INVESTMENT AND PROFITABILITY

A report for Vodafone

February 2019

CONTENTS

VODAFONE FOREWORD

Incentivising investment in digital infrastructure is vital to the UK's future. In a global economy powered by 5G and full fibre, it's critical that people and businesses in the UK have access to world-class mobile and fixed networks. 5G – the next generation of mobile communication – will transform how we live and work, enabling innovations like connected homes and workspaces, smart hospitals and smart cities. And full fibre will underpin 5G mobile services, enabling ultra-fast connection speeds of 1 gigabit per second, low latency and more reliable network performance than ever before.

To build Gigabit UK, we need a regulatory framework that incentivises investment. Today, just 4% of UK homes have access to full fibre, compared with 71% of homes in Spain and 89% in Portugal. If we are to meet the Government's goal for full fibre to reach all residential and business customers by 2030, we need to have the right framework in place.

We commissioned this report to understand better how UK regulation affects competition and investment in both mobile and fixed markets, and its impact on profitability. As the report shows, strong competition in the mobile industry has driven significant capital expenditure, despite low profitability. Looking ahead, however, it's crucial that mobile providers are able to invest in the 5G networks the UK needs

But as this report highlights, competition in fixed markets is lacking – especially when it comes to business and public sector customers. Under the current regulatory regime, a powerful incumbent provider earns outsized profits. This reduces its incentive to invest, resulting in a lower quality of service and fewer choices for customers. Indeed, in many parts of the UK, customers have no alternative provider to the incumbent operator. A different regulatory approach is needed if we are to ensure genuine competition that truly benefits the customer.

This report sets out a series of recommendations to facilitate competition and boost investment. For example, improving access to dark fibre – the currently unused sections of the fixed network – is critical. It's also important to ensure that the investment is focussed where it is needed – replacing broadband copper connections to people's homes with fibre, rather than overbuilding existing fibre connections to businesses. With the right framework in place, we can build a Gigabit UK that benefits everyone.

EXECUTIVE SUMMARY

Communications technologies have an important role to play in the UK economy

Communications technologies, in particular mobile communications, can support continuing productivity gains while improving quality of life. They can do this by increasing economic efficiency and allowing more flexibility for people in where they work and where services are delivered. However, the UK Telecommunications industry faces an investment challenge in the next decade to deliver these benefits.

Mobile network operators have invested consistently in the past and are expected to do so in the future

The mobile sector is coming to the end of an investment cycle to roll out fourth generation (4G) mobile equipment. However, the government has ambitions to move ahead quickly with the roll out of fifth generation (5G) technology – which offers a wider range of mobile applications – for business and public sector users in particular. In addition, the Government is seeking to further increase the geographic coverage of mobile networks into areas where demand is very low and the costs of mobile network roll out are high. While investment by mobile operators has delivered vastly improved services over time, recently there has been no corresponding revenue growth, making the investment case for accelerated roll out of 5G challenging.

There has been limited investment in fixed network infrastructure

In the fixed sector, investment in new broadband infrastructure has been limited since 2000, with increased broadband speeds being delivered by incremental upgrades to existing copper-based access networks. In other jurisdictions operators have been rolling out 'full fibre' broadband networks which offer significant advantages in terms of broadband speeds, quality of service and reduced operating costs. The Government wishes to see widespread roll out of 'full fibre' broadband networks in the UK to address this gap. Meeting the Government's objective for the fibre roll out to reach all residential and business customers by 2030, with the expectation of a degree of overlapping competitive roll out, will require significant growth in investment.

Competition drives investment in mobile networks, while lack of competition reduces investment incentives in fixed networks

The very different outcomes in mobile and fixed broadband – with mobile operators continuing to invest despite low profitability – but a lower investment on the fixed side, despite high profits, reflect competitive conditions. For mobile operators, investment is driven by the need to compete in the retail market.

In fixed markets BT has significant market power, meaning that competition does not effectively constrain profitability and hence there is less need to invest to maintain profitability. In large areas of the UK, there is no alternative fixed infrastructure operator, meaning that customers cannot move to another network, even if lack of investment means that the quality of service offered by BT is poor. Ideally regulation should result in outcomes which proxy those in competitive markets, both in terms of constraining profitability and providing appropriate

investment incentives. However, the outcomes in the UK fixed markets, for both mass market and corporate connectivity, suggest that regulation has not been effective, with BT generating significant excess profits while customers, particularly in those areas where there is no competition to BT, have a poor quality of service.

Regulation needs to be consistent with policy goals on investment

The Government's Future Telecoms Infrastructure Review highlighted the need to ensure regulation and policy were consistent in order to meet broader policy objectives. In the UK telecoms markets, unlike other regulated sectors, there has been little direct regulation of investment. Instead, regulation has had an indirect impact on investment incentives. This is the case both on the demand side, by affecting the expected revenues from new investments, and on supply side, by affecting costs of investment or by specifying quality standards.

Past regulation shifted profits from mobile to fixed

Over the last decade, regulation of 'termination rates' – paid by operators for calls made by their subscribers to subscribers of other networks – have been regulated such that the net payments from fixed to mobile have fallen significantly, increasing fixed profitability at the expense of mobile operators. This has reinforced the stagnation of mobile revenues over the last decade, despite huge growth in traffic and continued investment in mobile network technology and infrastructure.

Ofcom's current proposals will further shift profits from mobile to fixed

One case where regulation impacts on payments between different sectors of the industry is mobile 'backhaul', which uses very high bandwidth dedicated connections. The roll out of 5G networks will increasingly require mobile operators to purchase fixed fibre links, in place of microwave links, to deliver the bandwidth and latency required. The need to roll out dense networks of 'small cells' will increase demand for these services. BT currently has significant market power in the provision of these fibre links, meaning that in the absence of regulation, BT could increase the price of very high bandwidth dedicated connections above a competitive level.

Despite this, Ofcom is currently proposing to relax the price regulation of these services, allowing BT to price above cost without implementing the previous requirement for BT to provide 'dark fibre' access to the underlying network. This will have a limited impact on the incentives of BT and others to invest in full fibre networks for residential, but could significantly reduce the roll out of 5G technology by increasing the costs for each additional base station that is installed or upgraded.

BT may be able to leverage market power from the fixed into the mobile market

Furthermore, in the absence of effective regulation, BT's ownership of EE could allow BT to leverage its market power from the fixed market into the currently competitive mobile market, distorting the competition which has driven technology investments to date, further reducing investment incentives. The merger of BT and EE was cleared on the assumption that Ofcom would prevent such behaviour, including requiring BT to provide dark fibre access. Withdrawing this regulation – which was clearly signalled to the industry – without clear, evidence-based analysis

also increases regulatory unpredictability, further dampening investment incentives.

Increased prices do not automatically lead to increased investment

On the demand side, past experience shows that where BT has market power, there is no clear regulatory trade-off between allowing BT to increase prices and infrastructure investment. BT has generated £11.5 billion in excess profits since 2010, but BT's investment has remained broadly flat throughout this period. Only where BT faces competition from other operators leveraging new technologies has there been a strong incentive for BT to invest defensively, to compete in order to prevent a loss of revenues. Even in this case, a simple trade-off between prices and investment does not hold: BT has been over-rewarded in the past for making investments in areas where it faces some competitive constraint, with Ofcom taking account of demand 'risk' associated with the investment. In reality in competitive markets the true driver of investment is not necessarily increased willingness to pay, but rather the competitive risk associated with not investing.

Ofcom should consider:

(1) Reducing excess profits in areas where competitive investment is unlikely

Where BT does not face an effective competitive constraint, one lever to better proxy a competitive outcome for both prices and investment in new broadband networks would be to reduce the prices for services delivered using obsolete copper technology. Regulated prices would be set, not on the basis of replacing this technology 'like for like', but adjusting costs downwards to reflect the lower capabilities of copper networks compared to full fibre networks. While this is in principle the approach that BT uses in its regulatory financial statements, in practice BT uses the much higher costs of replacing its copper cable network with new copper cables. As well as incentivising further broadband roll out by increasing the incremental revenues generated by investment, an approach based on the value of the legacy network in a competitive market would also compensate those customers who do not yet benefit from full fibre broadband through lower prices. While lowering prices of legacy services pre-investment could arguably deter take up of new services, there are a range of regulatory levers that could be employed to increase incentives to invest, for example a 'copper tax wedge'.

(2) A balanced approach to regulation that addresses the needs of all customers today and is not solely focussed on future consumer fibre investment

Businesses and mobile operators rely on access to BT Openreach's existing fibre network to innovate and increase capacity without incurring high costs, for example to provide backhaul for 5G roll out. Regulation of dark fibre access could have a role to play in the interim transition from active regulation to passive regulation, by ensuring that customers of business connectivity products do not suffer higher prices before alternative networks emerge to act as an effective competitive constraint.

(3) Fully competitive spectrum award processes to deliver efficient outcomes and increase investment

Regulation also impacts mobile profitability and investment through spectrum awards. Allocation of additional spectrum should increase efficiency by delivering increased capacity and quality over existing infrastructure. However, spectrum award auctions can reduce mobile operators' profitability, particularly if some operators bid with a strategic intent – i.e. bidding prices up to weaken competitors by raising their costs – rather than because of the intrinsic value of spectrum. As such, when designing auctions, Ofcom should be careful to ensure that prices are likely to reflect intrinsic value alone – even if this may lessen auction receipts.

1 FUTURE REQUIREMENTS FOR INVESTMENT IN BROADBAND INFRASTRUCTURE

1.1 Full fibre fixed networks

1.1.1 Investment to date has focussed on upgrading existing networks

Residential fixed broadband services were introduced over copper-based infrastructure that had been built for another purpose. In the case of Openreach, the network was built largely under Government ownership to deliver telephone services. Virgin Media's network was built largely in the 1990s by a number of cable television franchises to deliver cable television and telephone services.

The introduction of ADSL technology on the Openreach network and DOCSIS technology on the cable network allowed for the delivery of broadband services, without the need to install new infrastructure to every home. Upgrades of this infrastructure, through a combination of improved technology (VDSL2 and DOCSIS 3.0) and new fibre infrastructure to replace some of the copper network, have allowed for increased speeds.

1.1.2 Significant investment in full fibre may be needed to meet future needs

There is a concern that future applications will be constrained by the bandwidths available on existing infrastructure, in particular the Openreach network (given cable network's ability to offer Gigabit speeds using DOSCIS 3.1 technology).

Given the time required to roll out full fibre networks across the UK, the decision on whether to deploy full fibre networks now or continue to upgrade copper-based networks needs to take into account customers' requirements in a decade's time.

The National Infrastructure Commission has provided estimates of the cost of a full fibre network roll out versus continuing to upgrade BT's copper network. Overall investment would need to be £25 billion higher to roll out full fibre, which means an additional £1.6 billion per year over 15 years.

The cost would be partially offset by reductions in operational expenditure, as full fibre access networks have lower operating costs and fewer faults than upgraded copper networks. (This reflects their 'passive' nature, i.e. there are no electronics between the central office and the customer, as well as the physical characteristics of glass fibre, i.e. it is not affected by water ingress). In addition, there are potential economies of scope with 5G mobile roll out and corporate connectivity services, which could help with recovery of the investment.

However, the currently limited nature of competition in fixed networks means that the incentives for moving to faster networks to win and retain customers is

diminished (in the case of areas where Openreach and Virgin Media compete) or non-existent (in areas where only Openreach has a network).

A number of other countries have moved to full fibre networks more rapidly than the UK, reflecting a combination of direct government intervention, better returns due to lower costs or higher prices, or a more limited scope for upgrading the existing copper-based networks. As a result, the UK has much lower full fibre penetration than many other developed countries. That said, in countries with widespread full fibre access, take-up of higher bandwidth services is often low.

1.2 5G mobile

1.2.1 Competition has driven continued investment in mobile networks

While UK fixed network structures still reflect 20th century technology, mobile networks have evolved rapidly. This is in part because fixed networks require high sunk costs to build connections to individual premises, and mobile networks do not.

Given the high degree of competition between the four network operators in the UK, each network operator has a strong incentive to invest to offer both retail and wholesale (i.e. MVNOs) customers improved quality of service. As a result, MNOs have invested to deliver increased quality of service in terms of coverage, capacity and speed since cellular networks were first launched in 1985. This investment has largely been in three areas:

- The number of base station sites has continued to grow, increasing coverage, speed and capacity available to end users;
- Operators have acquired increased spectrum holdings, principally through Ofcom spectrum auctions, allowing more capacity and enabling the introduction of new technologies; and
- Operators have continually invested in new technologies both in new 'generations' of technology (e.g. 4G technology) and upgrades within each generation.

1.2.2 The introduction of 5G will continue these trends

The introduction of a 5th generation of mobile technology, which is expected to co-exist with 4G technology for the foreseeable future, could deliver substantial additional capabilities.

Mobile network operators have already invested in additional spectrum to launch 5G services and are planning to roll out 5G equipment. However, delivering the full capabilities of 5G will require significant investment in new infrastructure, in particular a dense network of base stations to provide 'small cells' in urban areas.

Similarly, in the case of full fibre networks, the demand for the advanced capabilities offered by 5G networks is not yet well established. However, the existence of competing network operators should reduce the risk that investment fails to occur in a timely fashion. The experience of 4G, where the UK launch was

delayed due to the late award of spectrum, suggests that the risk of the UK falling significantly behind other countries is limited if the appropriate conditions for a rapid roll out are in place.

2 PAST INVESTMENT AND PROFITABILITY ACROSS THE UK INDUSTRY

2.1 Context

It is helpful to looks at investment trends in the industry to date to better understand the ability and incentives to fund future investment in 5G and full fibre.

We start by looking at past investment and the financial performance of the industry as a whole, and then drill down to sectors and companies in order to better understand the drivers of this performance and investment.

In particular, this shows that:

- Overall industry revenues have been broadly flat in the last decade, with increases in fixed revenues offset by a reduction in mobile revenues;
- Overall industry investment has also been relatively flat since 2000; and
- Mobile operators have consistently invested more of their available cash flow than fixed operators.

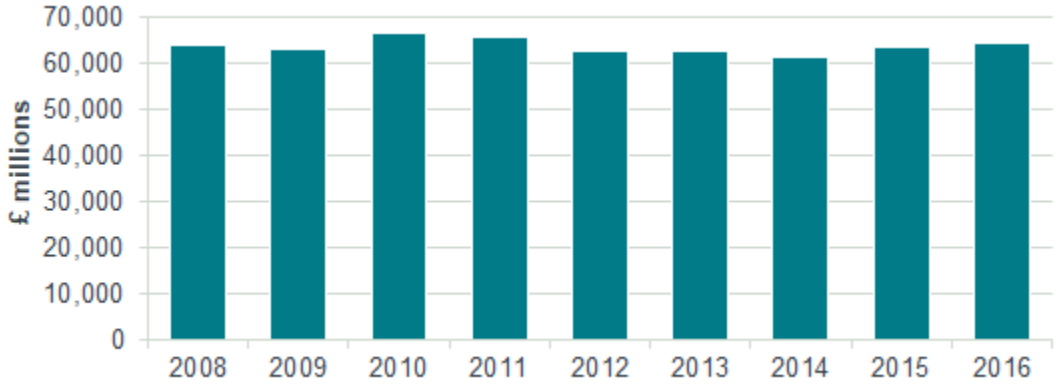
2.2 Overall industry performance

The financial performance of telecommunications companies is included in the UK 'Annual Business Survey' (ABS),[1] which publishes results classified by industry (according to the Standard Industrial Classification – SIC). The available data covers the period from 2008 to 2016. The global financial crisis (GFC) of 2008 reduced the income of customers and increased the financing costs of operators, due to higher risk aversion from investors. Over this period, there has been a strong migration of demand from narrowband (e.g. voice) networks to broadband networks for both mobile and fixed services.

The results show that overall turnover for the industry has been largely flat over the period.

[1] The advantage of the ABS is that it should be complete, i.e. include all companies including small companies. However, as the classification to industry is on a company basis, companies which provide communications services as a secondary activity may not be included and some non-telecommunications services provided as a secondary activity may be included.

Figure 1 Telecommunications industry turnover



Source: Annual Business Survey, ONS

This limited growth in turnover – despite significant growth in take-up of both fixed and mobile broadband over this period and increased data consumption – suggest a significant reduction in (quality adjusted) prices over the period. This may reflect a range of factors:

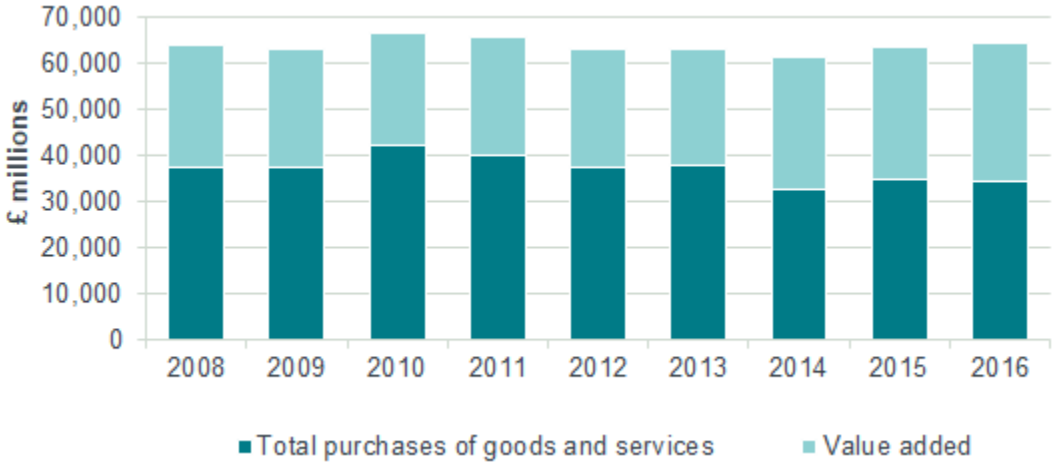
- Weak economic growth after the 2008 GFC, which will have reduced willingness to pay (i.e. an income elasticity effect), which in turn will have put pressure on operators to reduce prices;
- Productivity gains due to technological advances allowing operators to deliver increased quality and speed without significant increases in costs, which in competitive markets will feed through into lower unit prices; and
- Regulatory intervention leading to downward pressure on prices, e.g. mobile call termination rates, wholesale fixed access prices and prices for intra-EU mobile roaming.

One issue is that these turnover estimates include transactions within the industry, which can distort comparisons over time if there is consolidation or fragmentation in the market.[2]

Subtracting purchases of goods and services from turnover gives an estimate of 'value added' by the industry. This shows a similar trend to overall turnover, albeit with some growth in the later years, suggesting the relative stagnation of revenues is not an artefact.

[2] Some external wholesale transactions can become internal transactions following mergers and conversely higher industry fragmentation can increase the volume of wholesale transactions to deliver a quantum of output.

Figure 2 Industry 'value added'



Source: Annual Business Survey, ONS

Additionally, subtracting employment costs gives an estimate of operating cash flow, i.e. the cash generated by the industry before investment (purchases of capital equipment) and financing (cash raised from – or returns to – investors). Again the operating cash flow is relatively stable over time, but with some increases toward the end of the period, which we explore later in this section.

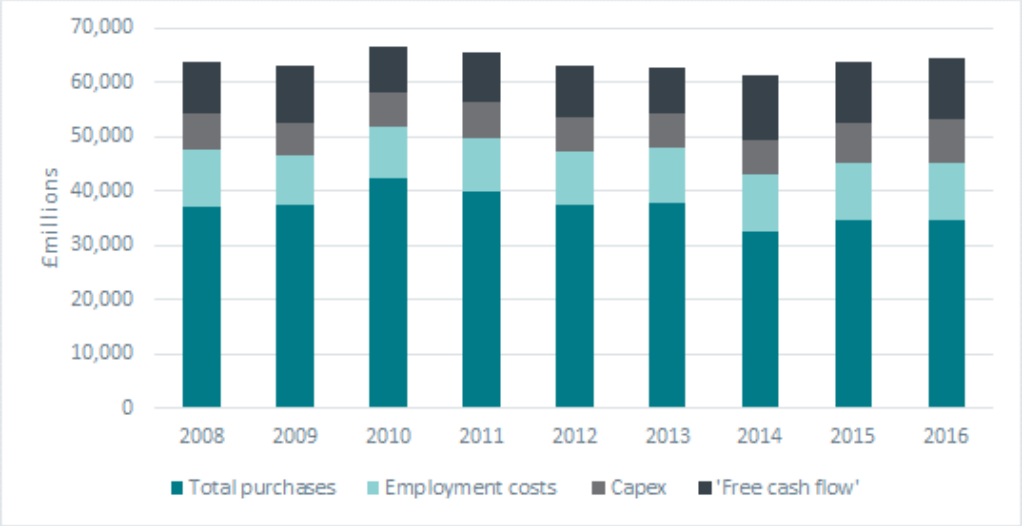
Figure 3 Industry 'operating cash flow'

Source: Annual Business Survey, ONS

We can then look at the capital expenditure[3] which can either be funded from operating cash flow if sufficient or from capital provided by investors.

[3] As spectrum is considered a 'non-produced' asset it is excluded from capital expenditure in official statistics.

Figure 4 Industry 'Free cash flow'

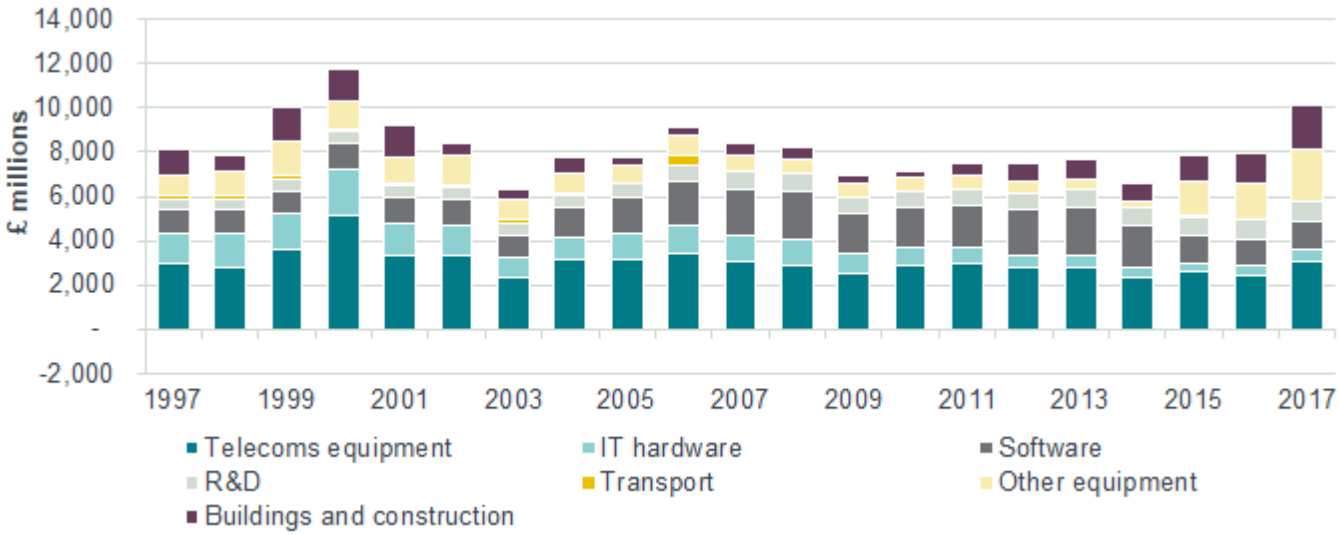


Source: Annual Business Survey, ONS

This shows that overall, the level of investment by the industry has been relatively stable and lower than the operating cash flow, showing that overall the industry has been able to return cash to investors. However, this may vary across the industry, with some companies/sectors acting as 'cash cows', while other individual operators may be raising additional capital in order to make investments in anticipation of future growth.

A further breakdown of industry capital expenditure is available over a longer time series from a separate ONS source.

Figure 5 Industry asset additions



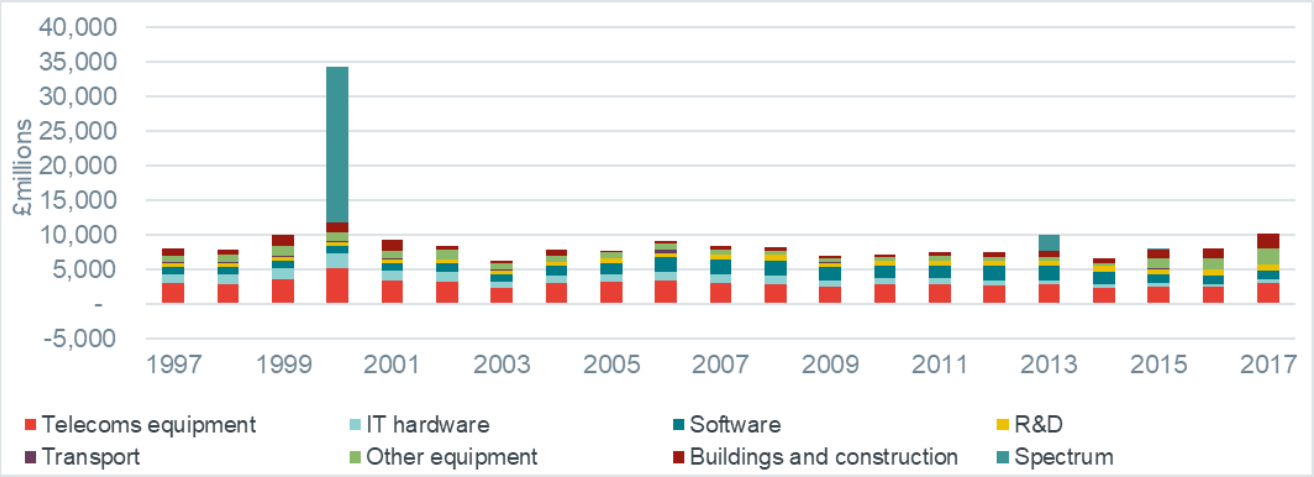
Source: Gross fixed capital formation data, ONS

Capital expenditure shows cyclical elements over the last two decades with peaks in 2000, followed by the dot com crash, some growth to 2006, which may be related to the growth of 3G mobile and ADSL/cable fixed broadband, followed by another

downturn after the GFC. There has been a clear increase in expenditure in the last year, with the level in 2017 higher than any year since 2000.

Adding one-off payments for spectrum by mobile operators to this time series (bearing in mind the timing of spectrum releases is set by Ofcom), the trend is dominated by the 3G spectrum auction in 2000, with another peak in 2013 reflecting the 4G spectrum auction.

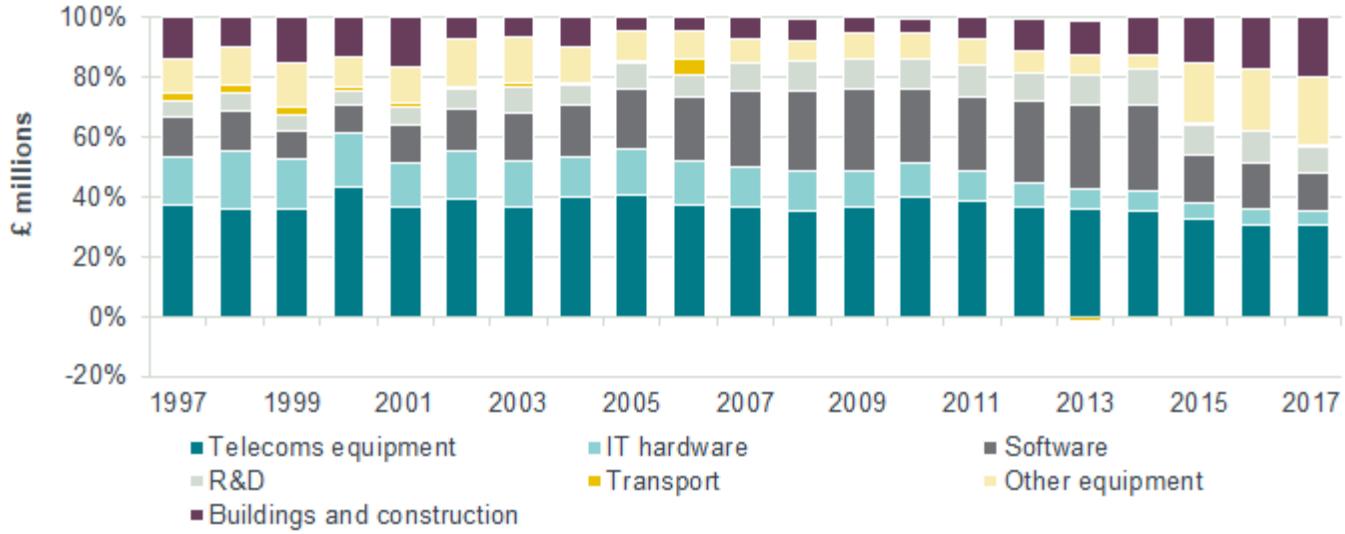
Figure 6 Industry asset additions including spectrum



Source: Gross fixed capital formation data, ONS

There have also been changes to the types of assets acquired over time (we have excluded spectrum auctions from this analysis given the sporadic nature of spectrum acquisition).

Figure 7 Industry assets additions by type of asset



Source: Gross fixed capital formation data, ONS

Over the period there has been a trend for reduced expenditure on IT hardware and increased expenditure on IT software. Expenditure on telecoms equipment as

a proportion of capital expenditure has been broadly stable. Expenditure on other equipment and on construction, i.e. infrastructure, has been at a relatively low level but has been a significantly higher proportion in the last three years.

This is broadly consistent with operators rolling out new infrastructure in the 1990s, in the case of mobile networks to support 2G networks and with the cable TV operators (who later consolidated to form Virgin Media) rolling out HFC networks. In the following years operators have 'sweated' these infrastructure assets, offering higher fixed broadband speeds over existing infrastructure and with mobile operators installing 3G and 4G equipment on existing sites. The increase in infrastructure investment in recent years will reflect in part further roll out of fixed network infrastructure, but also the need to upgrade both fixed and mobile infrastructure in order to deliver continued growth in quality of service.

2.3 Industry performance by sector and operator

While the whole industry data shows a consistent picture, there may be significant differences and trends within the industry, which do not show at the whole industry level.

More detailed information can be drawn from company reports and accounts. While this is not as complete as the ONS data, the concentrated nature of the telecommunications market means that by looking at the largest players, we should be able to understand the drivers of the trends shown at the total industry level.

We have focussed on seven operators: BT, Virgin Media, Vodafone, Telefonica UK, Three, TalkTalk and Sky. This will exclude a number of smaller operators, in particular a number of smaller infrastructure based fixed operators and some MVNOs.

As far as possible we have included only UK operations based on segmental information. We have also classified the operators into fixed and mobile, whilst recognising that this separation is not perfect. In addition, a number of the operators offer non-telecommunications services including pay television.

There are four MNOs in the UK: Vodafone, Telefonica UK, Three and EE:

- Telefonica UK and Three are effectively 'pure-play' mobile businesses.
- Vodafone has a significant fixed business service for both business users and residential users, but the majority of its revenues in the UK are derived from mobile services.
- EE is now a division of BT, and BT reports segmental information for EE. Prior to the merger EE also offered fixed broadband services.

There are two fixed operators with significant coverage of access networks, BT and Virgin Media:

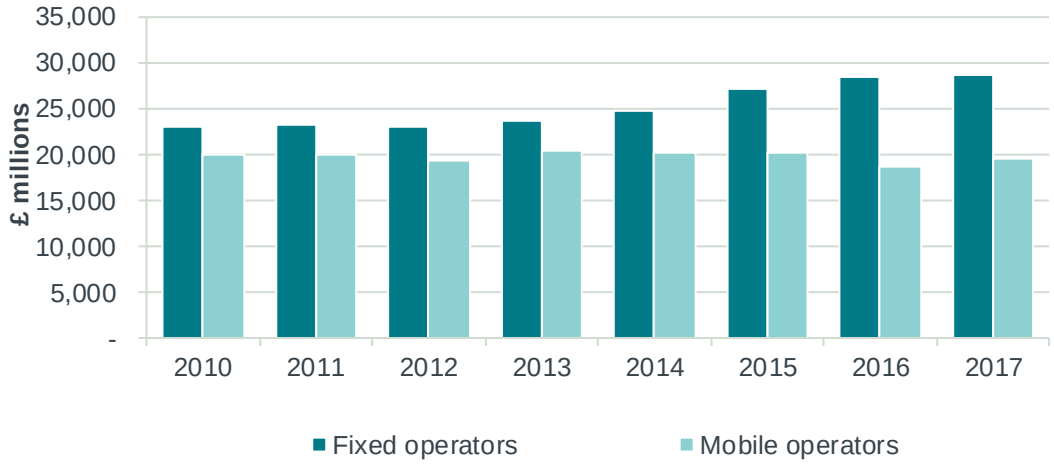
- BT offers a full range of telecommunications services and pay television, as well as mobile services through EE;
- Virgin Media offer pay television and mobile services through an MVNO arrangement;

In addition, TalkTalk and Sky also have significant mass market broadband and telephony businesses. Sky have a significant pay television business and offers mobile services through an MVNO arrangement.

2.3.1 Revenues

Looking at revenues reported by the larger operators shows significant growth in fixed revenues while mobile revenues are broadly static over the period.[4]

Figure 8 Industry turnover by fixed and mobile



Source: *Frontier Economics, from company financial statements*

Note: *Fixed operators are BT, Virgin, TalkTalk, and Sky. Mobile operators are EE, Vodafone, O2, and Three.*

The relatively static revenues from mobile services is consistent with Ofcom data showing that mobile ARPUs have been relatively flat over the period and with little growth in subscriber numbers, given the saturated nature of the mobile market.

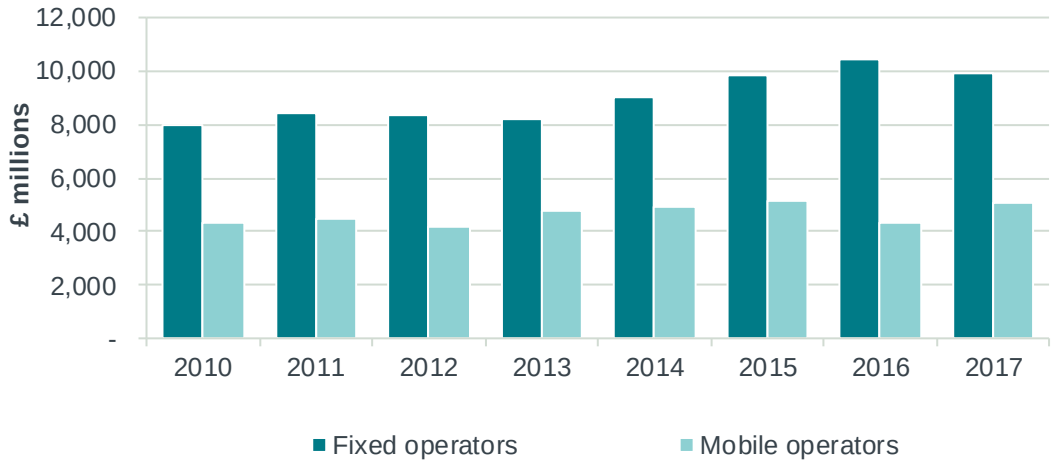
In the fixed market there has been growth in revenues reflecting continued increases in the number of fixed broadband subscribers over this period, growth in the high speed broadband subscribers who typically pay more than standard broadband customers and the growth of 'triple play' services where TV content is bundled with broadband and voice services.

2.3.2 EBITDA

Looking at EBITDA indicates to what degree increases in revenues are offset by operating costs. As noted above, revenues may be affected by wholesale transactions between the operators. EBITDA nets out these transactions (as one operators' revenues are another operators' costs).

[4] The BT/EE merger introduces a discontinuity into the series.

Figure 9 EBITDA by fixed and mobile



Source: Frontier Economics, from company financial statements

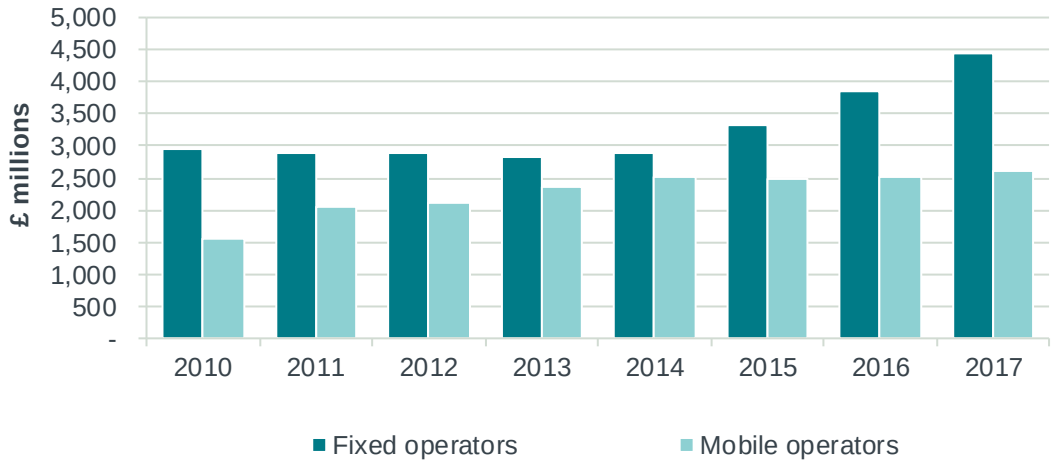
The overall picture is however similar to that for revenues, with fixed operators showing significant growth in EBITDA, suggesting that the increases in revenues have not led to proportionate increases in operating costs. At the same time mobile EBITDA has been broadly flat and a lower proportion of revenue than fixed, i.e. a lower EBITDA margin.

2.3.3 Capex

Looking at the expenditure on assets, i.e. capital expenditure, we see a similar pattern to that shown in the total industry statistics, broadly flat investment in fixed apart from an up-tick in the final year of the period, but with growth in investment by mobile operators as they rolled out 4G networks. The increased investment required to roll out 4G networks was offset by a degree of consolidation in mobile networks with Orange and T-Mobile merging to create EE. In addition, network sharing arrangements between Vodafone and O2 (CTIL and Project Beacon) and between EE and Three (MBNL) reduced the required investment to roll out 4G.

In the chart below we have excluded expenditure on spectrum licences by mobile operators from this data due to the sporadic nature of the investment. However, the payment of £2.3 billion by the operators in 2013 for 4G spectrum was broadly equal to the total investment on other assets in that period.

Figure 10 Capex by fixed and mobile

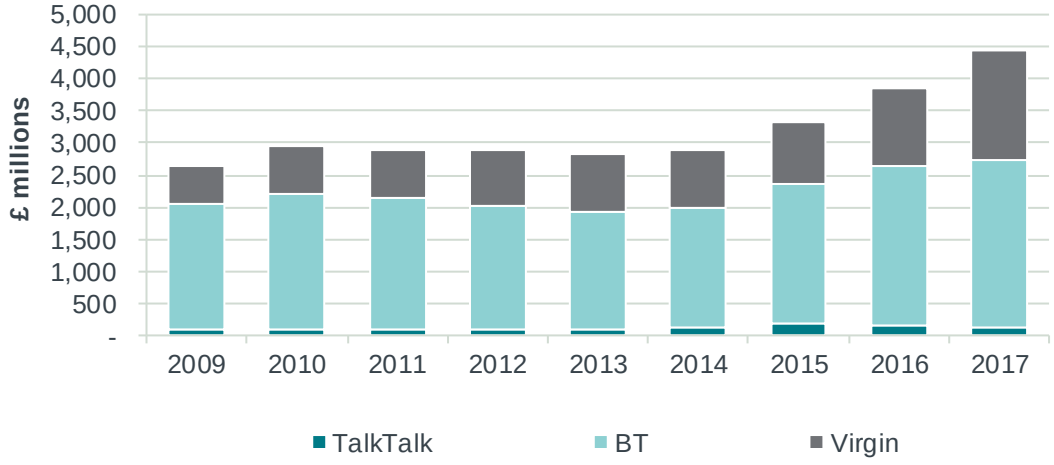


Source: Frontier Economics, from company financial statements

Note: All capex figures exclude investment made by Sky, as a large proportion of their capex is unrelated to telecoms.

Analysis of fixed capex confirms that the increase in the last year is largely driven by a significant increase in spend by Virgin Media, related to the extension of its footprint[5], with BT also increasing its expenditure in part to increase its roll out of fibre to the cabinet, in part funded by the Government under the BDUK programme.

Figure 11 Capex by fixed operator



Source: Frontier Economics, from company financial statements

2.3.4 Capex to EBITDA comparison

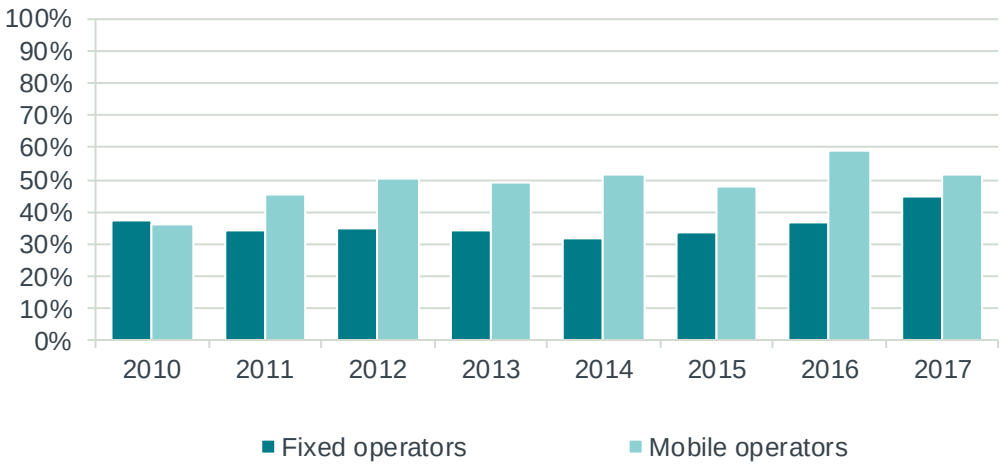
EBITDA takes no account of asset costs, either the recovery of the purchase cost of assets or the need to compensate investors for the capital tied up in these assets. Ideally we would choose a consistent measure of economic profit across

[5] Virgin's Project Lightning announced in 2015 that it planned to add 4 million homes to the network by 2020. However, the pace of roll out slowed considerably in 2018 with only 1.4 million homes connected by Q3 2018.

the industry, taking account of depreciation (the return of assets) and the cost of capital (the return on assets). However, this data is not readily available as most operators do not provide segmental information on asset values or depreciation charges. Even if it were available, differences in accounting policy, particularly with respect to long lived assets, could make comparisons of published information mis-leading.

Comparing EBITDA to Capex provides information on the sustainability of the business, to the extent that it shows the ability of a company to generate cash to compensate investors for past investments if the business is in a steady state, or provide information on the need to raise capital to fund current investments if the business is expected to grow. For the mobile operators, the exclusion of spectrum payments means that the proportion of EBITDA re-invested is understated (if we include the investment in spectrum, investment in 2013 was broadly equal to EBITDA).

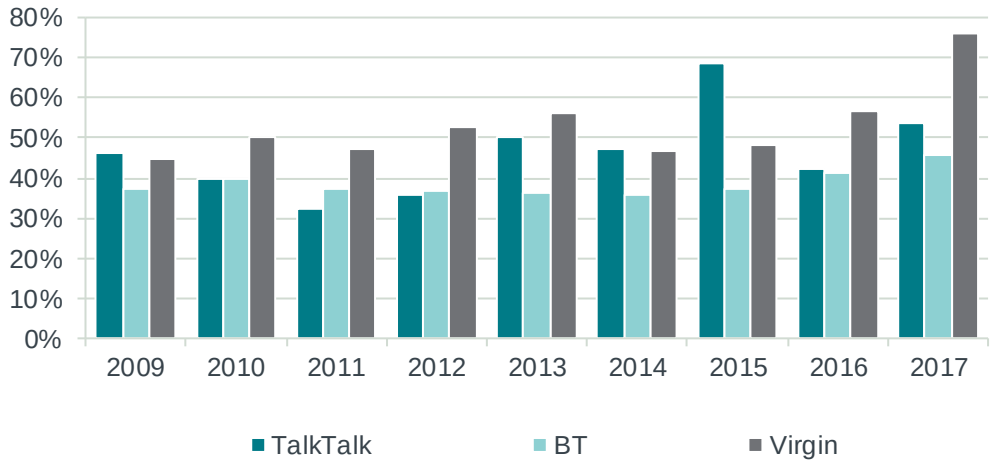
Figure 12 Capex as a percentage of EBITDA by fixed and mobile



Source: Frontier Economics, from company financial statements

The data suggests that all fixed businesses are currently in a position where EBITDA exceeds capital expenditure by a comfortable margin. For the mobile operators, capex is a higher proportion of EBITDA, and if we include the investment in spectrum, all of the cash generated by mobile operators in 2013 was re-invested.

Figure 13 Capex as a percentage of EBITDA for fixed operators



Source: Frontier Economics, from company financial statements

2.4 Conclusion

The level of investment in the UK telecommunications industry overall was relatively static from 2000 to 2015. The growth in investment by mobile operators rolling out 4G networks was offset by subdued growth in fixed investment. This has changed in the last two years with increased investment in fixed networks as well. This rise in fixed investment follows an increase in revenues and (EBITDA) margins due to higher take-up of broadband and a move toward higher-revenue superfast broadband services.

Despite high levels of profitability in BT's core regulated business throughout this period (as set out below), BT's investment was on a downward trend in most of the last decade, with the increase in the last two years presumably in part reflecting subsidised (BDUK) rollout. As a result, BT has been able to return proportionally more profits to investors than the other operators.

Mobile investment is consistently higher relative to EBITDA than fixed investment, even before taking account of spectrum fees. This, coupled with no significant growth in revenues and EBITDA suggests that it may be challenging to significantly increase mobile investment without certainty on future revenue growth. Ofcom should also take account of the impact of future regulation in mobile on operators' investment incentives, with past decisions such as the significant reductions in mobile termination rates in the last decade[6] reducing operators' profitability and hence the incentive to invest.

[6] While in competitive markets the impact of regulation which increases costs or reduces revenues may be partially offset by price rises, this 'waterbed' effect will generally not full offset the impact of regulation.

3 PAST FIXED REGULATION AND INVESTMENT

3.1 The framework for fixed telecoms regulation

In competitive markets prices are constrained by competition, as increasing prices above a certain level will lead to reduced profits due to customers choosing competitors. Competition also provides incentives for investment, with companies investing to maintain or improve service quality to compete for customers or to reduce costs over time in order to compete on prices.

Absent competition, a monopoly provider has incentives to increase prices above the level that would be seen in a competitive market and to also reduce investment below the level that would be seen in a competitive market. Regulation is designed to protect customer interests in the short term by ensuring prices are not excessive and in the longer term by ensuring sufficient investment to deliver services at an appropriate quality for end users. In utility markets, where there is little prospect of competition, regulators typically determine both the appropriate level of investment and the level of prices consistent with that level of investment, including a return on investment.

The fixed telecoms market falls between these two extremes, with the degree of competition varying between services and increasingly between geographies. However, in a number of product and geographic markets, Ofcom has determined that BT has significant market power (SMP) under the EU framework, i.e. competition is not sufficient to constrain BT's behaviour in terms of prices and investment.

Under the EU framework, national regulatory authorities such as Ofcom may impose obligations such as quality of service obligations, non-discrimination and price regulation on providers such as BT in markets where they are found to have SMP.

3.1.1 Regulation of investment

As noted above, in utility regulation, regulators generally directly determine the level of investment to meet the required quality of service. This investment is then being included in the regulatory asset base (RAB) which is used to determine prices. This provides investors in regulated companies with a high degree of certainty that they will fully recover their investments.

In fixed telecoms regulation, BT has been given a much greater degree of discretion over the appropriate level of investment, which may reflect a range of factors:

- To the degree that markets are contestable, BT has an incentive to maintain investment to compete on quality and price;
- Given the high rate of innovation in telecommunications technology and demand, it is difficult to determine the appropriate level of investment; and

- The current EU framework, drawn up in 2002 when broadband services were nascent, set out a relatively low (in current terms) minimum quality of service for fixed networks.

Only in recent charge controls has Ofcom introduced minimum quality of service requirements as well as maximum charges. In addition, in March 2018 the UK government introduced legislation of a universal minimum broadband speed, but this is only a binding constraint for a small proportion of customers. BT still has a large degree of discretion in deciding when to invest in technology which delivers service quality above this minimum required, for example in full fibre networks.

In a competitive market, a company's decision to invest in such technology is driven by the need to continue to compete. By enabling competition, Ofcom can incentivise BT to invest to compete with existing operators or potential entrants. However, where BT has market power because it faces limited competition it may choose not to invest, even where there is demand for more advanced services or where the investment would reduce costs. This is because BT faces a choice between two scenarios:

- An investment case, where it may generate returns which are capped by regulation and may potentially face some downside risk if customer willingness to pay is insufficient to cover investment costs;
- The counterfactual, where, if it maintains market power it can continue to generate a reasonable return under regulation.

Regulation affects BT's investment incentives through the potential impact on BT's future returns in both the investment case and under the counterfactual. However, this must be seen in a holistic fashion, in that it is the differential between the two cases that drives investment rather than returns for either case alone. Simply put, increasing profits will not lead to increased investments for an operator with market power if there is no dependency between the increase in profits and the desired investment.

3.2 Historic profitability of BT's regulated business

3.2.1 The regulatory financial statements and BT's cost of capital

In markets where Ofcom has determined BT to have SMP, Ofcom requires BT to produce Regulatory Financial Statements (RFS) and sets out publication requirements for a subset of the documents. The RFS are presented on a Current Cost Accounting basis (CCA), where assets are revalued each year to reflect changes in purchasing power and hence the replacement costs of assets.

The published RFS also allow stakeholders to monitor the effectiveness of regulation. For instance, if revenues far exceed costs, including the cost of capital, in a market where SMP has been found and regulation has been imposed, it could be indicative of issues with the effectiveness of the regulatory remedy that Ofcom has selected.

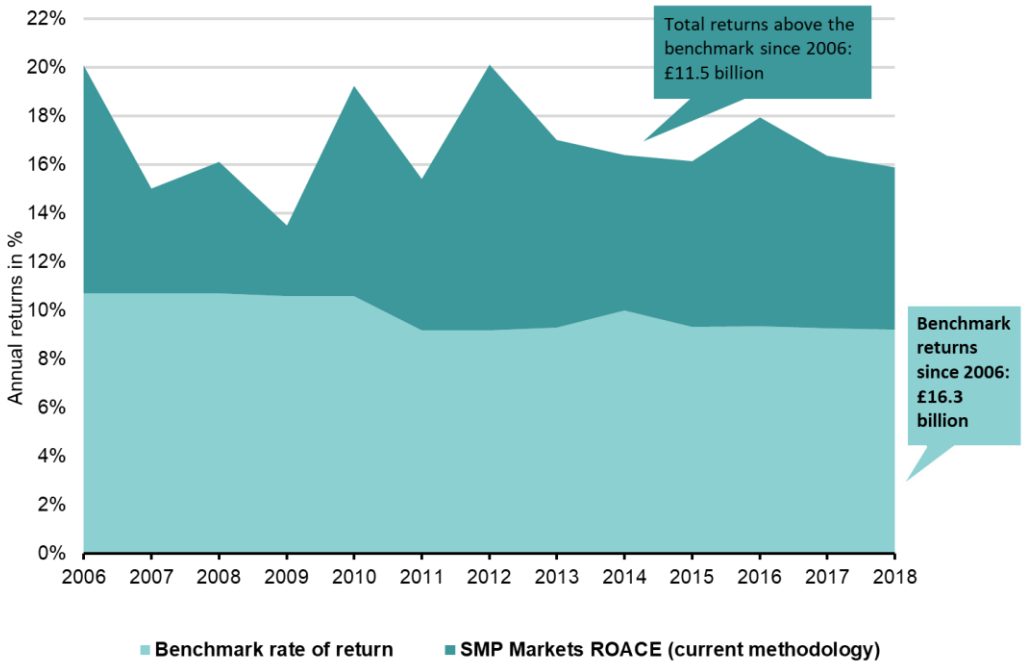
The costs referred to above include the regulated Weighted Average Cost of Capital (WACC). Periodically Ofcom determines the appropriate (regulated) cost

of capital for given charge controls[7]. This cost of capital therefore provides a benchmark of the return that BT's shareholders require to invest in the regulated business. In general, charge controls are set such that over time, prices are expected to converge to costs; this is equivalent in general to the Return on Average Capital Employed (ROACE) being equal to the determined (regulated) cost of capital.

3.2.2 Overall profitability

The overall level of profitability has remained significantly above the determined cost of capital throughout since 2006. While in the first part of the period this was largely due to charge controls inadequately constraining BT's prices to costs, in recent years Ofcom's charge controls have more effectively constrained regulated prices to cost. Instead BT's excess profits are increasingly derived from services where Ofcom chose either not to charge control prices ('pricing flexibility') to try and stimulate investment or to control prices at a level which reflects a 'hypothetical' cost above BT's actually incurred costs.

Figure 14 BT Total Regulated Profitability



Source: *Frontier analysis of BT RFS*

Note: *Historic data adjusted for changes in methodology*

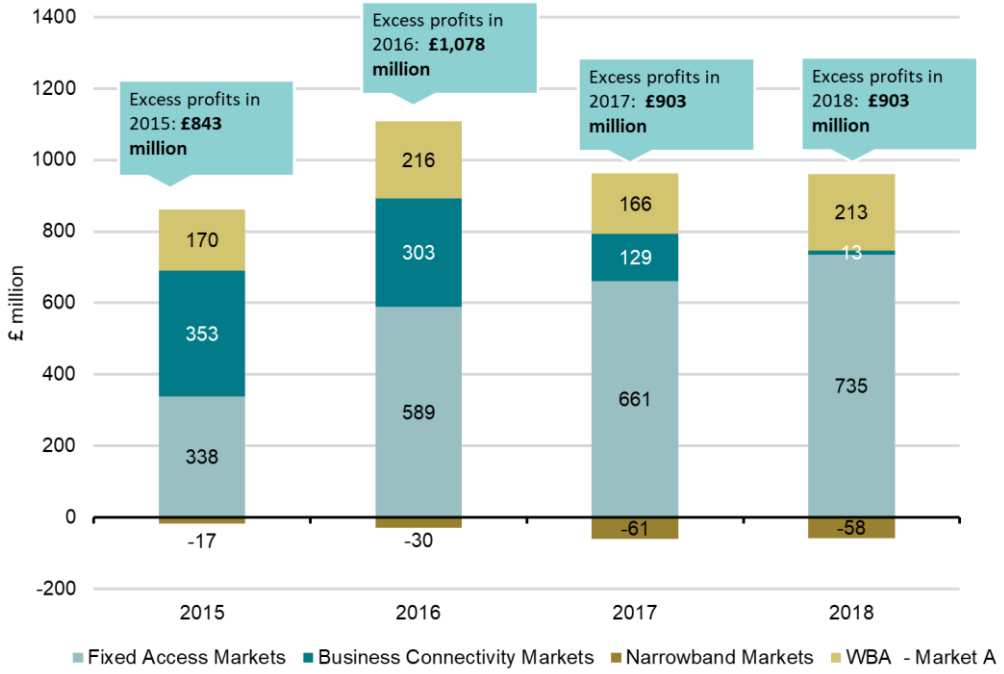
As shown in section 1, this high level of overall profitability did not result in significantly increased capital expenditure for BT as a whole, suggesting that the high profitability benefited investors rather than consumers.

[7] Compared to utilities, where the regulator both determines the level of investment but also provides a commitment that the operator will recover the investment, Ofcom sets a higher cost of capital. See for example http://www.ukrn.org.uk/wp-content/uploads/2018/06/2018-UKRN-Annual-WACC-Summary-Update-v2.pdf

3.2.3 Profitability by market

On a market basis, the majority of recent excess profits are generated by the Fixed Access market underlying the provision of mass market broadband and voice services. Excess profits reported in the BCMR market – which underlies services to large corporate customers and provides capacity for other network operators – have dropped considerably since the last charge control was introduced in 2016. Profits in the WBA market have remained strong despite the market only consisting of those geographies where there is limited competition to BT even at a retail level, i.e. where Openreach is closest to a utility unconstrained by competition.

Figure 15 Profitability by market



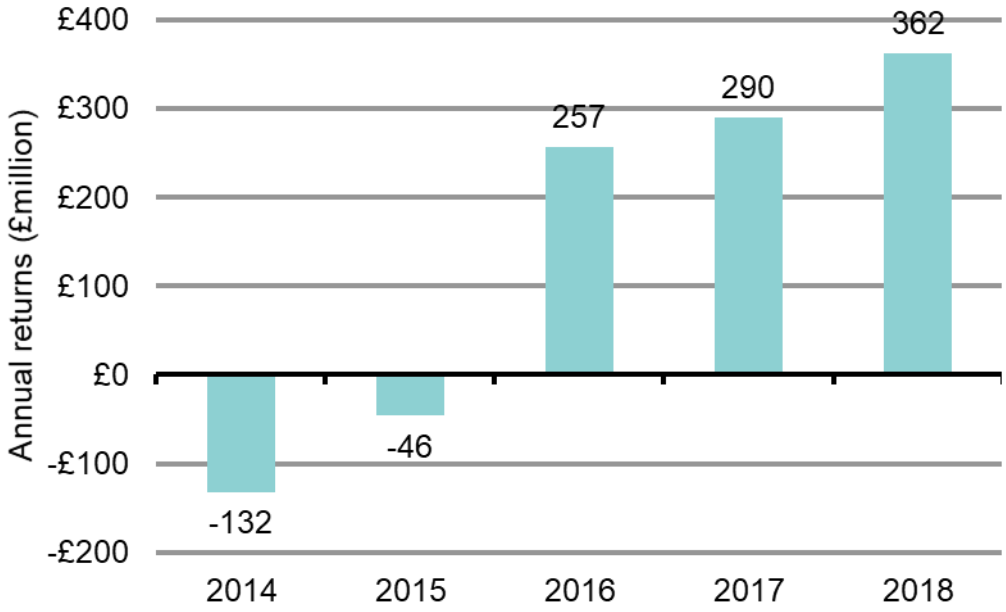
Source: Frontier analysis of BT RFS

3.2.4 WLA market

In the WLA market the growth in excess profits are largely driven by the 'Other WLA' category, which mainly consists of the GEA service revenues used to provide superfast broadband services and the corresponding incremental costs associated with the FTTC overlay network.

As shown below, until 2015 this service was reported as loss making, i.e. the revenues from GEA services were less than the cost of rolling out a FTTC overlay network to deliver these services.

Figure 16 GEA ('Other WLA') excess profits



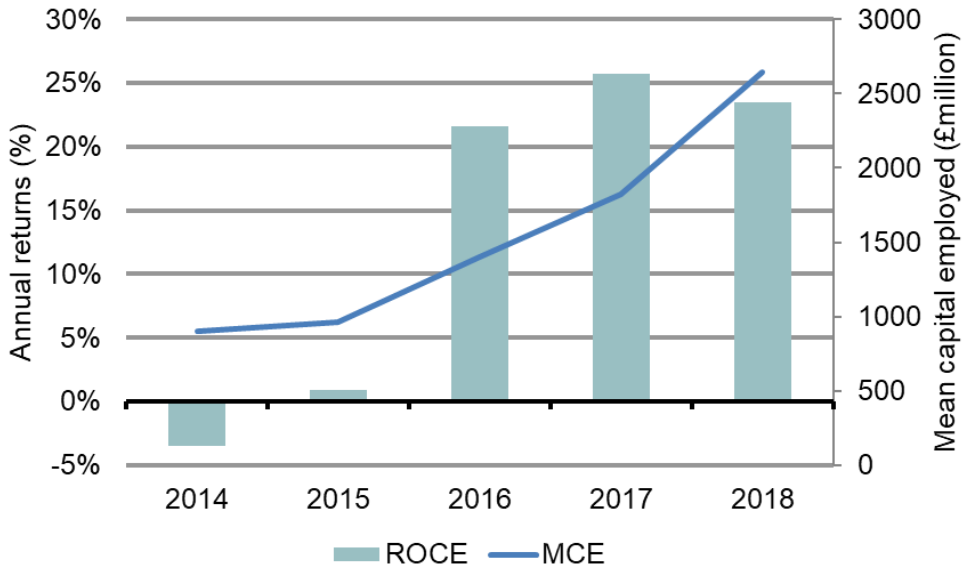
Source: Frontier analysis of BT RFS

Despite finding BT to have SMP for these services, during this period there was no charge control, with BT free to set the level of wholesale prices[8]. The justification of this approach was that the potential to make returns above the cost of capital was necessary to offset the potential downside risk if there had not been sufficient demand to make the investments profitable, the so-called 'fair bet'.

If we compared returns with the capital employed for these services in the chart below, it appears the majority of the investment to date took place once returns were above the costs of capital, i.e. when there was relatively little downside risk for BT when making these investments.

[8] Subject to a margin test to ensure sufficient margin between BT retail prices and the wholesale prices for competing operators to deliver services profitably.

Figure 17 GEA ('Other WLA') returns and capital employed



Source: Frontier analysis of BT RFS

This suggests that the risks, and hence the additional return required, could be (and were) mitigated by BT in terms of the timing of roll out, waiting until the business was profitable before making most investments.

In addition, the returns reported in the RFS for these services also does not take full account of the 'counterfactual', i.e. the impact on BT if it had not made the investment, but only looks at the revenues directly attributable to GEA services. There is likely to be significant defensive value in BT having made these investments in areas where it faced competition from Virgin Media, i.e. the revenues from other services would have been lower absent the investment, with GEA customers also being required to purchase other WLA subscriptions services (MPF or WLR).

Openreach would have an incentive to target their initial investment in geographic areas where it faced competition. For example, the body of European regulators BEREC have stated:

> *The strategic focus of incumbents in many [member states] on NGA rollout in areas where cable is already present has shown that incumbents deploy their NGA networks (VDSL, FTTP) in direct response to competition from the rollout of DOCSIS enabled broadband on cable networks.*[9]

To the degree that BT faced competition which would have reduced returns if it had not invested in FTTC, the returns shown in the RFS, which only show incremental revenues and costs for the FTTC services but exclude the impact on other services, would understate the benefits of the FTTC investment to BT. Even in the early years of deployment, where the RFS reports these services making a

[9] BEREC BoR (16) 171 6 October 2016 Challenges and drivers of NGA rollout and infrastructure competition

loss, the actual returns are likely to have been higher, compared to a counterfactual where BT lost market share.

Profitability of legacy copper service

While the GEA services make a considerable contribution to BT's overall excess profits, legacy services also make a large contribution, despite the charge controls applied to these services. To the degree that BT has an expectation that it can continue generating excess returns on its copper network in the counterfactual, this will dampen Openreach's investment incentives when assessing investment in full fibre networks.

These returns are also calculated using an asset base which reflects the replacement costs of the copper network. The rationale for revaluing assets in a contestable market is to proxy competitive costs, which would be based on costs to new entrants, i.e. the current costs of assets, not the cost that BT paid for assets in the past. However, it is clear that no new entrant would build a network similar to BT's copper network, as costs based on the replacement cost of this network are likely to overstate the competitive level of costs (adjusted for the increased quality offered by fibre networks). This means that the profits reported for legacy services may be understated compared to a competitive level of costs.

3.2.5 BCMR

The Business Connectivity Market(s) consists of high quality wholesale services which are used to provide services to corporate customers and which are used by operators, such as mobile operators, to connect equipment in their networks.

The reduction in profitability in the Business Connectivity Market is the result of two factors:

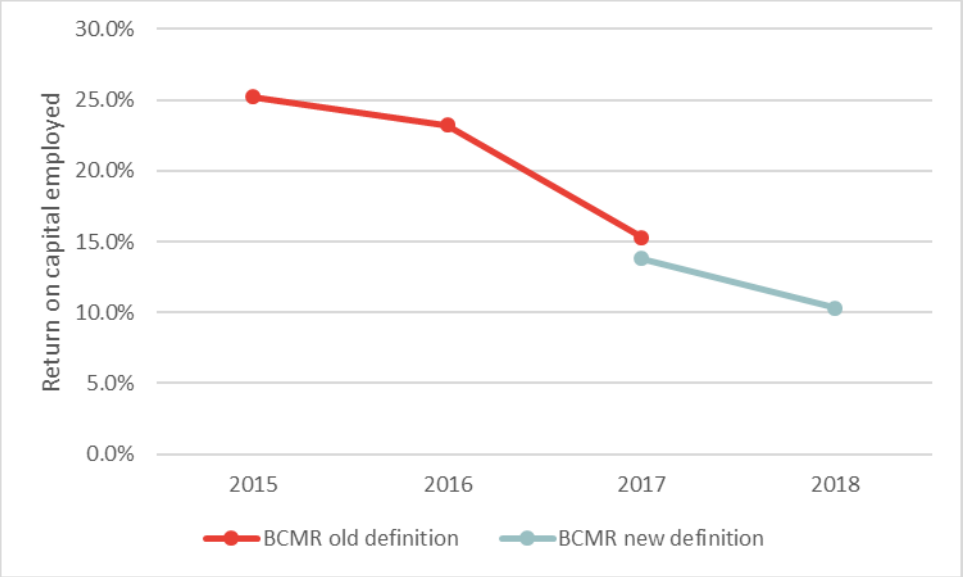
- A charge control that resulted in significant real terms price reductions following the 2016 BCMR decision; and
- A change in the services determined definitely to have SMP following BT's successful appeal of parts of the 2016 decision.

The first decision reflected the high level of profitability of these services at the start of the charge control, with significant price reductions in prices required to move prices toward costs over the three year period.

BT appealed a number of elements of both the product and geographic market analysis underlying Ofcom's finding that BT had SMP. The CAT found that Ofcom had erred in a number of areas but did not itself determine where BT had SMP. As a result of the CAT's findings, Ofcom introduced a provisional decision. This provisional decision removed the SMP determination from a subset of products and geographic areas and adjusted the charge control to reflect this removal.

As can be seen below, the returns in areas and products where SMP was removed, i.e. where there was a possibility that BT may not have SMP, were higher than those where Ofcom determined that BT clearly had SMP.

Figure 18 Returns on the Business Connectivity Market



Source: Frontier analysis of BT RFS

BT noted in its commentary issued with the accounts that if the price reduction required for 2018/19 were hypothetically applied to costs and volumes for 2017/18, BT's returns would be below their cost of capital. However, the X factor in the charge control, which requires a real term reduction in prices, reflects two factors:

- Expected efficiency gains over time to reflect forecast efficiency gains due to improved productivity and economies of scale as circuit numbers and bandwidth increases; and
- Where returns at the start of the charge control are significantly above the cost of capital, a glide path over time to normal returns.

Applying 2018/19 prices to 2017/18 costs and volumes does not take account of the expected efficiency gains and so would be expected to result in a lower level of returns than forecast when the charge control was set[10].

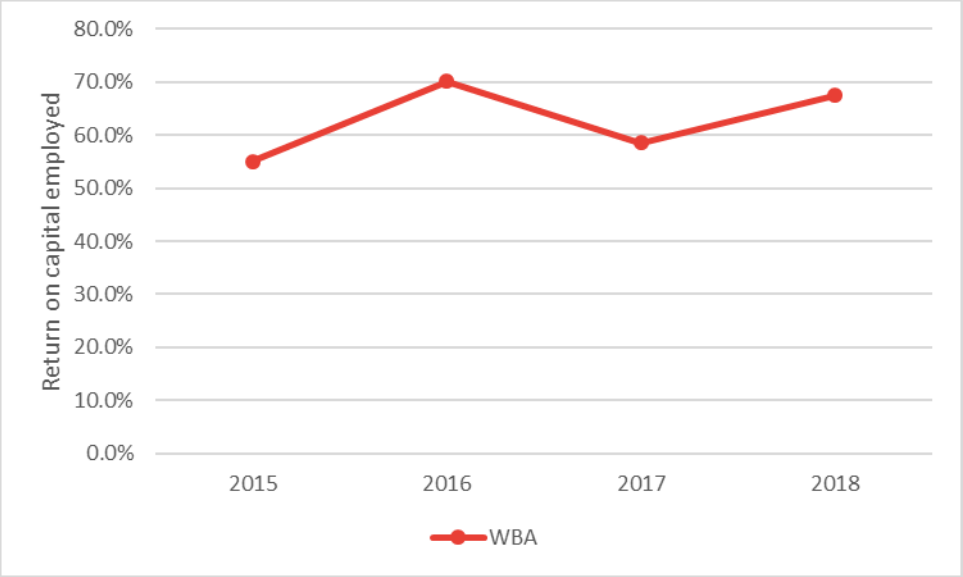
3.2.6 WBA Market A

In much of the UK, BT faces competition on broadband from companies such as Sky, TalkTalk and Vodafone using a combination of local loop unbundling and VULA to deliver services, collocating in BT exchanges to deliver services. In addition, Virgin Media provide infrastructure-based competition where it has a cable network. In a few areas access based operators are not present in exchanges, for example where the number of customers served by the exchange is relatively low. In general, Virgin Media does not serve these areas either. Ofcom requires BT to provide wholesale access to other operators, but due to the relatively low number of end customer served, the main retail competitors to BT (Virgin, Sky and TalkTalk) do not market to these customers.

[10] An unbiased charge control aiming to align prices with costs in the final year of the control would be expected to result in returns below the cost of capital approximately half of the time.

Effectively the competitive dynamics for these areas is similar to that of a utility in that there is little competitive constraint on BT. However, the returns at a wholesale level reported by BT for these customers are consistently extremely high.

Figure 19 WBA Market A returns



Source: Frontier analysis of BT RFS

Despite this high level of profitability, Ofcom decided in the recent WBA consultation to not impose a charge control on these markets. Given that BT can generate very high margins on these customers at the current level of quality without further investment, the incentives on BT to invest in offering higher quality of service to these customers appears limited as Openreach would only invest if it could earn even higher excess profits on these customers.

In addition, if it does not invest, there is the possibility that it will receive additional subsidies for increasing the quality of service for some of these customers either directly from government, for example through BDUK funding, or part of any Universal Service compensation mechanism.

This suggests that the withdrawal of regulation in areas where BT does not face competition is unlikely to be effective in incentivising investment. In addition, the incentives resulting from the interaction between regulation and any state aid for broadband investment needs to be considered when setting regulation.

4 FUTURE REGULATION IN THE TRANSITION TO FULL FIBRE

4.1 Context

Following DCMS's publication of the results of the FTIR, covering both fixed (full fibre roll out) and mobile (5G and enhanced geographic coverage), Ofcom has published a Strategic Policy Position covering full fibre broadband, but not mobile. Ofcom has also consulted on proposals for the Business Connectivity Market. The main policy measures include:

- Combining market reviews of mass market and high quality connections and allowing access to Openreach's infrastructure (DPA) to be used;
- Until the market reviews can be combined, setting the charge controls for high quality access to maintain the level of prices overall, although the expectation would be that this level would allow BT to earn excess profits;
- Not implementing Dark Fibre Access, except for some very limited cases; and
- Providing a degree of commitment on future returns for BT (a "fair bet") on new investments while using "anchor pricing" for legacy services to protect customers during the transition.

We review whether these policy measures are likely to achieve the Governments' and Ofcom's objectives, in light of the effectiveness of similar measures in the past (as described in Section 3).

4.2 Duct and pole access

While a form of access to Openreach's duct and pole infrastructure has been mandated since October 2010 (Passive Infrastructure Access – PIA), investment in competing networks to date has generally been based on new build duct and poles rather than access to Openreach's ducts and fibre. This suggests that under the prices and processes to date the cost of a 'greenfield' roll out has been lower than a 'brownfield' roll out based on PIA.

In 2017, Ofcom introduced a number of changes to both wholesale prices and processes which should lead to reduced cost of rolling out using DPA. In particular Ofcom aimed to provide equivalence of inputs in terms of process and costs, which should enable CPs to roll out full fibre networks using DPA at a similar cost to Openreach rolling out full fibre networks. This gives CPs the option to either roll out full fibre networks on a 'greenfield' basis, as they have to date, or on a 'brownfield' basis using DPA or some combination of the two. This should allow efficient CPs to match the cost to Openreach of rolling out a network.

4.3 Fair bet and anchor pricing

Openreach's investment decisions are complicated by the need to take account of the counterfactual if the investment is not made (in the case of other CPs the

counterfactual in new coverage areas is effectively zero value, i.e. no revenues nor costs). Ofcom then needs to consider the impact of regulation on both:

- Openreach's profitability if it makes the investment; and
- Openreach's profitability in the counterfactual[11].

Ofcom's approach can be broadly described as using 'anchor pricing' to determine costs for legacy services and then using the 'fair bet' principle to set prices if the investment is made.

Anchor pricing effectively sets the prices for legacy services using a hypothetical cost base which assumes that investment will not be made on more advanced technology. The cost base is used whether or not that investment is made, i.e. the baseline prices are independent of investment. This means that, in the absence of competition, the investment will be made if either: 1) the investment will reduce overall costs for equivalent services, or – more likely in the case of full fibre – 2) the investment will offer higher quality services which users will be willing to pay a premium for, which will cover any incremental investment costs.

When implementing anchor pricing, Ofcom has for some services applied a hypothetical ongoing network (HON) adjustment to BT's reported cost base, which is based on the assumption that BT would need to replace legacy equipment at the end of its useful economic life and increases the cost base accordingly compared to BT's actually incurred costs. However, accounting assumptions of asset lives appear to systematically underestimate the operating lifetime of equipment. This means that if BT chooses to continue to supply legacy services, rather than make investments in higher quality services, it does not need to replace existing equipment. If prices are based on the assumption that it will replace this equipment, returns are systematically biased upwards in the case that BT maintains legacy equipment rather than investing in new technology, reducing investment incentives.

The 'fair bet' principle recognises that Openreach may have market power after making the investment and as such may be regulated, i.e. it may be able to set prices above a level required to provide a reasonable return on investment. By setting out the principles under which Ofcom would regulate in the future, Ofcom is attempting to remove the 'hold up' problem where Openreach does not invest due to the risk that once cost are sunk, Ofcom could regulate at a level which will not fairly compensate investors for the risks they face. Ofcom suggests that a 'fair bet' requires the if Ofcom were to regulate more advanced services, such as those delivered over full fibre networks, then it would need to commit to only cap returns at a level above the cost of capital in order to compensate investors for the downside risks they face when investing, i.e. the risk that the incremental revenues Openreach could earn from investing would not cover the incremental costs.

While the principles set out by Ofcom would be reasonable in a monopolistic market[12], Ofcom's approach is complicated by the fact that the market is contestable. The contestability of the market has a number of impacts:

[11] Ofcom also needs to take account of the indirect impact of regulation on CPs investment incentives.

[12] Although in this case a utility type approach – where the business plan was agreed by the regulator in return for a commitment that investors would earn a reasonable return on approved investments – could be more appropriate.

- Actual investment may provide additional benchmark information on the competitive level of costs and expectations of customers' willingness to pay;
- Regulation, or the expectation of regulation, can alter the incentives for CPs that could invest in the future; and
- Competition or the potential for competition can reduce the level of profitability, particularly in the counter-factual, changing the incentives for Openreach to invest.

We discuss these points below.

4.4 Evidence from competitive roll out

Other CPs' roll out experience provides information on both the competitive level of costs and expectations of customers willingness to pay.

Unlike utility regulators in non-contestable markets, Ofcom seeks to set regulated prices to reflect a competitive level of costs, which would reflect the costs for an efficient new entrant. This should send the correct 'build or buy' signals to potential entrants. For example, in the 2018 WLA decision, Ofcom notes:

> *"We have a general preference for setting charges using the costs and asset values derived from the most efficient available technology that performs the same function as the current technology. This is often described as the modern equivalent asset (MEA) approach to pricing."*[13]

For a number of services, Ofcom has set charges based on 'bottom up' models of efficient networks. However, until recently the complexity of access networks and the absence of competitive build of comparable[14] access networks means that Ofcom has largely relied on information on Openreach's historically incurred costs set charge controls. In order to proxy a competitive level of costs, BT has been required to revalue copper cable and duct and pole assets on a current cost accounting basis (CCA) to reflect 'replacement costs'.

The situation is now different:

- A copper network is now clearly not the 'Modern Equivalent Asset' (MEA) and so BT's operating and replacement cost of a copper network does not reflect the competitive level of prices;
- Roll out by other CPs to date should provide information on the cost of a 'greenfield' roll out[15]; and
- Other operators using DFA should provide information on the cost of a 'brownfield' roll out.

Benchmarking the costs resulting from a 'anchor pricing + fair bet' cost base against benchmark costs, both greenfield and brownfield, should indicate whether Ofcom's proposed approach reflects the actual competitive level of prices in a

[13] Wholesale Local Access Market Review: Statement – Volume 2 Charge control design and implementation

[14] The roll out of HFC networks by cable operators in the 1990s was not closely comparable to the BT telephony network at this point.

[15] Albeit with the need to make some adjustments to reflect differences in cost between HFC networks and full fibre rollout and differences in the geographies covered.

given geography. If Ofcom's current approach results in higher costs for a given geography this could be the result of some combination of:

- The regulatory cost base underlying the anchor prices does not reflect the MEA, adjusted for differences in capability;
- or; the level of returns implicit in the 'anchor pricing + fair bet' cost stack are higher than required.

We look at the implications of these factors below.

4.4.1 BT's regulated cost base may not reflect the MEA

It is clear that BT's current copper based access network does not reflect the modern equivalent asset, in that no operator would choose in a competitive environment to build a new network with a similar structure and technology. Fibre to the premises is the MEA as it offers higher capabilities[16], lower operating costs[17] and the ability to reduce the number of network buildings[18].

Given this, in theory BT should adjust the valuation of legacy assets to reflect differences in quality and operating costs (an 'abatement'). In practice, applying such adjustments is difficult in all but the most straightforward cases. Valuing existing assets at replacement cost may be a reasonable proxy if the age of the assets is such that they are heavily depreciated, so will result in lower capital charges than a new build network based on MEA. However, if a new build network offers lower costs than the legacy network, despite the lower quality and higher costs associated with the legacy network, this may indicate that downwards adjustment to capital charges based on replacement cost is necessary. This could apply to either the copper cable or the underlying infrastructure or both.

Clearly this would result in Openreach not being able to recover the full value of the assets as currently stated in the RFS in the future. However, the nature of a CCA approach is that unexpected holding gains and losses may lead to under- or over-recovery, for example with Openreach benefiting from sharp increases in the cost of copper a decade ago leading to an upward valuation of copper cables. This risk is recognised in the higher cost of capital determined for Openreach than utilities (which are given an explicit commitment on recovery of asset costs). In addition, as noted in Section 2, BT has consistently over-recovered in the past against the regulated cost base, which could offset future under-recovery. Nevertheless, Ofcom may need to take account the impact of such a shortfall on overall industry investment incentives.

A further issue is that lowering the prices of legacy services through MEA adjustments, and hence the differential to higher quality full fibre services, could reduce the rate of transition to full fibre networks. If there are significant externalities or behavioural issues which slow the uptake of full fibre services[19] this

[16] GPON networks can offer much higher speeds and lower fault rates than copper based networks.

[17] Fibre networks are not affected by water ingress, a major source of faults and hence operating costs in copper based networks.

[18] Fibre networks deliver services over a far longer distance than traditional copper networks, reducing the number of network buildings required.

[19] For example, the fact that broadband is effectively an experience good, which means that consumers may undervalue the potential utility of faster broadband speeds until they actually upgrade.

could result in fibre investment and uptake being below a welfare maximising level. One proposed solution has been to apply a 'copper tax wedge' where the prices charged to customers are increased by application of a tax to incentivise migration, but the tax applied[20] means these higher prices do not feed through into higher returns for the incumbent.

4.4.2 Openreach's allowed returns may be excessive

Section 2 shows that Openreach historically makes returns significantly above its determined cost of capital. Ofcom's proposals on the pricing of high quality access would explicitly be set at a level allowing Openreach to earn returns above their cost of capital. To the extent that investors in Openreach believe this is sustainable in the absence of investment, the returns on full fibre networks would need to maintain this level plus a return of at least the cost of capital for future investment.

In addition, Ofcom has suggested that if it were to regulate full fibre prices, then investors in BT would need a return which is significantly greater than their cost of capital to reflect downside risks. The evidence suggests this risk does not appear to be related to customers willingness to pay for more advanced services. For example, Virgin Media's investors have been willing to invest in a 'greenfield' rollout network to deliver Gigabit speeds. Virgin Media has both cost and revenue disadvantages compared to BT: the cost of a greenfield rollout will be at least as great as a 'brownfield' rollout by Openreach, and as a new entrant in these areas Virgin Media will need to acquire new customers rather than simply migrating from existing networks. Despite these disadvantages investors must consider that customers are willing to pay sufficiently for advanced services to cover the costs of roll out[21].

4.4.3 Conclusion

Where Openreach has market power Ofcom's approach of setting anchor prices based on replacement costs (in some cases with hypothetical ongoing network adjustments) allows BT to earn higher returns on obsolete equipment then would be available in a competitive market. This then provides a disincentive to invest in upgrading the network unless any 'fair bet' applied by Ofcom allows BT the prospect of making at least the same level of excess returns where it does invest. Similarly, allowing Openreach to set prices for high quality access services above a cost based price, even where Openreach makes no further investment in fibre, may reduce the incentive to invest.

In contestable areas, applying a 'fair bet' is complex as this requires determining BT's returns in the counterfactual where its returns may have been expected to be reduced by the entry of alternative full fibre networks.

These two issues suggest that Ofcom's proposed approach may not lead to appropriate investment incentives for BT and other providers and may increase

[20] The tax could be hypothecated, for example used to subsidise fibre roll out, or

[21] An alternative explanation is that alternative investors are 'cherry picking' high value customers leaving BT with only low cost customers seems inconsistent with the extent of the Virgin Media roll out. While it is clear that Virgin Media will avoid the 'tail' of high cost rural customers, they are covering most of the urban population.

regulatory uncertainty. In particular, because assessment of the 'fair bet' relies on BT confidential information, the process is not transparent to other investors. Where Ofcom has employed similar approaches in the past in WLA and WBA markets, as set out in Section 3, there is strong evidence of high profitability for BT but little evidence that this has resulted in a greater level of investment than if prices had been set at a lower level.

4.5 Impact of regulation on competition

Regulation or potential regulation of Openreach can clearly have an impact on the investment incentives of CPs, as regulated prices for Openreach will affect the level of prices at which competitors can acquire and retain customers and hence the expected returns on their investment. Higher regulated prices will increase returns for competitors. However, to the degree that future regulated prices are uncertain, investors may require a higher discount rate to compensate for risk.

The price levels for the current approach of an anchor price for legacy service plus a fair bet for future investments are uncertain for external stakeholders, as they will be dependent on a range of variables such as the level of Openreach's investments, Openreach's prices in the period of any pricing flexibility and the costs of the underlying legacy network.

One approach which would offer more transparency would be to use external benchmarks on the cost of rolling out full fibre networks (as outlined above) to provide guidance on the level of prices at which Ofcom would intervene. To the extent that other operators may have cost disadvantages, for example due to lower economies of scale, Ofcom could determine explicitly whether to allow for these.

4.6 Impact of competition on BT's investment incentives

4.6.1 Areas subject to competition

In much of the UK, Openreach already faces competition from Virgin Media and will face competition from other CPs as they roll out full fibre networks. This will affect BT's returns in both the investment and counterfactual case. In particular, absent investment, Openreach may not be able to maintain prices consistent with its existing cost base, i.e. the anchor price may cease to be a binding constraint,[22] due to competition from other operators. In this case Openreach would make investments in full fibre if the incremental revenues between those in the investment case and the counterfactual based on a loss of revenues absent investment, were sufficient to provide a reasonable return on investment. In other words, the value brought by the investment needs to take account of the ability to defend existing revenues as well as the ability to generate additional revenues.

One approach when determining a fair bet once investment was made would be to identify any defensive value when determining if investments had made a

[22] This implies some assets would be stranded or equivalently the value of the assets would need to be written down to reflect the MEA.

reasonable return. However, this would further increase the complexity and lack of transparency of the 'fair bet' calculation.

An alternative approach would be to set a price ceiling in the case of investment based upon benchmarks or a bottom up model of competitive full fibre costs (which could be calibrated against the benchmarks). BT would then have a choice not to invest if it believed that competition from CPs would not reduce profitability to the point where it would be profit enhancing to make the investment.

4.6.2 Areas not subject to competition

In some geographies, the cost of roll out are such that there is little prospect of competitive entry. In this case the assumptions underlying Ofcom's approach to setting anchor prices – based on a counterfactual where Openreach can continue to maintain regulated prices on the appropriate regulatory cost base, and where investors need a return on incremental investment of at least their cost of capital to incentivise investment – may be reasonable.

However, in this case a more direct utility-based approach may be preferable, where Openreach make investments in return for a commitment that they will make a reasonable return on these investments.

4.7 Conclusion

The heterogeneous nature of prospective competition in the fixed market is likely to mean that the current regulatory cost base and pricing approaches proposed by Ofcom will perform badly in meeting Ofcom and the Government's objectives. The approach does not appear to send efficient pricing signals for Openreach in either case: those geographies where Openreach needs to invest to compete or geographies where competitive entry is infeasible.

An approach that should result in better investment signals for both Openreach and new investors, while protecting consumers, would base future price regulation on 1) information on the true competitive level of roll out costs of modern full fibre networks, rather than the aggregate cost of Openreach's legacy asset base, and 2) information on incremental investment to upgrade Openreach's network.

5 IMPACT OF REGULATION ON MOBILE INVESTMENT

5.1 Government objectives

To meet the Government's objectives on both geographic coverage and 5G roll out will require continued investment. Some 5G investment could be incurred as equipment is refreshed or will be necessary in any case to address localised congestion in the network to effectively compete. However, significantly increasing the geographic coverage of the network or building a network of 'small cells' to deliver increased capacity and quality using high frequency spectrum will increase the overall size of the networks and hence, in the absence of significant cost reductions, will increase the cost base and the level of investment required.

Given the lack of growth in mobile revenues in the last decade and the high proportion of profits already re-invested to maintain and upgrade the existing networks, the commercial and competitive case for significant incremental investment may be limited under the status quo.

While competition between mobile network operators has been the main driver of investment in the sector to date, given the potentially marginal nature of the future investments, regulation that affects the future business case for investment may have a significant impact on the ability to meet the Government's objectives.

5.2 Relationship between fixed regulation and mobile investment incentives

While mobile and fixed services are in separate markets, there are a number of inter-relationships between the two markets:

- Telephone calls may originate on a fixed network and terminate on a mobile network and vice versa requiring interconnection between networks;
- Mobile devices may use 'fixed' connections over WiFi for much of the time, for example when at home or in the workplace;
- Some customers may choose to buy mobile and fixed services in a bundle;
- Mobile services may provide a substitute for fixed services for certain customers; and
- Fixed networks increasingly provide inputs for mobile networks in the form of 'leased lines' use to connect base stations to the core network.

The payments resulting from interconnection between networks are regulated. A change in the basis on which these payments were set, following a 2009 EC Recommendation, resulted in a significant decline in the payments from fixed to mobile, which was only partially offset by a decline in the payments from mobile to fixed. As a result, the revenues and profitability of the mobile operators were significantly reduced by this change, which partially explains the poor financial performance of the mobile operators since 2009.

The case of call termination is exceptional in that all operators, both fixed and mobile, have market power irrespective of their size. For the other interactions between fixed and mobile there is a potential asymmetry in that a fixed operator, BT, has SMP while the mobile operators do not. In the absence of effective regulation, this could result in BT increasing its profits at the expense of the mobile operators and ultimately mobile subscribers. This increase in profits would not lead to any benefits to fixed subscribers but would simply increase returns to shareholders.

Fixed regulation to date has been effective in preventing such an outcome:

- Regulation of leased lines has ensured that mobile operators face appropriate 'build or buy' incentives for backhaul; and
- The availability of access to Openreach's broadband network has resulted in a competitive retail fixed broadband market allowing mobile operators to off load traffic to fixed broadband networks and allowing a wide range of retailers to deliver fixed mobile bundles[23]; and

The merger between EE and BT raises a further concern, that BT could leverage market power in the fixed market into the mobile market. This concern was raised by the CMA when approving the merger.

> *We assessed whether the merger could lead to input foreclosure of MNOs that compete with the merged entity in the downstream retail mobile market and that require fibre mobile backhaul services from the merged entity.*

However, effective regulation should prevent BT from distorting the downstream market, as recognised by the CMA:

> *The role of regulation is therefore taken into account where relevant in our assessment of BT's ability and incentive to cause harm to rival MNOs by pursuing various foreclosure strategies in relation to Openreach products and services. In particular, while charge control regulation can be seen as limiting BT's ability to foreclose, the situation for non-discrimination obligations is more nuanced […]. What matters ultimately is whether the regulation is effective in addressing the merged entity's ability and/or incentive to foreclose.*

The CMA's assessment was based on the actual and prospective regulation of Openreach in 2015-2016, at which point Ofcom was applying charge control which aimed to align prices with costs and was consulting on proposals to maintain this approach and introduce dark fibre access.

5.3 Ofcom's latest proposals on fixed regulation will negatively impact on mobile operators

Ofcom has proposed to reduce regulation on fixed services, both mass market and high quality services, where there is potential for infrastructure-based competition.

[23] Whether this is mobile operators using access to the Openreach network to deliver bundles or other players combining regulated wholesale access to both the Openreach networks and commercial access to mobile networks to deliver bundles.

In particular Ofcom has proposed to not implement the requirement for Openreach to provide 'dark fibre' access, except in very limited cases and to allow the prices for active leased lines to be set above cost.

Ofcom's proposals risk reducing investment in mobile in two ways:

- Directly as the higher cost of backhaul, compared to a counterfactual where cost based dark fibre backhaul is available, will reduce the returns from incremental investments in base stations by non-BT network operators and as such reduce the overall level of investments; and
- The greater ability for BT to distort competition in mobile retail markets will have a dampening effect on overall investment in mobile networks.

5.3.1 Increased backhaul costs will reduce investment in base stations by non-BT mobile operators

When deciding on an investment project, such as the investment in new base stations, mobile network operators will compare the returns on this investment by comparing the future costs incurred, both capital expenditure and operating costs, with the benefits in terms of increased revenues compared to the no investment case. If the returns exceed a hurdle rate, then the investment will be made.

If the costs of backhaul (generally opex) increase, either because an active service is set at a high price or a more efficient dark fibre services is not available, forward looking costs will increase. There is no reason to expect an offsetting increase in forward looking revenues and as such expected returns would decrease. This means that some investment, which would have been made if Ofcom had continued its previous approach to regulation, will be lost.

While it could be argued that in the long run competitive entry in the fixed market will reduce the cost of backhaul and thus increase the returns on investment, this is uncertain. This uncertainty could then lead to mobile operators taking account of the real option to defer investment until there was more clarity on the availability of competitive backhaul. This could, if anything, lead to a lower level of investment until there is certainty on the level of competition and hence long run prices.

5.3.2 Effect of leveraging market power

BT has an incentive to leverage market power in the fixed market into the mobile market. Effective regulation should constrain BT's ability. However, a relaxation of fixed regulation would not have the same impact on EE as on other mobile operators, which could distort competition.

This could take place at a number of levels. For example:

- Allowing EE to make investments that would not be viable for other operators due to high wholesale charges; and
- Providing preferential access to the Openreach fixed network for customers also buying mobile services from EE.

While legal separation of Openreach restricts the ability to actively co-ordinate the behaviour of Openreach and downstream divisions, the common ownerships of Openreach and downstream divisions can result in a similar outcome.

For example, the case outlined above, assessing an investment in the roll out of further base stations, only applies to non-BT mobile operators. From BT shareholders' perspective the price charged internally for backhaul to EE is irrelevant as it is a transfer between two business they own. The returns to these investors, which should be the deciding factor in management's investment decisions, will be the same independent of the level of wholesale prices charged to the other MNOs. This means that while an increase in Openreach's backhaul prices will reduce the level of investment by EE's competitors, it should have no impact on EE.

In addition, the uncertainty around the potential for competitive entry if prices are set higher will not lead EE to defer investment as it may to a degree for the other operators. This is because EE is very unlikely to purchase from future competitors to Openreach and will not be affected by any reduction in prices by Openreach following competitive entry[24].

The ability of BT/EE to make investments others would not find profitable, as a result of a relaxation in regulation that increases prices, would serve to reduce the level of competition. This could have a second round effect, with BT/EE itself being able to gain competitive advantage at a lower level of investment than in the counterfactual, leading BT to also reduce investment, lowering the overall level of investment by all players.

A similar dynamic could allow BT to offer bundles of fixed and mobile services at prices that mobile competitors, reliant on access to the Openreach network at wholesale prices, cannot profitably match. Again this could reduce competition industry wide and hence dampen investment incentives.

5.4 Regulation of mobile

The history of the mobile sector in the UK is clearly different to that of the fixed sector, in that there was never a statutory monopoly on mobile services, with Vodafone and Cellnet (now O2) being licenced at the same time. In addition, potential competition issues in the growth phase of the sector were largely addressed through market entry, i.e. issuing more licences, rather than intervention in wholesale markets.

However, despite the high level of competition, the profitability of mobile networks is still dependent to a greater degree on sector specific regulation than many other sectors of the economy. This regulation includes:

- Regulation which determines the structure of the industry, for example spectrum licencing, merger control and control of network sharing agreements;
- Regulation which impacts on the cost of key inputs, in particular site acquisition and rental, backhaul and spectrum pricing;
- Coverage obligations attached to spectrum licences;

[24] In 'real options' terms, the increased in uncertainty does not increase the value of the option to defer.

- Direct price regulation of interconnection and roaming services; and
- A range of consumer protection measures such as number portability or restrictions on commercial offers.

Given the competitive nature of the market, the impact of changes in regulation on profitability and hence on investment incentives, is complex.

5.4.1 Demand side regulation

In general, regulatory intervention in retail and wholesale markets has had the effect of constraining operators and hence reducing revenues and thus profitability. This will have a dampening effect on investment incentives.

Reductions in revenues for a service, for example due to reductions in mobile call termination rates, diminishes profitability and would be expected to lower incentives to invest to serve customers. This can be somewhat mitigated by increases in prices for other services. This is known as the waterbed effect, but it is likely to be partial. As such, the reductions in mobile termination rates in the last 10 years will have lowered the profitability of mobile operators, contributing to the stagnation in margins.

Similar reductions in profits may result from regulation which constrains the operators' ability to innovate in offers to users in retail markets, even if it does not directly affect prices. This may be particularly important during periods where there is a high rate of innovation, which could be expected following the introduction of 5G networks and use cases.

5.4.2 Supply side regulation

The impact of regulation on the supply side will be mixed depending on the degree to which it impacts on variable costs (i.e. costs which may vary between different scenarios) or fixed costs (i.e. costs which will be incurred in any reasonable scenario).

Marginal costs

Regulation which reduces marginal costs, for example reducing the costs of building new base stations, should be partially passed through to customers in terms of lower prices and higher quality as well as a higher level of investment[25].

Examples of regulation which can reduce marginal costs include changes which may directly reduce input costs, such as site rental and backhaul, or changes which may increase efficiency, such as allowing higher masts (allowing greater coverage from each site), releasing more spectrum (allowing greater capacity at each site) or allowing increased network sharing.

The regulation of fibre backhaul may be particularly complex due to the inter-relationship between mobile and fixed regulation. However, as noted above, to the degree that converged fixed mobile providers such as BT/EE have market power

[25] To the degree that they also reduce fixed costs, they should feed through to an increase in profitability

in the provision of backhaul services, the regulation of backhaul has a dual purpose:

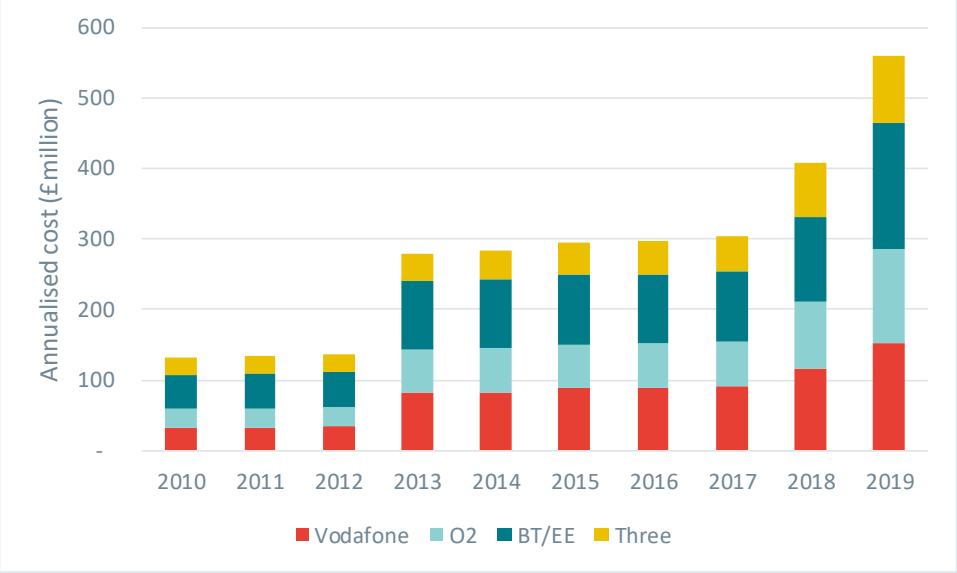
- Prevent the exercise of market power by increasing prices above a competitive level, the result of which will be passed on to mobile customers through higher prices and a lower quality of service
- To prevent distortions in the mobile market due to discrimination between the fixed operator's own mobile business and its competitors.

Fixed costs

In theory, investment which affects fixed costs (costs which do not vary with the level of demand) should not have a direct effect on future consumer prices or on investment incentives.[26]

For example, spectrum pricing, which is a fixed cost once spectrum is acquired, independent of how the spectrum is used, should not have an impact on investment incentives. However, over time the cost of spectrum used by UK MNOs has increased dramatically, both because more spectrum is being used, and also because Ofcom has increased the annual licence fees for existing spectrum.

Figure 20 Mobile industry annualised spectrum cost



Source: *Frontier Economics*

Note: *Spectrum auction payments annualised using the methodology set out by Ofcom in the 2018 ALF consultations*
2100 MHz spectrum revalued to reflect Ofcom's estimate of market value in MTR decisions
2019 includes Ofcom's proposals for revised ALF payments

Coverage requirements attached to spectrum licences may be another 'hidden' fixed cost as, to the degree that the coverage requirement would not be achieved without intervention, the cost will be incurred by the network operators but netted off the payments for spectrum.

[26] Unless they affect the overall viability of the business.

This increase in costs will reduce the level of profitability of UK operators, which as Section 1 suggests is already relatively low. This may affect investor sentiment and hence capital expenditure budgets, even if this has no impact on the profitability of any particular investment. For example, where international investors are choosing where to invest they may direct capital toward markets which have demonstrated a higher level of profitability in the past, independent of the details of individual project business cases.

5.5 Conclusion

Regulation can have a significant impact on investment, both directly and indirectly, and hence profitability.

Regulation which directly affects the expected future revenues of customers or incremental cost will influence investment incentives. Ofcom should carefully consider the impact on investment of such regulation as part of the cost benefit analysis of any changes in regulation.

A further effect is the possibility for operators with market power in the backhaul market to leverage this power into the mobile market. By distorting competition, this would also be expected to reduce the level of investment.

In theory changes in fixed costs, such as spectrum, should not affect the business case of any particular investment. However, investors may use overall profitability as an indicator of the attractiveness of the UK market and as such could constrain investment if profitability is low. Ofcom could take account of this mechanism when assessing the impact of any regulation or policy which could have a significant impact on fixed costs.

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