

# THE R&D INVESTMENT CHALLENGE

## MOVING TOWARDS A MORE RESEARCH-INTENSIVE ECONOMY

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November 2019

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### 60-second summary

Innovation is the process by which businesses improve how they do things – whether that be how they produce goods or services, what they choose to produce and how they organise their workforce. More innovative firms are likely to be more productive, better to work for, enable us to become more internationally competitive and could enable us to solve big societal problems such as climate change and an ageing society.

Dedicating resources to research and development is key to enabling innovation and the UK economy sits well below the OECD average, 1.7 per cent of GDP is spent on R&D in the UK compared to an average of 2.4 per cent across the OECD. Both the Conservative government and the opposition have set out targets to increase R&D spend as a proportion of UK GDP – up to 2.4 per cent by 2027 and 3 per cent by 2030 respectively.

This briefing note outlines how much public investment may be needed to reach these ambitions. Evidence suggests that public R&D has the potential to ‘crowd-in’ additional private R&D spending, particularly if that spending is ‘mission-based’. We factor in this crowding-in assumption to our modelling, assuming an additional £1 crowds in £1.60 over the decade that follows. On this basis, to achieve 3 per cent of GDP as R&D spend by 2030/31 will require substantial additional public funding rising from around 0.5 per cent of GDP today to at least 0.9 per cent by 2030. To achieve the Conservative goal under the same

assumptions would require an increase in public spend from 0.5 per cent of GDP to at least 0.7 per cent by 2027.

There are large uncertainties around these crowding-in impacts and so the government would need to take stock over the decade. Funding commitments may need to change accordingly as private sector investment could be more or less responsive than has been modelled here. However what is clear is that both targets will require ambitious uplift in funding over the next decade.

## The R&D investment challenge

### **What is innovation? Why does it matter?**

Innovation is the process by which businesses improve how they do things – whether that be how they produce goods or services, what they choose to produce and how they organise their workforce. The UK benefits from a number of dynamic world-leading industries such as aerospace and life sciences, which are at the forefront of innovation.

More innovative firms generate more economic value as they are better able to produce goods and services that people want and for which people are willing to pay more. This makes worker time more productive and so enables firms to pay higher wages and/or create more high-wage jobs.

Beyond increasing productivity there are benefits to workers and the wider economy in that innovative firms will likely:

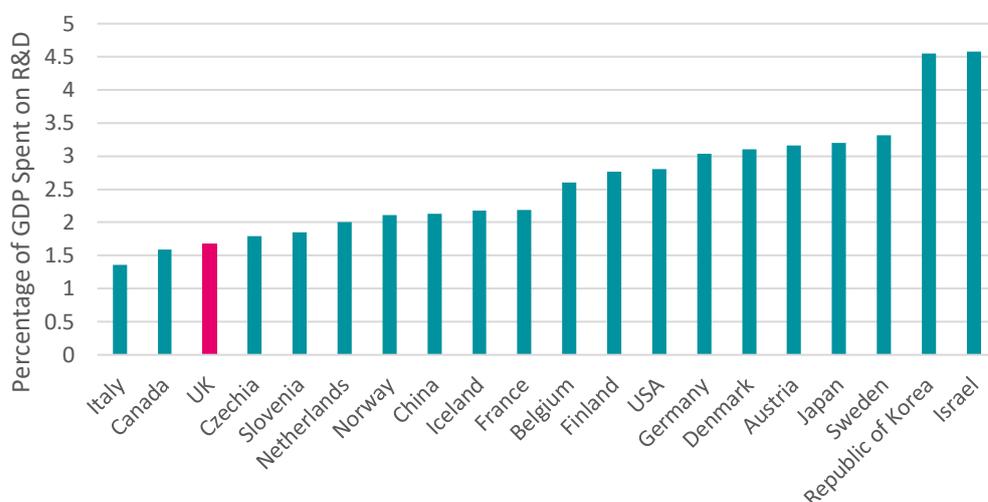
- be more internationally competitive, allowing us to sell more products to the rest of the world and reducing the UK's growing trade deficit. (Jacobs et al 2017)
- help solve big societal problems, whether that be moving towards carbon neutrality or dealing with the challenges of an ageing society – new solutions to problems are developed (ibid)
- make greater use of automating technologies, allowing workers to focus on those aspects of work which most add value as human beings, making better use of worker's skills and enabling greater autonomy. This would improve job satisfaction and quality of life (Roberts et al 2019).

### **Role of research and development and the rationale for a target**

Key to our innovation success are the resources we dedicate to research and development (R&D); that is investment focused on advancing new technology, ideas and products. Relative to other economies the amount of resources we dedicate to research and development spending is surprisingly low – just 1.7 per cent of GDP to 2017. This compares unfavourably to the OECD average of 2.4 per cent and a range of other diverse economies.

**FIGURE 1**

**Expenditure on R&D as a percentage of GDP around the world**



**Source: World Bank 2019**

Both the Labour and Conservative parties have previously set out plans to reach higher levels of R&D spend as a proportion of UK GDP. In 2017 the Conservatives set out to reach 2.4 per cent by 2027 (House of Commons 2019) whilst Labour in their last manifesto pledged to reach 3 per cent 2030 (Labour Party 2017). R&D targets are common amongst our competitors and can be a good way to focus a government’s attention on boosting the intensity of R&D spend in the economy, with all the benefits that would entail as set out above.

This briefing paper considers the level of spending required over the next decade if such targets are likely to be achieved.

**Modelling the counter-factual and the size of the investment gap**

Key to our innovation success are the resources we dedicate to research and development (R&D); that is investment focused on advancing new technology, ideas and products. Relative to other economies the amount of resources we dedicate to research and development spending is surprisingly low – just 1.7 per cent of GDP to 2017. This compares unfavourably to the OECD average of 2.4 per cent and a range of other diverse economies.

Firstly we forecast what we expect to happen to public R&D spend in the future.

- As outlined in the 2017 autumn budget– we assume direct public R&D spending increases to £12.5 billion by 2021/22 (HM Government, 2017), which we assume happens linearly from the last known data in 2016/17.
- We then assume from then on that public R&D spending increases by the compound average growth rate (CAGR) in public spending seen between 2006/07 and 2016/17, or 1.9 per cent per annum.

Figure 2 shows the baseline forecast for annual R&D growth.

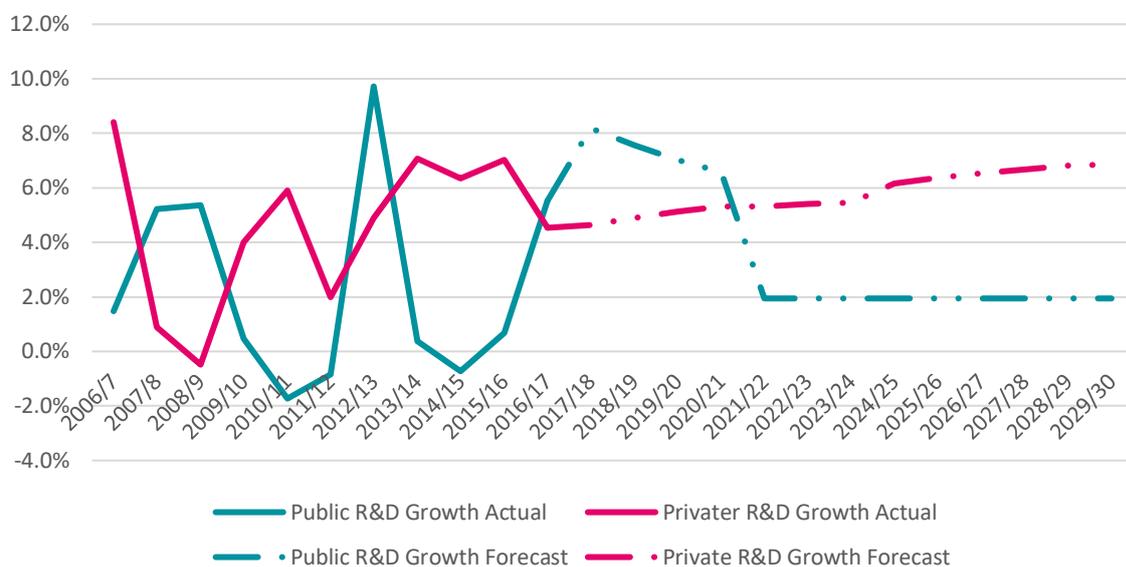
For private R&D, noting the historic relationship between GDP and private R&D spend.

- We calculate the historic CAGR between 2006/07 and 2016/17 for private R&D spend at 4.6 per cent. Over the same period the CAGR for nominal GDP is 3 per cent
- We compute the ratio between these as 1.5 and apply this to the future GDP growth forecast to estimate future R&D private spending growth

This chart shows actual and modelled counter-factual growth rates for public and private spending up to 2030/31.

**FIGURE 2**

**Actual and modelled public and private R&D spending growth**

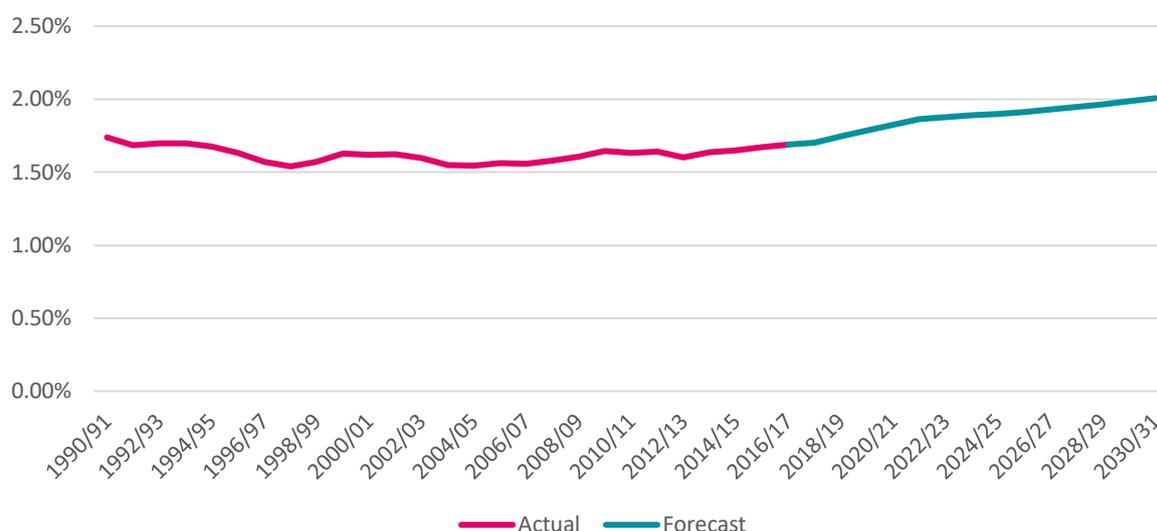


**Source: IPPR analysis of OBR 2019a, 2019b; ONS 2019a**

This implies that the proportion of GDP spend on R&D will have reached 1.95 per cent by 2027/28 and 2.01 per cent by 2030/31 – and so there will be sizeable gaps to reach either target. In cash terms we estimate this at £14 billion of additional R&D spend to reach 2.4 per cent by 2027/28 or £34 billion to reach 3 per cent by 2030/31.

### FIGURE 3

#### Actual and modelled R&D as a percentage of GDP in the counter-factual *R&D spend as a percentage of GDP: Actual and projected*



**Source: IPPR analysis of OBR 2019a, 2019b; ONS 2019a, 2019b**

In the counter-factual we expect the percentage to rise over time for two reasons:

- The government fulfilling its commitment to increase R&D spend to £12.5 billion in 2020/21 from £8.9 billion in 2016/17. We assume this spending level of spending is sustained in later years but that the growth slows to that in the 10 years prior.
- Growing private sector spend in R&D – over the last decade private R&D spending has outstripped GDP growth by 50 per cent on average and we expect this trend to continue.

#### The role of “crowding-in” and underlying modelling assumptions

In neoclassical economics, greater government investment is expected to “crowd out” private investment, as government borrowing drives up interest rates and deters private borrowing.

However there is in fact potential for public investment in R&D to leverage in additional private investment, particularly if this R&D spend is related to ‘missions’. This works as follows – government should commit to solving particular ‘wicked’ problems, whether that be getting to net-zero carbon emissions or dealing with the effects of an ageing society. By setting out long-term plans, with credible milestones and funding commitments for research, the government encourages ‘crowding in’ of spending by the private sector. Essentially, the private sector will be encouraged to invest in R&D projects related to the mission, as businesses take the plans seriously and see new business opportunities on the horizon. At IPPR we have advocated for a mission-

based approach to industrial strategy (Jacobs et al 2017) with the Institute of Innovation and Public Purpose leading work on what that would look like (IIPP 2019).

There is evidence that public R&D expenditure crowds in private R&D expenditure, although this considered general R&D rather than mission-based R&D. A study commissioned by the then Department for Business, Innovation and Skills (BIS) found that an additional £1 of government R&D spend in the UK was associated with an increase in private R&D spend of £1.36 over a 10-year period (Economic Insight 2015), though there was considerable uncertainty around this result (which ranged from £1.60 to £1.13). We take the higher estimate here and so these figures likely represent the minimum spending commitment required.

The BIS-commissioned analysis also suggests that the impacts may not be contemporaneous, but that additional crowded in spending would materialise in later years than the spending itself.

**TABLE 1**

**Modelled timing of when additional public R&D spending crowds in additional private R&D spending**

	Years After										
	0	1	2	3	4	5	6	7	8	9	10
%age Split When Additional Spend Arises	0.00%	43.07%	24.09%	13.87%	8.03%	4.38%	2.92%	1.46%	0.73%	0.73%	0.73%

**Source: IPPR calculations using Economic Insight 2015**

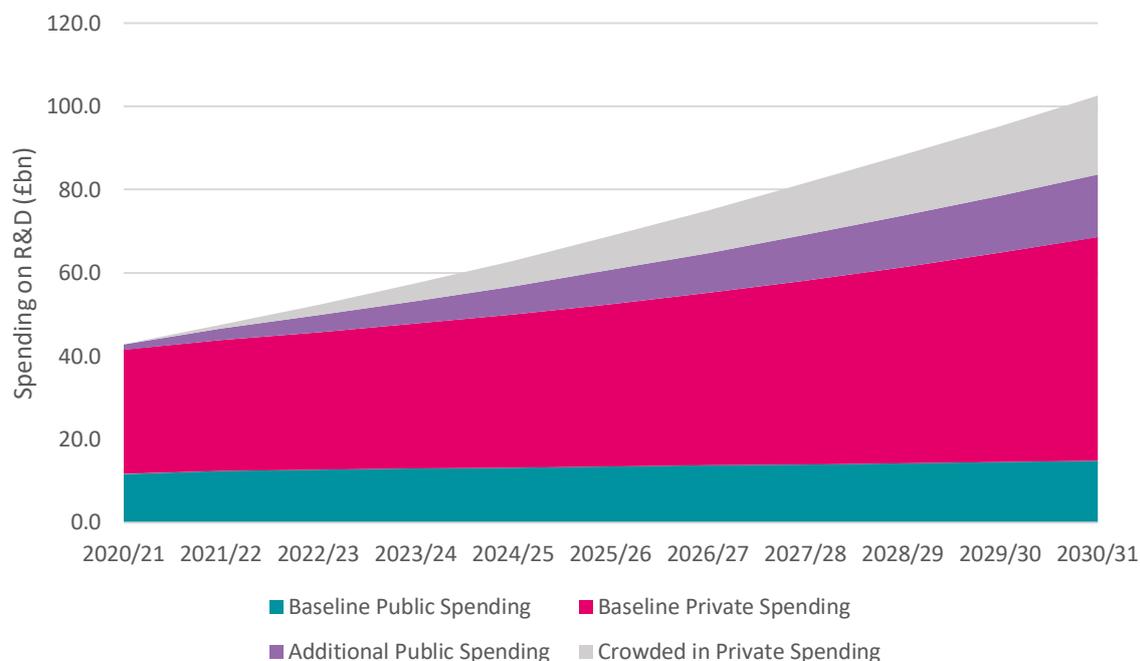
We combine these assumptions to estimate below how much government R&D spend might need to increase by over the next decade to reach the R&D targets set by the government and the opposition. Such calculations can only be illustrative, but give a sense of the scale of the investment challenge in any case.

## Reaching a 3 per cent target by 2030/31

Firstly we consider the 3 per cent target. We estimate the additional spending over and above the baseline required, and is one of many possible illustrative paths.

**FIGURE 4**

### Illustrative spending paths per year to reach 3 per cent of GDP by 2030/31



Source: IPPR analysis using ONS 2019a, 2019b; OBR 2019a, 2019b

This table summarises the path towards 3 per cent in terms of government funding commitments.

**TABLE 2**

### Summary of spending path to reach 3 per cent (All figures in £bn)

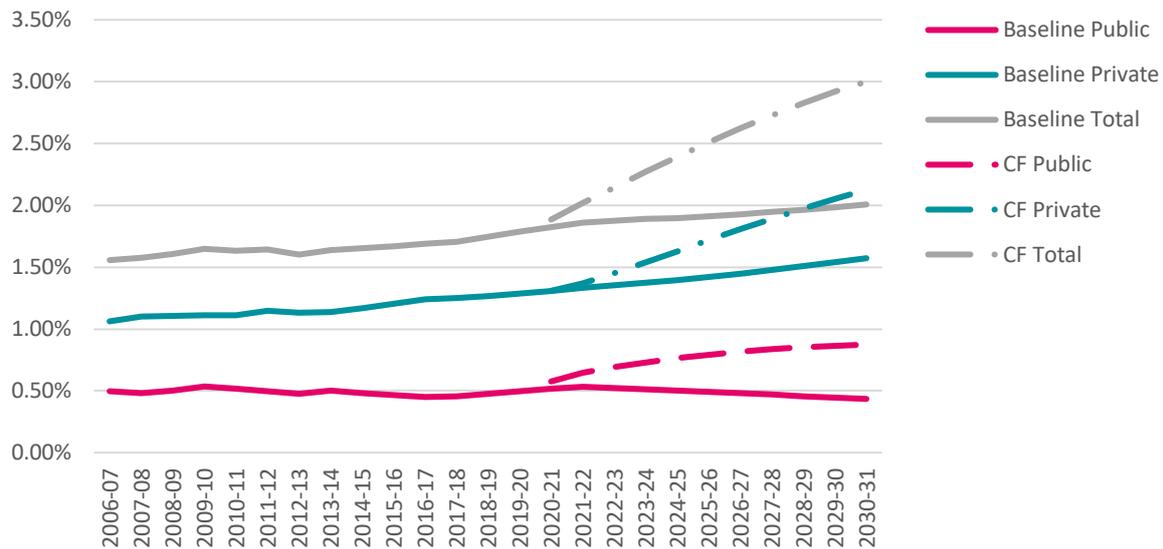
	Gov. Baseline Spending	Additional Spending Over Baseline	Total Gov R&D Spend
2020/21	11.7	1.4	13.1
2021/22	12.5	2.7	15.2
2022/23	12.7	4.1	16.8
2023/24	13.0	5.5	18.5
2024/25	13.2	6.8	20.1
2025/26	13.5	8.2	21.7
2026/27	13.8	9.6	23.3
2027/28	14.0	10.9	25.0
2028/29	14.3	12.3	26.6
2029/30	14.6	13.7	28.2
2030/31	14.9	15.0	29.9

Source: IPPR analysis using ONS 2019a, 2019b; OBR 2019a, 2019b

The following graph maps this out as an illustration. This suggests a substantive increase in public funding in R&D spend is needed to meet the 3 per cent target, increasing from 0.5 per cent of GDP to at least 0.9 per cent over the next 10 years.

**FIGURE 5**

**Illustration of how to reach 3 per cent of GDP by 2030/31**



**Source: IPPR analysis using ONS 2019a, 2019b; OBR 2019a, 2019b**

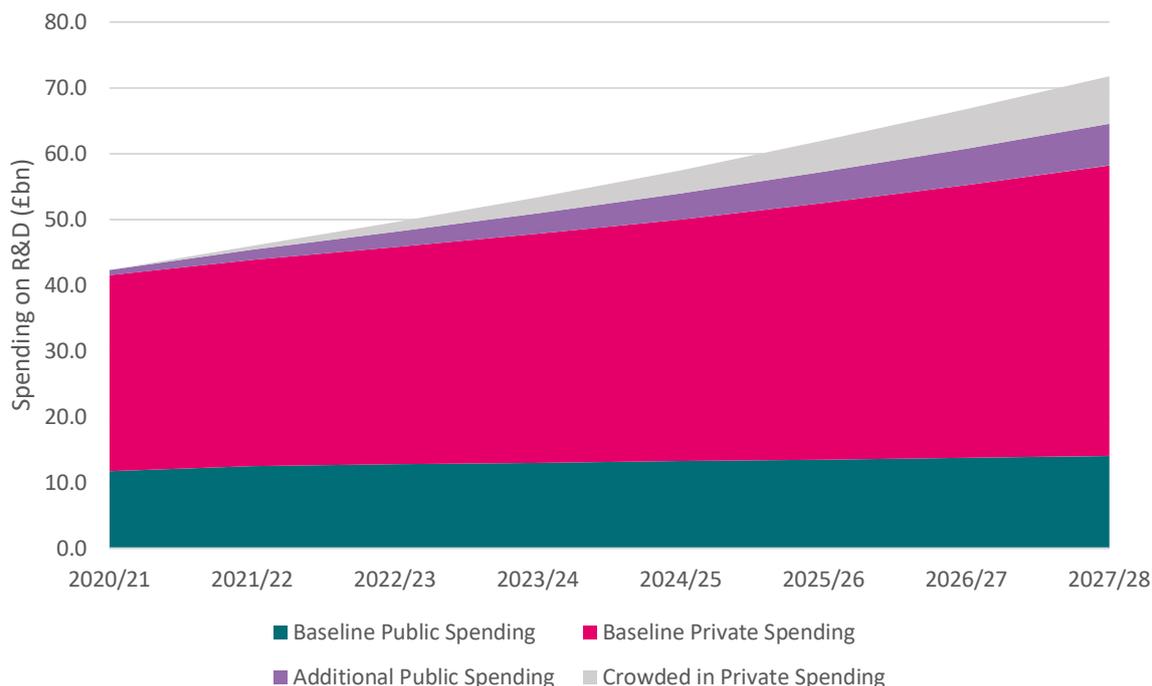
Based on the assumptions outlined above we would expect that this would lead us to reach 3 per cent of GDP as a proportion of R&D by 2030/31.

**Reaching a 2.4 per cent target by 2027/28**

Similarly we can use the model to estimate the additional spending required over and above the baseline. The investment challenge here is smaller but still requires substantially greater investment than in the counter-factual of current policy. As above, this analysis assumes the additional R&D spending is mission-based with substantial crowding in impacts.

**FIGURE 6**

**Illustrative spending paths per year to reach 2.4 per cent of GDP by 2027/28**



Source: IPPR analysis using ONS 2019a, 2019b; OBR 2019a, 2019b

**TABLE 3**

**Summary of spending path to reach 2.4 per cent of GDP by 2027/28**

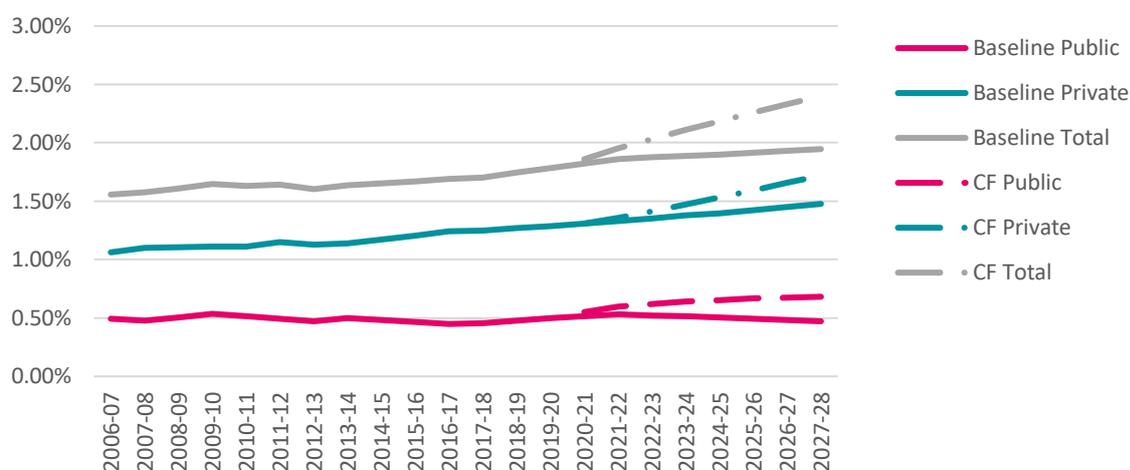
	Gov. Baseline Spending	Additional Spending Over Baseline	Total Gov R&D Spend
2020/21	11.7	0.8	12.5
2021/22	12.5	1.6	14.1
2022/23	12.7	2.4	15.1
2023/24	13.0	3.2	16.2
2024/25	13.2	4.0	17.2
2025/26	13.5	4.8	18.3
2026/27	13.8	5.6	19.3
2027/28	14.0	6.4	20.4

Source: IPPR analysis using ONS 2019a, 2019b; OBR 2019a, 2019b

The following graph maps this out as an illustration. This suggests a substantive increase in public funding in R&D spend is needed to meet the 2.4 per cent target, increasing from 0.5 per cent of GDP to at least 0.7 per cent over the 10 years

**FIGURE 7**

**Illustrative path reaching 2.4 per cent of GDP by 2027/28**



Source: IPPR analysis using ONS 2019a, 2019b; OBR 2019a, 2019b

**Key limitations**

There are various limitations around this modelling, in particular:

- there are large uncertainties around these crowding-in impacts and so the government would need to take stock over the decade and funding commitments may need to change accordingly as private sector investment could be more or less responsive than has been modelled here. Evidence suggests that the responsiveness will depend in part on to whether additional R&D spend is 'mission-based'
- the path that GDP will take is uncertain, the latest forecasts assume an orderly exit from the European Union. Similarly the path R&D spend will take in the baseline is highly uncertain, depending on choices the government makes (after 2021/22) and future private R&D spend growth could be affected by Brexit. Furthermore, increasing R&D spend could impact on the GDP path, particularly in the medium run. For simplicity, this dynamic is not modelled here.

**Financing the additional investment**

In 2016/17, £3.5 billion of R&D Tax Credit relief was claimed by businesses, according to the latest data available (HMRC 2018). IPPR have previously argued that such schemes subsidise investment which would have happened anyway (referred to as deadweight) and should be scrapped in favour of further direct investment in R&D spending (Jacobs et al 2017).

However even if they did this – the government must still be willing to invest further resources in later years if they are likely to be able to meet their respective R&D targets. Further, to increase the likelihood of the 'crowding-in' effect being realised any government should focus on R&D spending that is mission-based as outlined above.

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This paper was first published in November 2019. © IPPR 2019

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