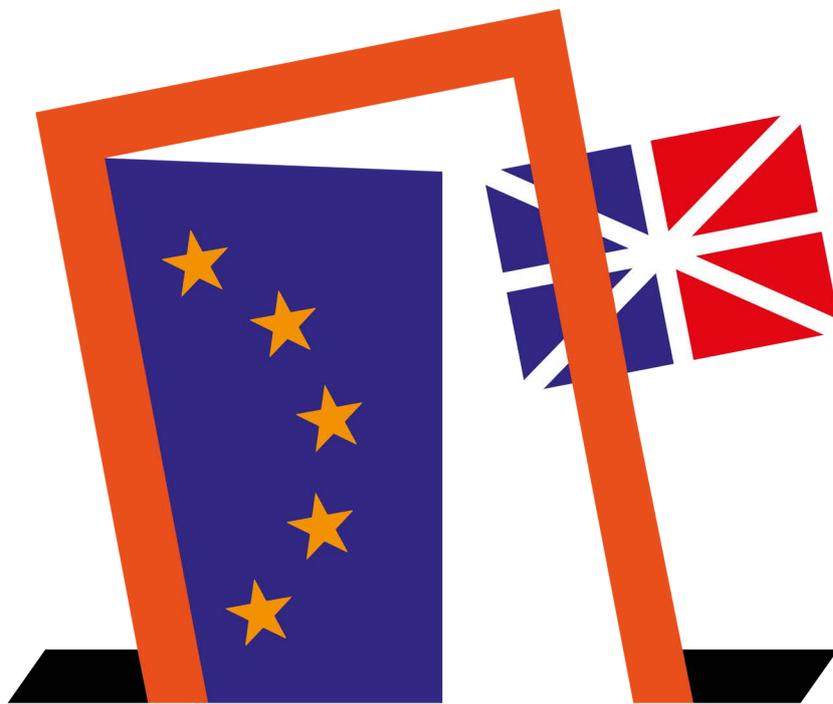


# The UK Treasury analysis of 'The long-term economic impact of EU membership and the alternatives': CEP Commentary

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# **The UK Treasury analysis of ‘The long-term economic impact of EU membership and the alternatives’: CEP Commentary**

*This week the UK Treasury released a much-discussed Report on the economic impact of the UK leaving the EU. Their central estimate was a 6.2% fall in GDP (£4,300 per household). We explain and analyse the Report and conclude it is a serious contribution to the Brexit debate. Our major criticism is that the Treasury have been overly cautious in their assumptions for their central case (a negotiated bilateral agreement, like the Canadian trade deal) and the true long-run costs of Brexit are likely to be higher than they estimate.*

The UK Treasury recently released an analysis of the long-run consequences of leaving the European Union (EU) for the UK economy <https://www.gov.uk/government/publications/hm-treasury-analysis-the-long-term-economic-impact-of-eu-membership-and-the-alternatives>.

The Report analyses the consequences of three different post-Brexit scenarios:

- (i) The UK adopts the ‘Norwegian’ model and joins the European Economic Area (EEA);
- (ii) The UK adopts the ‘Canadian’ model and negotiates a Free Trade Agreement (FTA) with the EU;
- (iii) The UK trades with the EU under World Trade Organization (WTO) rules.

The Treasury’s analysis suggests that Brexit would lead to a long-run fall in UK GDP of 3.8% under the Norway option, 6.2% under the Canada option and 7.5% under the WTO option.

But how did the Whitehall mandarins calculate these numbers? And should we believe them?

## **Roadmap to the Treasury analysis**

The Treasury studies the long-run effects of Brexit using a three-step process:

- **Step 1:** how Brexit would affect trade and foreign direct investment (FDI);
- **Step 2:** how the reduction in trade and FDI following Brexit would affect productivity;
- **Step 3:** the results of Steps 1 and 2 are combined with a global macroeconomic model to predict how Brexit would affect overall UK national income.

We consider each of these steps in turn.

### ***Step 1: How would Brexit affect trade and FDI?***

A ‘gravity model’ is used to estimate how leaving the EU would affect the UK’s trade (separate estimates are calculated for goods trade and services trade) and FDI. This gravity model approach follows best practice in the academic literature and the Treasury’s estimates are consistent with a large body of existing work. It is an empirical model relating data on the flows of trade between all pairs of countries to the characteristics of these countries (for example, their respective size as measured by GDP). For example, the bilateral goods data covers over 200 countries for the period 1948-2013 leading to the 390,521 observations in Table A.1. The bilateral flows of service trade and FDI works in basically the same way.

The models focus only on changes over time, so lots of things like culture and distance between countries are controlled for. Variables indicating whether or not two countries are in the EU (or other FTAs or the EEA) are included in these models to estimate how much more EU members trade with each other, after controlling for all the other determinants of trade or FDI.

In the ‘Canada’ case, the Treasury estimates that Brexit would reduce UK trade by up to 19% (Table 3.A) and FDI inflows would fall by up to 20% (Table 3.B). This is how much trade would fall by if, instead of being in the EU, the UK simply had a ‘deep’ FTA like the imminent EU-Canada deal.

### ***Step 2: How would Brexit affect productivity?***

The effects of Brexit on UK productivity are obtained by combining the changes in trade and FDI from Step 1 with estimates of how these changes affect productivity. Step 2 captures the dynamic effects of Brexit on productivity. Estimating the exact relationship between trade or FDI and productivity is tricky. For trade, the Treasury survey a range of estimates and settle on those from Feyrer (2011), who finds elasticities of 0.2 to 0.3 – that is, a 10% fall in trade reduces productivity by 2% to 3%.

For the impact of FDI on productivity, the literature is thinner than for trade so the Treasury conduct original empirical analysis. They relate productivity at the broad industry level to the level of the FDI stock. They find an elasticity of 0.04 – that is, a doubling of the FDI stock raises productivity by 4%.

### ***Step 3: How do these changes affect total GDP?***

The changes in trade, FDI and productivity from Steps 1 and 2 are fed into a macroeconomic model (NIESR’s NIGEM) to forecast the overall effects of Brexit on UK GDP. This final step also incorporates several additional effects of Brexit.

First, the short-run shock of Brexit through uncertainty and other channels is likely to cause some permanent loss of capacity. The Treasury assume this causes a 1% decline in GDP. Although the idea that uncertainty and other negative shocks can have large and long-run effects is reasonable (for example, Bloom, 2014), the precise magnitude of the persistence of the shock is hard to judge.<sup>1</sup>

Second, the fall in productivity growth will have an impact on the aggregate capital stock, which will also reduce GDP, and the macroeconomic model helps to pin this down. Third, the macroeconomic model allows for complex interactions between trade, investment, prices, etc.

Step 3 is the least transparent part of the analysis as the macroeconomic model has a lot of moving parts. It is difficult to incorporate all the elements in Steps 1-3. However, given the reasonable desire to take a comprehensive view of many elements of the economic effects of Brexit and allow for their interactions it seems a fair attempt.

Fortunately, it is not too hard to see how the various steps contribute to the overall decline in GDP. It seems that most of the quantitative action comes from the effect of reduced trade on

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<sup>1</sup> The Treasury has said that a future report will provide greater detail on the short-run disruption resulting from Brexit.

GDP, with a smaller contribution from FDI and the persistence of the shock. The macroeconomic model itself in Step 3 plays a more minor role.

## **An illustration of the Treasury calculations**

To illustrate how the numbers add up we give an example in Table 1 that shows how the different steps contribute to the overall decline in GDP. We do this for the ‘upper end of the negotiated bilateral agreement’ (for example, Canada) but the same logic applies to the other cases considered.

The first row of Table 1 looks at trade effects and the second row looks at FDI effects. The trade effects come from the gravity model comparing the coefficients on EU membership to FTA membership (a weighted average over the goods and service regressions). This is a 19% fall for trade (column 1). Column (2) is the effect of trade on GDP (0.3). Column (3) is simply the first two columns multiplied together, which generates the overall fall in GDP because of a Brexit induced trade loss of 5.7% ( $= 19\% \times 0.3$ ).

Row 2 repeats the same analysis for FDI. The gravity model predicts a fall in FDI of 20% (column (1)), which combined with the Treasury’s estimate of the FDI effect on productivity of 0.04 (column (2)) leads to a 0.8% ( $= 20\% \times 0.04$ ) fall in productivity in column (3).<sup>2</sup>

If we add the effects of trade (last column of row 1) and FDI (row 2) to the 1% fall of GDP due to the persistence of the ‘Brexit shock’ (row 3), we get in row 4 a total of 7.5% fall of GDP ( $= 5.7\% + 0.8\% + 1.0\%$ ).

The Treasury Report calculates that the overall GDP loss after feeding all the effects into their macroeconomic model is 7.8%. The additional 0.3% ( $= 7.8\% - 7.5\%$ ) loss of GDP in getting from row 4 to row 5 is from the general equilibrium effects introduced by the macroeconomic model. Exactly how their additional effects work through is not entirely clear. Part of it comes from the endogenous response of the capital stock to lower productivity. Other parts may come from interactions between various parts of the economy. Annex A goes into some more detail on this.

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<sup>2</sup> The reason why the sum of the effects of trade and FDI is 6.5% ( $= 5.7\% + 0.8\%$ ) instead of the 6% given in the middle column of the Treasury Report Table 3.C is basically to avoid double counting the effects of trade in the macro-model. Feyrer’s (2011) estimates are trade effects on GDP so include a pure productivity effect plus an effect on the capital stock. We explain this in Annex A.

**Table 1:**  
**How the Treasury arrives at their effects of Brexit on GDP- the example of the**  
**‘upper end’ of the negotiated bilateral arrangement (‘Canadian model’)**

	(1)	(2)	(3)
<i>Row 1: Trade</i>	<b><u>Step 1: Brexit effect</u></b> <b><u>on trade</u></b> , Tables 3.A & A.7 -19%	<b><u>Effect of trade on GDP</u></b> <b><u>(elasticity)</u></b> , _____ Feyrer (2011) 0.30	<b><u>Step 2: Brexit</u></b> <b><u>effect on GDP via</u></b> <b><u>trade</u></b> , -5.7%
<i>Row 2: FDI</i>	<b><u>Step 1: Brexit effect</u></b> <b><u>on FDI</u></b> , Table 3.B  -20%	<b><u>Effect of FDI on</u></b> <b><u>productivity</u></b> <b><u>(elasticity)</u></b> , Table A.14  0.04	<b><u>Step 2: Brexit effect on</u></b> <b><u>productivity via FDI</u></b>  -0.8%
<i>Row 3: Persistent effect of Brexit disruption shock (1% of GDP)</i>			-1%
<i>Row 4: Sum of effects of trade, FDI &amp; persistence shock</i>			-7.5%
<i>Row 5: Overall Effect on GDP (Step 3), Table 3.D</i>			<b>-7.8%</b>
<i>Implied additional effects of macroeconomic model</i>			-0.3%

**Notes:** CEP analysis of how to think about the Treasury’s results.

## The Treasury's bottom line

An important point in all of this is that the main parts of the quantitative effects are *not* driven by the less transparent macroeconomic model which only accounts for a small fraction of the overall effect (0.3% of the 7.8% total effect). The majority of the impact is through easily understood mechanisms of trade, FDI and the permanent effect on output from a big short-run Brexit shock.

The second important point is that most of the magnitude of the effect is coming from the impact of lower trade on productivity: (5.7% of the 7.8%).

Similar calculations can be made for the 'lower end of the range' negotiated bilateral arrangement. In this case, the fall in trade is only 14%<sup>3</sup> (instead of 19%), the fall in FDI only 15%<sup>4</sup> (instead of 20%) and the effect of trade on GDP reduced to 0.2 (instead of 0.3). Putting all these together with the transition shock leads to a total of 4.4% (= 2.8% + 0.6% + 1%). If compared to the Treasury Report's final number of 4.6% in Table 3.D, the implication is that the macroeconomic model adds another 0.2% of GDP to the cost. Again, Step 3 is quantitatively small and trade effects are the largest component of the overall effect.

The headline number of a loss of 6.2% of GDP is the simple average of the lower end and upper end estimates (i.e. = (7.8% + 4.6%)/2).

## The main problem of the Treasury Report: too cautious by half?

The Treasury analysis has been criticised by some for being deliberately designed to generate very large negative effects of Brexit. This criticism is off the mark. The assumptions and analysis are all explicitly stated and economically reasonable. Different people will have different views of which of the three trading arrangements is most likely after negotiations with the EU are complete, but the analysis lays out the economic consequences of the possible options. The 15-year horizon is sensible since such negotiations are usually extremely protracted.

In fact, our view is that the Treasury have been too conservative in many of their assumptions and should have generated larger effects. The following are some examples of their cautious approach.

### *The impact of Brexit on the loss of trade and FDI*

The Treasury's 'lower end' estimates assume some of the benefits of EU membership are 'banked' and will remain, even 15 years after the UK leaves the EU. For example, in our Table 1, their lower end estimates are of a case where trade and FDI fall substantially less than their empirical estimates suggest (they use 14% instead of 19% for trade and 15% instead of 20% for FDI). There is no obvious reason to do this, apart from wanting to be very cautious.

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<sup>3</sup> Middle column of Table 3.A.

<sup>4</sup> Middle column of Table 3.B.

### *The impact of trade on productivity*

The Feyrer (2011) elasticity of 0.2 to 0.3 is conservative. This paper uses the fall in trade costs due to the closure of the Suez Canal as a natural experiment. But Feyrer (2011) only looks at the effects over an eight year horizon, whereas the long-run horizon the Treasury is considering is 15 years, leading to larger dynamic effects.

A better study to use would have been Feyrer (2009) that looks over a longer period using multiple natural experiments of falls in transport costs. This paper finds elasticities of 0.5 to 0.75 – over twice as large as those used by the Treasury. One reason for the Treasury's more cautious approach is that these elasticities might include some FDI component that they want to model separately. But this seems excessively cautious as FDI flows were not so important during the time period for which the trade elasticity is estimated (Feyrer, 2011, ends in 1975).

### *The impact of FDI on productivity*

The approach used by the Treasury may also underestimate the benefits from FDI. First, the industry level data used to estimate the FDI elasticity may miss out on some of the cross-industry productivity effects that the literature has stressed (e.g. across supply chains and from learning). Second, the use of UK only data with time trends may reduce a lot of the useful variation in FDI, making - and so underestimating - the positive effects on productivity. This is suggested by the fact that dropping the industry trends doubles the impact of FDI on productivity (first column of Table A.14).

An alternative, using cross country data over time, is Alfaro et al (2004) whose model captures more of the cross industry benefits of FDI. We use this in Dhingra et al (2016b) which implies much larger impacts of FDI on GDP, as does the earlier work of Pain and Young (2004).

### *Continuing reductions in trade costs within the EU*

The Treasury Report assumes that there is no further integration within the EU to reduce trade costs. But one section of the Report does look at this and suggests that it would add up to another 4% of GDP (paragraph 3.89). It seems highly likely that there will be further reductions in non-tariff barriers within the EU, especially in services, which is critical to the UK economy. Over the last 50 years there has been an on-going process of reductions in within EU trade costs, so assuming this suddenly comes to a juddering halt is unduly pessimistic.

In Dhingra et al (2016a), we model this by considering whether falls in trade costs within the EU continue along their historical trend (business as usual) or slow down to half the historical rates. This seems a more likely scenario than the baseline considered by the Treasury.

### *Immigration*

The Report uses ONS projections of migration. This does not affect the results in any material way as they are on a per capita. The Treasury are essentially assuming no impact of migration on productivity. This is again rather cautious as most economists find positive effects of immigration on aggregate income per head, especially since EU migrants are more educated and younger than the UK-born (<http://www.niesr.ac.uk/blog/treasurys-brexit-analysis-and-immigration#.VxiKaE32aUn>).

## Other criticisms of the Treasury Report

### *Is forecasting so far out impossible?*

Many ‘Leave’ commentators have attacked the Report by saying it is impossible to forecast events so far in the future. Although the Report is pitched as what will be GDP in 15 years’ time, it is important to realise that this is an *analysis* rather than a *forecast*. The Report is in essence saying how much poorer the UK is likely to be because of Brexit. Current forecasts of the global economy could be too pessimistic as technological change may pick up. Or they might be too optimistic if China has a debt meltdown. But whatever happens, we can consider what will be the state of the UK economy *relative* to these outcomes. And the Report is essentially saying that whatever unexpected events happen in the world, the UK is likely be considerably poorer than it would have been if it remained in the EU.

### *Fiscal transfer*

The Report does not focus on net fiscal transfers to the EU. As we argue in Dhingra et al (2016a), these are not likely to be large enough to outweigh the economic losses as the transfer is about 0.31% of GDP. In the case of the EEA, there is likely to be a continued large transfer (Norway pays in 88% of what the UK does on a per capita basis) and similarly large transfers are made even in looser arrangements (for example, 40% in the Swiss case).

### *Benefits of cutting ‘red tape’*

The Report argues there is unlikely to be much of an effect from changes in regulation following Brexit, as the UK is already one of the most lightly regulated countries in the developed world. This is the same conclusion that we reach in Dhingra et al (2016a).

Although the UK Government’s Impact Assessment finds that the benefits of most regulations derived from EU laws have outweighed their costs, Booth et al (2015) point to 56 regulations where costs outweigh the benefits. Crafts (2016) estimates that the cost of these regulations is 0.9% of the UK’s GDP. But many of these regulations implement policies that the UK government is committed to following inside or outside the EU. For example, half of the total cost comes from just two policies: the Renewable Energy Strategy; and the Working Time Directive. Scrapping these regulations would mean abandoning the UK’s renewable energy targets and removing rights such as the entitlement to 20 days paid annual leave. And even if the regulatory costs of EU membership were 0.9% of GDP and there was the political will to abolish these regulations, this figure is substantially smaller than the GDP decline forecast in the Report.

### *‘Look globally and strike great trade deals’*

Another criticism is that the document ignores the possibility that after Brexit, the UK will re-orient its trade towards faster-growing economies such as China, India and the United States. The UK actively promote trade with these countries now, but it cannot strike trade deals with them alone.

When negotiating post-Brexit trade deals, the UK would not need to compromise with other EU countries. On the other hand, the UK would have to take on the cost of hiring civil servants to rebuild its capacity to undertake trade negotiations which can take decades. More

importantly, since the UK is under a fifth of the economic size of the EU Single Market it would have less bargaining power in trade negotiations than the EU does. And being outside the EU would mean it no longer automatically accessed the benefits from the EU's trade deals, such as the current ones being negotiated with the US and Japan worth around 0.6% of GDP. It beggars belief that these putative trade deals would be on so much better terms than the existing and future deals that the EU has negotiated, that they would outweigh the larger loss of trade and investment identified in the Report.

*'Leaving the EU will shield us from its decline'*

Some critics believe that the EU is about to collapse and the UK will be shielded from the fall out by jumping from the sinking ship. It is true that the EU (like the UK) has become a smaller part of the world economy over the last two decades. But this is not because the EU has not grown – it has simply not grown as fast as the rising economies such as China or India. Given the geographical fact that we are a neighbour to Europe, developments in the EU block will always have a major effect on the UK. Throwing up masses of trade barriers with the EU (which Brexit supporters claim they will not do) will 'shield' us only in the sense it would decouple us from our major economic partners.

## **Conclusions**

Forecasting the economic consequences of Brexit is a difficult challenge and all estimates will be subject to a degree of uncertainty. But our overall assessment is that the Treasury Report is a credible analysis, which, for the most part, uses the best available estimation methods. Our main criticism is that they have taken overly cautious assumptions which will tend to underestimate the economic costs of Brexit.

Their headline forecast that Brexit would reduce long-run UK GDP by 6.2% in the baseline case is broadly consistent with our previous work and many other independent estimates. For example, in Dhingra et al (2016a), our dynamic estimates of the cost of Brexit indicate a GDP loss of 6.3% to 9.5% in the case of moving from the EU to EFTA (see Annex B). Treasury estimates are at the lower end of this range.

The Treasury's findings reinforce the academic and business consensus that Brexit would make the UK significantly poorer. The Report is a serious contribution to the debate.

## Further Reading

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Feyrer, J. (2009) 'Trade and Income – Exploiting Time Series in Geography', NBER Working Paper No. 14910.

Feyrer, J. (2011) 'Distance, Trade and Income – The 1967 to 1975 Closing of the Suez Canal as a Natural Experiment', NBER Working Paper No. 15557.

Pain, N. and G. Young (2004) 'The Macroeconomic Effect of UK Withdrawal from the EU', *Economic Modelling* 21: 387-408.

## Annex A: How the macroeconomic model affects the results

In NIESR's NIGEM macroeconomic model the Treasury simulate for each of their scenarios:

- A shock to the size of the 'Rest of World', which reduces trade on par with the fall assumed in the relevant scenario.
- A fall in labour augmenting technical change equivalent to the impact from trade and FDI estimated in each scenario.

The macroeconomic model then calculates the long-run changes in GDP, prices, etc. These are compared to the baseline case without these shocks (i.e. the case if the UK stayed in the EU).

One tricky issue is the size of the technology shock. Consider our example in Table 1 of the upper end of the case of the negotiated bilateral agreement (Canada). An obvious strategy would be simply to use the implied productivity effect of -5.7% in Table 1 (column (3) of row 1). However, this would imply some 'double counting', as Feyrer's (2011) estimates of the impact of trade changes on income already include productivity increases due to endogenous increases in the capital stock that trade induces.

The Treasury's solution is to figure out what is the size of the productivity/technology shock necessary to generate a change of GDP equal to 5.7%. They do this by using the NIGEM model and the assumed change in exports (or its equivalent in a shrinkage of the exporter market size). It turns out that the implied magnitude of the technology shock is 5.2%.<sup>5</sup> They then add the productivity impact of FDI to get to a total technology shock of 6% (5.2% + 0.8%) They then add this shock of 6% into the NIGEM model alongside the trade shock to simulate the new level of GDP and other macro-economic outcomes.

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<sup>5</sup> We can tell this because Table 3.C indicates that a 6% technology shock has been fed into the NIGEM model, and the impact of FDI on productivity is 0.8% in our Table 1 (see column (3) of row 2). So  $5.2\% = 6.0\% - 0.8\%$ .

## **Annex B: How the Treasury Report relates to our own estimates**

The closest calculation that is comparable is the dynamic reduced form approach in Dhingra et al (2016a). There we find a 12.5% fall in trade after Brexit from a free trade agreement (like the Canadian case or EFTA). So this is similar to the Treasury's 'lower end' estimate of 14%. We use a higher GDP-trade elasticity from Feyrer (2009) of 0.5 to 0.75, which gives us a 6.3% to 9.5% GDP loss. These also probably include some FDI response.

The Treasury's baseline 6.2% GDP loss is at the lower end of these range of estimates.

The focus of Dhingra et al (2016a) is on static estimates from the costs of trade using a structural model. This finds smaller losses of GDP of between 1.3% and 2.6%. This is a very different methodology to the Treasury approach. In particular, it does not consider the dynamic effects of trade on productivity. In addition it does not consider the effects of FDI or immigration. In Dhingra et al (2016b) we take a simpler approach to looking at the effects of FDI and find that Brexit would cause a 3.4% loss of GDP if we moved into EFTA.

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Professor John Van Reenen who joined the CEP as Director in 2003, did not (and does not) support joining the Euro.

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