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# It's not EU, it's me: Estimating the impact of Brexit on the UK economy

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- In 2016, the UK voted to leave the European Union. In this paper, we explain the different transmission mechanisms by which Brexit is expected to impact the UK economy, both in the short and long term.
- We also present our own empirical findings of the impact Brexit will have on the UK economy under different scenarios. Like previous studies, we draw downbeat conclusions. The impact on UK GDP and living standards is likely to be negative in all cases and worst in those scenarios where the UK's trading relationship with the European Union changes the most.
- For investors, it is important to remain disciplined and maintain a long-term, strategic approach. Brexit negotiations remain highly uncertain and there are a wide range of possible outcomes. If anything, the last few years have demonstrated clearly the benefits to investors of holding a diversified portfolio in order to minimize exposure to the political and economic events of any one market.

## Introduction

In 2016, the UK voted to leave the European Union. The referendum result came as a shock to Leave and Remain voters alike. Yet in hindsight, the result could be explained by rising tensions on a range of issues including an increased flow of migrants into the UK, the growing threat of terrorism, increased stress to public services and a growing resentment of the political class. In fact, the vote for Brexit can be seen as part of a wider surge in populist sentiment which has been witnessed across both developed and emerging markets.

It remains doubtful whether leaving the EU will necessarily resolve the political challenges facing the UK and we do not attempt to address that question here. What is clear, however, is that the change will have consequences for the UK economy and many economists have issued stark warnings about the costs that might be incurred, arguing that both GDP and GDP per head will most likely fall under all versions of Brexit.

The purpose of this paper is to explain the different channels through which Brexit could affect the economy and to present our own empirical analysis of the different likely scenarios. We draw similar downbeat conclusions to many other economists about the economic impact of Brexit, especially in those scenarios where the UK's trading arrangements with the EU diverge the most from the status quo.

## The impact on the UK economy of leaving the EU: Theoretical considerations

What will the effects on the UK economy be if the UK leaves the European Union? As with previous studies, we separate the question into the long-run impact and the short-run impact. Of course, there is considerable uncertainty around any estimates, both in how Brexit occurs, as explained in the different scenarios we consider, and in the empirical estimates of the impact of each scenario. But for this section, we step back from that detail and give a simple theoretical explanation of the different channels by which the UK economy would be affected by the UK leaving the EU. We focus on the GDP impact, both in absolute terms and on a per-head basis<sup>1</sup>, and on the impact of any changes in the terms of trade for UK citizens, i.e. how much it will affect what UK citizens can afford to buy for a given level of GDP.

## The long run: when all the influences have played out

In the long run, the GDP impact of Brexit will be determined by the effect on the productive potential of the UK economy. This requires a focus on supply-side factors which, at the simplest level, comprise the impact on labour supply and the impact on the level of productivity. We consider these in turn.

### *Impact on the labour supply*

Leaving the EU will likely lead to a fall in the number of EU citizens coming to the UK to work and many Brexit scenarios will likely imply a complete end to the free movement of labour between the UK and the rest of the EU. Since 1975 (two years after the UK joined the EU), the net inflow of migrants has increased the UK population by 3.85 million, around nine-tenths of whom added to the working-age population<sup>2</sup>. Assuming the participation and unemployment rate of the UK population is mirrored by migrants, the UK labour supply has increased by 2.5 million as a result of net migration. It is this labour supply effect that impacts directly on GDP. Of that labour supply increase, 30% came from EU migration, while 70% was from non-EU countries.

In fact, much of the net inflow from the EU has occurred since 2004 following the accession of some Eastern European countries into the Single Market. As a consequence, since then, net migration has averaged 210,000 a year, with the labour supply increasing by a total of 2.1 million. Of that, around 35% came from the EU and 65% from non-EU countries.

The precise impact of Brexit on overall changes in the labour supply will depend on how much EU net migration changes, and whether there are additional increases or reinforcing falls in labour supply growth from outside the EU. This balance will be determined by the details of any new immigration arrangements for both EU and non-EU citizens. Our assumptions on that will be discussed later.

### *Impact on GDP versus GDP per head*

If it is assumed that the average EU worker is as productive as the average UK-born worker<sup>3</sup>, then the impact on the level of GDP will simply be the percentage change in the size of the working population accounted for by the change in the number of EU workers. And under that assumption, there will be no impact from the reduced labour supply on GDP per head.

<sup>1</sup> We acknowledge that voters' decisions on how to vote in the 2016 referendum were driven by additional considerations such as the amount of immigration or the degree of decision-making sovereignty afforded by EU membership.

<sup>2</sup> This and all subsequent data on UK population and net migration sourced from the Office for National Statistics (ONS).

<sup>3</sup> It seems reasonable to assume that even if there is a difference in productivity, such effects are relatively small, except under extreme assumptions. For example, if EU net migration rose by 2% and their productivity was 5% higher, the implied GDP effect would be 2.1%.

But even if GDP per head is unchanged, economic welfare more broadly defined might be altered because a lower population could imply reduced congestion and potentially less strain on the UK economy's infrastructure. Indeed, during the referendum campaign, it was argued that high EU immigration was stretching limited public resources such as the National Health Service. This might be the case, but to address this question comprehensively, one has to consider the overall fiscal consequences of an increased labour supply. In fact, Vargas-Silva and Sumption (2019) provide evidence that the average EU worker working in the UK makes a greater contribution to UK public finances than the average UK worker, so in principle higher immigration could facilitate an improved provision of public services.

### *Impact on productivity*

The main impact on the level of UK GDP from Brexit comes from the effect on productivity. It derives from the well-documented finding that a country's openness to trade and foreign direct investment (FDI) is positively related to its level of productivity<sup>4</sup>. This works through a number of channels:

- The most straightforward effect relates to the decline in trade specialisation. This is the mechanism that explains why free trade leads to an increase in economic welfare due to the principle of comparative advantage<sup>5</sup>. Trade restrictions implied by Brexit likely work in the opposite direction since UK producers will have less ability to exploit cheap imported inputs and consumers will face more expensive goods embodying a higher share of more inefficient domestically produced goods.
- A second channel relates to the fact that openness to trade facilitates productivity improvement by exposure to new ideas embodied in imported technology<sup>6</sup>.
- A third channel relates to the impact of firms competing in a larger global market which increases competitive pressure and enhances the potential profitability of innovative activity<sup>7</sup>.
- Separate to the direct effects of trade openness, there is also evidence that foreign direct investment has the effect of augmenting the effects of openness through

technology transfer<sup>8</sup>; the spread of robotic technology in the car industry following inward investment by Japanese firms from the late 1980s is an example of this.

The precise impact on productivity will depend on the trade and FDI effects of any new trading arrangements with the EU, which in all Brexit scenarios will be negative to varying degrees, but also on whether these effects will be mitigated or even more than offset by any changes in the relationship with non-EU countries. These details will be elaborated on when we characterise and quantify the different scenarios.

### *Other considerations: Impact on the trade balance, the real exchange rate and real income of UK citizens*

One common misconception about Brexit is that it will cause the UK's trade balance to be permanently lower. But this ignores the role of the real exchange rate, which in the long run will adjust to re-equilibrate the economy's external balance<sup>9</sup>. In theory, worse trading conditions caused by Brexit will ultimately be offset by a more competitive exchange rate. Importantly, this depreciation in the real exchange rate will imply that UK consumers will be worse off, over and above any fall in GDP. This is because of the deterioration in the terms of trade, since a given basket of goods will now be more expensive due to the higher cost of imported goods<sup>10</sup>.

### **Short-run effects: the transitional path to the long run**

Given that any change in the economic UK-EU relationship will probably be in place for many years, the long-run effect of the UK leaving the EU is by far the most important effect to understand. But the short-run transitional impact is also important, not least because we are living through these effects now, and current events may impact on the political debate which could in turn affect the eventual trading arrangements agreed.

Even if Brexit had been implemented immediately after the referendum result, the UK economy would have only moved to its new long-run equilibrium over a number of years as firms adjusted to the new trading regime and labour supply adjusted to new immigration arrangements.

<sup>4</sup> More accurately, it affects total factor productivity (TFP). Another determinant of productivity, capital intensity, is also likely to be affected in the long run by TFP.

<sup>5</sup> David Ricardo (1817), "The Principles of Political Economy and Taxation".

<sup>6</sup> Santacreu (2015), "Innovation, diffusion, and trade: Theory and measurement", Journal of Monetary Economics, Elsevier.

<sup>7</sup> Aghion et al., (2018), "The Impact of Exports on Innovation: Theory and Innovation", NBER Working Papers 24600.

<sup>8</sup> Office for National Statistics (2017), "Foreign direct investment and labour productivity, a micro-data perspective: 2012 to 2015".

<sup>9</sup> The equilibrium current account will not necessarily be zero but will depend on the growth rate, the return on assets and the desired equilibrium level of net overseas assets for the UK - see Isard (2007), "Equilibrium Exchange Rates: Assessment Methodologies", IMF Working Paper 07/296.

<sup>10</sup> Hamada and Iwata (1984), "National Income, Terms of Trade and Economic Welfare".

In practice, and more realistically, there is a delay between the realisation that Brexit will (or might) happen and its actual implementation. For example, a “transition period” is built into the current draft agreement between the UK and the EU which will allow details of the eventual Brexit to be finalised and to give time to firms and households to allow them to make preparations for the new arrangements. In current circumstances, of course, the situation is even more complicated because the precise form and date of that Brexit is still not known.

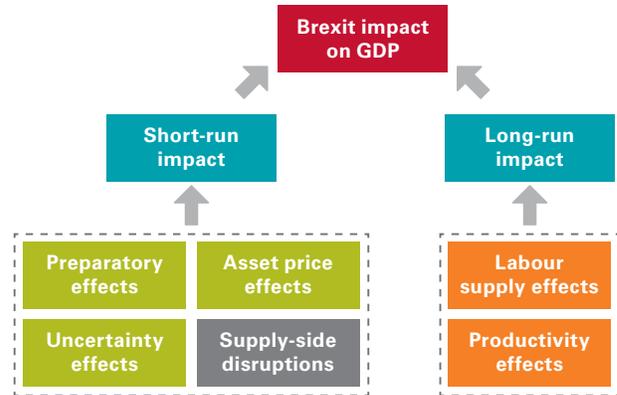
Given these lags in implementing Brexit, there are three broad types of anticipatory effects that can happen in advance of the actual date of the UK leaving the EU:

- **Uncertainty-related effects** as firms and households postpone spending due to the uncertainty around the range of different Brexit outcomes<sup>11</sup>.
- **Preparatory effects** as firms undertake spending in advance to prepare for the new trading arrangements, for example by scaling down operations in the UK or relocating personnel to Europe. They might also increase stock-building in anticipation of future supply disruption. Typically this spending will boost GDP but may depress productivity as economic resources would be allocated less efficiently.
- **Asset price effects** which react to changing expectations about Brexit. The most significant asset price impact is likely to be through the exchange rate, by which the overall effect on GDP is unclear. If sterling were to depreciate against the currencies of its major trading partners, this would push up import prices for consumers and therefore reduce household purchasing power and spending. However, the UK’s terms of trade would improve as exports are cheaper and imports more expensive, which will in turn provide a boost to GDP.

The above effects capture potential short-term shocks to the demand side of the economy. However, there may also be meaningful supply-side disruptions too, borne out by a lack of preparedness in leaving the EU. One such example could be logistical problems at major trading ports, where delays could last for up to six months<sup>12</sup>.

Both the long-run and short-run transmission mechanisms of the impact of Brexit on the UK economy that have been detailed above are summarised in **Figure 1**.

**Figure 1. The effect of Brexit on the UK economy – transmission mechanisms**



Source: Vanguard.

### Estimating the impact of Brexit under different scenarios

The impact on the UK economy, both in the short and long term, will depend on the type of Brexit that is eventually agreed. At the time of writing, we believe there are five plausible scenarios:

- **No Deal:** The UK leaves the EU without a deal and defaults to World Trade Organisation (WTO) rules. Freedom of movement from the EU ceases.
- **Free Trade Agreement:** The UK leaves the EU Customs Union and Single Market and enters a Canada-style Free Trade Agreement. There are restrictions on labour movement.
- **Permanent Customs Union:** The UK leaves the Single Market but remains in a Customs Union with regulatory alignment to EU standards. There is no free movement of labour.
- **Common Market 2.0:** The UK remains in the Single Market and stays in a Customs Union arrangement with the EU, but does not have direct involvement in changes to EU legislation and does not get seats in the European Parliament. There is free movement of labour.
- **No Brexit:** The UK revokes Article 50 and continues its existing trading relationship with the EU.

11 McDonald and Siegel (1982), “The Value of Waiting to Invest”.

12 Matt Hancock, Secretary of State for Health and Social Care (December 2018), “EU Exit – Medical Devices and Clinical Consumables supply in a March 2019 ‘no deal’ scenario: An update”, *Department of Health and Social Care*.

For each scenario, we estimate the short-run and long-run impacts of Brexit separately. As with our theoretical discussion, we start with our estimates of the long run.

### Long-run impact

The impact on the long-run, or sustainable, rate of economic growth is driven by two primary factors: labour supply<sup>13</sup> and productivity<sup>14</sup>.

#### Labour supply growth

Over the past 10 years, the UK population has grown at an average annualised rate of 0.7%, with around half of this driven by natural change — i.e. the number of births minus the number of deaths in any given year. The remaining half is driven by net migration.

We do not believe Brexit will materially affect the rate of natural change and so our focus is on how net migration changes under different Brexit scenarios.

Over the last five years, net migration into the UK from both EU and non-EU countries has averaged around 250,000 per year. Assuming a participation and unemployment rate in line with the whole of the UK, the effective labour supply has been boosted by 880,000, adding around 0.5% to GDP growth per year.

Even if the UK does not leave the EU, we would still expect this growth effect to fall in the coming years. This is because there is political pressure to cut back immigration to some degree in today's environment. The current government's stated migration policy, irrespective of Brexit, is to reduce annual net migration to the "tens of thousands"<sup>15</sup>. Although this target appears ambitious to us, it is a clear signal of the future direction of migration flows.

As a baseline, we therefore assume net migration eventually falls to 200,000 a year in the scenario where the UK stays in the EU. Our net migration assumption then varies from this baseline based on the UK's future trading relationship with the EU — we make the simple assumption that the harder the Brexit, the larger the impact will be on net migration.

This is due to (i) restrictions that will be put in place if the UK leaves the Single Market; (ii) a reduced willingness of migrants to move to the UK due to a perception that

economic prospects may be less attractive than before; and (iii) an assumption that there is a limited political appetite to radically alter migration flows from outside the EU.

The below sets out these assumptions in more detail:

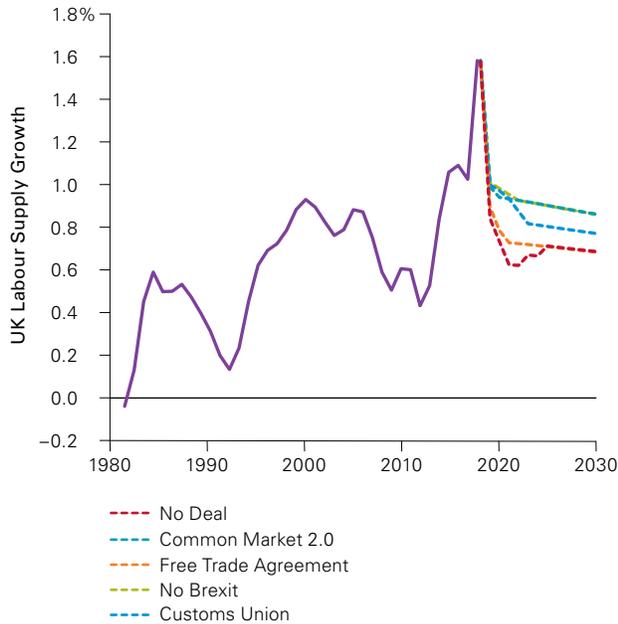
- **No Deal:** A departure from the EU without a deal will trigger the biggest negative shock to net migration. The UK will likely implement immigration controls and migrants will be less willing to move to the UK given the inevitable uncertainty No Deal will bring, especially in the short term. We assume net migration falls to 50,000 three years after Brexit, before then gradually rising to 100,000 over the long term as economic prospects improve again, consistent with the current government's stated migration policy.
- **Free Trade Agreement:** Leaving the EU Single Market will likely result in immigration controls being implemented. However, having free trade agreements will mean the economic outlook will look brighter than the No Deal scenario and so the shock to net migration is expected to be less severe. We assume net migration gradually falls to 100,000 three years after Brexit and stays at that level over the long term, consistent with the current government's stated migration policy.
- **Permanent Customs Union:** Leaving the EU Single Market will likely result in immigration controls being implemented. However, remaining part of the EU Customs Union will mean the economic relationship between the UK and EU will still be close. We assume net migration falls to 150,000 after five years and stays at that level over the long term.
- **Common Market 2.0:** The UK remains part of the EU Single Market and so there will be no restrictions on immigration. However, as the UK has left the EU, some EU migrants may be put off moving to the UK. We assume net migration falls to 200,000 after three years and stays at that level over the long term.
- **No Brexit:** The UK remains in the EU Single Market and there will be no restrictions on immigration. The government's stated intention of reducing net migration leads to a gradual fall to 200,000 after five years, which persists over the long term.

<sup>13</sup> In our modelling work, we define the labour supply using the following equation: labour supply = (working-age population) x (labour participation rate) x (1 – structural unemployment rate).

<sup>14</sup> GDP can be broken down using the following identity:  $GDP = (GDP/L) \times L$ , where (GDP/L) is a proxy for productivity and (L) is the labour supply.

<sup>15</sup> The Conservative 2017 manifesto included a commitment to reduce net migration to "tens of thousands a year". The Home Office's 2010 business plan also stated an intent to reduce annual net migration to the "tens of thousands".

**Figure 2. The estimated impact of Brexit on UK labour supply growth**



**Notes:** Data on UK population and net migration has been sourced from the Office for National Statistics (ONS). In each Brexit scenario, the labour supply is calculated by multiplying the total number of working-age people (14-64) by the participation rate and then by one minus the unemployment rate. Changes due to domestic effects are assumed to be the residual between total labour supply change and those adding to the labour supply through net migration. The forecast rate of natural change in the UK labour supply due to domestic effects is equal to its average over the last five years. Source: Vanguard calculations, ONS, Macrobond.

We assume in every scenario that the UK participation rate follows its current upward trajectory, and the UK unemployment rate settles at 4.25% in the long run — the Bank of England’s current estimate for the natural rate.

The impact on the UK’s rate of labour supply growth under each scenario is illustrated in **Figure 2**.

**Productivity growth**

As highlighted earlier, Brexit is likely to affect UK productivity through two main channels: trade openness and foreign direct investment.

In order to calibrate our shocks to these two variables, we use assumptions that are broadly consistent with the analysis conducted by the HM Treasury<sup>16</sup> and Bank of England<sup>17</sup>. These studies derive their assumptions on both trade and foreign direct investment using a gravity model approach<sup>18</sup>.

In the No Deal scenario, the UK is assumed to initially default to WTO rules before eventually negotiating alternative bilateral trade agreements. These new trade barriers are deemed to have a very significant impact on UK imports from and exports to the EU. The Free Trade Agreement scenario is expected to have a still significant, but less severe impact relative to No Deal. In both these scenarios, the range of possible outcomes is very large as there is significant uncertainty on how effective the UK will be in negotiating beneficial bilateral trade agreements with other countries after it leaves the EU.

In principle, these renegotiated non-EU trading arrangements could lead to higher overall trade for the UK and hence higher productivity growth. In practice, however, the EU accounts for 46% of UK exports, and countries with EU trade agreements account for a further 15% of UK exports, while only 39% of UK trade is not currently covered by trade agreements<sup>19</sup>. And these remaining countries are more distant from the UK. As such, we think the more optimistic positive outcome is hard to reconcile with conventional models of trade and so consider such an outcome unlikely. In any case, here we present the median estimates for the trade effects under No Deal and Free Trade Agreement, and these are both unequivocally negative.

This degree of uncertainty reduces if the UK remains in the EU Customs Union and/or the EU Single Market. Under these softer Brexit scenarios, the shocks to trade openness and foreign direct investment will be more moderate:

- **No Deal:** Despite initially defaulting to WTO rules, the UK will eventually negotiate bilateral trade deals with third countries as well as with the EU. Trade openness and foreign direct investment are 18% lower by 2030 relative to their pre-2016 trend.

<sup>16</sup> HM Treasury (2016), “HM Treasury analysis: the long-term impact of EU membership and the alternatives”.

<sup>17</sup> Bank of England (2018), “EU withdrawal scenarios and monetary and financial stability”.

<sup>18</sup> The Gravity Model approach establishes the impact of different trade agreements by looking across countries and back over time by incorporating variables important to bilateral trade such as distance, historical ties, GDP and population. Data for FDI are more limited than for trade and so the FDI effects are assumed to be proportional to the trade effects for each bilateral agreement. For example, see Fournier et al. (2015), “Implicit Regulatory Barriers in the EU Single Market: New Empirical Evidence from Gravity Models”, OECD.

<sup>19</sup> Office for National Statistics (ONS), The Economist.

- **Free Trade Agreement:** Instead of allowing free movement on all goods, the UK will negotiate a Canada-style free trade agreement covering the majority of goods with the EU. Bilateral trade deals with third countries will be rolled over eventually, possibly on less favourable terms given the UK's reduced bargaining power. Trade openness and foreign direct investment are 15% lower by 2030 relative to their pre-2016 trend.
- **Permanent Customs Union:** The Customs Union arrangement will cover most if not all goods trade, and thus trade with the EU and third countries will be largely unaffected. The UK, however, will not be able to negotiate its own bilateral trade agreements while also having no input in EU trade deals with other regions. Trade openness and foreign direct investment are 9% lower by 2030 relative to their pre-2016 trend.
- **Common Market 2.0:** As a member of the Single Market, the UK's trade will be little affected, both with the EU and third countries. However, given the UK will formally have exited the EU, we do expect a small negative impact on productivity. Trade openness and foreign direct investment are expected to be 3% lower by 2030 relative to their pre-2016 trend.
- **No Brexit:** Trade openness and foreign direct investment are unaffected by 2030 relative to their pre-2016 trend.

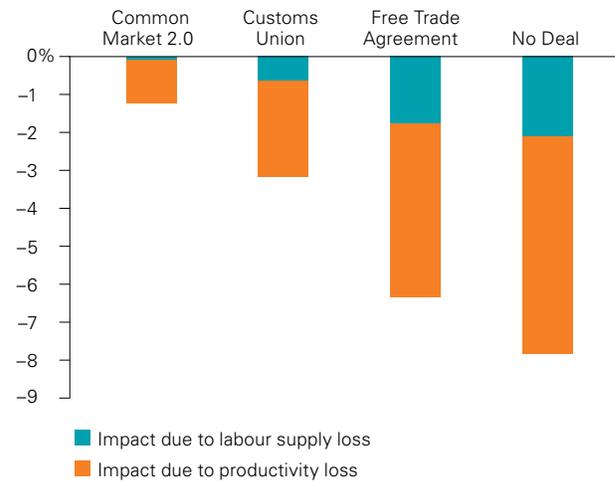
We then use a Vector Error Correction Model (VECM)<sup>20</sup> to estimate the impact of these shocks on UK productivity growth under different Brexit scenarios. The results are shown in **Figure 3**.

By 2030, UK productivity is expected to be around 6% lower than the pre-EU referendum trend in a No Deal scenario. This estimate drops to 5% in the Free Trade Agreement scenario and 3% under a permanent customs union. In Common Market 2.0, productivity is expected to be 1% lower relative to its pre-2016 trend; and in the No Brexit scenario there will be no shortfall.

### Short-run impact

As noted above, the long-run impact of Brexit will occur gradually over a number of years, even if Brexit were to happen immediately and with complete certainty as to its version. However, Brexit has already influenced the

**Figure 3. The long-run impact of Brexit on GDP**



**Notes:** Cumulative impact of Brexit on GDP by 2030. The productivity impact has been estimated using a Vector Error Correction Model (VECM) that incorporates a proxy for trade openness and foreign direct investment. We assume human capital growth is unaffected by Brexit. The impact due to changes in the labour supply uses the data in Figure 2 above. Labour supply growth is assumed to grow at a similar rate to total population growth. The long-run impact on GDP in the No Brexit scenario is zero. Source: Vanguard calculations, Macrobond, ONS

economy due to greater uncertainty during the extended period between the vote and the eventual departure from the EU that we are currently in. This uncertainty manifests itself through a combination of uncertainty, preparatory and asset price effects. The Bank of England has found that these effects are already taking place in the lead-up to the departure<sup>21</sup>. Among other anticipatory behaviours, these include households increasing precautionary savings and businesses delaying investment and stockpiling inventory.

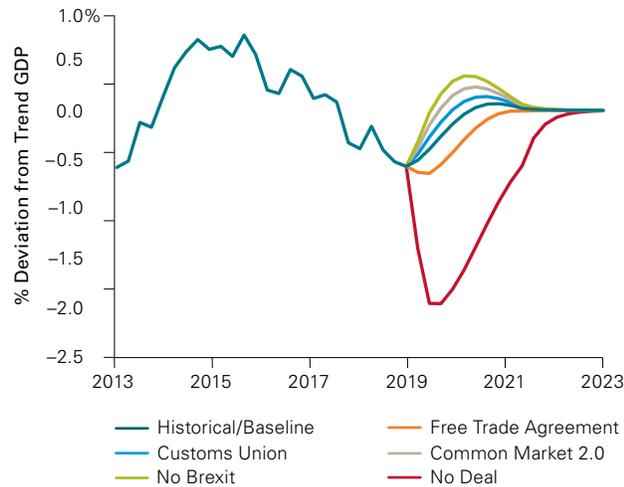
Other researchers have attempted to quantify the impact of the referendum vote during this interim period and found that GDP is cumulatively 2%-2.5% lower than it otherwise would have been had UK voters chosen to remain in the EU<sup>22</sup>. While these analyses estimate GDP relative to the counterfactual where Brexit never occurred, our analysis assesses the impact on GDP in different Brexit scenarios from where the UK economy stands today.

<sup>20</sup> A Vector Error Correction Model is an econometric model used to establish both short- and long-run relationships between different variables in order to forecast them statistically.

<sup>21</sup> See Appendix A of the Bank of England's "EU withdrawal scenarios and monetary and financial stability".

<sup>22</sup> The cost of Brexit to June 2018", John Springford, September 30, 2018 and "£350 million a week: The output cost of the Brexit vote", Born et al, October 1, 2018.

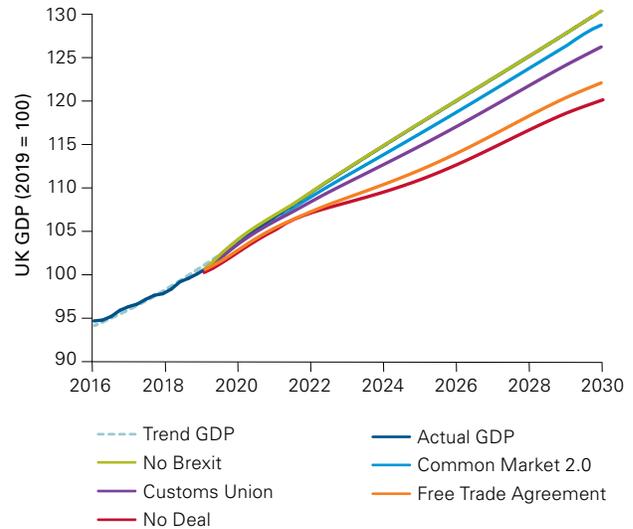
**Figure 4. The short-run impact of Brexit on GBP**



**Notes:** Estimates derived from a Vector Auto-Regression (VAR) model that incorporates the cyclical component of UK GDP, the UK financial conditions index, the UK policy uncertainty index and other exogenous variables. Source: Bloomberg, Vanguard calculations.

Ultimately, the final form of the deal announced will affect uncertainty and financial conditions. In order to estimate the short-run impact of the announcement on GDP, we model different assumed values of uncertainty and financial conditions, while controlling for broad domestic and international economic conditions<sup>23</sup>. Uncertainty is measured as a composite of the policy uncertainty index, business confidence and consumer expectations<sup>24</sup>. In line with the scenarios above, No Brexit assumes a fall from the elevated levels of uncertainty and financial conditions leading up to the deal announcement. Other scenarios have adverse assumptions for uncertainty and financial conditions, with the No Deal scenario increasing uncertainty to new all-time highs, tightening financial conditions to levels close to the European Sovereign Debt Crisis and rapidly increasing unemployment. Under the No Deal scenario, we also assume that supply-side disruption, such as logistical bottlenecks between major trading ports due to a lack of preparedness, subtracts an additional 0.7% from GDP over eight quarters.

**Figure 5. The estimated impact of Brexit on the UK economy**



**Notes:** A summation of both long- and short-run impacts of Brexit on UK GDP. Long-run growth estimates used for trend level of GDP, with percentage deviation from trend GDP (calculated in short-run estimates) overlaid on top. Source: Bloomberg, Macrobond, ONS, Vanguard calculations.

**Figure 4** shows the expected deviations from trend GDP in the 12 quarters after a future Brexit deal is announced. The impact of the shock to GDP persists for more than a year before reverting back to trend levels, with the highest deviation occurring two quarters after the deal announcement. This reversion reflects the eventual willingness of households and businesses to return to “business as usual” by spending the precautionary savings and making the investments that were put off in the extended period of uncertainty and immediate aftermath of the shock.

**Overall estimated effects under all scenarios**

The combined short- and long-run effects of Brexit on the UK economy under different scenarios are shown in **Figure 5**.

<sup>23</sup> To estimate the short-run impact on GDP, we estimate parameters using a system of equations known as a Vector Auto-Regression (or VAR). This model incorporates two lags of each of the following five variables: cyclical UK GDP, cyclical total hours, cyclical world trade, the uncertainty index, and the Bloomberg UK Financial Conditions Index.

<sup>24</sup> The uncertainty index is the first principal component of the UK economic policy uncertainty index, the UK CBI Enquiry (Factors Limiting Investment – Demand Uncertainty), and the GFK Consumer Survey (General Economic Situation over the next 12 months).

Based on our modelling, the size of the UK economy is expected to be around 8% smaller in the event of No Deal than if Brexit never happened. It will be roughly 7% smaller if the UK enters a Canada-style Free Trade Agreement with the EU. These estimates fall to 3% and 1% under a Customs Union and Common Market 2.0. Finally, given our assumptions that UK GDP returns to its pre-referendum trend if Article 50 is revoked, there is no difference in this No Brexit scenario.

In the short run, the impact on growth rates will be slightly positive for the two softer Brexit scenarios as uncertainty diminishes. But, for the No Deal scenario, the impact on growth is severe, pushing the economy into an outright recession and causing cumulative GDP to be over 2% lower compared with the No Brexit scenario after one year.

Figure 6 summarises the impact of Brexit under different scenarios on the UK economy.

## Conclusion

This analysis has been designed to spell out the economic mechanisms that will affect the UK economy if the UK leaves the EU and to provide our own empirical estimates of those effects. Like previous studies, we have concluded that the impact on GDP and more broadly on living standards will be negative in all cases, but markedly worse under a Free Trade Agreement and the No Deal scenario (especially in the short run in the No Deal case).

As for the implications for investors, it is important to not react too hastily. Some of the asset price moves that have already occurred, most notably the 10%-15% depreciation of sterling in trade-weighted terms<sup>25</sup>, could either be reversed or magnified depending on which scenario occurs. If anything, the last few years have illustrated clearly the benefits of investors holding a diversified portfolio so that they are not over-exposed to political and economic events in any one economy.

Figure 6: The impact of Brexit

	No Deal	Free Trade Agreement	Permanent Customs Union	Common Market 2.0	No Brexit
1-year GDP impact	-2.3%	-0.8%	-0.1%	+0.1%	+0.4%
GDP impact by 2030	-7.8	-6.4	-3.2	-1.2	0.0
GDP per head impact by 2030	-5.7	-4.6	-2.5	-1.2	0.0

Notes: Vanguard estimates.

## References

- Aghion et al. (2014), "What Do We Learn From Schumpeterian Growth Theory?" *Handbook of Economic Growth, Elsevier, Vol. 2, pp.515-563*.
- Aghion et al. (2018), "The Impact of Exports on Innovation: Theory and Innovation", *NBER Working Papers 24600, National Bureau of Economic Research*.
- Baier, S L and Bergstrand, J H (2009), "Bonus vetus OLS: A simple method for approximating international trade-cost effects using the gravity equation", *Journal of International Economics, Elsevier, Vol. 77, pp. 78-85*.
- Bank of England (2017), "The Bank of England's approach to resolution".
- Bank of England (2018), "EU withdrawal scenarios and monetary and financial stability".
- Bloom, N (2009), "The impact of Uncertainty Shocks", *Econometrica, Vol. 77, No. 3, pp 623-685*.
- Born et al. (2018), "£350 million a week: The output cost of the Brexit vote".
- Department for Exiting the European Union (2018), "Political Declaration setting out the framework for the future relationship between the European Union and the United Kingdom".
- Dhingra et al. (2016), "The consequences of Brexit for UK trade and living standards", *CEP Brexit Analysis No. 2, London School of Economics*.
- Economists for Free Trade (2018), "Brexit could boost UK economy by £135 billion, say top economists".
- Fournier et al. (2015), "Implicit Regulatory Barriers in the EU Single Market: New Empirical Evidence from Gravity Models" *OECD*.
- Hamada and Iwata (1984), "National Income, Terms of Trade and Economic Welfare".
- Haskel et al. (2007), "Does Inward Foreign Direct Investment Boost the Productivity of Domestic Firms?" *The Review of Economics and Statistics, MIT Press Vol.89, pp.482-496*.
- HM Treasury (2016), "HM Treasury analysis: the long-term impact of EU membership and the alternatives".
- Isard (2007), "Equilibrium Exchange Rates: Assessment Methodologies" *IMF Working Paper 07/296*.
- McDonald and Siegel (1982), "The Value of Waiting to Invest".
- Office for National Statistics (2017), "Foreign direct investment and labour productivity, a micro-data perspective: 2012 to 2015".
- Pain and Young (2004), "The macroeconomic impact of UK withdrawal from the EU", *Economic Modelling, Elsevier, Vol. 21, pp. 387-408*.
- Ricardo (1817), "The Principles of Political Economy and Taxation".
- Santacreu (2015), "Innovation, diffusion, and trade: Theory and measurement" *Journal of Monetary Economics, Elsevier*.
- Springford (2018), "The cost of Brexit to June 2018".
- Vanguard Economic and Market Outlook (2019), "Down but not out".
- Vargas-Silva and Sumption (2019), "The Fiscal Impact of Immigration in the UK" *The Migration Observatory, The University of Oxford*.
- Westaway et al. (2018), "'Brexit means Brexit' means what?" *Vanguard Global Macro Matters*.

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