

A BUDGET FOR BREXIT

ECONOMIC REPORT

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INTRODUCTION

In this Budget Report we consider the future of the UK economy assuming that Brexit goes ahead promptly after the end of the Article 50 negotiations in March 2019. We assume that the policies of the Government for free trade agreements around the world, and for leaving the EU single market and customs union, take effect around mid-2020. We also assume that there will be a simple trade deal with the EU involving zero mutual tariffs and otherwise normal international relationships, taking effect at the same time. Between the end of the Article 50 talks in March 2019 and this 2020 date, we assume a short period of implementation of a bit over a year during which there is little change in policy. We also look at some variant assumptions in our effort to quantify the uncertainty surrounding policy at present.

It is right to start by focusing squarely on the issue of uncertainty. During the Brexit referendum, the Remain side advanced the argument that Brexit uncertainty would cause a recession if there was a vote to Leave. Plainly this was wrong; there has been no recession. The uncertainty surrounding Brexit amounted to whether it would be a 'soft Brexit', close to the status quo, or a 'clean Brexit' as assumed above. Since a 'clean' Brexit would mean moving the country to general free trade, its own regulation and restoration of control over unskilled immigration, all of which we have calculated would give the economy a substantial gain, this uncertainty amounted to possible outcomes that ranged from no change to large gains - uncertainty on the upside, hardly likely to inspire fear. This uncertainty could be assumed to be eliminated by a clear government choice of one or the other.

Nevertheless, we are now, a year and half on from the referendum, facing a different sort of uncertainty: that of a government seemingly unable to resolve internal disagreement about which choice to make. One group favours soft Brexit which is essentially the status quo, a negation of what was decided in the referendum, namely to return power over trade, regulation and migration to the UK; the other favours clean Brexit. It could well be that this disagreement will continue for several years, with the ultimate decision being constantly kicked down the road.

This sort of uncertainty is potentially extremely damaging. It resembles 'planning blight' where a road is marked as due to be developed but the development is constantly deferred as a council argues over future plans. Here, the existing residents will not invest and nor will any developers invest either; the road rots and falls into squatting and decay. The UK also faces this blight if the government does not take firm decisions on these policies. Those who see a bright future in free trade will not commit; those who want the status quo but fear it will not continue will also not commit.

In this Economic Report, we assume there will soon be a final decision by this Government along the lines it has announced to date and as set out above. The ministers and civil servants who oppose this will we assume fall into line with this Government's policy. Indeed it is their duty as British leaders to

fall into line with what the referendum decided; otherwise they will be destroying their country's economic prospects and will be vilified by history.

One of the problems in making this assumption is the difficulty of predicting the behaviour of the EU and its demands. It is clear enough that the EU wishes the UK to continue paying a large contribution to the EU budget; presumably the EU would also favour an agreement on trade, regulation and migration close to the status quo. However, these contradict current government policy and yet guessing what the EU would agree short of these demands is well-nigh impossible; one can have no reasonable expectation that the EU will agree to a simple trade deal involving zero tariffs.

An important part of our Economic Report is to assess the effects of not reaching a trade deal with the EU as assumed above. We will argue that the Government need not be concerned about reaching such a deal, because the economic effects of not doing so are minimal; this implies that those pushing for the status quo should fall into line behind current policies on pure economic grounds and not merely from the obligation to respect the referendum. They should not fear the 'fall out' from no trade deal.

This Economic Report is organised around the following sections:

- I. The current economy and the status quo baseline forecast (page 2)**
- II. The post-Brexit forecast assuming current government policy for a clean Brexit from Q3 2020 (page 7)**
- III. The post-Brexit fiscal dividend available for support of Brexit policies (page 9)**
- IV. Evaluation of a no trade deal outcome and the forecast of a clean Brexit from Q2 2019 (page 13)**
- V. Why the Treasury has got it wrong (page 16)**

I - THE CURRENT ECONOMY AND THE STATUS QUO BASELINE FORECAST

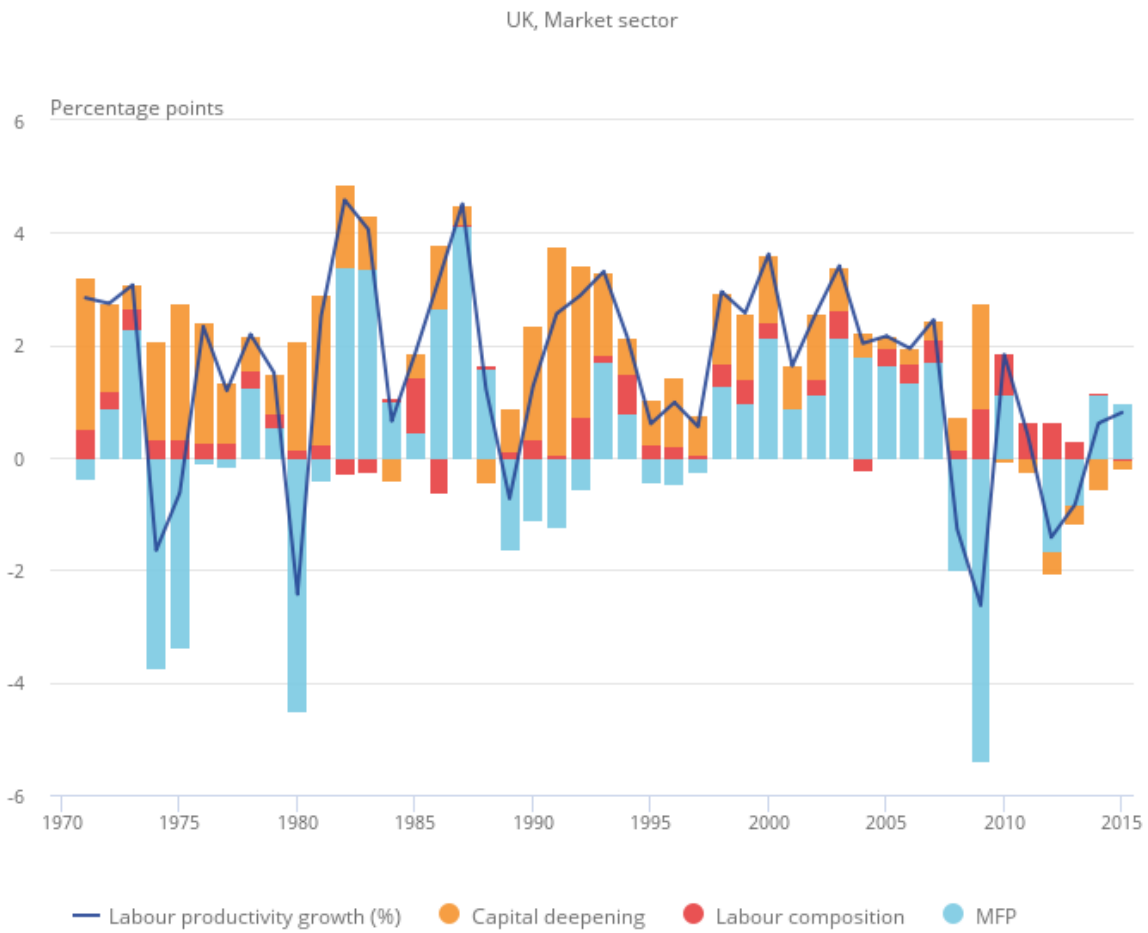
In a week's time the Office of Budget Responsibility, which has taken over from the Treasury its macro-modelling and forecasting duties, will reveal its Budget forecast for the UK. In this it will, we understand from press reports, assume essentially the status quo continues - i.e. a long transition with no change followed by a 'soft Brexit'. Whether it will make these assumptions entirely clear, we do not know; presumably not as it would probably precipitate an unholy row to do so. But it is certain that the OBR will not make the positive assessment of Brexit that we have indicated above. It would seem they, similarly to the Treasury, do not question the analysis of a clean Brexit made by the Treasury during the referendum, which asserted that the long run effects would be substantially negative and the short run effects would be a recession. On the recession part, plainly that did not happen; but the OBR may still regard Brexit as having a negative short run effect, even if delayed.

Nevertheless, we can regard the OBR's policy assumptions as much the same as for our baseline forecast in which there is no clean Brexit, simply the status quo.

The OBR forecast is likely to be dominated by what has been called the 'productivity slowdown'. This issue is also applicable to the US. It is suggested in the press that the OBR will project slow growth for the years ahead because productivity growth (measured by output per person employed) has slowed down. Indeed the ONS's present estimate of this growth over the past year is about 1 per cent - that is GDP growth of 1.7 per cent (Q2) minus employment growth of 0.7 per cent to the June-August 2017. This compares with a typical growth rate before the financial crisis of around 2 per cent. This can be seen from the chart below ('Figure 3' from ONS, 2017) showing UK labour productivity (output per worker) and its contributing components from 1971 to 2015. While

performance was weak up to 1980, from 1981 it improved to fluctuate between 1 per cent and 4 per cent, apart from the recession of 1989. Since the financial crisis recession, it has fluctuated between – 2 per cent and 1 per cent, apparently settling down recently at this 1 per cent rate.

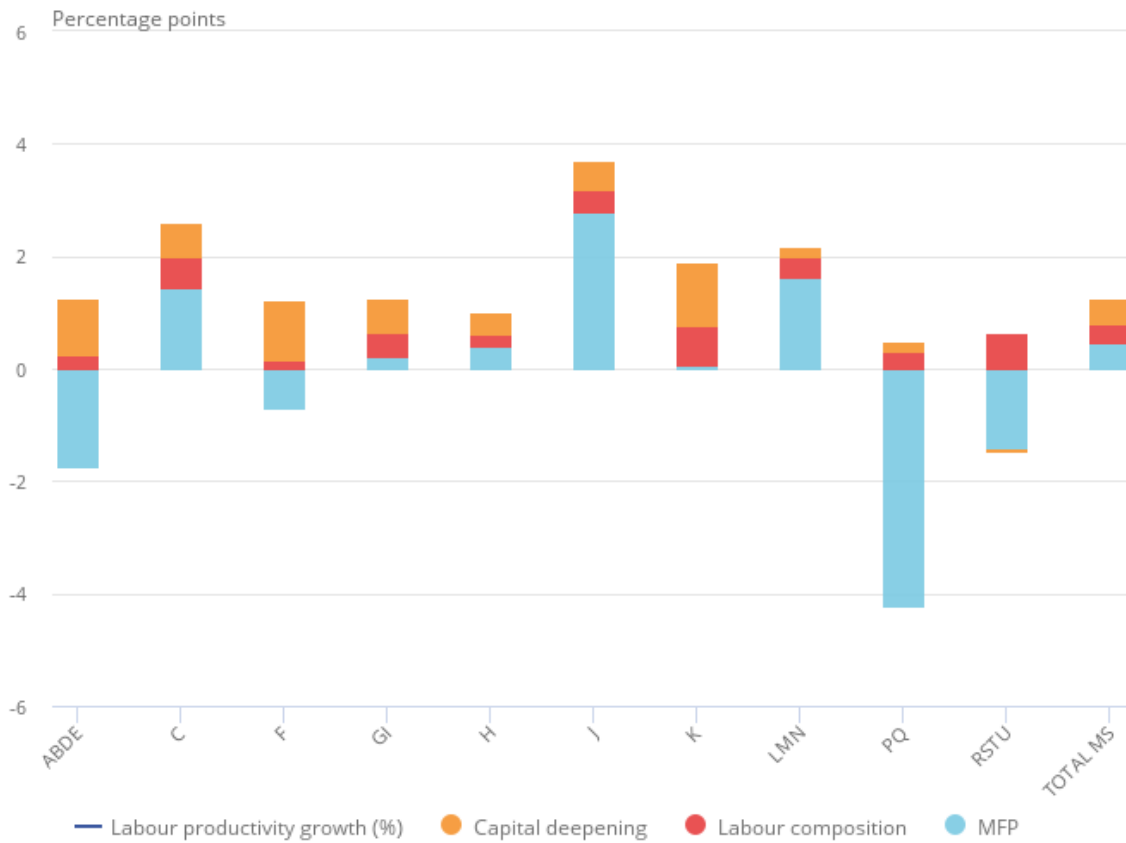
Figure 3: Decomposition of annual labour productivity growth, 1971 to 2015



Source: Office for National Statistics

Figure 4: Decomposition of annual average labour productivity growth, 1998 to 2015

UK, Market sector, By industry



Source: Office for National Statistics

Sectors in 'Figure 4' above, by industry from left to right

Industry ¹	Industry Description
ABDE*	Agriculture; forestry and fishing; Mining and quarrying; Utilities
C	Manufacturing
F	Construction
GI	Wholesale and retail trade; Accommodation and food services
H*	Transportation and storage
J*	Information and communication
K	Financial and insurance activities
LMN*	Real estate activities; Professional and scientific activities; Administrative and support activities
PQ*	Education; Health and social work
RSTU*	Arts and entertainment; Other services
Total MS	Total Market Sector

Source: Office for National Statistics

Notes:

1. Standard Industrial Classification (2007)
2. * Denotes industry affected by removal of non-market sector components

The difficulty of relying on productivity growth as a guide to the future growth of GDP is one of measurement. It is relatively easy to measure non-services productivity, such as manufacturing, where the UK made huge strides in productivity in the 1980s and 1990s as it contracted low-value manufacturing in favour of high-tech manufacturing, shrinking the labour force employed substantially from 25 per cent of total employment in 1980 to only 8 per cent today. However, by the time of the financial crisis, the economy was dominated by services where productivity measurement is notoriously bad. This can be seen from the second chart from ONS, 2017, 'Figure 4', which shows productivity growth by sector from 1998 to 2000. The sectors from Distribution (denoted GI) and to its right are the service sectors of the market economy, as listed below the chart. (Public sector productivity by definition grows at zero because output is actually measured by the number of employees times their real wages.) But plainly some of these numbers are completely absurd: consider for example education (PQ) and health, and the arts (RSTU), respectively third and second from the right, where productivity supposedly plunged.

This is a point that has been made carefully by Hal Varian, a distinguished academic, now the chief economist of Google. He argues that GDP - which cannot capture the huge gains in quality of services such as those of a mobile phone, not to speak of goods now available freely (such as free software) - should be abandoned in favour of measuring the value to consumers of their expenditure.

In the past year, nominal GDP has grown 3.7 per cent and the 'GDP deflator' (representing the 'price' of GDP) by 2.1 per cent. Interestingly, the public finances are improving as revenues have risen around 4 per cent with public spending rising by only 3 per cent (reflecting weak growth in public employee wages). By looking at these facts in terms of real GDP growth, one misses the point that wage growth is weak partly because prices quality-adjusted are not rising as much as the CPI indicates while revenues are rising because the Government can afford for the same reason not to 'index' them to the CPI.

It is for this reason that our baseline forecasts for government finances are more optimistic. In the current year 2017-18, it now seems that the PSBR will fall to around 2 per cent of GDP. By 2022 we think it will be around zero and will subsequently go into surplus. Essentially, this is coming from moderate restraint of departmental spending (no further dramatic 'cuts') and weak wage growth together with the stronger growth of revenues with nominal GDP growth running around 4 per cent per annum.

Our own baseline forecast attempts to allow for these factors. We cannot revise real GDP figures for 'quality-adjustment' of prices since no estimates exist. We continue to use the same basis as the ONS but make allowances only for what we regard as under-reporting in the surveys the ONS uses for its early GDP estimates.

Our assessment is that the UK is growing at around 2 per cent in the baseline economy; using current ONS figures would imply around 1.7 per cent growth in 2017 but we believe this will be revised upwards to about 2 per cent, in line with data from surveys such as Purchasing Managers Indices. Add in the ONS estimate of GDP deflator growth and nominal GDP is growing around 4 per cent. Employment continues to rise in our forecast and wages continue to grow weakly as we judge from the data that people are continuing to join the labour market, mainly women and older people,

as the retirement age rises and the pattern of employment favours women, in part due to their adaptability to the service sector.

Other trends in the baseline are the continuous improvement in the current account at the lower post-Brexit-referendum exchange rate.

Baseline Forecast- Status Quo

Table 1: UK forecast summary

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
GDP Growth ¹	1.8	2.2	2.0	1.9	2.0	2.0	2.0	2.0	2.0	2.0
Inflation CPI	1.1	2.6	2.5	2.1	2.0	2.0	1.9	1.9	2.0	2.0
Wage Growth	2.4	2.0	2.3	1.7	1.8	1.9	2.0	2.1	2.3	2.2
Unemployment (Mill.) ²	0.8	0.8	0.8	0.7	0.7	0.6	0.5	0.4	0.3	0.2
Exchange Rate ³	80.6	74.9	75.0	74.5	74.3	75.1	74.6	74.4	75.1	74.6
3 Month Interest Rate	0.5	0.4	0.6	1.1	2.0	2.0	2.0	2.0	2.0	2.0
5 Year Interest Rate	0.7	1.1	1.4	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Current Balance (£bn)	-87.4	-65.9	-55.5	-47.8	-40.5	-33.3	-24.9	-16.9	-8.2	-0.4
PSBR (£bn)	45.1	39.1	31.6	22.2	9.6	5.5	2.0	-5.0	-12.0	-22.0

¹Expenditure estimate at factor cost

²U.K. Wholly unemployed excluding school leavers (new basis)

³Sterling effective exchange rate, Bank of England Index (2005 = 100)

See Appendix A for detailed forecasts

A number of commentators of the ‘Remoaner’ camp argue that Brexit is ‘damaging the economy’ by producing a slowdown in consumer spending, as well as a fall in business investment. Inconveniently for this story, business investment has grown by 2.4 per cent on a year ago, according to recently revised ONS figures. This is not fast but then the economy is not growing fast either and is well away from full capacity, besides still having access to a labour market also apparently with spare capacity.

The other problem with this story is that we have been running the economy at a huge current account deficit in recent years, on the order of 5-8 per cent of GDP. This deficit seems to have emerged on the back of a very weak European economy to which our exports have accordingly slowed and low returns on foreign investment (also perhaps connected to poor European profits), whereas UK profits have done fairly well with the recovery from the 2009 recession. This asymmetry of returns has soured our investment income account.

But, whatever the reasons, it was necessary for this external deficit to be corrected. Hence, the Brexit devaluation has come in handily for this purpose. At a substantial 15 per cent or so, it is likely in time to correct this problem. The method by which it will do so entails a slowing of consumption as prices rise faster than wages, and an improvement in profits of exports and import-substitutes; this is known as ‘expenditure-switching’ designed to ‘rebalance’ the economy towards net exports. The very same commentators who have bemoaned the consumer slowdown as an evil Brexit effect have spent years in the past bemoaning our current account deficit and excessive consumer spending financed by over-fast credit growth. So now that Brexit has brought about a corrective, they should explain its corrective effects, not attack it, demonstrating some mature self-restraint and honesty.

Our baseline forecast under a status quo Brexit therefore shows the current account improving, the PSBR steadily going into surplus and the economy growing rather moderately at or around 2 per cent, with inflation settling at 2 per cent. Employment growth continues with the labour market yielding continued increases in participation, and measured productivity growth improves a little. Interest rates slowly rise to return monetary conditions towards normality. This baseline is not a disastrous one, as in our view actual productivity is growing faster because of unmeasured

improvements, and hence causing growing pleasure to consumers. Full employment, expanding job opportunities, and improving products are a good recipe for household satisfaction.

II - THE POST-BREXIT FORECAST: CURRENT GOVERNMENT CLEAN-BREXIT POLICIES IMPLEMENTED FROM Q3 2020

Under the status quo, we are in the EU's customs union and the single market, and so subject to the EU's freedom of migration. This status quo promotes the interests of existing producers who obtain protection from the EU through its high trade barriers on food and manufacturing, who benefit from EU regulation that supports the aims of large lobbying businesses against smaller competitors, and who gain from taxpayer-subsidised cheap unskilled EU labour.

A clean Brexit would eliminate this protection and regulation in favour of free trade and full competition and would remove taxpayer subsidy (through various benefits) from unskilled EU migration. These moves benefit UK consumers, lowering the cost of living by 8 per cent on our estimates and by so introducing competition raising productivity across the economy - with a total gain in UK welfare and GDP of around 4 per cent from free trade and another 2 per cent from improved regulation, a total gain to GDP of 6 per cent. On top of this, there are gains from regaining our net EU budget contribution (0.6 per cent of GDP) and removing the taxpayer subsidy to unskilled immigration (roughly a 20 per cent wage subsidy, costing 0.2 per cent of GDP). There will also be longer term gains to growth through enhanced innovation and entrepreneurial activity (Minford et al, 2015).

The proponents of the status quo argue that it 'preserves jobs'; yet what they mean is it preserves existing jobs by stopping competition from home and abroad. As every schoolboy knows and every politician ought to know, this aborting of competition reduces jobs in the long run. We never would justify stopping competition in order to keep existing jobs because we know the dynamics of a modern economy require that existing jobs go if they cannot compete with better ones. Competition increases productivity and so employment because higher wages paid for by higher productivity make work more attractive; competition also increases our general welfare because we produce more.

The gains we identify above come in the long term. For the Budget judgements, we need to translate these long-term gains into their effects on the short and medium term behaviour of the economy.

Brexit in Q3 of 2020

Table 1: UK forecast summary

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
GDP Growth ¹	1.8	2.2	2.0	1.9	1.9	2.2	2.3	2.3	2.3	2.8
Inflation CPI	1.1	2.6	2.5	2.1	2.0	2.1	2.8	2.3	2.1	2.0
Wage Growth	2.4	2.0	2.3	1.8	1.8	2.6	3.6	2.7	2.5	2.2
Unemployment (Mill.) ²	0.8	0.8	0.8	0.7	0.7	0.6	0.5	0.4	0.3	0.2
Exchange Rate ³	80.6	74.9	75.0	74.5	73.1	72.4	71.7	70.7	70.9	69.9
3 Month Interest Rate	0.5	0.4	0.6	1.2	2.4	3.1	3.1	2.6	2.3	2.0
5 Year Interest Rate	0.7	1.1	1.4	2.5	3.5	2.9	2.6	2.4	2.2	2.0
Current Balance (£bn)	-87.4	-65.5	-54.3	-48.9	-39.2	-28.5	-15.3	-12.0	-5.5	0.7
PSBR (£bn)	45.1	39.9	32.9	23.4	6.4	-7.0	-11.0	-24.2	-29.5	-39.0

¹Expenditure estimate at factor cost

²U.K. Wholly unemployed excluding school leavers (new basis)

³Sterling effective exchange rate, Bank of England Index (2005 = 100)

See Appendix B for detailed forecasts

In this post-Brexit forecast - based partly on the Liverpool Model (Minford et al, 1984) to obtain the supply-side effects, and partly on more recent modelling of the UK economy to obtain the timing of effects, the 'dynamics' - we take the current forecast without Brexit and allow for Brexit. The assumptions we make are based on the figures above (which follow Minford et al (2015)) for the trade and regulation effects:

- We assume the gain in consumer living standards from leaving the EU customs union is 3.2 per cent due to the fall in tariff-equivalents (which we treat as a fall in the UK expenditure tax) and 0.8 per cent due to an improvement in the terms of trade (whereby the prices of UK imports from the EU fall, partially offset by a fall in the prices of UK exports to the EU, which are some 8 per cent of GDP smaller than the imports).
- The net EU budget contribution, 0.6 per cent of GDP, plus the 0.2 per cent of GDP paid to EU unskilled immigrants is returned to UK consumers in the form of an income tax cut
- The reduction of the regulative burden is modelled as a fall in the employer rate of national insurance by 2 per cent
- There is no direct effect on the public sector borrowing requirement (PSBR) since none of these changes affect the net public revenues
- The 0.8 per cent terms of trade gain plus the 0.6 per cent return of the net EU budget contribution are received as direct improvements of the current account

All these changes are phased in gradually over five years.

The main effect of these changes is to boost the economy's supply-side in the longer term. Growth improves as UK costs fall. Unemployment falls slightly - as it is of course already extremely low. Real wages rise as firms demand more labour given higher profits. The higher output drives down the exchange rate as new markets are sought by exporters.

In the shorter term, there is a rise in inflation as the exchange rate falls and demand increases. Interest rates rise in reaction during the early 2020s.

It is interesting to see, after Brexit, the UK becomes a more 'normal' economy, with growth reviving, monetary policy 'normalising', and inflation getting back on track. The fall in the exchange rate and the direct improvement in the current account largely correct the recently persistent current account deficit. The PSBR, as a share of GDP, continues to fall towards balance at the end of the decade, with the growth of nominal GDP boosting revenues. From 2020 onwards there are further gains in revenues which move the PSBR into surplus, enabling debt to fall reasonably swiftly over the decade.

What about the short term uncertainties? Essentially, the Brexit effect in the short term divides into two parts:

1. There is a rise in long-term performance that translates into higher profitability and more investment; and rising productivity. The rising capital stock also raises output in a gradually increasing way.
2. There is a gradual fall in the exchange rate, which triggers a rise in interest rates (in order to maintain the incentive to keep portfolio investment in the UK). This has a negative effect on demand.

In the forecast below, these two forces are seen as balancing out. A completely forward-looking model – i.e. “act on what you think will happen in future” - makes (1) dominate.

This is because the Liverpool Model is based on rational expectations. Therefore, people understand the long-term changes in the environment. The fall in the exchange rate we see in the Liverpool Model after Brexit is coming from the expansion of the economy and the requirement to find larger markets to absorb the higher output. In recent work on the UK economy in which investment is forward-looking, as in Meenagh et al (2010), we find, in the short run, output does not move much so a rise in interest rates is needed to stop demand from surging upwards, because of better investment returns and higher longer term income prospects. This mechanism has been built into this forecast.

The essential point about rational expectations is that it assumes people understand the supply-side changes brought in by Brexit, and build these changes into their plans at once. Rational expectations have been found in recent tests of models to fit the facts impressively (Liu and Minford, 2014), unlike rival assumptions such as 'behavioural expectations', which are mainly or entirely backward looking. Hence the long term changes start immediately to have beneficial effects on demand through the role of expectations.

III - THE POST-BREXIT DIVIDEND

The Post-Brexit Fiscal Fund

The forecast made above shows that Brexit reinvigorates the economy and in so doing improves the budgetary outlook. Making the assumption of continued restraint in public spending - so that it grows around 0.5% per annum in real terms - we find by 2025 there is a PSBR 'surplus' (i.e. a negative borrowing requirement) of some £40 billion in money terms, around 1.3% of money GDP as it will then be.

The debt/GDP ratio starts to fall from 2016, at which point nominal GDP growth of around 4% more than offsets the PSBR at 2% of GDP, reducing debt by about 1.5% of GDP. Hence, the PSBR will be steadily falling and going into surplus. If this growing fiscal gain is allowed to reduce debt, then by the end of the 2025 financial year, the debt/GDP ratio would have fallen to around 53% of GDP, and reached 60% by the end of 2024. The reasonably 'safe' ratio is usually set at 60%, in the sense that, if there were a large rise in the rate of interest, it would not trigger too large a rise in interest payments on the national debt, requiring harsh and difficult cuts. In fact, the Maastricht target of 60%, was chosen for this reason.

So, our post-Brexit forecast would get our finances into reasonable shape by 2024, permitting the government to start spending more beforehand without endangering progress to a 60% target by around the middle of the decade. Five per cent of GDP could therefore be spent additionally from the 2020 financial year over the succeeding 5 years, while still reaching a 60% debt/GDP ratio in around 2026. This amounts to about £135 billion. Therefore, beginning from the date of Brexit in 2020, some £25 billion extra spending a year could be accommodated, while still reaching the 60% debt/GDP target by the end of 2025.

From 2025, the debt arithmetic becomes even more friendly. A surplus of £40 billion (1.5% of GDP) implies that, because of growth in nominal GDP, the government can spend this surplus and also another 2.4% of GDP on top, without raising the debt/GDP ratio. In total, this would imply approximately 4% of GDP as an additional 'dividend'. To take it all probably would not be a desirable choice because it would be better to spend less and let the debt/GDP ratio continue to fall slowly. But the government could reasonably run a small deficit of say 1% of GDP, allowing a total dividend of some £65 billion to be used. This would imply that from 2025 a further £40 billion per year could be used for taxcuts and/or higher spending, and still the 60% debt ratio target would be hit in 2026.

Spending Options

What could this money be spent on? Plainly it could, on the one hand, be used to ease the spending constraints on key public services or spent on infrastructure.

On the other hand, it could be used progressively to improve the competitiveness of the economy through tax cuts. To give an idea of the tax cuts possible we take HMRC's tax 'ready reckoner' estimates for 2020-21 and uprate them in line with projected nominal GDP growth.

For example, a 1% rate cut in

- Corporation tax would cost £3.2 billion by 2025
- The standard rate of income tax £5.6 billion
- The top rate of income tax £1.5 billion
- The very top ('additional') rate £0.2 billion.

From the viewpoint of supply-side incentives, corporation tax and the two top rates are the highest priorities for taxcutting. If corporation tax and the top rate were both cut by 2% in 2025, and the very top rate by 7% (to equality with the top rate), the cost would be of the order of £11 billion. Together, with additional spending of £14 billion, a 'Brexit dividend' from 2020 of £25 billion would begin to reduce the strains in the public sector and also give a useful boost to competitiveness.

From 2025, the further dividend of £40 billion per annum could be taken. At this point,

- The standard rate could be cut by 2%, at a cost of £11 billion (raising the tax threshold is very expensive and hardly affects any marginal rates, mainly going in the form of lower taxes to the better off, barely helping the less well-off because they lose benefits);
- Corporation tax could be cut another 3%, costing another £10 billion ; and
- The top rate could come down by 2%, costing around £3 billion.
- The remaining £16 billion could be used on spending.

With the use of the Brexit dividend (i.e., the 'Post-Brexit Fiscal Fund ') in this way, it would be plain to all that, indeed, Britain was 'open for business'.

Table : The Path of Public Borrowing and Debt with The Post-Brexit Fiscal Fund (£ Billion, Current Prices)

	<u>Brexit PSBR</u>	<u>+Fiscal Fund</u>	<u>Debt</u>	<u>GDP (Mkt Prices)</u>	<u>Debt/GDP % (ratio without Fund)</u>
2018	32.9		1679	2127	78.9
2019	23.4		1702	2215	76.8
2020	6.4	+25	1734	2310	75.1 (74.0)
2021	-7	+25	1752	2410	72.7 (70.6)
2022	-11	+25	1766	2514	70.2 (67.3)
2023	-24.2	+25	1767	2630	67.1 (63.4)
2024	-29.5	+25	1762	2753	64.0 (59.5)

2025	-39.0	+65	1788	2891	61.8 (55.3)
2026	-49	+65	1804	3035	59.4 (51.0)
2027	-59	+65	1810	3187	56.7 (46.7)

Note- Public sector net debt (excluding public sector banks) estimated at £1646 billion at end 2017-18 FY (in Sept 2017 £1638 billion, source ONS.)

The role of the Bank of England's monetary operations: a source of fiscal reassurance

In these projections we have ignored the effects of the Bank of England's monetary operations on public debt. Our debt series is that of the public sector ignoring the debt of the Royal Bank of Scotland, currently held by the government as owner of RBS; and also ignoring the Bank's holdings of government debt and debts to the private sector, almost all in the form of bank reserves held at the Bank by commercial banks.

It is rather obvious that the RBS debt should be excluded since the government will in the not too distant future sell off RBS, together with its debts, as a going concern. While we cannot know what it will get for this sale, this amount whatever it is will go to reducing public debt as a cash inflow. However this future cash gain is of little consequence for our calculations, as it is a one-off amount and not likely to be very large.

The Bank's operations might seem to be another matter. There is a series of public debt which includes the Bank's debts to the commercial banks in the form of bank reserves. This runs about 7% of GDP higher than the series we have used.

However it is plain that these bank reserves are not in any proper sense debt of the Bank or the public sector. They are in fact money! The commercial banks can only exchange them for notes and coins, and indeed that is what they are worth, though they also carry a small rate of interest. Once created bank reserves can only be destroyed by the Bank if it decides to sell its government bond holdings back to the market. In that case it would be paid in commercial bank deposits by the public selling the bonds; and these deposits would be transferred to the Bank, so cancelling the same amount in bank reserves. If the Bank does not do this the bank reserves stay as they are. They cannot be 'called in' by the commercial banks because they are only a promise to pay cash; however cash is also a liability of the Bank, the only difference being that it does not pay interest. The Bank would not have any problem with converting bank reserves into cash, a non-interest bearing liability substituting for an interest-bearing one. The conversion would leave its 'debts', cash plus bank reserves, the same. This is why bank reserves plus notes and coin are called M0, or the 'monetary base'. In practice the commercial banks would never substitute cash for bank reserves because they would lose interest; they hold the minimum necessary notes and coins in their vaults for satisfying the public's demands for them.

The role of bank reserves is to create credit. This is how credit works: a commercial bank makes a loan to Company A which banks with a different bank, bank B. Company A deposits its loan in bank B. Bank A pays bank B by transferring its bank reserves to the amount of the loan. Total bank reserves remain the same; credit and deposits are now both bigger, and have a higher ratio to the stock of bank reserves. Credit creation would then go on potentially until the banks feel their 'backing' of their deposits by bank reserves is just adequate. What this shows is that the bank reserves remain the same as originally created by the Bank; it is the credit and deposits that change relative to these reserves until the banks are unwilling to increase them any more given the reserves they have.

So it makes no sense to classify the Bank's bank reserves as 'public debt'; they are simply money created by the Bank as part of its monetary policy, in this case 'QE' (Quantitative Easing), designed in this case to stimulate lending by the banks by lowering longer term interest rates.

However, matters do not end there. In creating this money the Bank has bought a large amount of the bonds issued by the government, 'gilts'. In the course of its QE during and since the financial crisis the Bank has in fact bought some £370 billion gilts. It has also lent out another £160 billion in various ways. So it has assets in the form of either gilts or loans of £529 billion at the present time in its 'Asset Purchase Facility' account. Effectively we can deduct this from the debt of the public sector since the government owns the Bank. Notice that, if we do so, the government's true debt to the private sector at home and abroad is only £1109 billion, or 54% of GDP.

Of course what this means is that while the government pays debt interest on all its debt of £1638 billion, it gets back interest from the Bank on £529 billion of it which is extremely helpful to the public finances.

Yet we cannot rely on this situation to last, which is why we do not include it in our financial projections. The Bank is supposed to reverse its QE over time as monetary policy 'normalises'. It has needed to print so much money and make so many loans because of the unusual problems created by the financial crisis and the heavy bank regulation brought in, supposedly to prevent future such crises. Because of the crisis and the resulting regulation banks have been unwilling to lend to the same extent as in the 2000s before the crisis. This in turn has forced the Bank to encourage them to do more by printing money in its QE programme. However it has only had a limited effect; most of the extra money created in bank reserves as discussed above has not been lent out and so has failed to cause a general growth in deposits and credit.

Our post-Brexit forecast assumes that as growth returns monetary policy is tightened and the Bank sells off its loan portfolio. We think this will take a decade (£50 billion a year), largely because the banking system will continue to be heavily regulated for the foreseeable future and this will continue to dampen credit growth; so monetary pressures will also be dampened, and this will allow the Bank to proceed at a leisurely pace in selling off its portfolio. It will also prevent interest rates from rising sharply in the forecast period.

By 2027, a decade hence, public debt in total will on our projections have fallen to just below 60% of GDP, by which time the Bank should also have no loans on its balance sheet. Notice also a reassuring fact in this projection: the true debt of the public sector, net of the Bank's holdings, during the whole decade will probably never exceed 60%. It is now 54% and will be brought down from this by falling total debt; but this fall will roughly be offset by the selling off in QE loans.

This gives reassurance that the UK should not face any public finance crisis over the next decade as we pursue the Brexit Fiscal Fund, since throughout the period the situation on the ground will be one where the net debt/GDP ratio is less than the 'safe' 60% percentage. Beyond 2027 it will continue falling on our projections, steadily moving into even safer territory.

IV - EVALUATING A NO EU TRADE DEAL OUTCOME: CLEAN BREXIT BEGINNING Q2 2019

It is frequently claimed by 'Remoaners' that if we 'crash out' of the EU without a deal and are forced to trade under WTO rules, we will be faced with various disasters, ranging from airline flights being cancelled and queues of lorries piling up at Dover, to our manufacturers being unable to export to the EU.

To understand why such fears are not, in fact, great concerns, it is first necessary to understand how WTO rules work. Upon leaving the single market/customs union under WTO rules, we would immediately adopt the Most Favoured Nation (MFN) tariffs that initially would be the same as we operate now. So, no immediate change. However, what generally is not understood is that these MFN rules do not dictate the level of our tariffs – only the maximum tariffs we can levy. We are free to reduce or even eliminate tariffs (as long as we treat all countries the same); and we are also able to pursue free trade agreements with other countries individually. WTO rules also prevent the EU making a special case of the UK – i.e. they are prohibited from 'penalising' us out of spite.

In addition, negotiations on trade arrangements must be separated from negotiations on the myriad of arrangements that govern the day-to-day lives of UK and EU citizens – e.g. airlines, chemicals, and medicines. While such areas are detailed and tedious, they are separate from the subjects of trade arrangements and there are powerful incentives for all sides to find solutions within the myriad of international bodies that regulate these areas. Indeed, one benefit of leaving the EU is that the UK could regain its membership of the many important international committees where such regulations most often are initiated.

Customs clearing. A concern some express about the WTO Option is that it could lead to customs 'hold-ups'. People envisage queues at customs points around the world and particularly at the EU border. But modern customs bear no relation to what is in most people's minds – i.e. border queues as 'paperwork is checked'. Modern customs procedures are almost entirely computerised and so 'virtual'. If a consignment's (electronic) paperwork is out of order this will be known well before arrival at port and will either have been fixed by arrival or if not, unusually, that particular cargo will be stopped. A recent survey of customs clearing in all developed countries showed that 97 per cent to 99 per cent of all goods were immediately cleared electronically and the vast majority of the remaining 1 per cent to 3 per cent was cleared within a day – most likely a few hours (World Bank, 2016).

With regard to fears about our computerised customs systems not being ready on time, a recent appearance by HMRC before the Public Accounts Select Committee demonstrated that such fears have been grossly exaggerated. HMRC provided convincing testimony that not only will the new EU-inspired CDS system be ready by January 2019 but in addition HMRC have implemented a backup plan to have the existing CHIEF system augmented as well so that it will be able to handle the increased demand.

Another related worry is that if the EU were to levy tariffs on our exports where currently none exist, then many of our industrial inputs would be subject to tariffs and, because they 'cross borders many times', they would face tariffs multiple times. First, tariffs on inputs are levied in a 'virtual warehouse' manner. If any input is re-exported, it is not subject to duty as an input; hence, duties are not payable unless the end product is consumed inside the border. So the fact of inputs crossing borders multiple times simply does not matter - duties will be paid only if they finally do not leave

the country. Note that this applies crucially to Irish-Northern Ireland trade; if inputs are crossing this border many times they will pay no duty at all if the final product is for export to the rest of the world.

Furthermore, in spite of stories to the contrary, the majority of inputs do not cross the EU-UK border multiple times. For example, most auto components come from the EU to the UK and remain, unless the finished car is exported to the EU (when, as above, no tariffs would be levied on the inputs). Also, under EU rules, tariffs are not payable at all on inputs in certain sectors, such as aerospace, where inputs do cross borders multiple times.

EU import tariffs. As for the tariffs the EU levies on our manufacturing exports, these are rather low on average, at around 3.5 per cent on our manufactures – far less than half of our current net annual budget payment to the EU. In fact, the large fall in sterling has more than compensated for any potential EU tariffs on manufacturing exports and we believe sterling is likely remain low for many years.

Even if sterling were to regain its pre-Brexit parity, analysis shows that the lower cost of inputs from the rest of the world coupled with enhanced productivity opportunities once out of the EU, mostly compensates for any EU tariffs (Minford and Miller, 2017). And, our manufacturers could always decide to raise their prices in the EU and lose some market share, diverting their products to the rest of the world where they already on average sell half their output.

Farmers. Global free trade means lower, world, prices for farmers - an end to EU protection. This is inevitable and important for the UK and our consumers if we are to reap the full gains of leaving the EU. EU tariffs on food are high, at nearly 20 per cent on average. But under free trade agreements with major world food producers such as the US, Australia and New Zealand, we would cease to levy these food tariffs and our farmers' prices would fall to world levels. They would export their food to the world market at these lower prices. If they export to the EU, they would get these same lower prices, on top of which EU tariffs would be paid bringing the total price up to the EU price level for EU consumers. If we were to levy existing EU tariffs against the EU on food, then for EU producers to sell anything at all in the UK market they would need to match the world prices being charged by our new world suppliers. However, our farmers still can be supported as required; but they will need to raise productivity and switch crops to gain the greatest efficiencies. The UK taxpayer could support farmers directly in both the short term (as they adjust to new competition) and in the long term (as we protect our environment), thereby providing the country with a huge gain relative to the current regime of EU protection and the Common Agricultural Policy.

A recent detailed modelling analysis, sponsored by the Agriculture and Horticulture Development Board, showed broadly that large farms and farms with high productivity would be able to cope with the changes created by free trade in the agriculture sector (AHDB, 2017). It also showed that, if the Government maintained traditional agriculture support payments to farmers, many farmers would do well post-Brexit. The Government has stated repeatedly that this is their intention.

Competing with the EU. Another concern is that the EU 'will not like' our independent settings of trade, regulation, tax and immigration policy; some politicians have 'assured' the French we will continue to play by EU rules, even after we have left.

Why so? To do that would risk simply throwing away our hard-won freedom from EU rules that reduce our competitiveness as a nation; we would be throwing away the very gains from Brexit that we enumerate above. If the EU does not like competing against our new UK rules, then it is free to adjust to them as it likes: it could follow free trade, more liberal regulation and more sensible

immigration policies itself. Indeed, it might well have to because of the new competition it would face on its own doorstep. This is an entirely healthy reaction, beneficial to the world economy. It is argued by some that the EU would instead become yet more protectionist, especially against us. But this would harm them, not us.

Border Controls. A final worry concerns the movement of people across UK borders. However, today, everyone generally has to show identification at these borders since the UK is not in the Schengen agreement. It is a matter of detail what identification is needed and how it is controlled. This worry is particularly invoked for the Irish-Northern Ireland border, but the Government has already announced its post-Brexit policy of maintaining the Common Travel Area between Ireland and Northern Ireland. It is worth remembering that there is no EU border agency: EU governments each provide the border service on its behalf.

When we put all these elements together we find there is little to fear from leaving the EU without a trade deal. There could be a small negative effect if we charge tariffs on EU manufactures, on the assumption that EU producers raise UK prices because they do not lose sales massively to competing world producers selling freely at world prices in the UK market. On this pessimistic assumption, the gain to our consumers is reduced by the higher EU prices and so is the competition effect on our producers - making a reduction of 2 per cent in our trade gain to GDP. However, this estimate itself is likely to be much exaggerated: if EU producers cannot raise prices because of the new world competition then there would be no loss at all. We would effectively - via our FTA liberalisation - have eliminated protectionist effects from the UK market. In any case, all such issues can be avoided if we resolve to eliminate these EU tariffs unilaterally over time- after we have signed free trade agreements generally around the world.

Redoing Our Forecast Assuming No Trade Deal and No Implementation Period

Apart from making virtually no difference to our long-run gains from Brexit, there is one key advantage from a no-trade-deal and no-implementation-period scenario: we move immediately to a clean Brexit in March 2019, a year and a half earlier than assumed before. Thus the gains from Brexit kick in earlier; this includes the need to pay no further EU contributions during the transitional period, which appear to the 'price' demanded for a trade deal (it could be higher but we have not assumed so).

Brexit in 2019 Q2

	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
GDP Growth ¹	1.8	2.2	2.0	1.8	2.2	2.3	2.2	2.3	2.9	3.0
Inflation CPI	1.1	2.6	2.5	2.1	2.3	3.1	2.9	2.1	2.0	2.0
Wage Growth	2.4	2.0	2.3	1.8	3.3	2.9	2.4	2.2	2.4	2.3
Unemployment (Mill.) ²	0.8	0.8	0.7	0.6	0.5	0.4	0.3	0.3	0.2	0.2
Exchange Rate ³	80.6	74.9	75.0	72.7	71.4	72.1	70.7	70.1	70.3	69.3
3 Month Interest Rate	0.5	0.4	0.6	1.8	3.2	3.1	2.4	2.3	2.0	2.0
5 Year Interest Rate	0.7	1.1	1.4	3.2	3.8	2.5	2.3	2.2	2.0	2.0
Current Balance (£bn)	□87.4	-65.9	-55.5	-49.0	-39.3	-25.8	-15.3	-11.9	-5.5	0.7
PSBR (£bn)	45.1	39.1	31.6	14.8	5.5	-12.7	-20.3	-35.8	-37.4	-44.0

¹Expenditure estimate at factor cost

²U.K. Wholly unemployed excluding school leavers (new basis)

³Sterling effective exchange rate, Bank of England Index (2005 = 100)

See Appendix C for detailed forecasts

Manufacturing Prospects under Post-Brexit Free Trade

We pointed out earlier that free trade implies tougher competition for producers of manufactures who are currently protected by EU trade barriers. This is good for the economy. But is the effect on manufacturing somehow damaging?

Plainly, the end of EU protection of manufacturing must mean greater competition for UK manufacturing. However, much of UK manufacturing is high-tech, high value-added in nature, much of it competes successfully in world markets and the trends continue in this direction. This sector is one that increasingly resembles services where the UK has a strong comparative advantage because it is intensive in skilled labour.

Inefficient low-tech manufacturing will struggle. Judging how much of manufacturing (currently 10 per cent of GDP and 8 per cent of employment) falls into the high-tech category is difficult. However, we know that productivity growth in manufacturing has been strong for decades. Over the last 30 years it has averaged around 3 per cent per annum. To offset the long run effect of losing EU protection (assuming sterling regains pre-Brexit parity), manufacturing productivity needs to be raised, compared with no Brexit, by only about 1 per cent a year for a decade, which looks entirely feasible.

An important element is the fall in the exchange rate post-Brexit. At 15 per cent, this has greatly boosted manufacturing profits and provided a cushion, which we believe could well last five or ten years, during which productivity adjustment can take place. Our analysis (Minford and Miller, 2017) shows, for example, that auto manufacturers will improve profitability post-Brexit. If sterling regains its pre-Brexit parity, only a modicum of incremental productivity improvement and re-sourcing of supply chains (both facilitated by Brexit) will be required to compensate for the increased strength of sterling.

The effect on jobs of this adjustment will be positive, as indeed it has been overall during the contraction of manufacturing from 35 per cent of employment in 1970 to the 8 per cent of today. Because jobs have been created in services to replace jobs displaced from manufacturing; we have full employment in the UK and also a record level of employment at 75 per cent of the population of working age. Time and again, some short-sighted politicians have proclaimed their intention to 'revive manufacturing' to 'create jobs'; in this they have failed but jobs have certainly been created in the economy as a whole as manufacturing has necessarily contracted in response to the changing nature of society and competition from the world economy. Note however that because of growth in the economy and population, a decline in the share of manufacturing does not necessarily equate to an absolute decline.

V - HOW THE TREASURY GOT IT WRONG

It is clear that the Treasury and its several institutional acolytes have made a mess of its forecasts. Why is this?

Let us begin with the issue of uncertainty discussed earlier. During the Brexit referendum, the Remain side advanced the argument that Brexit uncertainty would cause a recession if there was a vote to Leave. Plainly this was wrong; there has been no recession. The uncertainty surrounding Brexit amounted to whether it would be a 'soft Brexit', close to the status quo, or a 'clean Brexit' as we assume. Since a 'clean' Brexit would mean moving the country to general free trade, its own regulation and restoration of control over unskilled immigration, all of which we have calculated would give the economy a substantial gain, this uncertainty amounted to possible outcomes that ranged from no change to large gains - uncertainty on the upside, hardly likely to inspire fear. And, of course, this uncertainty could be quickly eliminated by a clear government choice of one or the

other. Furthermore, the government could take offsetting monetary and fiscal measures to counteract any residual effects of uncertainty; and indeed the Bank of England did take measures to ensure banking and market liquidity, as well as (rather misguidedly) loosening monetary policy via both an interest rate cut and additional purchases of government bonds ('Quantitative Easing').

A second reason why the Remain side's forecasts have been and continue to be so wide of the mark lies in the assumptions used and models employed by the Treasury in forecasting the long-term impact of Brexit. It has emerged that the Treasury chose assumptions to drive their models that were guaranteed to produce a negative outcome. For example, the Treasury assumed that Post-Brexit the government would

- Elect to maintain the EU Common Customs Tariff. This would have the effect of obviating one of the primary reasons for leaving the EU - namely to reduce tariffs with the rest of the world, thereby eliminating one of the major economic reasons for leaving
- Not capture any gains from no longer paying the annual EU budget contribution
- Not pursue any benefits from deregulation
- Not eliminate the taxpayer subsidy to unskilled EU immigrants

Our research has shown that such inputs to any economic model - including our own - will lead to negative economic outcomes. In spite of widespread criticism from economists and other observers, the Treasury appears to have had no second thoughts and has not made any reply to these criticisms.

Finally, the Treasury has chosen to employ what has been described as a 'gravity model', in projecting post-Brexit outcomes. As we explain below in some detail, there have been numerous problems in their use of this general framework, both theoretical and empirical. After work over the past year our research team has been able to replicate what a gravity model for the UK would have looked like, how it would have matched the historical facts of UK trade compared with our classical trade model (poorly), and what it would have said about the effects of UK Brexit trade policies (much the same as our classical model).

Our conclusion from all this is that the Treasury used damaging policy assumptions out of line with the best clean Brexit policies and pursued a poor modelling procedure. Had it pursued a proper gravity procedure under the best policy assumptions it would have delivered similarly positive results of Brexit to ours. Had it pursued the more empirically valid classical model with these policy assumptions it would have replicated our results.

The Dark Secret of 'Gravity Models'

During the referendum debate and since, the Remain side has relied on a 'consensus' of trade economists in favour of the 'gravity model'. The Treasury's case against Brexit was based on this, as has been the work at the London School of Economics (LSE) on which the Treasury relied for much advice.

Gravity models. But what is a gravity model? In principle it is a full model of the economy open to international trade, investment and borrowing. It (e.g. Costinot and Rodriguez-Clare, 2014) regards trade as an outcrop of internal trade, the only difference being that it crosses borders. Otherwise trade grows naturally due to the specialisation and division of labour within neighbouring markets. Viewed through the lens of the gravity model, a customs union merely makes official what is already a fact of neighbourly inter-trade. Other sorts of trade, with more distant markets, grow analogously but more weakly, the greater the distance; size of distant markets may make up for their distance to

some extent, because they are a 'neighbourhood' that naturally leads to inter-trade. 'Gravity' in trade creation can be thought of as a function of distance and size. In this view of trade, it makes no sense to put obstacles in the way of trade with close neighbours, such as the EU, in the hope of boosting trade with distant markets via new trade agreements that lower trade costs. The disruption from the former will reduce welfare while the gains from the latter will be small, simply because the reduced trade costs will have little effect in switching demand from existing products in the presence of weak and imperfect competition.

Under this model trade is determined largely by the forces of demand, from neighbours wanting imports and from others modified by the factor of distance - due to transport costs and border costs; competition is rather limited, highly 'imperfect', and prices are set by producers as a mark-up on costs, so they move rather little. Once demand has determined trade and the production to meet it, foreign direct investment (FDI) and associated innovation follow it, boosting productivity. In short, while supply is important in this gravity approach, supply is largely determined by the forces of demand.

Because it is hard to break into new and distant markets it makes sense in this approach to support existing markets. Hence leaving the EU will damage existing markets' demand, so reducing trade and so reducing supply and productivity via falling FDI and innovation. Reducing trade barriers with the rest of the world will only weakly substitute for this loss of demand by stimulating more demand there.

Even though the EU protects its markets via trade barriers, this on the gravity view is good for the UK because it raises demand for our exports within the EU. Hence this school of thought is in favour of EU protectionism - it could be called 'neo-protectionist'. In general, free trade, according to the gravity approach, is something that must be evaluated case by case on the basis of its effects on demand for UK products and so the supply side of the economy.

Proponents of this gravity approach claim that it is supported by the 'facts' - consisting of many estimated relationships between exports and the GDP of the demanding countries, adjusted for distance. Indeed the gravity 'model' is essentially calibrated to replicate these relationships. However, as already explained, we need to allow for a possible problem: that the rival classical model also generates these relationships. Indeed it has routinely been thought by proponents of this rival model that such gravity equations, first estimated by Tinbergen (1962) and well known since, would be implied by the model.

The Classical Model. This classical model was developed by the great trade theorists of the past two centuries - starting with Ricardo (1817) - and pursued in much empirical work based on it. The fact that these ideas come from a long tradition of thinking does not of course mean that they are thereby wrong because 'old'. We have also witnessed an earlier major reversal of classical thought, the Keynesian Revolution, which has now been largely ditched in favour of a return to classical principles.

The classical model assumes high competition across world markets, with world prices being the same across the world subject to transport costs and trade barriers; there is free entry into all industries so that prices equal average costs. Capital flows freely across borders in the modern world version, but each country has largely fixed supplies of other factors, namely unskilled labour, skilled labour and land. In this model, supply forces such as the supply factors and their productivity determine the size of a country's different sectors. The resulting income is then spent according to home demands and the surplus of supply over demand is then exported, the deficit imported in each sector. The model is silent on the allocation of demand to imports and home goods and on the

allocation of exports to different foreign markets. However, it would be normal to add on some such allocative model of demand on top of the basic structure.

Thus, it can be seen that the causal structure of the classical model is quite different from that of the gravity model. In the classical model supply determines the essential structure of trade; demand adjusts to be consistent with this. In the gravity model demand determines the structure of trade and in turn forces supply to adjust to this.

How Do Gravity Modellers Implement Their Model?

You might think from this account of the gravity model that you would expect to see - at the Treasury and at the LSE - a full computable general equilibrium model of the UK's economy, trade and foreign investment, complete with final demands, markets for labour and capital, and market-clearing, including balance of payments equilibrium. But this is not what you will find. Instead, there will be some equations for bilateral trade in a lot of different goods with different countries in which GDP at home and in foreign countries figure together with relative prices; then another lot of equations for different countries relating foreign direct investment (FDI) to trade; then yet another lot of equations for UK industries relating productivity to FDI. The 'model' generates results by computing what under the first set of equations a trade regime change would do to trade; then this is 'fed' into the second set of equations relating FDI to total trade; finally the FDI effect is fed into the last set of equations relating FDI to productivity. The resulting estimate of the productivity effect of the trade regime change is then put into a model of the economy. This procedure can be found in the Treasury's long-term assessment of the effects of Brexit. The LSE pursues a broadly similar methodology.

So far so reasonable, you may say. However, notice that there is no model here of the UK trade and economy interacting as it were from top to toe. What we have is one set of empirical associations between trade and trade regimes; another set of associations between trade and FDI; then another set of associations between FDI and productivity. Only at the last stage when all this has been computed from these associations is a model brought in, where productivity is inputted into a standard 'macro' model where the origins of trade and its interactions around the economy are not included. While all the empirical associations are based on data, they do not tell us what the causal origins of these associations are. There could be reverse causation (FDI could cause trade or productivity cause FDI; trade regimes could have been caused by closer trade), or simultaneous causation by a third factor (better policies could have led simultaneously to more trade, more FDI and more productivity). Association as is well known does not imply causation.

Gravity trade economists dismiss these objections as nitpicking. They think they 'know' what the causal processes are and their estimates give these a concrete numerical reality; all this empirical evidence makes their case a shoo-in. However, for those who are more sceptical, such as those who espouse the classical model, there is a serious question of interpretation. They would like the gravity modellers to write out a complete system of causal equations that they believe and set them side by side with a rival system such as the classical model. Then we could check which of these two systems comes closest to implying all these associations we observe - more precisely since this is about Brexit, implying the associations we find for UK trade and the UK economy, i.e. the 'UK trade facts'.

The 'dark secret' of gravity modelling and Brexit is that no gravity modeller has done this and that hence: THERE IS NO GRAVITY MODEL, either at the Treasury or at the LSE. There is in existence at the Treasury (see appendices to HM Treasury, 2016) and the LSE (see chapter 2 of Breinlich et al, 2016) no complete gravity trade model linking all goods, labour, capital and land markets into one (UK) 'economy' linked to the rest of the world. Nor by implication has anyone in either place asked

whether such a model would fit the UK trade facts; it simply has not occurred to them to build the model or to ask it this question.

It is important to understand what these gravity modellers have done. They have used the argument (based on work by Costinot and Rodriguez-Clare, 2014) that if one did have a gravity model, including cost, price and consumer demand equations, one could arrive from this at associations between GDP, traded prices and trade- the 'gravity equations'. So far, so correct.

They have then used these associations - their so-called 'state of the art' model of international trade relationships - to predict how trade would move if trade barriers were changed. This is where we meet the problem. The problem is twofold. First, some other model may also generate the very same associations, but with a quite different causal interpretation. Thus it may be quite wrong to use these equations to predict trade, as if they work according to the logic of the gravity model. For, as we have seen, the classical model may be generating these associations: if so, the effects of the trade barriers would work differently, with possibly different results.

The second problem is that, when these associations are used, it is assumed that the GDPs and prices (and costs) in the equations can be held fixed. This assumption is not warranted. GDP and prices/costs will react to trade regimes indirectly.

Without repeating the same critique in detail we can say that exactly the same problems apply to the other steps used by gravity modellers. The next steps are to use associations between FDI and trade; and then associations between FDI and productivity. Again these associations are justified as being generated by some causal chain in the gravity production relationships; such a chain is largely asserted at this time, as there is no good theory for why FDI in particular is either linked to trade or to productivity, as opposed to capital in general, linked to them by the usual marginal productivity theory. In this case, the causation may run from productivity to both trade and FDI. In addition, the same argument applies as above: that other elements in these associations respond also to trade barriers indirectly. So they should have used not the associations but the underlying causal model; and again they should have tested it against rival models that could also produce these associations.

What these gravity modellers should have done, according to standard modelling practice, was to use a full gravity model of the UK economy 'from top to toe' to assess the effects of the trade regime changes. Furthermore, they should have tested this model against the facts of UK trade and shown that they fitted. It is one thing showing that 'gravity equations result from' the gravity model; what we need to know is whether the data-based gravity equations and other key trade associations in the data could have been generated with some numerical accuracy by the gravity model. The gravity modellers should then have compared this with a similar test of the 'classical model' (which indeed also generates gravity equations and other data associations).

Testing Gravity and Classical Trade Models against UK Trade Facts and checking their policy Implications

To make some progress on these issues, our research team has spent a year doing this work on a gravity model of the UK. We took a full classical trade/economy model and adjusted it for gravity assumptions: first, imperfect competition and second an effect from total trade to productivity (via FDI). What we found is detailed in Minford and Xu (2017).

- We found that the main UK trade associations on their own are broadly accounted for by both the classical and gravity model, though the classical is slightly more probable. But when

you add in the associations with labour market developments, which strengthen the test, the gravity model is statistically rejected while the classical model survives the test.

- But perhaps more important for policy - since for all the statistical tests in the world, we can never know for sure which model is really true - when we put the assumption of free trade into the gravity model it produces the SAME answer for the effects on UK welfare and GDP as the classical model.

What this means is had gravity modellers used the true underlying causal model of trade and the economy, together with the full free trade assumptions about policy, to compute the effects of Brexit they would have come to a strongly positive conclusion about post-Brexit economics, as we did. The reason is clear: even in the gravity model general free trade lifts all boats: that is, lowers consumer prices and stimulates resource movement to the more productive sectors.

The policy simulation, under which free trade agreements are made with all including the EU, assumes that EU producers match the fall in price in the UK market to avoid a catastrophic loss of market. But, even if it is assumed they keep their prices higher than this and so experience a loss of trade share to rest of the world (ROW) competition, there is simply a shift of trade away from the EU within each sector, which is offset by a rise in trade with others, so that total trade remains unchanged. In this case, which corresponds to the no-EU-deal assumption discussed above, there would be some minor loss of welfare but the Brexit assumptions would not be triggered, so that one obtains the same result again as in the classical model.

Notice that when discussing the no-deal assumption above, we argued that even under no EU deal it was more likely that EU producers would drop their prices in the UK market to match the competition; so even under no EU deal we consider the most likely result to correspond to full free trade.

In conclusion, gravity modellers did not do their job properly and produce/use a full causal model in their calculations. Such a model, had they used it, could have been shown not to fit the UK trade facts well statistically; but it would also have supported the Government's free trade Brexit policies strongly, to the same extent as the classical model.

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Appendices: Details of the Forecasts

Appendix A: Base Line Forecast on the status quo

UK FORECAST DETAIL

Prices, Wages, Interest Rates and Exchange Rate Forecast (Seasonally Adjusted)

	Inflation %¹ (CPI)	Short Dated (5 Year) Interest Rates	3 Month Int. Rates	Nominal Exchange Rate (2005=100)²	Real Exchange Rate³	Real 3 Month Int. Rates %⁴	Inflati on (RPIX)	Real Short Dated Rate of Interest⁵
2016	1.1	0.7	0.5	82.1	80.6	-1.0	1.9	-1.6
2017	2.6	1.1	0.4	77.1	74.9	-2.0	3.3	-1.1
2018	2.5	1.4	0.6	76.4	75.0	-1.5	3.1	-0.6
2019	2.1	2.0	1.2	75.6	74.5	-0.8	2.8	0.0
2020	2.0	2.0	2.1	75.2	74.3	0.0	2.7	0.0
2021	2.0	2.0	2.0	75.5	75.1	0.0	2.7	0.0
2022	1.9	2.0	2.0	74.9	74.6	0.0	2.6	0.0
2023	1.9	2.0	2.0	74.5	74.4	0.0	2.6	0.0
2024	2.0	2.0	2.0	74.7	75.1	0.0	2.7	0.0
2025	2.0	2.0	2.0	74.1	74.6	0.0	2.7	0.0

¹ Consumer's Expenditure Deflator

² Sterling Effective Exchange Rate Bank of England

³ Ratio of UK to other OECD consumer prices adjusted for nominal exchange rate

⁴ Treasury Bill Rate less one year forecast of inflation

⁵ Short Dated 5 Year Interest Rate less average of predicted 5 year ahead inflation rate

Labour Market and Supply Factors (Seasonally Adjusted)

	Average Earnings (1990=100)¹	Wage Growth²	Unemployment (New Basis) Percent³	Millions	Real Wage Rate⁴ (1990=100)
2016	253.2	2.4	2.2	0.8	142.9
2017	257.8	2.0	2.2	0.8	142.2
2018	263.8	2.3	2.1	0.8	141.9
2019	268.4	1.7	2.0	0.7	141.4
2020	273.2	1.8	1.9	0.7	141.0
2021	278.2	1.9	1.6	0.6	140.9
2022	283.9	2.0	1.3	0.5	141.0
2023	290.0	2.1	1.1	0.4	141.3
2024	296.7	2.3	0.8	0.3	141.8
2025	303.1	2.2	0.6	0.2	142.0

¹ Whole Economy

² Average Earnings

³ Wholly unemployed excluding school leavers as percentage of employed and unemployed, self employed and HM Forces

⁴ Wage rate deflated by CPI

Estimates and Projections of the Gross Domestic Product¹ (£ Million 1990 Prices)

	Expenditure Index	£ Million '90 prices	Non-Durable Consumption²	Private Sector Gross Investment Expenditure³	Public Authority Expenditure⁴	Net Exports⁵	AFC
2016		763130.					113348.
	159.4	9	440238.4	292912.0	198473.7	-55145.2	0
2017		779812.					115462.
	162.8	4	447261.8	297871.6	199478.8	-49899.0	3
2018		795269.					117962.
	166.1	2	455685.6	301376.8	200245.3	-44082.7	2
2019		810118.					120376.
	169.2	0	465665.9	303898.4	200695.7	-39774.2	3
2020		825951.					122961.
	172.5	3	476357.6	307158.2	201283.9	-35894.0	7
2021		842273.					125630.
	175.9	1	486042.3	311778.1	202262.9	-32178.7	3
2022		858829.					128344.
	179.3	2	496018.8	317329.5	202188.7	-28363.5	3
		875695.					131115.
2023		5	505978.0	322048.9	203415.5	-24633.6	2
	182.9						133952.
2024		892943.					136854.
	186.5	1	515935.4	327107.5	204893.4	-21038.0	8
		910543.					
2025		8	525893.3	332579.7	206581.2	-17658.1	4
	190.1						
2017/1							
6	2.2		1.6	1.7	0.5		2.0
2018/1							
7	2.0		1.9	1.2	0.4		2.2
2019/1							
8	1.9		2.2	0.8	0.2		2.0
2020/1							
9	2.0		2.3	1.1	0.3		2.1
2021/2							
0	2.0		2.0	1.5	0.5		2.2
2022/2							
1	2.0		2.1	1.8	0.0		2.2
2023/2							
2	2.0		2.0	1.5	0.6		2.2
2024/2							
3	2.0		2.0	1.6	0.7		2.2
2025/2							
4	2.0		1.9	1.7	0.8		2.2
2017:1		193453.					
	161.6	0	111073.9	73556.2	51435.0	-14278.1	28888.6
2017:2		194333.					
	162.3	4	111493.7	73922.9	49462.3	-11914.6	28633.6
2017:3		195558.					
	163.3	8	111962.1	74943.0	49336.1	-11909.3	28775.5
2017:4		196467.					
	164.1	2	112732.1	75449.5	49245.4	-11796.9	29164.6
2018:1		197416.					
	164.9	9	112867.3	74962.9	50854.4	-11955.1	29313.8
2018:2		198385.					
	165.7	9	113568.5	75197.8	49963.7	-10947.8	29398.1

2018:3		199353.					
	166.5	4	114271.5	75491.4	49779.7	-10643.6	29547.2
2018:4		200113.					
	167.1	0	114978.2	75724.6	49647.5	-10536.2	29703.1
2019:1		201083.					
	168.0	3	115343.2	75679.8	50223.8	-10299.7	29865.1
2019:2		202041.					
	168.8	6	116056.5	75875.3	50207.6	-10088.0	30011.9
2019:3		203007.					
	169.6	7	116772.1	76073.5	50155.0	-9827.5	30167.8
2019:4		203985.					
	170.4	4	117494.1	76269.8	50109.3	-9559.0	30331.5
2020:1		204980.					
	171.2	1	117987.0	76433.1	50356.4	-9303.9	30495.0
2020:2		205982.					
	172.0	6	118718.9	76652.5	50332.2	-9066.3	30657.6
2020:3		206990.					
	172.9	6	119455.7	76882.0	50311.9	-8840.2	30822.1
2020:4		207998.					
	173.7	0	120196.0	77190.6	50283.3	-8683.6	30987.0
2021:1		209020.					
	174.6	7	120572.1	77318.1	50620.2	-8334.3	31154.3
2021:2		210049.					
	175.4	8	121198.2	77804.5	50590.0	-8220.7	31322.7
2021:3		211085.					
	176.3	9	121823.9	78128.3	50580.9	-7955.4	31492.3
2021:4		212116.					
	177.2	6	122448.0	78527.1	50471.8	-7668.3	31661.0
2022:1		213144.					
	178.0	7	123070.3	78761.9	50579.6	-7436.7	31829.6
2022:2		214181.					
	178.9	9	123693.6	79140.0	50559.5	-7213.9	32000.0
2022:3		215227.					
	179.8	4	124316.2	79531.2	50530.4	-6977.9	32171.4
2022:4		216275.					
	180.6	1	124938.7	79896.4	50519.2	-6735.0	32343.3
2023:1		217326.					
	181.5	3	125560.2	79995.0	50809.1	-6521.2	32516.0
2023:2		218387.					
	182.4	0	126183.6	80268.7	50889.0	-6265.9	32690.6
2023:3		219455.					
	183.3	6	126806.3	80673.7	50868.8	-6027.0	32866.2
2023:4		220526.					
	184.2	5	127428.0	81111.5	50848.7	-5819.6	33042.4
2024:1		221600.					
	185.1	8	128049.4	81057.0	51278.5	-5564.9	33219.2
2024:2		222688.					
	186.0	2	128672.8	81472.6	51228.4	-5286.7	33398.0
2024:3		223779.					
	186.9	3	129295.3	81988.3	51198.3	-5124.1	33577.6
2024:4		224874.					
	187.8	7	129918.0	82589.6	51188.1	-5062.2	33758.0

2025:1		225972.					
	188.7	5	130540.1	84119.3	50068.0	-4815.3	33939.0
2025:2		227079.					
	189.7	0	131162.8	81943.1	52657.9	-4564.9	34121.7
2025:3		228187.					
	190.6	8	131784.1	82465.2	52537.7	-4294.0	34304.6
2025:4		229304.					
	191.5	6	132406.4	84052.1	51317.6	-3984.0	34489.1

¹ GDP at factor cost. Expenditure measure; seasonally adjusted

² Consumers expenditure less expenditure on durables and housing

³ Private gross domestic capital formation plus household expenditure on durables and clothing plus private sector stock building

⁴ General government current and capital expenditure including stock building

⁵ Exports of goods and services less imports of goods and services

Financial Forecast

	PSBR/GDP % ¹	GDP ¹ (£bn)	PSBR (£bn) Financial Year	Debt Interest (£bn)	Current Account (£ bn)
2016	2.3	1960	45.1	58.7	-87.4
2017	2.0	2044	39.9	61.4	-65.9
2018	1.5	2124	31.6	63.5	-55.5
2019	1.0	2209	22.2	67.0	-47.8
2020	0.4	2297	9.6	65.2	-40.5
2021	0.2	2387	5.5	61.5	-33.3
2022	0.1	2482	2.0	60.0	-24.9
2023	-0.2	2581	-5.0	54.1	-16.9
2024	-0.4	2684	-12.0	55.5	-8.2
2025	-0.8	2791	-22.0	55.0	-0.4

¹ GDP at market prices (Financial Year)

Appendix B: Forecast with Brexit in 2020 Q3

UK FORECAST DETAIL

Prices, Wages, Interest Rates and Exchange Rate Forecast (Seasonally Adjusted)

	Inflation % ¹ (CPI)	Short Dated (5 Year) Interest Rates	3 Month Int. Rates	Nominal Exchange Rate (2005=100) ²	Real Exchange Rate ³	Real 3 Month Int. Rates % ⁴	Inflati on (RPIX)	Real Short Dated Rate of Interest ⁵
2016	1.1	0.7	0.5	82.1	80.6	-1.0	1.9	-1.7
2017	2.6	1.1	0.4	77.1	74.9	-2.0	3.3	-1.4
2018	2.5	1.4	0.6	76.4	75.0	-1.5	3.1	-1.0
2019	2.1	2.5	1.2	75.6	74.5	-0.9	2.8	0.2
2020	2.0	3.5	2.4	74.1	73.1	0.2	2.7	1.2
2021	2.1	2.9	3.1	73.0	72.4	0.2	2.8	0.5
2022	2.8	2.6	3.1	71.3	71.7	0.7	3.4	0.5
2023	2.3	2.4	2.6	69.8	70.7	0.6	3.0	0.3
2024	2.1	2.2	2.3	69.0	70.9	0.1	2.8	0.2
2025	2.0	2.0	2.0	67.3	69.9	0.0	2.7	0.0

-
- ¹ Consumer's Expenditure Deflator
 - ² Sterling Effective Exchange Rate Bank of England
 - ³ Ratio of UK to other OECD consumer prices adjusted for nominal exchange rate
 - ⁴ Treasury Bill Rate less one year forecast of inflation
 - ⁵ Short Dated 5 Year Interest Rate less average of predicted 5 year ahead inflation rate

Labour Market and Supply Factors (Seasonally Adjusted)

	Average Earnings (1990=100)¹	Wage Growth²	Unemployment (New Basis) Percent³	Millions	Real Wage Rate⁴ (1990=100)
2016	253.2	2.4	2.2	0.8	142.9
2017	257.8	2.0	2.2	0.8	142.2
2018	263.8	2.3	2.1	0.8	141.9
2019	269.3	1.8	2.0	0.7	141.4
2020	272.7	1.7	1.9	0.7	141.1
2021	279.7	3.0	1.6	0.6	141.1
2022	289.6	3.4	1.2	0.5	141.3
2023	297.9	2.6	1.0	0.4	141.9
2024	305.2	2.4	0.7	0.3	142.7
2025	312.2	2.2	0.7	0.2	143.0

¹ Whole Economy

² Average Earnings

³ Wholly unemployed excluding school leavers as percentage of employed and unemployed, self employed and HM Forces

⁴ Wage rate deflated by CPI

Estimates and Projections of the Gross Domestic Product¹ (£ Million 1990 Prices)

	Expenditure Index	£ Million '90 prices	Non-Durable Consumption²	Private Sector Gross Investment Expenditure³	Public Authority Expenditure⁴	Net Exports⁵	AFC
2016		763130.9	440238.4	292912.0	198473.7	-55145.2	113348.0
2017	159.4	779812.4	447261.8	297871.6	199478.8	-49899.0	115462.3
2018	162.8	795269.2	455685.6	301376.8	200245.3	-44082.7	117962.2
2019	166.1	810118.0	465665.9	303898.4	200695.7	-39774.2	120376.3
2020	169.2	825265.9	476271.3	305733.3	201283.9	-35172.7	122848.9
2021	172.3	843406.4	485895.1	309365	202262.9	-28326.6	125787.3
2022	176.1	862742.6	495792.2	317273.8	202188.7	-23593	128916.8
2023	180.2	882759.5	505717.5	328036.6	203415.5	-22251	132160.1
2024	184.3	903300.7	515688.7	339272.3	203593.4	-19759.4	135493.1
2025	188.6	928795.4	525694.1	353295.5	206581.2	-17191.4	139583.4
2017/16	193.9						
2018/17	2.2		1.6	1.7	0.5		2.0
2019/18	2.0		1.9	1.2	0.4		2.2
2020/19	1.9		2.2	0.8	0.2		2.0
2021/20	1.9		2.3	0.6	0.3		2.1
2022/21	2.2		2	1.2	0.5		2.4
2023/22	2.3		2	2.6	0		2.5
2024/23	2.3		2	3.4	0.6		2.5
2025/24	2.3		2	3.4	0.1		2.5
2017:1	2.8		1.9	4.1	1.5		3
2017:2		193453.0	111073.9	73556.2	51435.0	-14278.1	28888.6
2017:3	161.6	194333.4	111493.7	73922.9	49462.3	-11914.6	28633.6
2017:4	162.3	195558.8	111962.1	74943.0	49336.1	-11909.3	28775.5
2018:1	163.3	196467.2	112732.1	75449.5	49245.4	-11796.9	29164.6
2018:2	164.1	197416.9	112867.3	74962.9	50854.4	-11955.1	29313.8
2018:3	164.9	198385.9	113568.5	75197.8	49963.7	-10947.8	29398.1
2018:4	165.7						

2018:3		199353.					
	166.5	4	114271.5	75491.4	49779.7	-10643.6	29547.2
2018:4		200113.					
	167.1	0	114978.2	75724.6	49647.5	-10536.2	29703.1
2019:1		201083.					
	168.0	3	115343.2	75679.8	50223.8	-10299.7	29865.1
2019:2		202041.					
	168.8	6	116056.5	75875.3	50207.6	-10088.0	30011.9
2019:3		203007.					
	169.6	7	116772.1	76073.5	50155.0	-9827.5	30167.8
2019:4		203985.					
	170.4	4	117494.1	76269.8	50109.3	-9559.0	30331.5
2020:1		204814.					
	171.1	7	117969.4	76868.3	50356.4	-9911.8	30467.9
2020:2		205815.					
	171.9	0	118699.1	75980.1	50332.2	-8566.9	30630.1
2020:3		206820.					
	172.7	8	119433.4	75224.2	50311.9	-7354	30793.8
2020:4		207815.					
	173.6	5	120169.5	77660.7	50283.3	-9339.9	30957
2021:1		209297.					
	174.8	4	120542.2	77666.9	50620.2	-8338.1	31192.8
2021:2		210334.					
	175.7	3	121163.9	77067.5	50590	-7124.2	31362.1
2021:3		211371.					
	176.6	6	121785.1	76361.6	50580.9	-5823.4	31531.6
2021:4		212403.					
	177.4	1	122403.9	78269	50471.8	-7041	31700.8
2022:1		214129.					
	178.9	8	123020.8	78892.3	50579.6	-6388.7	31973.8
2022:2		215160.					
	179.7	5	123636.9	78747.1	50559.5	-5639.5	32143
2022:3		216195.					
	180.6	0	124257	78687.3	50530.4	-4966	32312.9
2022:4		217257.					
	181.5	2	124877.5	80947.1	50519.2	-6598.8	32487.1
2023:1		219075.					
	183.0	0	125498.3	81806.1	50809.1	-6264.1	32774.7
2023:2		220147.					
	183.9	2	126118.9	81642.3	50889	-5552.4	32950.9
2023:3		221227.					
	184.8	2	126739.7	81595.3	50868.8	-4848.7	33128.3
2023:4		222310.					
	185.7	1	127360.6	82993	50848.7	-5585.8	33306.2
2024:1		224166.					
	187.2	7	127985.4	84243.4	50978.5	-5440.2	33600.5
2024:2		225269.					
	188.2	7	128609.6	84492.2	50828.4	-4878.5	33781.8
2024:3		226374.					
	189.1	5	129234.3	84623.3	50898.3	-4417.4	33963.6
2024:4		227489.					
	190.0	9	129859.4	85913.4	50888.1	-5023.3	34147.2

2025:1		230522.					
	192.5	5	130485.5	88394.2	51068	-4805.9	34619
2025:2		231639.					
	193.5	5	131110.8	88083.8	51657.9	-4409.8	34803.4
2025:3		232755.					
	194.4	9	131736.1	87415.7	52537.7	-3945.5	34987.8
2025:4		233877.					
	195.3	5	132361.6	89401.8	51317.6	-4030.3	35173.2

¹ GDP at factor cost. Expenditure measure; seasonally adjusted

² Consumers expenditure less expenditure on durables and housing

³ Private gross domestic capital formation plus household expenditure on durables and clothing plus private sector stock building

⁴ General government current and capital expenditure including stock building

⁵ Exports of goods and services less imports of goods and services

Financial Forecast

	PSBR/GDP % ¹	GDP ¹ (£bn)	PSBR (£bn) Financial Year	Debt Interest (£bn)	Current Account (£ bn)
2016	2.3	1960	45.1	58.7	-87.4
2017	2.0	2044	39.9	61.5	-65.5
2018	1.5	2127	32.9	63.8	-54.3
2019	1.1	2215	23.4	67.6	-48.9
2020	0.3	2310	6.4	65.2	-39.2
2021	-0.3	2410	-7	62.0	-25.8
2022	-0.4	2514	-11	62.0	-15.3
2023	-1.0	2630	-24.2	58.5	-12
2024	-1.1	2753	-29.5	59.0	-5.5
2025	-1.3	2891	-39.0	58.0	0.7

¹ GDP at market prices (Financial Year)

Appendix C: Forecast with Brexit in 2019 Q2

UK FORECAST DETAIL

Prices, Wages, Interest Rates and Exchange Rate Forecast (Seasonally Adjusted)

	Inflation % ¹ (CPI)	Short Dated (5 Year) Interest Rates	3 Month Int. Rates	Nominal Exchange Rate (2005=100) ²	Real Exchange Rate ³	Real 3 Month Int. Rates % ⁴	Inflati on (RPIX)	Real Short Dated Rate of Interest ⁵
2016	1.1	0.7	0.5	82.1	80.6	-1.0	1.9	-1.8
2017	2.6	1.1	0.4	77.1	74.9	-2.0	3.3	-1.3
2018	2.5	1.4	0.6	76.4	75.0	-1.5	3.1	-0.9
2019	2.1	3.2	1.8	74.0	72.7	-0.6	2.8	0.9
2020	2.3	3.8	3.2	72.4	71.4	0.2	3.0	1.6
2021	3.1	2.5	3.1	71.6	72.1	1.0	3.6	0.5
2022	2.1	2.3	2.4	70.0	70.7	0.4	2.8	0.3
2023	2.0	2.2	2.3	68.5	70.1	0.1	2.7	0.2
2024	2.0	2.0	2.0	67.6	70.3	0.0	2.7	0.0
2025	2.0	2.0	2.0	66.0	69.3	0.0	2.7	0.0

¹ Consumer's Expenditure Deflator

² Sterling Effective Exchange Rate Bank of England

³ Ratio of UK to other OECD consumer prices adjusted for nominal exchange rate

⁴ Treasury Bill Rate less one year forecast of inflation

⁵ Short Dated 5 Year Interest Rate less average of predicted 5 year ahead inflation rate

Labour Market and Supply Factors (Seasonally Adjusted)

	Average Earnings (1990=100)¹	Wage Growth²	Unemployment (New Basis) Percent³	Millions	Real Wage Rate⁴ (1990=100)
2016	253.2	2.4	2.2	0.8	142.9
2017	257.8	2.0	2.2	0.8	142.2
2018	263.8	2.3	2.1	0.8	141.9
2019	269.3	1.8	2.0	0.7	141.5
2020	280.1	3.3	1.9	0.7	141.2
2021	289.3	2.9	1.5	0.6	141.2
2022	293.0	2.4	1.2	0.5	141.6
2023	295.0	2.2	1.0	0.4	142.2
2024	301.5	2.3	0.9	0.3	142.8
2025	308.1	2.2	0.6	0.2	143.2

¹ Whole Economy

² Average Earnings

³ Wholly unemployed excluding school leavers as percentage of employed and unemployed, self employed and HM Forces

⁴ Wage rate deflated by CPI

Estimates and Projections of the Gross Domestic Product¹ (£ Million 1990 Prices)

	Expenditure Index	£ Million '90 prices	Non-Durable Consumption²	Private Sector Gross Investment Expenditure³	Public Authority Expenditure⁴	Net Exports⁵	AFC
2016		763130.9	440238.4	292912.0	198473.7	-55145.2	113348.0
2017	159.4	779548.4	447217.3	297468.3	199478.8	-49748.7	115420.3
2018	162.8	794703.8	455615.8	300332.1	200245.3	-43622.0	117875.4
2019	165.9	809353.7	465631.8	303733.9	200695.7	-40451.5	120256.4
2020	169.1	827793.4	476308.3	308728.0	201283.9	-35300.1	123226.3
2021	172.9	846807.8	485932.7	313340.8	202262.9	-28431.7	126297.1
2022	176.8	865360.8	495833.3	320311.6	202188.7	-23662.2	129310.7
2023	180.7	885413.9	505763.4	331089.9	203415.5	-22294.0	132559.8
2024	184.9	911342.6	515743.3	348515.6	203593.4	-19806.9	136702.8
2025	190.3	938882.9	525752.9	364887.4	206581.2	-17235.0	141103.6
2017/16	196.1						
2018/17	2.2		1.6	1.6	0.5		2.0
2019/18	2.0		1.9	1	0.4		2.1
2020/19	1.8		2.2	1.1	0.2		2.0
2021/20	1.8		2.2	1.1	0.2		2.0
2022/21	2.2		2.3	1.6	0.3		2.5
2023/22	2.2		2.0	1.5	0.5		2.5
2024/23	2.3		2.0	2.2	0.0		2.4
2025/24	2.3		2.0	3.4	0.6		2.5
2017:1	2.9		2.0	5.3	0.1		3.1
2017:2	2.9		2.0	5.3	0.1		3.1
2017:3	3.0		1.9	4.7	1.5		3.2
2017:4	3.0		1.9	4.7	1.5		3.2
2018:1		193453.0	111073.9	73556.2	51435.0	-14278.1	28888.6
2018:2	161.6	194331.1	111486.2	73922.1	49462.3	-11907.3	28632.6
2018:3	162.3	195451.6	111945.7	74789.4	49336.1	-11857.2	28758.3
2018:4	163.3	196312.6	112711.6	75200.6	49245.4	-11706.1	29140.9
2018:1	164.1	197251.5	112847.4	74678.4	50854.4	-11844.5	29289.0
2018:2	164.8	198235.7	113548.3	74927.1	49963.7	-10830.2	29375.1
2018:3	165.6						

2018:3		199218.					
	166.4	1	114255.2	75233.7	49779.7	-10525.3	29526.2
2018:4		199998.					
	167.1	5	114965.0	75492.8	49647.5	-10421.9	29685.1
2019:1		200982.					
	167.9	4	115333.3	75469.7	50223.8	-10196	29849.2
2019:2		201952.					
	168.7	1	116047.1	75691.9	50207.6	-9997.4	29997.1
2019:3		202726.					
	169.3	7	116764.5	75261.6	50155	-9329.8	30124.3
2019:4		203692.					
	170.1	6	117486.9	77310.7	50109.3	-10928.3	30285.8
2020:1		205450.					
	171.6	0	117979.7	77624.7	50356.4	-9948.2	30562.7
2020:2		206446.					
	172.4	4	118708.0	76729.6	50332.2	-8599.1	30724.2
2020:3		207446.					
	173.3	6	119440.8	75965.9	50311.9	-7384.5	30887.3
2020:4		208450.					
	174.1	4	120179.8	78407.7	50283.3	-9368.4	31052.1
2021:1		210153.					
	175.5	2	120552.5	78667.5	50620.2	-8365.9	31320.9
2021:2		211184.					
	176.4	9	121173.4	78062.9	50590.0	-7152.1	31489.5
2021:3		212219.					
	177.3	6	121794.0	77353.2	50580.9	-5849.7	31658.9
2021:4		213250.					
	178.1	1	122412.8	79257.2	50471.8	-7063.9	31827.9
2022:1		214786.					
	179.4	1	123030.2	79658.3	50579.6	-6409.1	32072.3
2022:2		215819.					
	180.3	0	123647.5	79511.0	50559.5	-5657.6	32242.0
2022:3		216849.					
	181.1	3	124267.9	79444.8	50530.4	-4982.7	32411.4
2022:4		217906.					
	182.0	3	124887.6	81697.5	50519.2	-6612.8	32584.9
2023:1		219737.					
	183.5	5	125508.8	82570.3	50809.1	-6275.9	32874.3
2023:2		220809.					
	184.4	6	126129.9	82404.2	50889.0	-5562.8	33050.6
2023:3		221890.					
	185.3	3	126751.3	82356.8	50868.8	-4858.2	33228.2
2023:4		222976.					
	186.2	4	127373.4	83758.5	50848.7	-5597.1	33406.7
2024:1		226178.					
	188.9	6	127997.7	86557.4	50978.5	-5452.2	33902.7
2024:2		227280.					
	189.8	8	128623.2	86803.2	50828.4	-4890.1	34084.3
2024:3		228385.					
	190.8	7	129248.7	86934.2	50898.3	-4429.1	34266.3
2024:4		229497.					
	191.7	6	129873.7	88220.8	50888.1	-5035.5	34449.6

2025:1		233044.					
	194.7	5	130499.6	91295.3	51068.0	-4819.3	34998.8
2025:2		234162.					
	195.6	8	131125.4	90983.9	51657.9	-4420.8	35183.5
2025:3		235276.					
	196.5	9	131751.0	90311.5	52537.7	-3955.3	35367.8
2025:4		236398.					
	197.5	6	132377.0	92296.8	51317.6	-4039.7	35553.5

¹ GDP at factor cost. Expenditure measure; seasonally adjusted

² Consumers expenditure less expenditure on durables and housing

³ Private gross domestic capital formation plus household expenditure on durables and clothing plus private sector stock building

⁴ General government current and capital expenditure including stock building

⁵ Exports of goods and services less imports of goods and services

Financial Forecast

	PSBR/GDP %¹	GDP¹ (£bn)	PSBR (£bn) Financial Year	Debt Interest (£bn)	Current Account (£ bn)
2016	2.3	1960	45.1	58.7	-87.4
2017	2	2044	39.1	61.4	-65.5
2018	1.5	2129	31.6	63.5	-54.5
2019	0.7	2222	14.8	67.7	-49
2020	0.2	2317	5.5	67.5	-39.3
2021	-0.5	2417	-12.7	61.3	-25.8
2022	-0.8	2521	-20.3	62.4	-15.3
2023	-1.4	2629	-35.8	55.9	-11.9
2024	-1.4	2755	-37.4	55.0	-5.5
2025	-1.5	2893	-44.0	55.0	0.7

¹ GDP at market prices (Financial Year)