vote to leave the EU.

A.10 An overview of the modelling framework is illustrated in Figure A.1.

---

<sup>2</sup> *Macroeconomic uncertainty: what is it, how can we measure it and why does it matter?*, Haddow, Hare, Hooley and Shakir, Bank of England (2013).

Figure A.1: Modelling Framework



# Part 1: Assessing the immediate effects from a vote to leave the EU

A.11 A vote to leave the EU would have three immediate effects: a transition effect; an uncertainty effect; and a financial conditions effect. This Part assesses each of these effects to produce inputs for the overall macroeconomic modelling described in Part 2.

## Assessing the transition effect

A.12 The long-term document provided detailed analysis and estimates of the trade, FDI and productivity effects that would be expected to permanently lower UK output in the case of the UK leaving the EU. As Sections 1 and 2 set out, a proportion of these effects would begin to appear immediately as firms, households and financial markets begin to adjust to the UK's new relationship with the EU.

A.13 In the shock scenario, the modelling incorporates the long-term trade and productivity shocks from the negotiated bilateral agreement central estimate described in the long-term document. This leads to a long-term loss of 6.2% of GDP relative to the counterfactual case of remaining in the EU. In the severe shock scenario, the modelling is based on the World Trade Organization (WTO) central estimate, consistent with a long-term 7.5% loss of GDP.

A.14 The effects build up over 15 years.<sup>3</sup> When combined with the uncertainty effects and financial conditions effects, the three effects lead to a significant impact on the supply side of the economy, as set out in Section 2.

## Assessing the uncertainty effect

A.15 The measurement of the impact of uncertainty on the UK economy builds on the approach used by the Bank of England (2013) to link empirically measures of uncertainty to economic outcomes. It is also consistent with a growing academic literature quantifying the macroeconomic impacts of uncertainty using VAR models, such as Bloom (2009),<sup>4</sup> Baker et al (2015),<sup>5</sup> and Denis and Kannan (2013).<sup>6</sup>

## Measuring uncertainty

A.16 A summary uncertainty indicator is constructed based on a number of direct uncertainty measures. An indicator based on a range of measures is a more robust approach than relying on one single measure, which may not capture the full range of uncertainty effects. For example, some measures are more likely to capture consumers' perceptions of uncertainty, such as the GfK unemployment expectations survey, while others will capture those of businesses, such as the Industrial Trends survey, or of

---

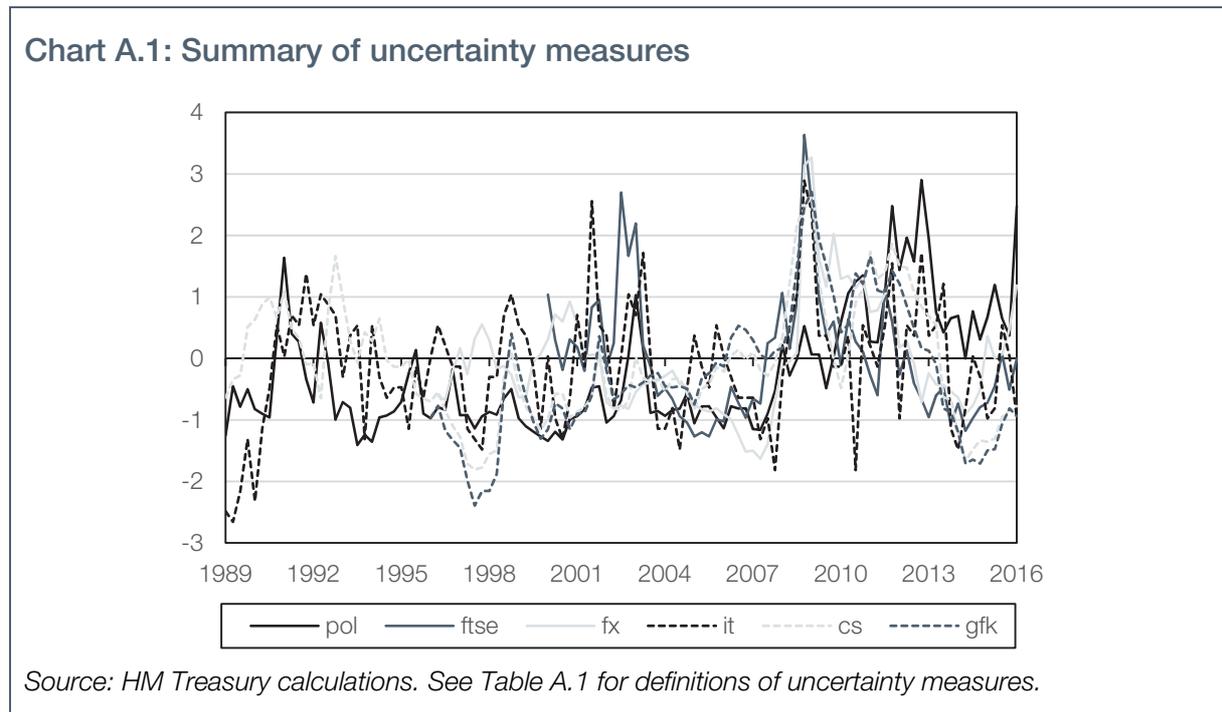
<sup>3</sup> The long-term effects on trade, FDI and productivity can be found in Table A.7, Table A.12 and Table A.15 of HM Government (April 2016).

<sup>4</sup> *The Impact of Uncertainty Shocks*, Bloom (2009).

<sup>5</sup> *Measuring economic policy uncertainty*, Baker, Bloom, and Davis (2015).

<sup>6</sup> *The impact of uncertainty shocks on the UK economy*, Denis and Kannan (2013).

financial markets, such as the FTSE 100 implied volatility. The uncertainty measures used are shown in Chart A.1 and described in Table A.1.<sup>7</sup>



A.17 Each of the uncertainty measures in Table A.1 is normalised by subtracting its mean and scaling by its standard deviation over the period 2000 to 2015, which is the period covered by all the uncertainty measures. The normalised uncertainty measures are then combined into a single uncertainty indicator running from 1989 to 2015,<sup>8</sup> with each measure weighted equally. A similar approach, used in Bank of England (2013), is to construct a closely related uncertainty indicator using principal components analysis. As a robustness check, both approaches were tested and they were found to produce very similar uncertainty indicators.

<sup>7</sup> Every uncertainty measure is adjusted to be on a quarterly basis. All the data except the CBI industrial trend survey are available monthly and are included as quarterly averages.

<sup>8</sup> The shorter time series for some measures has little impact on the pre-2000 uncertainty indicator because the correlation between the selected uncertainty measures is relatively high.

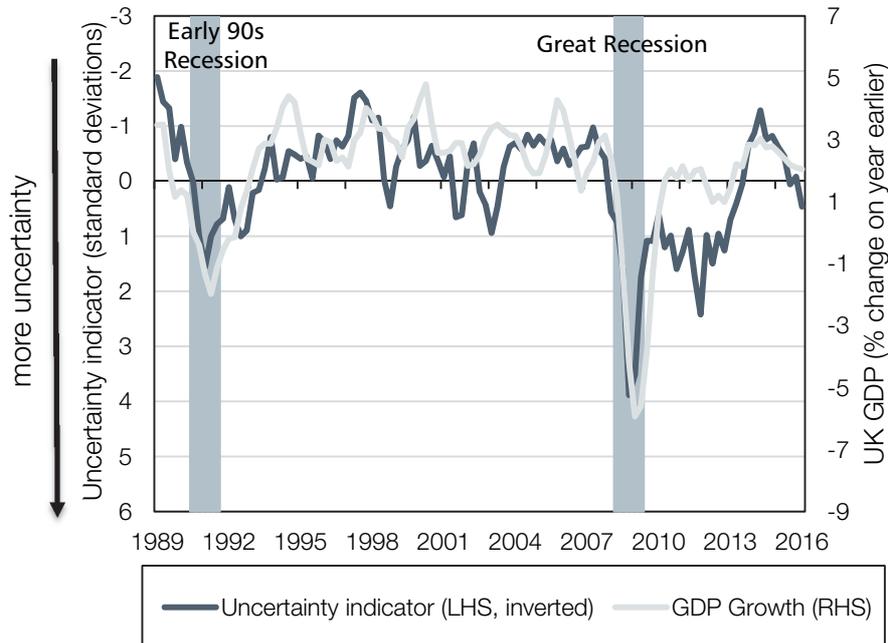
Table A.1: Summary of uncertainty measures

Type	Sector	Description	Source
Policy-related economic uncertainty (pol)	Whole economy	Index based on references relating to UK policy uncertainty in print media	Baker, Bloom and Davis (2015), policy.uncertainty.com
FTSE 100 implied volatility (ftse)	Whole economy	Implied volatility of FTSE 100 index <sup>9</sup>	Bloomberg
Sterling implied volatility (fx)	Whole economy	Weighted average of EUR-GBP 1-year ATM implied volatility and USD-GBP 1-year ATM implied volatility <sup>10</sup>	Bloomberg
Industrial Trends uncertainty measure (it)	Manufacturing	The proportion of firms answering that “Uncertainty is likely to limit capital expenditure in the next 12 months”	Industrial Trends survey (CBI)
Consumer survey uncertainty measure (cs)	Consumers	Equally weighted average of indices covering the: (i) financial situation over the next 12 months; (ii) general economic situation over the next 12 months; and (iii) unemployment expectation over the next 12 months.	Consumer survey (European Commission)
GfK unemployment expectation (gfk)	Consumers	Index of unemployment outlook over the next 12 months	GfK

A.18 Chart A.2 shows the composite uncertainty indicator and its relationship with GDP growth. The indicator identifies a heightened level of uncertainty around the time of the 1990s recession and the Great Recession. The chart shows that uncertainty in the most recent period, 2016 Q1, has risen to above-average levels, which is likely to be associated with the UK referendum on EU membership, as discussed in the Bank of England’s May 2016 Inflation Report.

<sup>9</sup> The implied volatility is based on option prices which reflect the future volatility of the FTSE 100.

<sup>10</sup> The weights are based on the Bank of England effective exchange rate measure.

**Chart A.2: Uncertainty and GDP growth**

Source: HM Treasury calculations

Note: the indicator has been normalised, which means that 1 unit on the y-axis corresponds to 1 standard deviation from the average level of uncertainty between 1989 and 2015.

### VAR analysis: specification

A.19 To establish how a change in the level of UK uncertainty affects other key macroeconomic variables, a VAR model is used. VAR models are a common tool in macroeconomics, which describe the evolution of a set of variables over the sample period over which they are estimated. Once estimated, they can show how a change in one variable in the system affects all the other variables in the system, capturing both the initial impact and subsequent dynamic effects.

A.20 The VAR includes eight variables: the uncertainty indicator, consumption, business investment, the GDP deflator, Bank Rate, and three financial risk premia. The three financial risk premia used are: the household borrowing spread, corporate borrowing spread and equity risk premium, as defined in NIESR's NiGEM model.

A.21 All variables in the VAR are included in differenced form,<sup>11</sup> with the exception of the uncertainty indicator, which was found to be stationary and enters into the VAR in levels.<sup>12</sup> The specification used implies that uncertainty affects the growth rate of the economic variables included in the VAR.

A.22 One approach taken in analysis such as Bloom (2009) uses filtered data in levels. The approach below does not use a filter to construct a stationary series, motivated by the view that it is unclear with statistical filters to what extent important information is

<sup>11</sup> GDP, consumption and business investment are in log-differences, which correspond approximately to their growth rates.

<sup>12</sup> All variables were tested for non-stationarity using the Augmented Dickey-Fuller test.

being filtered out and because the choice regarding the smoothness of the trend introduces a potentially arbitrary assumption. This approach to the construction of the variables is in line with a more recent study by Caldara et al (2016).<sup>13</sup>

A.23 The specification of the VAR that is estimated is shown in equation A.1 below.<sup>14</sup>

$$(A.1) \quad \begin{bmatrix} \text{uncertainty}_t \\ C_t \\ I_t \\ P_t \\ R_t \\ hhprem_t \\ corpprem_t \\ equityprem_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} \text{uncertainty}_{t-1} \\ C_{t-1} \\ I_{t-1} \\ P_{t-1} \\ R_{t-1} \\ hhprem_{t-1} \\ corpprem_{t-1} \\ equityprem_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} \text{uncertainty}_{t-2} \\ C_{t-2} \\ I_{t-2} \\ P_{t-2} \\ R_{t-2} \\ hhprem_{t-2} \\ corpprem_{t-2} \\ equityprem_{t-2} \end{bmatrix} + \varepsilon_t$$

Where *uncertainty* is the level of the uncertainty indicator; *C*, *I* and *P* are consumption, business investment and the GDP deflator, all in log differences; *R* is Bank Rate, *hhprem* is the household borrowing spread, *corpprem* is the corporate borrowing spread and *equityprem* is the equity risk premium, all in differences.  $A_0$  is a vector of constants and  $\varepsilon_t$  is a vector of residuals.<sup>15</sup>

### VAR analysis: results

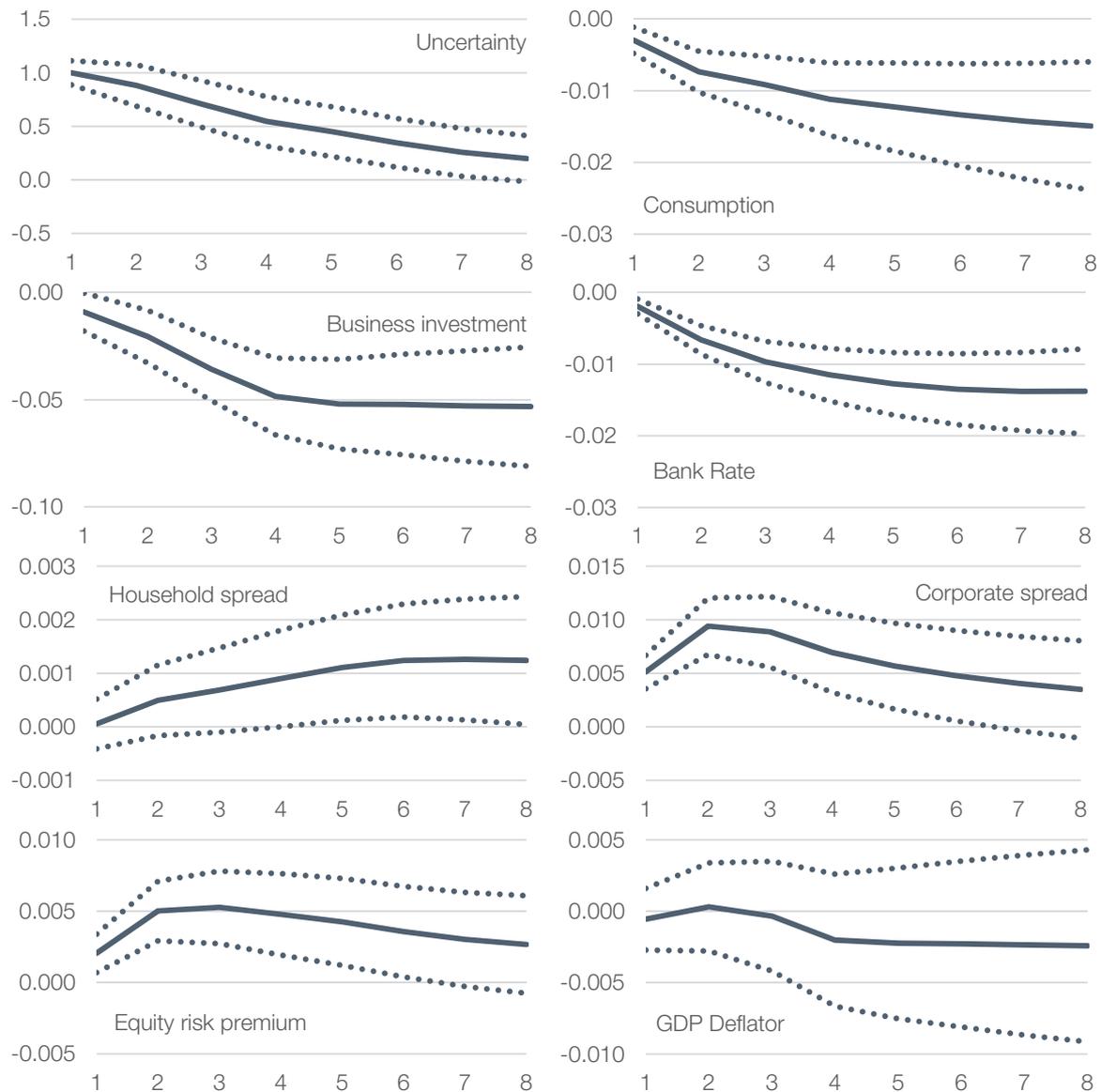
A.24 The results from the estimated VAR are presented as ‘impulse responses’, which show how a ‘shock’ to one variable in the VAR affects each of the other variables in the model. Chart A.3 shows the effect of a 1 standard deviation increase in the uncertainty indicator. The impulse responses for all variables are in levels. For variables that enter into the estimation as differences, level effects have been generated by showing the cumulative differences over eight quarters.

<sup>13</sup> *The Macroeconomic Impact of Financial and Uncertainty Shocks*, Caldara, Fuentes-Albero, Gilchrist and Zakrajsek (2016).

<sup>14</sup> The choice of two lags is based on tests using information criteria for model selection.

<sup>15</sup> The Cholesky decomposition is adopted as an identification strategy. The variables follow the order shown in equation A.1.

**Chart A.3: Cumulative impulse responses from a 1-unit uncertainty indicator increase**



Source: HM Treasury calculations

Note: the dotted lines show 90% confidence intervals. The uncertainty chart shows the persistence of a 1-unit uncertainty shock, while the other charts show cumulative impulse responses to the 1-unit uncertainty shock.

A.25 To check the robustness of the results, various alternative specifications of the VAR were constructed. The VAR model was found to be robust to the following checks: varying the construction of the uncertainty indicator;<sup>16</sup> expressing the variables included

<sup>16</sup> The uncertainty indicator was replaced by the consumer survey uncertainty measure in one check and by the GfK uncertainty measure in another.

in the VAR in levels and first differences;<sup>17</sup> the number of lags included in the VAR;<sup>18</sup> and the identification strategy.<sup>19</sup>

### The size of the uncertainty effect

A.26 In the shock scenario, the size of the uncertainty effect following a vote to leave the EU is based on a 1 standard deviation increase in the uncertainty indicator. In the severe shock scenario, the effect is based on 1.5 standard deviations. For the shock scenario, this is a cautious assumption as it is based on the average fluctuation in uncertainty over the available time period, rather than previous episodes of elevated uncertainty.

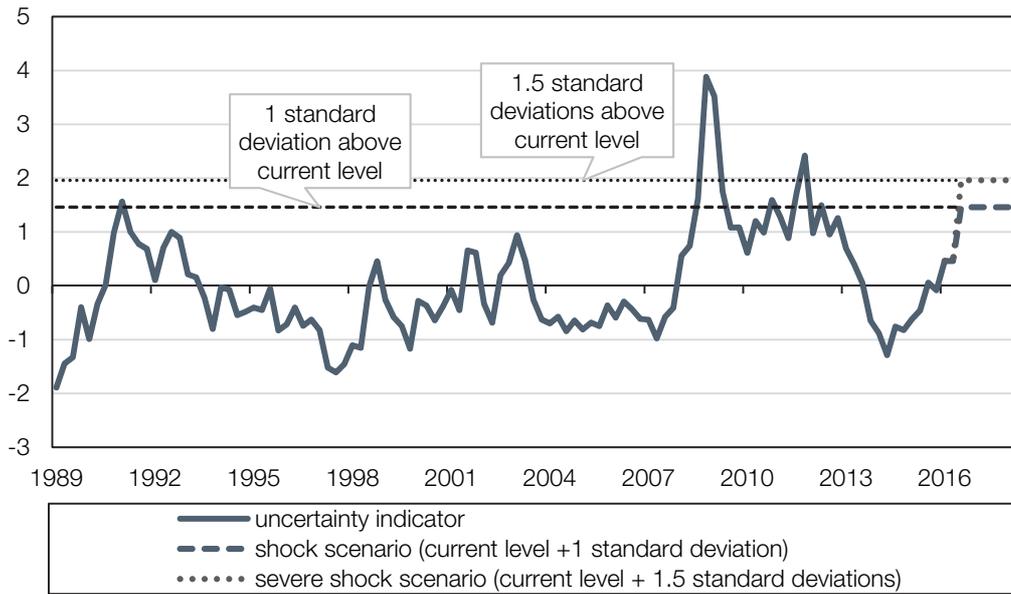
A.27 The current level of uncertainty is already heightened at around 0.5 standard deviations above its average. This means that an additional increase by 1 standard deviation raises the level of uncertainty to 1.5 standard deviations above its mean in the shock scenario (and 2.0 in the severe shock scenario). The level of uncertainty remains at this level for the 2 years of the scenario. Over the 27 years since 1989, the uncertainty indicator has been at the level of the shock scenario for 7% of the time. The increase in uncertainty in both the shock scenario and the severe shock scenario from its low point is less than the 3.5 standard deviation increase in uncertainty seen in the run up to and during the early 1990s recession. Chart A.4 shows the level of uncertainty in each scenario.

---

<sup>17</sup> All variables, including the uncertainty indicator, were expressed in levels, with and without a trend, and in differences.

<sup>18</sup> The two-quarter lags were replaced by four-quarter lags. The response is similar to that of the model used.

<sup>19</sup> A VAR including the VIX index was estimated and another including the FTSE 100 index. The VIX index measures the implied volatility of S&P 500 index options and is considered to be a proxy for global uncertainty, while the FTSE 100 is considered to proxy for general economic downturns. The indices are used to identify domestic uncertainty in the VAR model and distinguish it from global uncertainty and general economic downturns. VAR models with the uncertainty indicator put last or in the middle of the ordering for the Cholesky decomposition are also estimated.

**Chart A.4: Uncertainty during the transition period**

Source: HM Treasury calculations

## Assessing the financial conditions effect

A.28 The uncertainty and the transition effect would weigh on financial markets and increase volatility. Tighter financial conditions would be reflected in higher bank funding costs and increased risk of credit losses, which tighten credit conditions<sup>20</sup> for households and corporates and put upward pressure on UK government bond rates. This is modelled via increases in the household and corporate borrowing spreads and in the ‘term premium’, which reflects the additional compensation demanded by investors in order to hold long-term bonds instead of short-term bonds.

A.29 Investors’ concerns would also be reflected in falls in asset prices. This is modelled via a depreciation in sterling and an increase in the risk premium on equity prices – the difference between the expected returns on equities and a ‘risk free’ rate such as government bond yields.

A.30 In the shock scenario, household and corporate borrowing spreads and the equity risk premium all rise by 1 standard deviation of their 1990-2015 levels. This results in a shock of 70 basis points to the household lending spread, 130 basis points to the corporate borrowing spread and 120 basis points to the equity risk premium.

A.31 A 40 basis points shock has been applied to the term premium, which is an increase of half a standard deviation of its 1992-2015 level.<sup>21</sup> The smaller standard deviation shock was chosen to reflect that UK government bond yields have fallen and become less volatile since the financial crisis.

A.32 In the shock scenario, an impact on sterling is calibrated to generate a 12% depreciation in sterling after allowing for the model’s endogenous response to all the

<sup>20</sup> Modelled as an increase in the ‘price’ of credit but without rationing the ‘supply’ of credit.

<sup>21</sup> Standard deviation based on data from *Evaluating the robustness of UK term structure decompositions using linear regression methods*, Malik and Meldrum (2016). The sample starting year is selected to correspond to the 1992 introduction of inflation-targeting.

other effects. This is based on a review of a range of published estimates,<sup>22</sup> where the average expected depreciation following a vote to leave the EU is 12%.

A.33 In the severe shock scenario, household and corporate lending spreads and the equity risk premium all rise by 1.5 standard deviations of their 1990-2015 levels. This results in a shock of 110 basis points to the household lending spread, 200 basis points to the corporate borrowing spread and 180 basis points to the equity risk premium.

A.34 In the severe shock scenario, the impact on the term premium increases to 100 basis points, to reflect the impact of heightened instability on government borrowing costs. The exchange rate risk premium rises by an amount that causes a 15% depreciation in sterling when including all the other effects.

A.35 In the severe shock scenario, due to financial contagion effects, financial risk premia in other European countries also increase. This reflects the possibility that a vote to leave the EU could cause a significant immediate negative shock to other EU member states, reflecting close links with the UK economy.<sup>23</sup>

---

<sup>22</sup> *The economic consequences of Brexit: a taxing decision*, OECD (2016); *National Institute Economic Review No.236*, NIESR (2016); *Brexit Risk – Implications for Economies and Markets*, Citi (2016); *Brexit: A market perspective*, Commerzbank (2016); *Brexit; The UK & EU: Exit Emergency*, Deutsche Bank (2016); *Brexit Strategies: What if the UK leaves?*, HSBC (2016); *Brexit: What impact might uncertainty have on UK GDP?*, JP Morgan (2016); *Brexit carries a recessionary risk*, Nomura (2016); *The short-term impact of Brexit*, Oxford Economics (2016); *Bloomberg Intelligence: Brexit Special*, Bloomberg Intelligence (2016).

<sup>23</sup> The financial premia effects in other European countries are based on the UK effects and the empirical correlation between UK financial premia and those in each European country, or bloc of countries, in NiGEM. These effects are calibrated in NiGEM.

## Part 2: Modelling the immediate macroeconomic impact of a vote to leave the EU

A.36 This Part sets out the modelling approach for estimating the immediate macroeconomic impact of the UK leaving the EU, using NiGEM.<sup>24</sup>

A.37 NiGEM is a global macroeconomic model developed and maintained by NIESR. It is used to differing degrees by over forty organisations including the IMF, OECD, Bank of England and ECB.

### Inputs for macroeconomic modelling

A.38 The calibrated impacts of uncertainty on consumption and business investment described in Part 1 are used as inputs in NiGEM. The effects are calibrated so that when they enter the macroeconomic model in the absence of any other effects they deliver paths that match the maximum deviations from base shown in the impulse responses. The specific dynamic paths in the impulse responses are not calibrated to, with NiGEM instead determining the dynamic path.

A.39 The impacts on financial conditions and the transition to the long term are added to the uncertainty impacts so that the final paths for consumption and business investment will deviate from those in the uncertainty impulse responses. For example, the lower level of productivity growth will further weaken consumption and investment relative to a path driven by the uncertainty effect alone.

A.40 Table A.2 below presents all the effects – from the transition, uncertainty and financial conditions – included in the modelling of the short-term macroeconomic impact of a vote to leave the EU.

---

<sup>24</sup> For more information on NiGEM, please refer to the NiGEM Technical Documentation, available from NIESR.

Table A.2: Summary of modelling inputs

	Shock scenario	Severe shock scenario
<b>Transition effect</b>	Central estimate of the negotiated bilateral agreement alternative phased in over 15 years	Central estimate of the WTO alternative phased in over 15 years
<b>Uncertainty effect</b>	+1 standard deviation	+1.5 standard deviation
<b>Financial conditions effect</b>		
Corporate borrowing rates	+130 basis points	+200 basis points
Household borrowing rates	+70 basis points	+110 basis points
Equity risk premium	+120 basis points	+180 basis points
Government debt term premium	+40 basis points	+100 basis points
<b>Euro-area economic spillovers</b>	None assumed	Increase in EU financial risk premia

A.41 To assess the impact on house prices of a vote to leave the EU, a version of the Office of Budget Responsibility (OBR) house price model is used.<sup>25</sup> This model is based on a commonly-used household demand function for housing services that relates house prices to household income, the supply of houses, the number of households and a housing discount rate. These are then applied to outputs from the macroeconomic modelling. Property transactions have been adjusted in both scenarios consistent with the current property transaction equation in the shared OBR/HMT macroeconomic model.

A.42 As NiGEM does not include a variable for RPI inflation,<sup>26</sup> the impact on RPI is based on the results for CPI inflation. The OBR's assumption of the long-run wedge between RPI and CPI inflation is adopted, adjusted for short-run movements in the mortgage interest payments and housing depreciation components. These are estimated to grow broadly in line with average mortgage rates and house prices, respectively.

## Monetary and fiscal policy

A.43 For the shock and severe shock scenarios, Bank Rate remains fixed over the two-year horizon. This assumption does not pre-suppose how monetary policymakers would balance higher inflation from the fall in sterling with the reduction in demand and supply.

A.44 The path of fiscal policy in NiGEM is governed by a fiscal policy rule, which limits budget deficits to stay within bounds through a targeted adjustment of income tax rates. In both the shock and severe shock scenario, the fiscal policy rule in NiGEM has been switched off, allowing automatic stabilisers to operate. This assumption does not pre-suppose how policymakers would balance the need for additional fiscal consolidation with a weaker economy. UK nominal government consumption,

<sup>25</sup> Working paper No.6: Forecasting house prices, OBR (2014).

<sup>26</sup> RPI inflation is used to model the short-term fiscal implications of a vote to leave the EU in Part 3 of this Annex.

government investment and the government consumption deflator are all held constant, fixed at the levels set out in HM Treasury's Budget 2016.

## Modelling results

A.45 The final modelling results showing the impact of a vote to leave the EU relative to a vote to remain are presented in Table A.3 below.<sup>27</sup> After eight quarters, GDP would be 3.6% lower in the shock scenario compared to GDP with a vote to remain. The results are discussed in more detail in Section 2.

Table A.3: Immediate impact of a vote to leave the EU on the UK (% difference from base level unless specified otherwise) <sup>a</sup>

	Shock scenario	Severe shock scenario
GDP	-3.6%	-6.0%
CPI inflation rate (percentage points)	+2.3	+2.7
Unemployment rate (percentage points)	+1.6	+2.4
Unemployment (level)	+520,000	+820,000
Average real wages	-2.8%	-4.0%
House prices	-10%	-18%
Sterling exchange rate index	-12%	-15%

<sup>a</sup> Peak impact over two years. Unemployment level rounded to the nearest 10,000.

<sup>27</sup> In addition to the headline results presented in Table A.3, in the shock scenario, UK equities would fall by 20%, and the foreign currency value of foreign equities would be unchanged. In the severe shock scenario, UK equities would fall by 29%, and the foreign currency value of foreign equities would fall by 10%.

## Part 3: Modelling the immediate impact on the public finances of a vote to leave the EU

A.46 This Part describes how the macroeconomic modelling described in Part 2 is used to model the short-term fiscal implications of a vote to leave the EU.

A.47 Following a vote to leave the EU, the resulting economic weakness would reduce tax receipts and increase welfare spending. This in turn would increase Public Sector Net Borrowing (PSNB) and increase Public Sector Net Debt (PSND).

### Ready reckoner models

A.48 The main tools used to estimate the impact of changes in the economy on the fiscal position are a set of ‘ready reckoner’ models. These models use elasticities that describe how a particular element of spending or taxation will change given a 1% change in an underlying economic variable. The economic variables that are inputs to the ready reckoners are produced by the economic modelling as set out in Part 2.

A.49 The ready reckoners are derived from the forecast models used to produce the OBR’s fiscal forecast. They are a version of the ready reckoners that appear in the OBR’s *March 2015 Economic and fiscal outlook* and have been updated to take account of recent forecast and policy changes. The OBR use the ready reckoners at each fiscal event to inform the scenario analysis that appears in their *Economic and fiscal outlook*.<sup>28</sup> The IFS also often use the ready reckoners as part of their analysis in the *IFS Green Budget*.<sup>29</sup>

A.50 An estimate of the response of the public finances to changes in the economy is repeated for each element of tax and spending covered by the ready reckoners.<sup>30</sup> These estimates are then totalled to give an estimate of the change in PSNB in each year.

A.51 Additional modelling is required to estimate the implications for PSNB of the Asset Purchase Facility’s (APF) holding of government gilts. This modelling is highly complex and no simplified ready reckoner model exists. The Debt Management Office have provided analysis of the APF based on the scenarios set out in Section 2, using the model that underpins the OBR’s APF forecast.

A.52 Once a total has been estimated for the change to PSNB then the additional debt interest costs of this borrowing are calculated using the debt interest ready reckoner. This calculation is based on a single iteration of the ready reckoner (i.e. the

---

<sup>28</sup> Annex B of the OBR March 2015 Economic and fiscal outlook set out some of the uncertainties around the ready reckoner estimates.

<sup>29</sup> See for example *IFS Green Budget* (2016).

<sup>30</sup> The ready reckoner models cover the following taxes: income tax, value added tax, corporation tax, fuel duties, capital gains tax, inheritance tax, stamp duties, tobacco duties, alcohol duties, air passenger duty, insurance premium tax, betting and gaming duties, interest and dividend receipts and customs. The ready reckoner models cover the following areas of spending: debt interest (gross of the APF), public sector pensions and welfare spending. The ready reckoner models do not cover nominal government consumption and investment (as this is assumed to be fixed), taxes which are not directly related to the economy (such as council tax) and a number of smaller taxes (such as the bank levy and soft drinks industry levy).

additional debt interest costs that arise from additional borrowing are not then put back into the financing requirement).

A.53 To produce an estimate of the impact on PSND, extra borrowing is assumed to flow straight through to the debt position. In reality PSNB is an accrued measure whereas PSND is a cash measure. However, as the tax, welfare and debt interest changes that make up the impact on PSNB do not have substantial accrual to cash adjustments, this is a reasonable assumption. The analysis also captures the APF accounting impact on PSND resulting from the economic scenario. As a result of the changes to the yield curve the nominal value of the APF's gilt holdings increases in both scenarios. Due to the way gilts are valued in PSND, this serves to reduce PSND. The impact on PSND of the valuation of central government assets has not been modelled (including financial institutions, foreign exchange reserves and the student loan portfolio).

## Fiscal policy

A.54 The exact nature of the government's fiscal policy response is uncertain and depends on the ultimate nature of the shock.

A.55 In both the shock and severe shock scenarios it is assumed that the government allows the 'automatic stabilisers' to operate. This means keeping government policy unchanged, but allowing tax receipts to fall and welfare spending to rise in response to the changes to the economy, whilst holding government departmental spending fixed in nominal terms. By presenting the fiscal impact of allowing the automatic stabilisers to operate, this analysis shows the scale of the deterioration in the public finances the government would be faced with.

## Shock scenario

A.56 Table A.4 below provides a more detailed breakdown of the PSNB impacts from the shock scenario in Section 2.

Table A.4: Breakdown of overall impacts on borrowing relative to base level (PSNB)

(£billion)	2016-17	2017-18
<b>Receipts</b>	<b>-4.2</b>	<b>-17.9</b>
Of which		
Income tax & NICs	-0.7	-5.5
VAT	-0.9	-5.5
<b>Spending</b>	<b>+8.0</b>	<b>+6.3</b>
Of which		
Welfare	+0.7	+2.1
Debt Interest (net of APF)	+7.7	+3.8
<b>PSNB effect</b>	<b>+12.2</b>	<b>+24.2</b>
<b>PSNB effect (% GDP)</b>	<b>+0.7</b>	<b>+1.3</b>

A.57 Tax receipts are lower due to lower GDP. As the largest component of receipts, income tax and national insurance contributions (NICs) see a large fall in cash terms, reaching a fall relative to the baseline of £5.5 billion by 2017-18. Due to the nature of

the scenario, with large shocks to consumption and equity prices, there are also particularly sharp falls in VAT and capital gains tax.

A.58 Welfare spending is £2.1 billion higher by 2017-18, with unemployment the largest driver. Debt interest spending rises by £7.7 billion in 2016-17 and by £3.8 billion in 2017-18, largely reflecting the profile of RPI inflation and its impact on the accrued stock of index-linked gilts. The combination of changes to spending and receipts leads to a total impact on PSNB in the shock scenario of £24.2 billion by 2017-18. Table A.5 below provides a breakdown of the PSND impacts from the shock scenario in Section 2.

Table A.5: Breakdown of overall impacts on debt relative to base level (PSND)

(£billion)	2016-17	2017-18
Additional debt from higher borrowing	+12.2	+36.4
APF accounting impact	-0.9	-2.1
<b>PSND effect</b>	<b>+11.3</b>	<b>+34.4</b>
<b>PSND effect (% GDP)</b>	<b>+2.7</b>	<b>+4.5</b>

A.59 The additional borrowing across the period adds £36.4 billion of debt to PSND by 2017-18. The APF accounting impact reduces cash debt by £2.1 billion by 2017-18. Total PSND is £34.4 billion higher by 2017-18.

A.60 In addition to the scenario's impact on debt in cash terms, the decrease in nominal GDP has a large impact on PSND as a percentage of GDP. Combined with the change to cash debt, PSND as a percentage of GDP increases by 4.5 percentage points by 2017-18.

## Severe shock scenario

A.61 Table A.6 below provides a more detailed breakdown of the PSNB impacts from the severe shock scenario in Section 2.

A.62 As the scale of the shocks in this scenario are larger, so are the underlying fiscal effects. The deterioration in receipts is higher than in the shock scenario with receipts falling relative to baseline by £31.9 billion by 2017-18. Spending rises by £6.6 billion in 2017-18, driven by increases to welfare spending, due to higher unemployment, and debt interest spending. The combination of changes to spending and receipts leads to a total increase in PSNB of £38.5 billion by 2017-18.

A.63 The additional borrowing across the period adds £57.5 billion of debt to PSND by 2017-18 as shown in Table A.7. The APF accounting impact reduces cash debt by £4.0 billion by 2017-18. Total PSND is £53.5 billion higher by 2017-18. The decreases in nominal GDP mean that PSND as a percentage of GDP increases substantially against the baseline, increasing by 8.1 percentage points by 2017-18.

Table A.6: Breakdown of overall impacts on borrowing relative to base level (PSNB)

<b>(£billion)</b>	<b>2016-17</b>	<b>2017-18</b>
<b>Receipts</b>	<b>-8.1</b>	<b>-31.9</b>
Of which		
Income tax & NICs	-2.0	-11.9
VAT	-2.0	-8.5
<b>Spending</b>	<b>+10.9</b>	<b>+6.6</b>
Of which		
Welfare	+0.9	+2.7
Debt Interest (net of APF)	+10.4	+3.2
<b>PSNB effect</b>	<b>+19.0</b>	<b>+38.5</b>
<b>PSNB effect (% GDP)</b>	<b>+1.1</b>	<b>+2.1</b>

Table A.7: Breakdown of overall impacts on debt relative to base level (PSND)

<b>(£billion)</b>	<b>2016-17</b>	<b>2017-18</b>
Additional debt from higher borrowing	+19.0	+57.5
APF accounting impact	-1.7	-4.0
<b>PSND effect</b>	<b>+17.3</b>	<b>+53.5</b>
<b>PSND effect (% GDP)</b>	<b>+4.5</b>	<b>+8.1</b>



# Annex B

## Article 50 of the Treaty on European Union

B.1 Article 50 of the Treaty on European Union reads as follows:

- 1 Any Member State may decide to withdraw from the Union in accordance with its own constitutional requirements.
- 2 A Member State which decides to withdraw shall notify the European Council of its intention. In the light of the guidelines provided by the European Council, the Union shall negotiate and conclude an agreement with that State, setting out the arrangements for its withdrawal, taking account of the framework for its future relationship with the Union. That agreement shall be negotiated in accordance with Article 218(3) of the Treaty on the Functioning of the European Union. It shall be concluded on behalf of the Union by the Council, acting by a qualified majority, after obtaining the consent of the European Parliament.
- 3 The Treaties shall cease to apply to the State in question from the date of entry into force of the withdrawal agreement or, failing that, two years after the notification referred to in paragraph 2, unless the European Council, in agreement with the Member State concerned, unanimously decides to extend this period.
- 4 For the purposes of paragraphs 2 and 3, the member of the European Council or of the Council representing the withdrawing Member State shall not participate in the discussions of the European Council or Council or in decisions concerning it.  
  
A qualified majority shall be defined in accordance with Article 238(3)(b) of the Treaty on the Functioning of the European Union.
- 5 If a State which has withdrawn from the Union asks to rejoin, its request shall be subject to the procedure referred to in Article 49.

## Glossary of key terms

Term	Definition
Council of the European Union (also known as Council of Ministers)	The Council of the EU brings together the representatives of EU member states' governments. It is the EU's main decision-making body and agrees EU laws, usually together with the European Parliament.
European Central Bank (ECB)	The European Central Bank (ECB) is the central bank of the 19 European Union countries that have adopted the euro. Its main function is to safeguard the value of the euro and maintain price stability.
European Commission (the Commission)	The European Commission is responsible for proposing draft legislation, implementing decisions, upholding the EU Treaties and managing the day-to-day business of the EU.
European Council	The European Council is the body in which the heads of state or government of the EU's 28 member states, together with an appointed President and the President of the European Commission, take strategic decisions about the direction of the EU.
European Economic Area (EEA)	The EEA, established on 1 January 1994, comprises the 28 member states of the EU and Norway, Iceland and Liechtenstein in a Single Market area, but not a customs union. The agreement establishing the EEA covers the free movement of persons, goods, services and capital (although agriculture and fisheries are covered in a more limited way) as well as other EU policies including inter alia social policy, consumer protection and environment. Generally Members of the EEA must adopt the <i>acquis communautaire</i> in the areas covered by the EEA agreement.
European Parliament	The European Parliament was established in 1979 in order to represent the views of citizens directly in EU decision-making. It shares responsibility with the Council for passing EU laws and for agreeing the EU's budget, although the Council enjoys broader decision-making powers.
European Union (EU)	The European Union is an international organisation made up of 28 European countries, including the UK. The EU has its origins in the European Coal and Steel Community, founded by 6 European states after the Second World War. However, its remit has evolved and is much broader today. The EU facilitates cooperation between its member states on a wide range of objectives, from facilitating trade to protecting the environment, and security and development overseas. The EU has created the Single Market, enabling the free movement of goods, services, capital and people.
European Union Treaties	The European Union is based on the rule of law. This means that every action taken by the EU is founded on Treaties that have been approved voluntarily and democratically by all EU member states. If a policy area is not cited in a Treaty, the Commission cannot propose a law in that area. There are eight main Treaties.
Foreign Direct Investment	Foreign Direct Investment (FDI) refers to investment that adds to, deducts from or acquires a lasting interest in an enterprise operating in an economy other than that of the investor where the investor's purpose is to have an effective voice in the management of the enterprise. For the purposes of FDI statistics, an effective voice is taken as equivalent to holding 10% or more of the equity share capital in the direct investment enterprise. Other investments, in which the investor does not have an effective voice in the management of the enterprise, are mainly portfolio investments and these are not covered in the release.

Term	Definition
International Monetary Fund (IMF)	The International Monetary Fund (IMF) is an international organisation of 188 countries. It works to foster global monetary cooperation, secure financial stability, facilitate international trade, promote high employment and sustainable economic growth, and reduce poverty around the world. The UK is a member.
Non-tariff barriers	Non-tariff barriers refers to all barriers to trade that are not tariffs. Examples of these include countervailing and anti-dumping duties, "voluntary" export restraints, subsidies which sustain in operation loss making enterprises, technical barriers to trade, and obstacles to the establishment and provision of services.
Passporting	The EU's financial services passport or passporting regime are shorthand terms for the collection of measures in EU secondary law, which specify how the EU fundamental freedoms operate in the context of financial services. These measures have been extended to the European Economic Area (EEA). Passporting entitles a financial services firm authorised in a EEA state to carry on permitted activities in any other EEA state by either exercising the right of establishment (i.e. setting up a branch and/or agents), or providing cross-border services. These rights are subject to the fulfilment of conditions under the relevant Single Market directive.
Preferential market access	A country or trading bloc grants preferential market access to another when it grants it better terms of trade than as standard, for instance by reducing tariffs or providing access to public tenders. The WTO sets a number of rules about how countries and blocs can grant each other preferential access. Between developed economies this is usually granted through Free Trade Agreements, through which each side agrees to reduce trade barriers.
Regulation	A legislative act of the EU which is directly applicable in member states without the need for national implementing legislation. (as opposed to a Directive, which must be transposed into national law by member states using domestic legislation).
Single Market	The Single Market gives the UK access to the EU and facilitates access to wider markets, and works by treating the EU's member states as a single economic area. It is founded on the 'four freedoms': the free movement of goods, services, capital and people. These are enshrined in the EU's founding Treaties and the Single Market has developed progressively over the past half a century. The Single Market provides access to EU markets through three broad elements. First, it removes tariffs and quotas on goods trade within the EU. Second, it creates a customs union within the EU. Third, it creates a level playing field by reducing non-tariff and other barriers to trade within the EU.
Tariffs	A tariff is a tax or duty imposed on a particular class of imports or exports.
World Trade Organization (WTO)	The WTO was established on 1 January 1995 as the successor to the GATT. The WTO is an Organization for the discussion, negotiation and resolution of trade issues covering goods, services and intellectual property. Its essential functions are administering and implementing the multilateral (GATT, GATS and the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS)) and plurilateral trade agreements that constitute it, acting as a forum for multilateral trade negotiations, seeking to resolve trade disputes and cooperating with other international institutions involved in global economic policy-making. The WTO currently has 162 members including the EU and all its member states.

## List of tables

Table 2.A	Annual impact of leaving the EU on the UK after 15 years (difference from being in the EU)
Table 2.B	Summary of modelling inputs
Table 2.C	Quarter-on-quarter GDP growth (%)
Table 2.D	Regional impact on youth unemployment of the shock scenario by region
Table 2.E	Immediate impact of a vote to leave the EU on the UK (% difference from base level unless specified otherwise)
Table 2.F	Net impact on public sector finances of a vote to leave the EU (positive numbers imply higher deficit/debt)
Table A.1	Summary of uncertainty measures
Table A.2	Summary of modelling inputs
Table A.3	Immediate impact of a vote to leave the EU on the UK (% difference from base level unless specified otherwise)
Table A.4	Breakdown of overall impacts on borrowing relative to base level (PSNB)
Table A.5	Breakdown of overall impacts on debt relative to base level (PSND)
Table A.6	Breakdown of overall impacts on borrowing relative to base level (PSNB)
Table A.7	Breakdown of overall impacts on debt relative to base level (PSND)

## List of figures

Figure 1.A	Process 1 for withdrawal from the EU and Process 2 for the new trading relationship with the EU
Figure 1.B	The interdependencies of the 4 processes triggered by a vote to leave the EU
Figure 2.A	Modelling framework
Figure 2.B	Impact on unemployment of the shock scenario by region
Figure 2.C	Comparison between the scenarios and the long term (GDP % difference from base level)
Figure A.1	Modelling framework

## List of charts

Chart 1.A	UK GDP growth and uncertainty
Chart 1.B	Sterling trade-weighted exchange rate and weighted relative interest rate
Chart 1.C	2-month ahead Sterling, Euro and Yen implied volatility against the US dollar (%)
Chart 1.D	Sovereign credit default swap spreads (index, 1 November 2015=100)
Chart 1.E	Expectations of UK capital expenditure and uncertainty
Chart 1.F	Investment intentions over the next 12 months
Chart 1.G	UK Purchasing Managers Index (balance, over 50 = expansion)
Chart 1.H	Property indicators
Chart 2.A	Uncertainty indicator (standard deviations)
Chart 2.B	Shock scenario – GDP level (contributions to % difference from base level)
Chart 2.C	Severe shock scenario – GDP level (contributions to % difference from base level)
Chart 2.D	Sterling exchange rate index (% difference from base level)
Chart 2.E	Consumer prices index (CPI) (% difference from base level)
Chart 2.F	Unemployment (difference from baseline of rate (ppt) and levels)
Chart 2.G	Average real wages (% difference from base level)
Chart 2.H	UK current account (% of GDP)
Chart A.1	Summary of uncertainty measures
Chart A.2	Uncertainty and GDP growth
Chart A.3	Cumulative impulse responses from a 1-unit uncertainty indicator increase
Chart A.4	Uncertainty during the transition period





### **HM Treasury contacts**

This document can be downloaded from  
[www.gov.uk](http://www.gov.uk)

If you require this information in an alternative  
format or have general enquiries about  
HM Treasury and its work, contact:

Correspondence Team  
HM Treasury  
1 Horse Guards Road  
London  
SW1A 2HQ

Tel: 020 7270 5000

Email: [public.enquiries@hmtreasury.gsi.gov.uk](mailto:public.enquiries@hmtreasury.gsi.gov.uk)