Review of Output Change in Imperfectly Competitive Markets (OCICM) Parameter for Transport Appraisal Guidance

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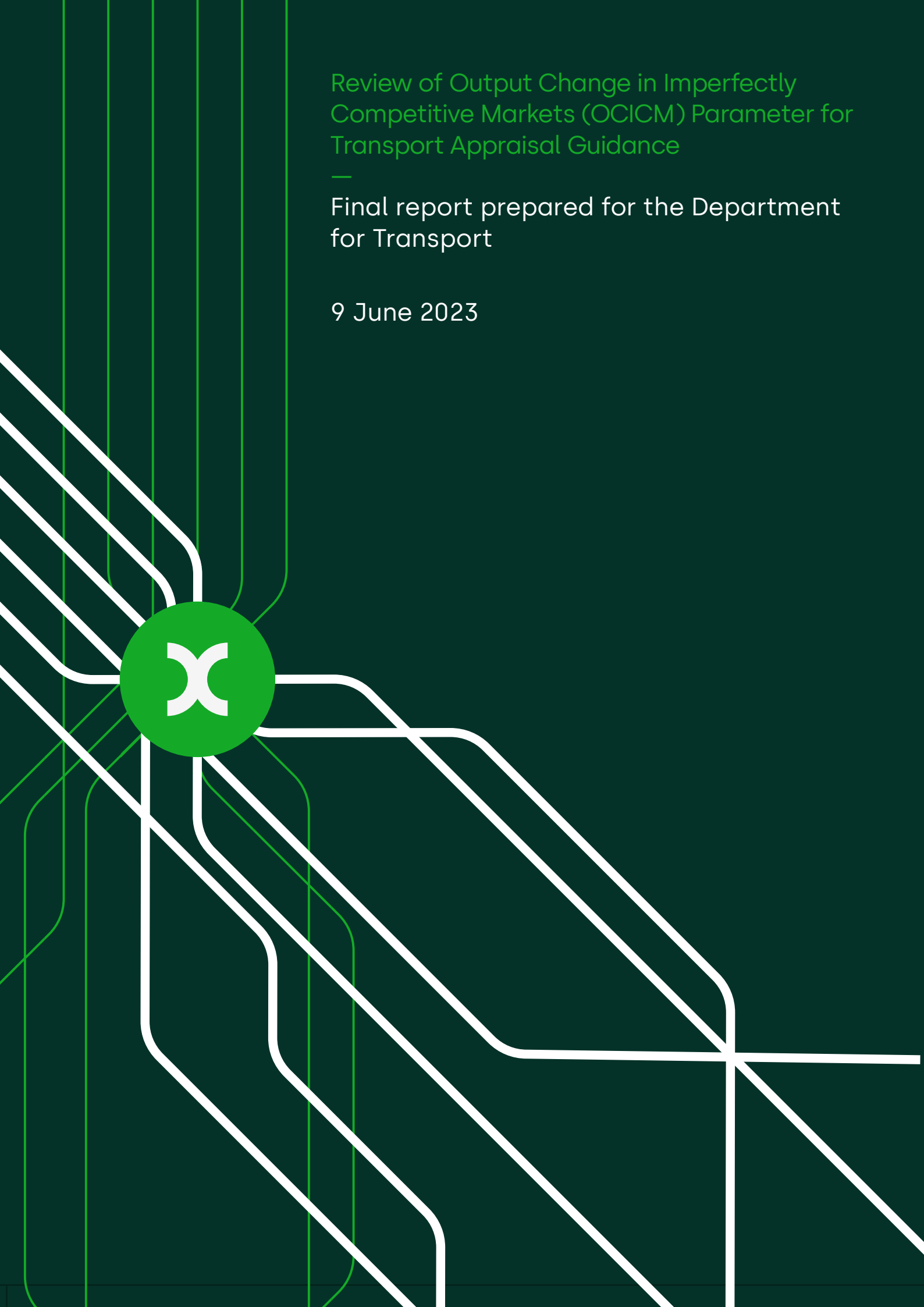
Final report prepared for the Department for Transport

9 June 2023



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Executive summary

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The Department for Transport's (DfT) Transport Analysis Guidance (TAG) sets out methods for incorporating wider economic impacts into appraisals for transport projects that require UK government approval. The focus of this literature review is on such wider economic impact—i.e. output change in imperfectly competitive markets (OCICM). The rationale behind this wider economic impact is that a transport investment will not only bring benefits to the direct users of that particular project, but will also reduce costs for firms operating in imperfect competition.

TAG accounts for this impact in its guidance by recommending that a 10% uplift factor should be applied to the business and freight-user benefits, to account for additional welfare effects 'which arise due to the presence of imperfect competition.[1] DfT's working hypothesis is that if markups and price-cost margins have increased across UK industries, then the uplift in TAG should be amended accordingly, to reflect the increase to additional welfare benefits. This uplift factor is calculated as the price-cost margin ((P-MC)/P) multiplied by the elasticity of demand (ED) and cost pass-through (k).

$$k \times \frac{P - MC}{P} \times ED$$

The objective of this report is to inform DfT's understanding of the current evidence base relating to OCICM impacts, and its related uplift factor. We review the evidence of each of the components of the uplift factor in turn, focusing on the core parameter of price-cost margins/markups.

Trends in price-cost margin, markups and concentration

We conclude that there is sufficient evidence to demonstrate that concentration has increased between the 1990s and late 2010s in the UK. The evidence also supports the conclusion that markups, and by extension price-cost margins, have increased over the same time period. Consequently, based on the current methodology of the OCICM benefit, we recommend that TAG's assumed price-cost margin should be updated from the current 0.2

[1] Department for Transport (2020),, 'TAG Unit A2.2 Appraisal of Induced Investment Impacts', May, p.17.

to 0.31 to reflect empirical evidence of an increase in average economy-wide price-cost margins since the late 1990s.

Sectoral and regional considerations

There are some differences in markups between sectors, with the services sector accounting for the biggest increases in markups since the late 1990s. With respect to regional considerations, while there is insufficient evidence in the literature on differences between UK regions, regional differences can be inferred from the sectoral concentration in that region. Given the various offsetting factors, at this time, we do not believe that there is sufficient evidence to depart from the simplification that a transport project affects all sectors equally, but recommend this area for further analysis.

Firm-level output responsiveness and countervailing effects on profit margins

We find that there is some evidence of countervailing effects, which may mean that while price-cost margins have increased, economic profits may not have increased as much when considering fixed costs and trade effects. With that said, the impact of fixed costs is inconclusive in a UK context and warrants further research. On trade effects, we find evidence that accounting for export data may reduce the concentration in some areas of the economy. This is because some export-focused industries may have a small share of the domestic market and thus reflect lower concentration (as measured by standard concentration measures which do not consider exports) than is actually the case. This may impact total price-cost margins by extension, although this hypothesis is based on intuition and warrants further research to confirm.

Cost pass-through and elasticity of demand

Finally, on cost pass-through, we find that there is insufficient justification or evidence for why pass-through is assumed to be very close to one. Economic theory suggests that for an imperfectly competitive market the pass-through rate should be greater than it would be in a monopoly (i.e. greater than 0.5) and less than it would be in perfect competition (i.e. less than one). Therefore, in the absence of further evidence we recommend that a more

suitable approach may be to take the mid-point between 0.5 and one for cost pass-through in imperfectly competitive markets, i.e. 0.75, as the cost pass-through rate.

With respect to elasticity of demand, we have been unable to identify more recent robust empirical studies of an aggregate elasticity of demand that may replace the current assumptions underpinning TAG. Noting the unclear rationale for the current assumption, there may be some justification to reduce the current assumption in light of the higher concentration and markups which the evidence supports. Further work would need to be undertaken to determine if the elasticity of demand should decrease, and if so, by how much.

Recommendation

In summary, based on the current methodology for calculating uplift, we recommend that the price-cost margin be adjusted to 0.31, that the cost pass-through be adjusted to 0.75, and no change is made to the elasticity of demand, such that the new uplift factor can be calculated as:

$$k \times \frac{P-MC}{P} \times ED = 0.75 \times 0.31 \times 0.5 = 0.116$$

Instead of the current:

$$k \times \frac{P-MC}{P} \times ED = 1 \times 0.2 \times 0.5 = 0.1$$

With that said, we note that the TAG methodology for the OCICM uplift factor does not have any means for differentiating between economic profit and price-cost margins. A revised approach to this methodology may wish to consider a variable to account for economic profits to address countervailing effects (such as fixed costs), which may allow for a more accurate application of the uplift factor in transport appraisals.

1 Background

The DfT's TAG sets out methods for incorporating wider economic impacts into appraisals for transport projects that require UK government approval. The underpinnings of some of the appraisal methodology pertaining to wider economic impacts in the current TAG, are based on a 2005 DfT discussion paper entitled 'Transport, Wider Economic Benefits and Impacts on GDP'[2] (2005 DfT Paper).

This discussion paper highlights wider economic impacts that are often not considered within conventional appraisals, and for which adjustments need to be made to account for market imperfections. The wider economic impacts considered within the 2005 DfT Paper include:

- economies of agglomeration (productivity clusters);
- increased competition as a result of better transport;
- increased output by firms in imperfectly competitive markets;
- economic welfare benefits arising from an improved labour supply.

The focus of this literature review is on the third impact above—output change in imperfectly competitive markets (OCICM).

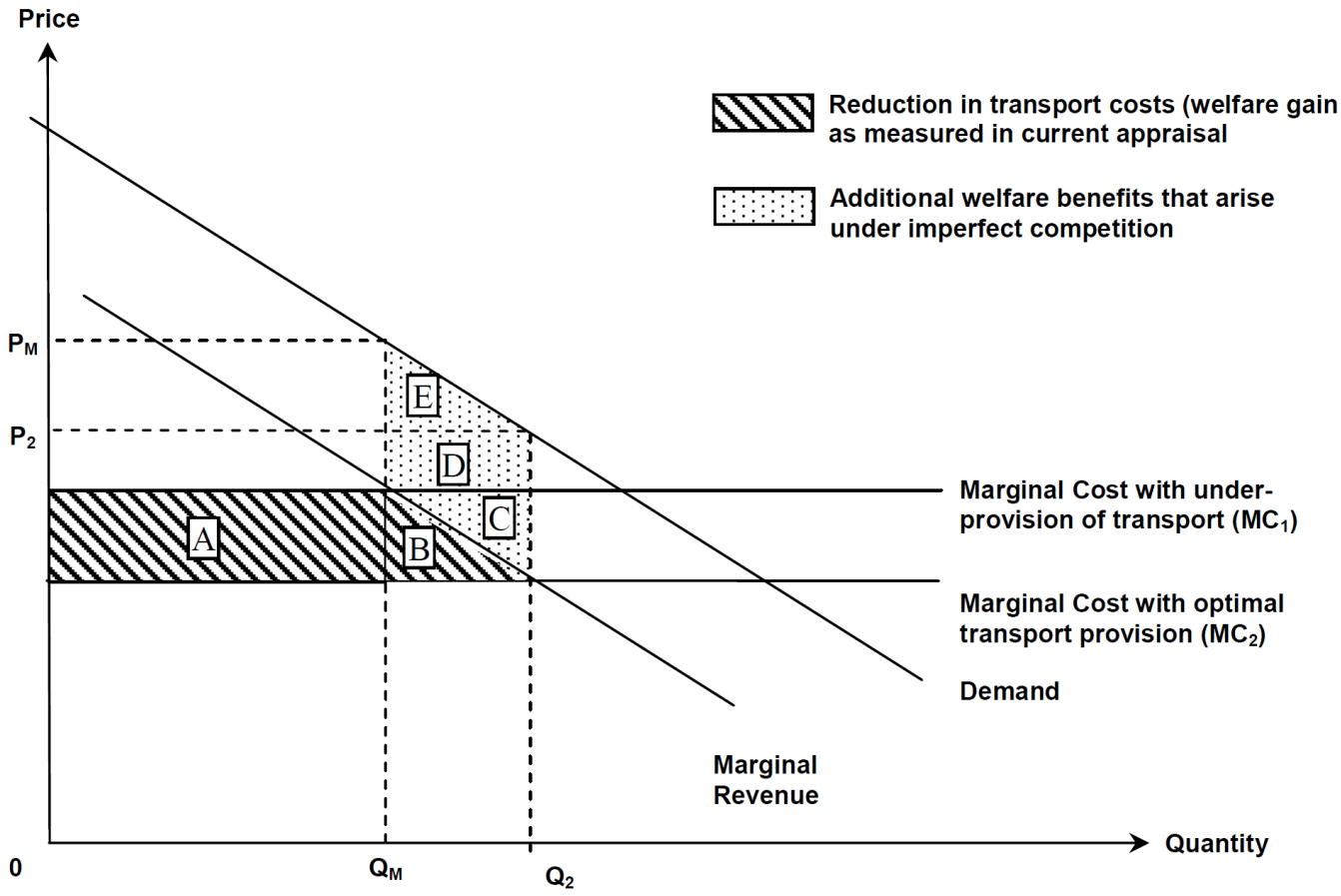
1.1 Wider economic impact of increased output by firms in imperfectly competitive markets in the current TAG

The rationale behind this wider economic impact is that a transport investment will not only bring benefits to the direct users of that particular project, but will also reduce costs for firms operating in imperfect competition.

Under imperfect competition, where firms price at a markup above marginal cost, there is a deadweight loss compared to perfect competition where prices are equal to marginal cost. A transport project, by reducing transport costs for firms, leads to the firm increasing output. This will in turn result in a lower price compared to the markup price before the transport project. When this occurs, there are additional welfare benefits that arise as demonstrated by segments E, D and C in Figure 1.1 below.

[2] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', July 2005.

Figure 1.1 Efficiency gain in imperfectly competitive markets from a reduction in transport costs



Source: Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', July 2005, p. 45.

Based on the assumptions in the 2005 DfT Paper, TAG accounts for this impact in its guidance by recommending that a 10% uplift factor should be applied to the business and freight-user benefits to account for additional welfare effects 'which arise due to the presence of imperfect competition'.[3]

We note that as of 2016, values of time in TAG for business trips are based on willingness to pay (WTP), rather than wages. This report and its recommendations are based on the TAG methodology for the OCICM uplift factor as it currently stands, and does not consider value of time for business trips based on WTP. As such, further research should be undertaken to determine the extent to which WTP will encapsulate the OCICM benefit and whether any adjustments to the uplift factor are necessary.

[3] Department for Transport (2020),, 'TAG Unit A2.2 Appraisal of Induced Investment Impacts', May, p.17.

The 10% uplift is based on the following formula:

$$V = \frac{P - MC}{P} \times ED$$

Where:

- V = imperfect competition uprate factor;
- $\frac{P-MC}{P}$ = price-cost margin;
- ED = elasticity of demand.

The size of welfare benefits based on this formula is dependent on estimating the margin and the elasticity of demand,[4] and as shown above, the uplift factor is a product of these two factors.

The 2005 DfT Paper outlines the evidence base available at the time of publication (i.e. up until the late 1990s/early 2000s) for each of these factors. On price-cost margins, it proposes a 'best estimate of the aggregate (P-MC)/P for UK industries is about 0.2'.[5] On elasticity of demand, it notes the lack of consensus on aggregate elasticity of demand across industries in the literature. It concludes, based on two pieces of academic literature, that the elasticity of demand can be estimated as approximately 0.5.[6]

Therefore, the current uplift factor in TAG is estimated as:

$$V = \frac{P - MC}{P} \times ED = 0.2 \times 0.5 = 0.1$$

1.2 DfT working hypothesis

The Competition and Markets Authority published a report in April 2022 on 'The State of UK Competition'. The report provides evidence on markups in the UK based on recent data, and shows that markups [7]have increased significantly since the late 1990s. It concludes:

[4] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', p. 46.
[5] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', p. 49.
[6] Department for Transport (2013),, 'Transport Analysis Guidance', 29 October, Link (last accessed 17 April 2023)..
[7] The markup is a ratio of marginal costs to prices and is usually expressed as 1+μ, where μ is the percentage markup over marginal costs (normalised to 1). As explained in the Competition and Markets Authority (2022) report, 'The State of UK Competition', p. 87: 'If a firm's markup is 1 then the firm's prices are the same as its marginal costs – this means the firm does not have market power and that the market it operates in is highly competitive. If, for example, a firm's markup is 1.2 then the firm's prices are 20% higher than its marginal costs.'

using a large dataset of all UK firms with 250 employees, we find that the mean markup has risen from 1.22 to 1.34 over the last two decades.[8]

Based on these findings, DfT's working hypothesis is that if markups and price-cost margins have increased across UK industries, then the uplift in TAG should be amended accordingly to reflect the increase to additional welfare benefits.

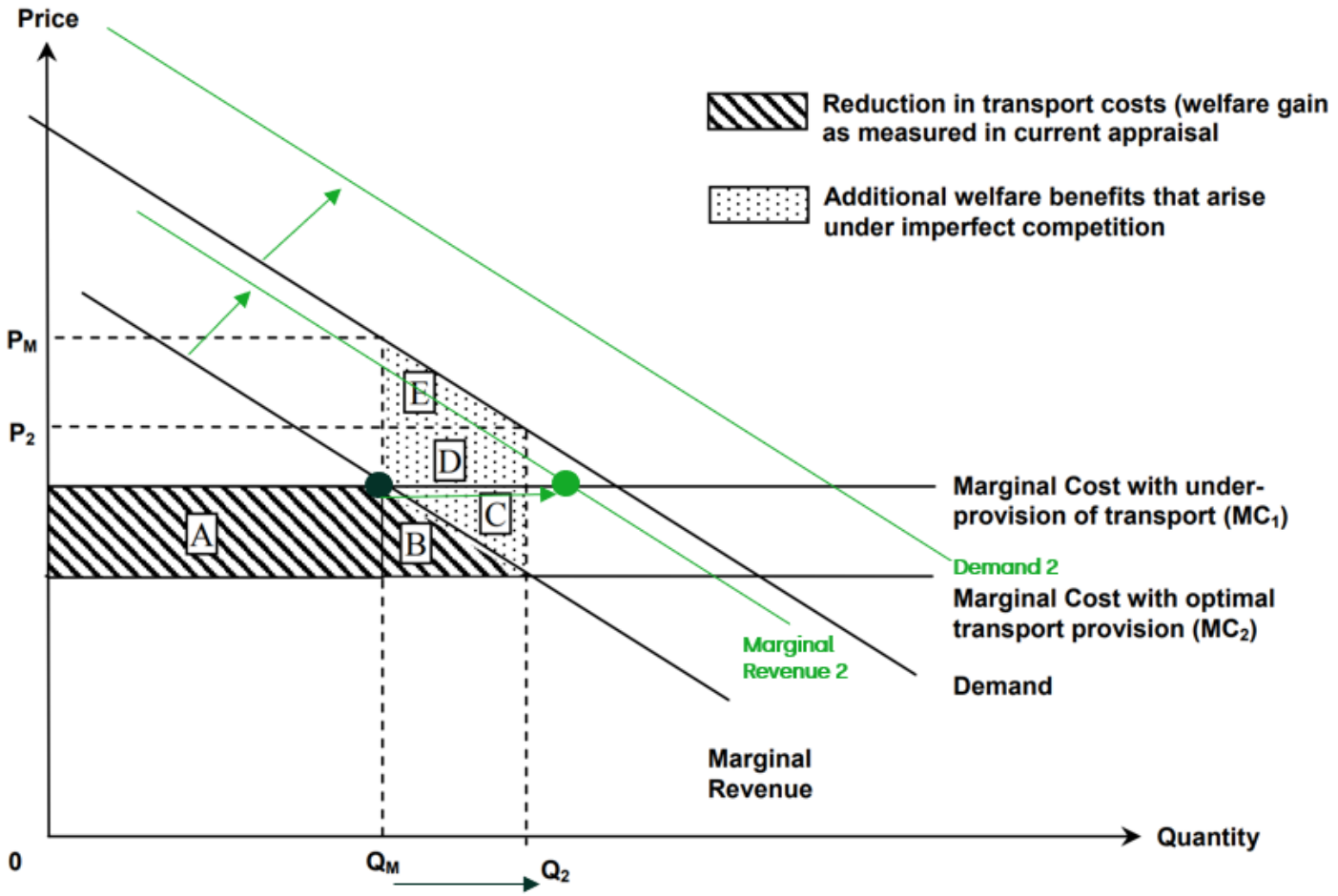
This is because higher markups and higher price-cost margins will mean that a reduction in transport costs to a firm due to a transport investment will result in the firm increasing its output, which will result in additional welfare benefits than if the transport investment had not been made, as shown in Figure 1.2 below. Therefore, the uplift factor in transport appraisal must be increased accordingly to account for this impact.

If, as we assume, the increase in margins reflects higher industrial concentration, that means that the demand for individual firms is increased, therefore generating generates higher prices for given costs.

[8] Competition and Markets Authority (2022), 'The State of UK Competition', p. 86.

The demand curve and marginal revenue curve shift out, as shown below, such that the intersection of MC_1 with under provision of transport and MR occurs at a different point.

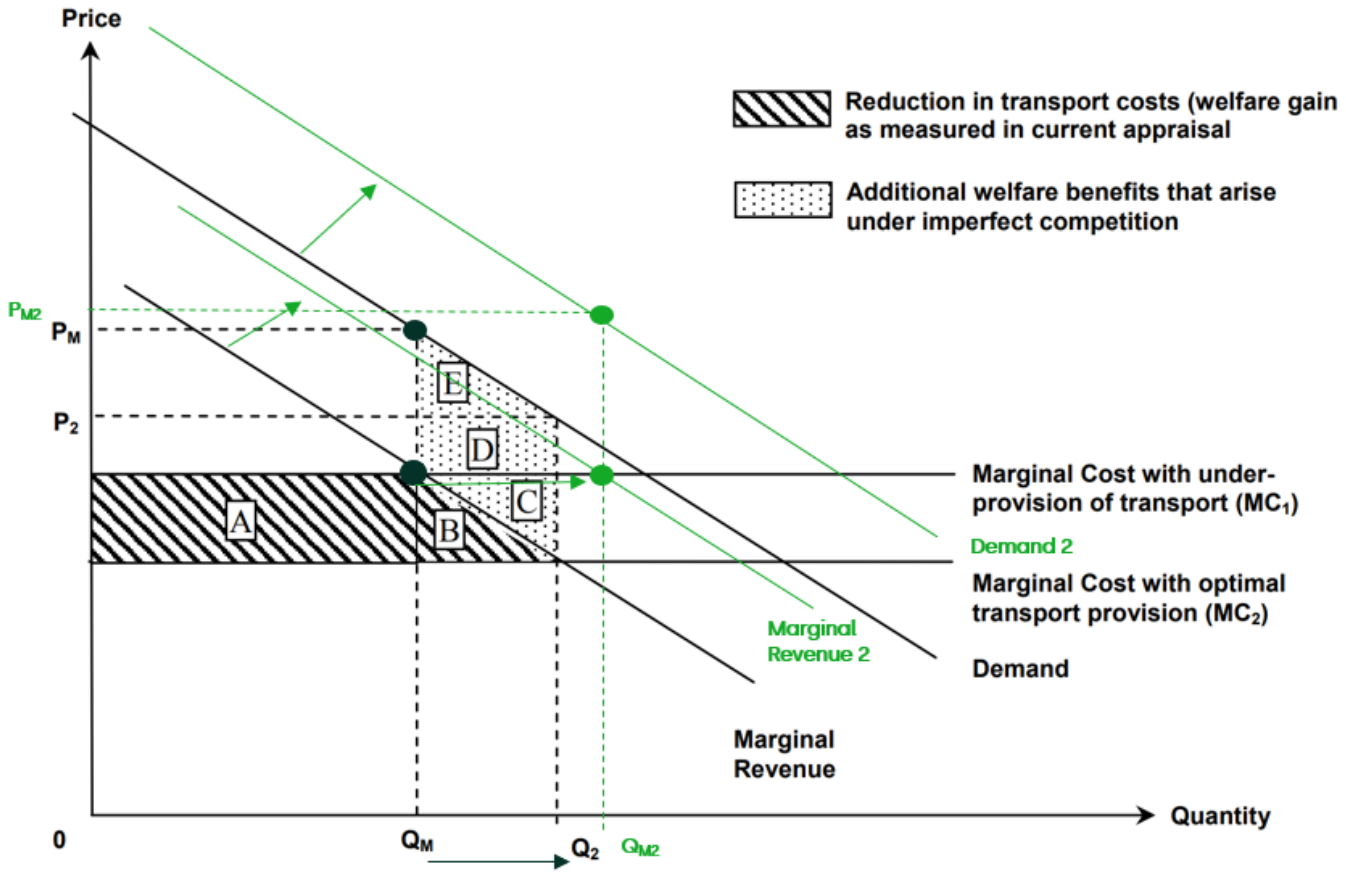
Figure 1.2 DfT working hypothesis (I)



Source: Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', July 2005, p. 45 and Oxera.

The intersection of the new MR_2 and the MC_1 curve, and the corresponding point on the Demand 2 curve, shows that the price before the transport investment has increased from P_m to P_{m2}, and the related quantity is higher.

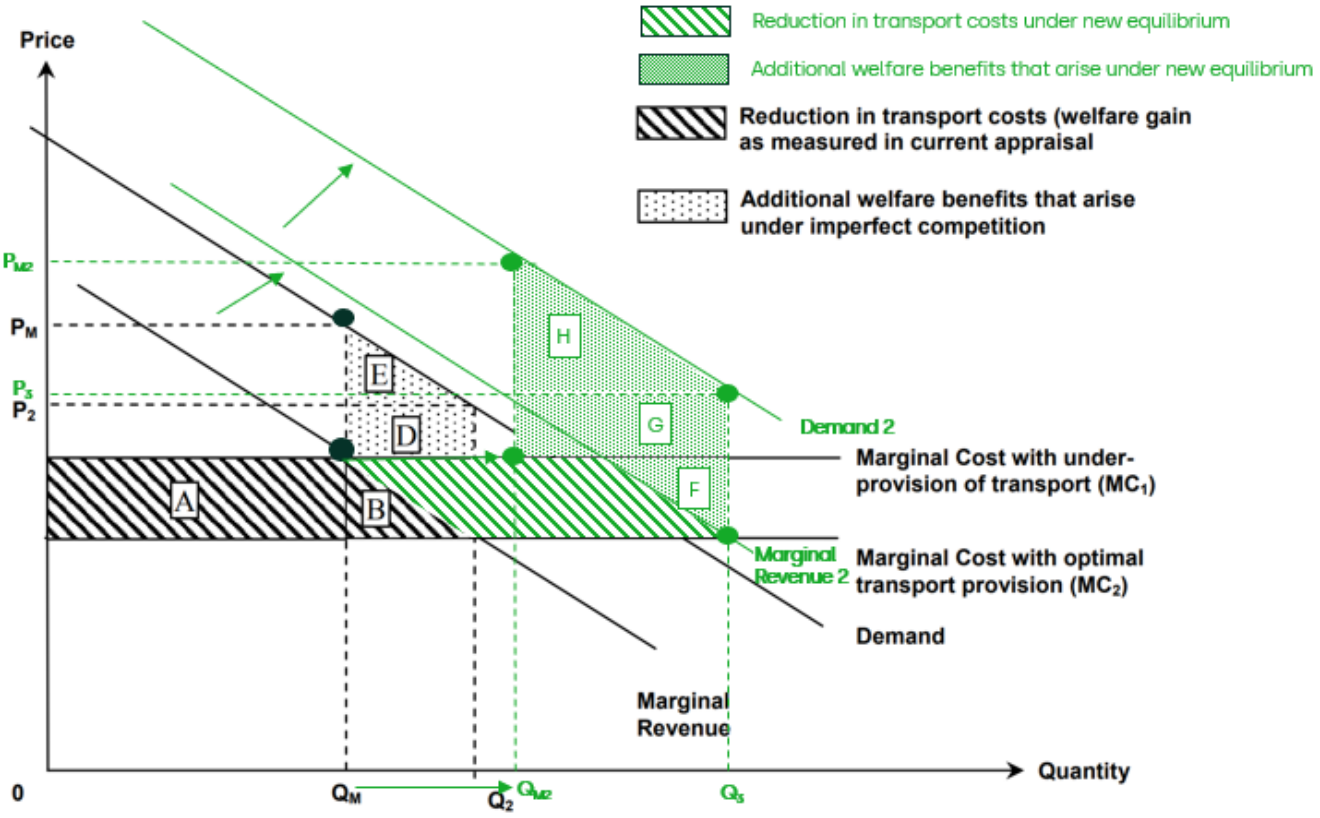
Figure 1.3 DfT working hypothesis (II)



Source: Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', July 2005, p. 45 and Oxera.

DfT's working hypothesis is that since price markups have increased, a transport cost reduction will result in firms increasing output, and thus greater welfare benefits than if markups had not risen. Therefore, the uplift factor should increase to reflect this. This is illustrated in Figure 1.4 below: price falls from P_{m2} to P_3, while output increases from Q_{m2} to Q_3 after the transport cost reduction in the new equilibrium. The new welfare benefits (F, G, and H) are assumed to be larger than under the previous equilibrium (C, E, D).

Figure 1.4 DfT working hypothesis (III)



Source: Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', July 2005, p. 45 and Oxera.

1.3 Objectives of this report

DfT 'endeavours to keep the guidance up-to-date in light of new evidence and developments in best practice modelling and appraisal methodologies'[9]. To this end, DfT has commissioned Oxera to undertake a literature review of academic and grey literature on price-cost margin/markup trends since the late 1990s, and provide recommendations on updated parameters to be included in TAG.

The objective of this report is to inform DfT's understanding of the current evidence base relating to OCICM impacts, particularly focusing on the core parameter of price-cost margins/markups.

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In the first instance, this will include considering whether price-cost margins/markups have seen an increase, decrease or have stayed relatively stable across UK industries, building on the analysis in the CMA report.

[9] Department for Transport, 'Transport Appraisal Guidance', Link, last accessed 19 May.

We also consider the evidence base on aggregate estimates of elasticity of demand across UK industries. Should there be more robust evidence available in the literature to depart from the current 0.5 estimate of price elasticity, this will have direct implications for how firms in imperfectly competitive markets would respond to a transport cost reduction.

Next, we consider how price-cost margins may differ in a sectoral or regional approach, whether this context-specific approach is potentially more accurate than an economy-wide average.

Alongside this, we consider countervailing effects and whether the microeconomic underpinnings of the methodology regarding output responsiveness still hold. In other words, if price-cost margins have increased, is there still sufficient evidence to support the assumption that 'high estimates of the price-cost margin will tend to be associate with low estimates of [elasticity of demand], and vice versa'?[10]

Finally, we turn our attention to cost pass-through. In the 2005 DfT Paper, cost pass-through is assumed to be one, and as such drops out of the uplift factor formula. We consider whether this assumption still holds with more recent evidence, and the implications on the uplift factor if is not equal to one.

We conclude by offering our advice and recommendations to the Department on how the OCICM parameters may be updated in the future, and what additional work would be required to achieve this.

[10] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', p. 46.

2 Trends in price-cost margin, markups and concentration

Before exploring the literature on concentration, price-cost margins and markups, it is important to first explain what each of these terms means and how they relate to each other.

First, in economic terms, market or industry concentration is generally defined by the number of competitors in that market—put simply 'the fewer the competitors in a market, the higher the concentration'.[11] In other words, it is a measure of market power. According to competition economic theory, generally the more concentration in a market, the less competitive pressure on firms, leading to a potential increase in market power.[12] This implies that more industry concentration leads to less competitive pressure faced by firms. This allows them to potentially exert market power, leading to higher markups and price-cost margins. Consequently, industry concentration is intrinsically linked to other measures of market power, such as price markups.[13] This is why the empirical evidence on concentration trends within the UK is important for our analysis of markup and margin trends.

Second, the price-cost margin is estimated as the price less the cost divided by the price *(P-C)/P,* while the markup is estimated as the price less the cost divided by the cost *(P-C)/C*. Although both measures look at the price-cost differential, and can be used as measures of market power, they differ in magnitude and may grow at different rates.

For example, if a product costs a firm £50 to produce (cost) but it is sold for £125 (price), the markup would be:

$$\frac{P-C}{C} = \frac{£125 - £50}{£50} = 1.5$$

However, the margin would be:

$$\frac{P-C}{P} = \frac{£125 - £50}{£125} = 0.6$$

[11] Niels, G., Jenkins, H. and Kavanagh, J. (2016),., 'Economics for Competition Lawyers', second eLawyers Second dition, *Oxford University Press*, p. 104.
[12] Competition and Markets Authority (2022), 'The State of UK Competition', April, p. 25.
[13] Savagar, A., Aguda, O., Galanakis, Y. and., Wu, J. (2022), 'Product Market Concentration and Productivity: Evidence from the UK', p. 2.

Therefore, if prices increased to £150 and costs remained the same, the markup would change to 2.0 (an increase of 33%):

$$\frac{P-C}{C} = \frac{£150 - £50}{£50} = 2.0$$

while the margin would change to 0.67 (an increase of 11%):

$$\frac{P-C}{P} = \frac{£150 - £50}{£150} = 0.67$$

As discussed in section 1.2, the CMA's 2022 report explores the evidence base for the latter—i.e. price markups—and finds sufficient support to suggest that the mean markup has increased from 1.22 to 1.34 since the early 2000s, and particularly over the last decade. In other words, the mean price went from 22% higher than marginal costs in the early 2000s to 34% higher by the 2020s. Moreover, this effect is particularly pronounced among firms that already had the highest markups, which saw an increase of markup from 1.58 to 1.82.

The CMA report's evidence, while well supported, was presented from a competition regulator's perspective. Below, we assess the evidence on industry concentration, price-cost margins and markups from a transport appraisal point of view, while differentiating between evidence that is more directly related to transport-intensive sectors, and/or is underpinned by a more robust methodology.

The bottom line is that there is considerable evidence across the literature of increasing levels of concentration across industries in the UK and the rest of the developed world, with very high levels of concentration noted in the top 90th percentile of firms.

2.1 Industry concentration has increased

Our analysis involved the review of several papers in the UK-specific context, as well as more broadly in the developed world.

The bottom line is that there is considerable evidence across the literature of increasing levels of concentration across industries in the UK and the rest of the developed world, with very high levels of concentration noted in the top 90th percentile of firms.

2.1.1 Evidence of Concentration in literature based on the Herfindahl-Hirschman Index and ONS' Business Structure Database

Davies, whose work was key to the 2005 DfT Paper's assumptions, published in 2021 research on concentration

which looks at the Herfindahl-Hirschman Index (HHI) for 'over 300 UK industries at the 4-digit-level',[14] using data from ONS' Business Structure Database (BSD). The HHI is a measure of concentration which is 'the sum of the squared market share of all businesses in a sub-sector and has a minimum value of almost 0 and a maximum value of 10,000 – possible only if a market is entirely composed of one business'.[15] Davies finds that approximately 30% of these industries can be classified as concentrated or highly concentrated as per the HHI, with industry concentration rising until 2011 and remaining steady since then.

This echoes the findings elsewhere in the literature. For instance, Bell and Tomlinson (2018) also use BSD data and find an increase in concentration between 2004 to 2016 at the sub-sector level—that is, using five-digit SIC sectors. They use concentration ratios to demonstrate that the 100 biggest firms (CR100) account for 23% of total revenue, up from 18.5% in 2003/04.[16] While concentration among the CR100 has been declining post-financial crisis (i.e. as of 2007-08), it is doing so at a much slower rate than in the run up to the financial crisis. They also find that the five biggest firms within each sub-sector (CR5) accounted for approximately 43% of revenue at the sub-sector level, up from 39% in 2003/04. The authors note that 'rising concentration is not only driven by sub-sectors becoming more concentrated, but can also result from already highly concentrated sub-sectors growing in size'.[17] In addition, the authors turn to a weighted CR approach to provide 'higher-level summary statistics by calculating a weighted average for industries... and the economy as a whole'.[18] The authors exclude some industries from their economy-wide analysis at the sub-sector level where revenue data suffers due to measurement issues (finance) or high volatility (wholesale fuels). However, this may create limitations in the results of their analysis since the

[14] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 1.
[15] Bell, T. and Tomlinson, D. (2018), 'Is everybody concentrating? Recent trends in product and labour market concentration in the UK', Resolution Foundation Briefing, p. 9.
[16] Bell, T. and Tomlinson, D. (2018), 'Is everybody concentrating? Recent trends in product and labour market concentration in the UK', Resolution Foundation Briefing, p.10.
[17] Bell, T. and Tomlinson, D. (2018), 'Is everybody concentrating? Recent trends in product and labour market concentration in the UK', Resolution Foundation Briefing, p.12.
[18] Bell, T. and Tomlinson, D. (2018), 'Is everybody concentrating? Recent trends in product and labour market concentration in the UK', Resolution Foundation Briefing, p.12.

exclusion of 'all business[es] in finance related sub-sectors' is a significant omission, and may skew the data to appear to be more or less concentrated than it is. The authors acknowledge this limitation and note that the omitted sectors may actually be some of the most concentrated sectors, and thus it is likely that the 'true value' of concentration is even higher than that presented here'.[19]

Savagar et al. (2022) find that 'concentration for a broad market definition has been stable over the sample period 1997-2020'[20] However, when the financial services sector is omitted, the UK has witnessed greater concentration among its largest firms over roughly the same period (until 2016). The financial services sector is omitted because it accounts for the largest proportion of turnover at the sectoral level in the UK, and because using turnover in finance, and some other subsectors, to represent output is misleading.[21] The authors also find that concentration increases on average when data at the five-digit Standard Industry Classification (SIC) level is analysed. Moreover, Savagar et al. find evidence that large increases in concentration (i.e. by 10%) relate to a 0.4% decrease in labour productivity.

It is worth noting that the trends towards increasing concentration are not a uniquely UK phenomenon, but are evident in other developed economies. For example, Brauning et al. (2022) find that concentration is at least 50% higher in the United States compared to 2005. In addition to impacting markups and cost pass-through (discussed in section 4), 'industry concentration over the past two decades could be amplifying inflationary pressure from current supply chain disruptions and a tight labour market'.[22]

[19] Bell, T. and Tomlinson, D. (2018), 'Is everybody concentrating? Recent trends in product and labour market concentration in the UK', Resolution Foundation Briefing, p. 9.
[20] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 17.
[21] Savagar, A., Aguda, O., Galanakis, Y. and., Wu, J. (2022), 'Product Market Concentration and Productivity: Evidence from the UK', p. 8.
[22] Brauning, F., Fillat, J.L. and Joaquim, G. (2022), 'Cost-Price Relationships in a Concentrated Economy', Federal Reserve Bank of Boston Research Department Current Policy Perspectives.

2.1.2 Limitations of concentration ratios and HHI

Most of the above literature relies on concentration ratios and/or HHI to measure market concentration amongst firms. The limitations of the HHI as a measure of concentration is well documented. In short, its key advantage—its simplicity—is also its main limitation. As Davies (2021) notes the data typically used to define the HHI is too aggregated considering that it is at the industry-level, rather than the market-level.[23] Since competition takes place at the market-level, data at the industry-level may not provide the sufficient level of granularity. With that said, Davies (2021) also notes that as opposed to concentration ratios, the HHI 'takes account of potentially key size asymmetries amongst the largest firms in the industry'.[24]

2.1.3 Other approaches to estimating concentration

While the above section discussed estimates of industry concentration using traditional methods, Davies (2021) also attempts to use an innovative approach to assess concentration beyond the HHI. He does this in an attempt to provide a view of concentration that addresses some of the shortcomings of conventional measures that may underestimate concentration—such as using data that is 'far more aggregate than is ideal'.[25]

He argues that an 'anti-trust market' (ATM) which is based on the market definition typically used in anti-trust cases 'could be less than 1% of the aggregate SIC industry to which it belongs'.[26] Based on an ATM approach, Davies demonstrates that a significant number of industries are even more concentrated than the 'yardsticks' used to determine the concentrated and highly concentrated categories at the SIC level mentioned above.[27]

Davies' ATM approach is based on developing a measure based on leadership rankings within an industry. In other words, Davies argues that because the ability of the top

[23] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 3.
[24] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 8.
[25] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 11.
[26] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 11.
[27] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 3.

ten firms in the market to retain leadership has been stronger, it has led to less churn in market shares, and has weakened competition. The approach taken by Davies to estimate this however is questionable in its robustness, and relies on a number of heroic assumptions. It fails to account for other factors that may impact leadership retention and by its own admission, 'further robustness tests are called for'.[28]

2.2 Literature generally supports that markups have increased since the late 1990s

Not surprisingly given the findings discussed above on increasing industry concentration, the literature consistently demonstrates that the UK has witnessed an increase in price markups and by extension, price-cost margins, compared to the late 1990s.

First, a recently published ONS research report shows that 'average markups have increased by over 9.22% in Great Britain in the period between 1997 and 2019', with a particular focus on increasing markups in the services sector (discussed further in section 3).[29] ONS relies on measuring market power using a simplified methodology presented by De Loecker and Warzynski in their 2009 paper which uses plant-level data and looks at expenditures on variable inputs and revenue at the plant-level. It also supports the idea that changes in markup rates are higher for firms at the 90th percentile than in the middle of the distribution (50th percentile).

Limitations with the ONS paper include the fact that production functions are estimated at the two-digit or three-digit SIC level. On the surface, and based on academic literature discussed in section 2.1 which focuses on four-digit and five-digit level aggregation, a two-digit or three-digit approach may underestimate concentration. This is because data that is more detailed to the subsector—i.e. at the four-digit or five-digit level—looks at a smaller market definition than data at the two-digit or three-digit level. Therefore, the smaller the product market

[28] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 17.
[29] Office for National StatisticsONS, 'Estimates of markups, market power and business dynamism from the Annual Business Survey, Great Britain: 1997 to 2019', Link (last accessed 19 April).

definition, the fewer the firms operating within that product market, and therefore the more potential for higher levels of concentration.

In more recent work by De Loecker and Eeckhout (2018), the authors estimate markups with a cost-share based method—using data on firm financial statements to estimate variable costs, overhead costs and the firm's sales, alongside firm's wage bills, dividends and stock market valuation. They use this approach as the conventional demand-based approach to estimating markups require detailed data and limit markups to short periods of time. Their results show that, generally speaking, markups have increased across the globe from around 1.0–1.2 in 1980 to 1.5–1.7 by 2016, and in the UK from 0.94 to 1.68 over the same time period.[30] When we consider the author's results from 2000 to 2016, markups in the UK have increased by roughly 36%, from approximately 1.5 to 1.68.[31]

Limitations to this approach are based on the dataset used, which focuses on large and mainly publicly traded companies which may not be representative of the economy as a whole. The authors counter this concern by citing previous work they have done which shows that trends in markups among large and publicly traded companies are generally representative of all sectors.[32] With that said, this previous work was in a US only context and the representativeness of markups in publicly traded companies of all sectors may differ in a UK specific context.

Similarly, Hwang, Kariel and Savagar (2022) aim to 'robustly document markups in the UK economy'[33] given that different measures of market power (i.e. concentration, profits, markups) can sometimes contradict each other. This paper presents a sophisticated and unique approach to measuring markup growth, both

[30] De Loecker J. and Eeckhout, J. (2018), 'Global market Power', National Bureau of Economic Research, Working Paper 24768, ppp. 6–7.
[31] De Loecker J. and Eeckhout, J. (2018), 'Global market Power', National Bureau of Economic Research, Working Paper 24768, p. 11.
[32] De Loecker J. and Eeckhout, J. (2017), 'The Rise of Market Power and the Macroeconomic Implications', National Bureau of Economic Research, Working Paper 23687.
[33] Hwang, K., Savagar, A. and Kariel, J. (2022), 'Market Power in the UK', Kent University, ESRC project reference ES/S000089/1, p. 3.

from a data perspective and by testing the effects of different assumptions that drive markup estimation.

The authors use firm-level data from ONS (ARDx data) which combines three administrative surveys of UK businesses with 62,000 businesses and more than 600 variables. They find that 'aggregate price markups in the UK are rising, and this is robust to many methodological choices'.[34] They test this using two different production functions—Cobb-Douglas and translog—which offer different magnitudes of results (with the Cobb-Douglas function showing much higher increase in markups), but both of which trend upwards over the time period considered. In addition, the authors' work uses the translog function and supports the findings of the CMA report that markups have increased from 1.22 to 1.34, based on a sample set that uses ten times the number of firms that the CMA analysis used.[35] Their results differ because the CMA report uses a cost-share approach, as do De Loecker and Eeckhout (2017). They also corroborate the findings elsewhere—that markups have increased most sharply among the 90th percentile firms, while the bottom of half of firms have had relatively little markup growth and even a drop after the financial crisis.

Based on these core pieces of literature, which use different methods of estimating markups, there appears to be a general consensus in the literature that markups are rising in the UK, even when accounting for their limitations.

2.2.1 Exceptions

One exception to this consensus on rising mark-ups is documented in a 2018 OECD working paper. While the authors show that markups over marginal costs have generally risen between 1985 and 2016 across the OECD, their findings demonstrate a significant decrease in the UK (from 1.45 to 1.25) in the period considered.[36]

One explanation for why this data may deviate from other trends in aggregate markups in the UK that we explore

[34] Hwang, K., Savagar, A. and Kariel, J. (2022), 'Market Power in the UK', Kent University, ESRC project reference ES/S000089/1, p. 3.
[35] Hwang, K., Savagar, A. and Kariel, J. (2022), 'Market Power in the UK', Kent University, ESRC project reference ES/S000089/1, p. 5-6.
[36] Schreyer, P. and Zinni, B. (2018), 'Productivity measurement, R&D assets and mark-ups in OECD countries. OECD WORKING PAPER No.93', p.21.

above is that the time period considered—1985 to 2016 differs from the periods considered in other works, which are focused more on the period between the late 1990s to the mid–late 2010s. It is possible that this is because this data looks at a longer period (1985 to 2016) the total increase in markups over that period is higher than in the period between 2000 and mid–late 2010s, as considered by other papers. As the authors note:

> ...mark-up levels across countries vary significantly... [reflecting] a host of factors, including the degree of competition and regulation, differences in the presence and in the returns to other assets such as natural resources or intangibles that have not been explicitly captured; and measurement issues.[37]

The authors use OECD productivity statistics to estimate markups over marginal costs, which likely differ from the ONS data used in the above studies in several important ways. Unfortunately, the paper does not provide much detail on how markups are estimated using this OECD data or at what level of aggregation, so it is difficult to ascertain precisely the reason for this discrepancy compared to the rest of the literature.

2.3 Conclusions on concentration, markups and margins

We conclude, despite the caveats about the limitations of the HHI method and the CR method, that there is sufficient evidence to demonstrate that concentration has increased between the 1990s and late 2010s in the UK. Davies (2021) estimates that concentration increased in the 2000s until 2011 and has remained steady since then, with 30% of industries classified as concentrated or highly concentrated. Bell and Tomlinson (2018) use a weighted CR approach and find that the top 100 firms account for 23% of total revenue (compared to 18.5% in 2003/04) and that this trend is evident at the sub-sector level as well. Savagar et al. (2022) also corroborate this by showing that when excluding the financial services sector, there has been greater concentration among the UK's largest firms between 1997 and 2016. These trends are also apparent in other developed economies such as the USA, as shown in the work of Brauning et al. (2022).

[37] Schreyer, P. and Zinni, B. (2018), 'Productivity measurement, R&D assets and mark-ups in OECD countries. OECD WORKING PAPER No.93', p.20.

The evidence also supports the conclusion that markups, and by extension price-cost margins, have increased over the same time period. Table 2.1 below shows the markup estimates of the various evidence we have considered on the left-hand side.

It is worth noting here that the TAG uplift factor, as discussed in section 1.1, is based on the price-cost margin, rather than the markup. While price-cost margins and markups tend to move in the same direction, they may do so by different magnitudes and at different rates. We convert the markups to margins on the right hand side of Table 2.1, based on the following conversion (normalising cost to 1):

$$margin = \frac{markup}{1 + markup} \rightarrow markup = \frac{margin}{1 - margin}$$

Table 2.1 Summary of markups and margins trends

	Markups[38]			Margins		
Source	Markup late 1990s/Early 2000s	Markup mid–late 2010s	Average markup change	Margin late 1990s/Early 2000s	Margin mid–late 2010s	Average margin change
CMA	0.22	0.34	54.5%	0.18	0.25	40.7%
ONS**	0.16	0.26	62.5%	0.14	0.21	53.9%
De Loecker and Eeckhout (2018)	0.5	0.68	36.0%	0.33	0.40	21.4%
Hwang et al. (translog function)*	0.32	0.56	75.0%	0.24	0.36	48.1%
Average	**0.30**	**0.46**	**57.0%**	**0.22**	**0.31**	**41.0%**

* We have excluded the estimates using the Cobb-Douglas function presented by Hwang et al., since it differs significantly from the rest of the results.

Markup changes between the late 1990s and mid-late 2010s range from 36% to 75%, with an average of 58.4% markup increase, based on the four sources cited above. The CMA, ONS and De Loecker and Eeckhout estimates use a standard cost share approach to estimating markups. The standard cost share approach:

[38] While markups are usually expressed as 1+μ, we have omitted the 1 in Figure 2.1 so that the change calculations and the conversions to margins are easier to interpret. Markup changes presented above are also based on the increase in μ.

> simply estimates the output elasticity as the expenditure on a variable input divided by total expenditure on all inputs [...] it requires two significant assumptions: that the technology has constant returns to scale, and that the optimisation conditions hold for all inputs in all years...[39]

At the upper bound of the distribution shown in Figure 2.1, Hwang et al. use the production function approach (which according to the authors is more reliable than other approaches)[40] as well as a larger dataset than the other sources. They conclude a 75% increase in markup between 1998 and 2014. This is over twice the amount estimated by De Loecker and Eeckhout who find a 36% increase in markup between 2000 and 2016 using a standard cost share approach.

These markups translate to a 21.4–53.9% increase in margins, as per the conversion presented on the right-hand side of Table 2.1.

There are several approaches that could be taken to apply the findings on price-cost margins shown in Table 2.1. to the TAG, since all four estimates have their respective merits. Hwang et al.'s estimate uses the biggest dataset, but uses a novel approach to markup estimation. De Loecker and Eeckhout's, ONS and CMA estimates all use the standard cost share approach, with the ONS estimate using the most up-to-date data (up to 2019).

Given that all the sources above have merit for different reasons, we recommend that TAG should be updated to reflect the average of the four sources above. The average markup of the four sources is 1.46 and the related average price-cost margin is 0.31. This represents the mid-point of the estimates of margin increase presented above, and prevents overestimation of the uplift factor. By this rationale, the current price-cost margin in the TAG should increase from the current 0.2 to 0.31.

[39] Competition and Markets Authority (2022), 'The State of UK Competition', April, p. 95.
[40] Hwang, K., Savagar, A. and Kariel, J. (2022), 'Market Power in the UK', Kent University, ESRC project reference ES/S000089/1, p. 6.

3 Sectoral and regional considerations

Section 2 discussed markup trends in the literature on an economy-wide basis. This resonates with the approach taken in the 2005 DfT Paper underpinning the current TAG. However, there is considerable evidence of sectoral heterogeneity explored in the literature as well. This may call into question whether the simplifying assumption in the current TAG that an increased provision of transport 'affects all sectors equally' should still hold.

Behrens et al. (2020) state that sectors are highly heterogenous and the literature to date on imperfectly competitive markets does not look at how the welfare losses from the differences between equilibria and optima differ with number of firms, firm-level outputs, on an aggregate economy basis.[41] This is particularly important for policy analysis because most 'government intervention in a particular sector typically relies on partial equilibrium analysis, ignoring the interdependencies between heterogenous sectors'.[42]

Sector-specific or regional considerations may provide more insight into how to apply the uplift factor more accurately in different contexts. For instance, if a transport project is being considered in a region where the manufacturing sector accounts for most economic activity, it may warrant a different uplift factor than a region where the services sector dominates the local economy.

However, this needs to be balanced with implementation considerations. Moving to a sector-specific or regional approach would need to consider second- and subsequent-round effects from different magnitudes of changes in outputs in different sectors or regions. There also needs to be sufficiently robust granular evidence to provide recommendations on the application of different uplift factors for different regions/sectors.

[41] Behrens, K., Mion, G., Yasusada, M., and Suedekum, J., 'Quantifying the gap between equilibrium and optimum and monopolistic competition', The Quarterly Journal of Economics, 135:4, November 2020, pp. 2299–2360.
[42] Behrens, K., Mion, G., Yasusada, M., and Suedekum, J., 'Quantifying the gap between equilibrium and optimum and monopolistic competition', The Quarterly Journal of Economics, 135:4, November 2020, p. 3.

3.1 Sectoral considerations for price-cost margins

Some of the literature discussed in section 2 highlights sector-specific views on markups. For instance, the ONS study looks at differences in sector markups (see Figure 3.1 below), and finds that markups have risen in the services sector (excluding financial services) from 1.15 in 1998 to 1.28 in 2019 (a 91% increase[43]) and manufacturing has increased from 1.08 in 1998 to 1.17 in 2019 (a 102% increase). By comparison, non-manufacturing production has seen a decline in markups from 1.62 in 1998 to 1.36 in 2019 (a 41% decrease) while construction has seen a 12% decline from 1.23 to 1.20 over the same period.[44]

Figure 3.1 Markups on intermediate consumption, using a gross output production function (1998–2019)

Source: Oxera and ONS, 'Estimates of markups, market power and business dynamism from the Annual Business Survey, Dataset, August 2022 edition', Link, last accessed 1 June.

Intermediate consumption markups refer to how many more inputs to produce more products a firm could buy at a reduced profit, and labour markups refer to how much additional labour input could be hired. Based on the ONS findings, services and non-manufacturing production, appear to have witnessed higher markup growth rates between 1999 and 2019 on average, as shown in Figure 3.1 below.

[43] Calculated as the growth between the markup in 1998 and the markup in 2019, when costs are normalised to 1. Thus markup growth is measured as an increase from 0.15 to 0.28 ((0.28-0.15)/0.15 = 91%).
[44] ONS, 'Estimates of markups, market power and business dynamism from the Annual Business Survey, Dataset, August 2022 edition', Link, last accessed 1 June.

Similarly, Hwang, Savagar and Kariel (2022) break down markup trends across sectors and find that the services sector witnessed the highest increase in markups post-financial crisis, using both a translog and a Cobb-Douglas production function. They propose that firms at the 90th percentile of the distribution ('superstar firms') have trended towards having higher markups between 1998 and 2014, and these firms tend to be in the services sector. For example, the authors find that in the services sector, the average markup rose from approximately 1.7 in 1998 to 1.8 in 2014, but the distribution of markups between firms in the top and bottom percentiles is particularly notable in the services sector. Firms in the top tenth percentile consistently had markups over 3.0 between 1998 and 2014, with a sharp increase towards 3.5 between 2010 and 2014. Meanwhile those in the bottom tenth have consistently had markups under 1 over the same time period.[45] Because the UK is a service-dominated economy, this pulls the aggregate economy-level markup trends upward.[46] Other sectors such as have also seen increases in markups– but by less magnitude. For example, the average markup construction rose from over 1.3 to 1.4, but the markup distribution between the top tenth percentile (2.0 in 1998 to 2.5 in 2014) and bottom tenth percentile firms (0.9 in 1998 and 0.7 in 2014) was less pronounced than in the services sector.[47]

3.2 Regional considerations for price-cost margins and markups

The literature on specific regional trends related to markups and/or price-cost margins is understandably more limited. Data on markups, price-cost margins and concentration tends to be aggregated on a sectoral basis. Thus, concentrations of certain sectors in particular regions allow for the link between the sector-focused evidence base to be applied on a regional basis. In other words, if particular regions have higher representation of sectors, such as services, the evidence base on sectoral specific trends can be applied to that region. In the OECD paper referred to in section 2.2.1 above, the authors state

[45] Hwang, K., Savagar, A. and Kariel, J. (2022), 'Market Power in the UK', Kent University, ESRC project reference ES/S000089/1, p. 38.
[46] Hwang, K., Savagar, A. and Kariel, J. (2022), 'Market Power in the UK', Kent University, ESRC project reference ES/S000089/1, p. 3.
[47] Hwang, K., Savagar, A. and Kariel, J. (2022), 'Market Power in the UK', Kent University, ESRC project reference ES/S000089/1, p. 38.

that countries that have a strong digital sector may see higher markups, such as Ireland, which saw a 'particularly strong hike in residual markups… possibly reflecting supra-normal returns to intellectual property assets'.[48] This may also explain why similar trends have been noted in the United States, where the digital sector accounts for many of the 90th percentile firms.[49]

In addition, there are other important regional considerations. Most of the literature looks at bigger cities vs smaller cities or rural areas. Research presented by Venables (1999), which is heavily relied on in the methodology for price-cost margins presented in the 2005 DfT Paper shows that there may be regional displacement in welfare due to a transport project. In his more recent paper for the International Transport Forum, he uses the example of the cost-benefit analysis done for Crossrail to show that while additional workers coming into central London has a positive impact on productivity, it needs to be offset by displacement of productivity elsewhere.[50] This is considered elsewhere in TAG but further research may be required to consider whether the OCICM parameter warrants some inclusion of this opportunity cost as well. For example, there may be negative firm-level output changes that are driven by transport projects that take workers outside of the region where those firms operate. This may impact firm-level output responsiveness in response to a transport cost reduction and may mean that the uplift factor needs to be adjusted accordingly.

Venables (2016) also discusses the 'elasticity of productivity'—or agglomeration elasticity, as per TAG—with respect to city size. Put another way, productivities in bigger cities tend to be larger. This is captured in the agglomeration impact within TAG but it is worth noting that it may have an implication on uplift factors applied to capture OCICM. For instance, firms may cluster in bigger cities which may reduce the level of imperfect competition in bigger cities vs smaller towns. This could mean that firms may respond to a reduction in transport costs differently depending on where they are based, which may

[48] Schreyer, P. and Zinni, B. (2018), 'Productivity measurement, R&D assets and mark-ups in OECD countries. OECD WORKING PAPER No.93', p.21.
[49] De Loecker J. and Eeckhout, J. (2017), 'The Rise of Market Power and the Macroeconomic Implications', National Bureau of Economic Research, Working Paper 23687, p.12 and p. 23.
[50] Venables, A. (2016), 'Incorporating Wider Economic Impacts within Cost-Benefit Appraisal', OECD International Transport Forum Discussion Paper 2016-05, p. 18.

in turn impact the uplift factor based on the region in which a transport appraisal is conducted. However, further research would need to be undertaken to explore this hypothesis. We also note however that this agglomeration elasticity may have been impacted by COVID-19, , and further research would need to be undertaken to determine if it was still valid and to what extent.

In Scotland, Scot TAG has taken the approach of applying a 20% uplift factor 'for schemes in very remote rural areas... defined as areas with a population of less than 3,000 and over a 60 minute drive time to settlement with a population of 10,000 or more'.[51] This is based on the work by the Office of Fair Trading which showed using evidence from the petrol industry that less competitive pressures and differences in scale of operation in very remote rural areas led to higher prices, and '[b]y implication this implies higher price-marginal cost margins in very remote areas compared to elsewhere'.[52] We note that the applicability of this kind of rural/remote regional specific consideration of the uplift factor is better suited to Scotland, and less likely to be relevant in England and Wales which have higher population densities and are therefore unlikely to have significant numbers of areas that would meet the definition above to justify a very rural/remote specific uplift factor. It therefore does not change our conclusions.

3.3 Countervailing effects on increasing markups in particular sectors

While price-cost margins and markups appear to have increased economy-wide and in the services sector in particular, there are some studies that provide a more nuanced view. In a study using Belgian data, Abraham et al. (2021) explain that 'price-cost margins can be decomposed into two components: the fixed costs ratio and the excess profits ratio. The former is needed to cover fixed costs whereas the latter represents the remaining profitability'. The authors find that the amount of the increase in price-cost margins attributable to excess profits is highest in the trade and industry sectors, while services has the lowest excess profits ratio.

[51] Transport Scotland, 'Stag Technical Database: Section 9.3.2 – Wider economic impacts in the appraisal process', Link, last accessed 9 May 2023.
[52] National Records of Scotland, 'Review of Economic Assessment in Rural Transport Appraisal', Section 5.15, Link, last accessed 9 May 2023.

The TAG's assumption, as shown in Figure 1.1., is that the difference between the markup price and output and the price and output under perfect competition, is all the additional welfare benefits (C, D and E) that arise under imperfect competition. However, if some sectors have lower excess profits ratios, this may mean that these welfare benefits are not being realised to the extent that the TAG assumes and a lower uplift may need to be considered. This concept is discussed further in section 4.

3.4 Conclusions on sectoral and regional factors in TAG

In summary, as illustrated above, there are some differences in markups between sectors with the services sector accounting for the biggest increases in markups since the late 1990s. As Davies points out 'in the UK, the services sector account for roughly 80% of GDP'[53] which is likely driving the aggregate economy-wide markup increase.

With that said, there is some evidence that the services sector has lower excess profits ratios than others. In a study using Belgian data, Abraham et al. (2021) find that although firms have higher price-cost margin growth in the services sector, when accounting for fixed cost growth since the late 1990s, 'the increasing fixed costs ratio dominates the rising price-cost margins such that the excess profits ratio has declined'.[54] This may mean that the welfare benefits are not being realised to the extent that TAG assumes and a lower uplift may need to be considered than if it was based solely on the increase in markups. This idea is considered further in section 4.

With respect to regional considerations, while there is insufficient evidence in the literature on differences between UK regions, regional differences can be inferred from the sectoral concentration in that region. A more services-dominated local economy may mean higher markups, while non-manufacturing production may mean lower markups. In addition, the size of the city and regional displacement of welfare should be considered if uplift is being applied on a regional basis. On the other hand, in a transport appraisal, the impact of higher markups in the services sector may be partially offset by lesser weighting

[53] Davies, S (2021), 'Competition and Concentration: Charting the Faultlines', Centre for Competition Policy Working Paper 21-11, p. 13.
[54] Abraham, F., Bormans, Y., and Konings, J. and Roeger, W. (2021), 'DP16796 Price-Cost Margins and Fixed Costs', CEPR Press Discussion Paper No. 16796, p.19.

of this sector due to it being less transport intensive. Further research would need to be undertaken to evidence this hypothesis.

Given the various offsetting factors, at this time, we do not believe there is sufficient evidence to depart from the simplification that a transport project affects all sectors equally.

Further research on this topic could consider the number of sectors that heavily use transport using ONS' supply and use tables. The supply and use tables provide estimates of industry-level outputs of differentiated products, and estimates of inputs used by each industry to produce these outputs. These are sometimes referred to as 'input-output tables'. Alternatively, or in addition to the above, National Travel Survey and domestic road freight activity data could be used to analyse the sectoral breakdown of business travel mileage and determine which sectors are heavily reliant on transport . This would allow for a determination of the sectors which would be most affected by a transport investment. By extension, based on the sectoral concentration in particular cities and areas, it would also allow for the determination of which regions would be affected.

4 Firm-level output responsiveness and countervailing effects on profit margins

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It is important to bear in mind that while price-cost margins and markups may have increased as demonstrated in sections 2 and 3, countervailing effects may mean that these increases are not necessarily reflective of higher economic profits. This is because there may be increases to firms' total costs, due to increases in fixed costs, for example. As profit is determined by total revenues less total costs, and markups are measured as the price level above marginal costs., an increase in markups does not necessarily mean an increase in profits In other words, the profit is determined by total costs and revenues, while the markup is based on marginal costs. If marginal costs do not increase, but total costs do, this would impact profits but may not have the same impact on markups. The implication of this is that outputs of firms may not be as responsive to reductions in transport costs due to a transport project investment, and thus the uplift factor may not be a simple product of price-cost margin and elasticity of demand.

It is important to note that the TAG methodology for the OCICM uplift factor does not have any means for differentiating between economic profit and price-cost margins. A revised approach to this methodology may wish to consider a variable to account for economic profits to address countervailing

It is important to note that the TAG methodology for the OCICM uplift factor does not have any means for differentiating between economic profit and price-cost margins. A revised approach to this methodology may wish to consider a variable to account for economic profits to address countervailing effects (such as fixed costs), which may allow for a more accurate application of the uplift factor in transport appraisals.

Kariel and Savagar (2022) note that a rise in returns to scale will increase markups, 'but it also means that higher markups will not translate one-to-one into higher economic profits since higher returns to scale increase the marginal product of inputs which raises their price and therefore reduces profits'.[55]

We focus on two specific effects below — fixed cost effects and trade effects — and demonstrate how they may impact how price-cost margins are considered within the methodology for the uplift factor in the TAG methodology. In other words, we evaluate how increasing

[55] Kariel, J. and Savagar, A. (2022), 'Return to Scale and Productivity', University of Oxford and University of Kent, ESRC project reference ES/V003364/1, p.1.

trends in markups may not necessarily have the same magnitude of increases on price-cost margins, and how that should be factored into the TAG uplift.

4.1 Fixed cost effects

The CMA report explores this concept through earnings before interest and taxes (EBIT) margins, and other metrics to support the idea that 'an increase in markups may not imply an increase in economic profits if firms also incur larger fixed costs to produce goods and services'.[56] In other words, this may mean that higher markups, due to high fixed costs, only allow firm owners to recover their cost of capital, and do not necessarily drive higher profits.

To account for this, the CMA report looks at EBIT Margins as an additional measure of profitability through pure accounting profits. It divides EBIT by turnover to obtain a 'turnover-weighted mean EBIT' margin for a group of large companies, in order to determine profitability over the period 2000–2020. Its results show that while the mean EBIT margin has been broadly constant around 5% in the time period considered, the EBIT margin for firms in the 90th percentile has 'overall tended to remain 10-12 percentage points higher than the [...] mean'.[57]

In addition, the CMA report considers return on capital employed (ROCE) as an additional measure of profitability, which is estimated by dividing EBIT by capital employed. Capital employed is 'measured as total assets minus current (short-term) liabilities or[...] equity plus long-term liabilities'.[58] ROCE takes into account the capital intensity of a firm and thus may have some advantages over the EBIT by turnover measure when assessing profitability, since 'in general, to stay in business in the long run a firm with a higher capital intensity will require a higher EBIT margin to cover its cost of capital than a firm with a lower capital intensity'.[59] Their findings show that firms at the 50th percentile have had relatively stable turnover-weighted mean ROCE (and close to the median ROCE) over the period 2000–2020, while firms at the 90th percentile remained 25–30% higher than the turnover-

[56] Competition and Markets Authority (2022), 'The State of UK Competition', p. 86.
[57] Competition and Markets Authority (2022), 'The State of UK Competition', p. 100.
[58] Competition and Markets Authority (2022), 'The State of UK Competition', p. 101.
[59] Competition and Markets Authority (2022), 'The State of UK Competition', p. 101 (footnote 197).

weighted mean. They then use a cost of debt as a proxy for cost of capital to demonstrate that the cost of capital fell more than the turnover-weighted mean ROCE, which 'could indicate that economic profits have been rising over time'.[60]

With that said, the ROCE measure of profitability, as with the turnover-weighted mean EBIT margin above, is based on accounting profits and therefore may not necessarily follow the trend in economic profits. Another important caveat with these results is that the CMA's analysis focuses on firms that have sufficient data for the CMA to calculate markups and EBIT margins, which may mean that the sample is not necessarily representative of all firms in the economy.

Evidence that firms' fixed costs have increased significantly over the period 1985-2014 is also explored by Abraham et al. (2021), which according to the authors may explain a large part of the price-cost margin increases. As referenced in section 3.1, the authors differentiate between the fixed cost component of price-cost margins and the excess profit component. They state that much of the literature does not separate the effects of fixed costs from excess profits in price-cost margins/markups and that 'the rise in markups may just reflect in fixed costs associated with production, such as overhead costs'.[61]

They employ a method, based on the primal and dual Solow residual models, which simultaneously estimates price-cost margins and fixed costs in production using observed variation in firm-level expenditures on inputs and revenues. Their model allows them to estimate the level of 'fixity' for each input (capital, labour, intermediate inputs, etc.) based on firm-level data, rather than having to classify costs as variable, fixed- or quasi-variable and quasi-fixed. They find that when no fixed costs are assumed, the price-cost margin matches the excess profits ratio exactly. They find, using Belgian data from 1985 to 2014, that when fixed costs are introduced, price-cost margins increase to 25.9%, but that the fixed cost ratio increases also almost as much to 23.4%, leaving

[60] Competition and Markets Authority (2022), 'The State of UK Competition', p. 105.
[61] Abraham, F., Bormans, Y., and Konings, J. and Roeger, W. (2021), 'DP16796 Price-Cost Margins and Fixed Costs', CEPR Press Discussion Paper No. 16796, p.1.

excess profits as only 2.5%.[62] The authors summarise their findings as follows:

> ...sectors with the highest price-cost margins also have the highest fixed costs ratio but not necessarily the highest excess profits ratio. This suggests that most of the price-cost margin goes to covering fixed costs.[63]

An obvious limitation of this paper is that it uses Belgian data and may not be applicable in the UK context. This is particularly the case when considering that the study finds that Belgian price-cost margins either remained roughly constant between 1985 and 2014 (when no fixed costs are taken into account) or moderately declined (when fixed costs are taken into account). The literature has consistently demonstrated that markups (and by extension price-cost margins, which will move in the same direction, even if it has a different growth rate) have increased between the 1990s and 2020 in the UK, as discussed in section 2. This may mean conclusions from the Belgian study may not be easily extrapolated to the UK economy. There may be significant reasons why trends in price-cost margins diverge in the two countries, such as sectoral composition of the respective economies.

It is also worth noting that the ONS study discussed in section 2.1 presents evidence that profit margins mirror markup trends in almost all sectors in the UK, reflecting an increase in profits which is greater than what is required to cover average costs.[64] With that said, according to the ONS, 'the profit margin is an accounting measure of the profitability of the firm. It is computed by dividing a firm's pre- or post-tax profit by its revenue'.[65] Thus, this is not reflective of economic profits that account for changes in fixed costs. In conclusion, the evidence on the impact of fixed costs is inconclusive in a UK context and warrants further research.

[62] Abraham, F., Bormans, Y., and Konings, J. and (eds) (2021), 'DP16796 Price-Cost Margins and Fixed Costs', CEPR Press Discussion Paper No. 16796, p. 15.
[63] Abraham, F., Bormans, Y., and Konings, J. and (eds) (2021), 'DP16796 Price-Cost Margins and Fixed Costs', CEPR Press Discussion Paper No. 16796, p. 18.
[64] ONS, 'Estimates of markups, market power and business dynamism from the Annual Business Survey, Great Britain: 1997 to 2019', Link, last accessed 19 April.
[65] ONS, 'Estimates of markups, market power and business dynamism from the Annual Business Survey, Great Britain: 1997 to 2019', Link, last accessed 19 April.

4.2 Trade effects

In slightly older research by Boulhol (2008), the author highlights the need to search for factors counterbalancing the pro-competitive effect on markups[66] such as the effects of trade. For instance, targeting of exports at more profitable markets, resulting in higher markups. This may also be due to market structure, where 'competition operates not only through prices but also through R&D and advertising, more competitive pressure generates the scaling up of expenditures which leaves less profitable firms in operation. Their exit may entail a rise in average markup'[67] In other words, because of competitive pressures, firms spend more on advertising and R&D, increasing their costs and lowering their profits. If markups are not high enough, some of the less profitable firms will exit the market, and this will result in a higher average markup amongst the 'surviving' firms that remain operational.

This is corroborated by Davies (2021) when considering how trade may impact concentration. As discussed in section 3.2, some trade-intensive industries such as parts of the manufacturing sector focused on exports, may reflect lower concentration as measured by the HHI, as they may have a small share of the domestic market. If concentration is reflective of market power and directionally moves the same way as price-cost margins, this may mean that consideration of an open economy in the literature, by accounting for import/export data, would reduce the concentration of some areas of the economy and may impact total price-cost margins by extension. This hypothesis is based on intuition and warrants further research to confirm.

[66] Boulhol, H. (2005), 'The convergence of price-cost margins', *Cahiers de la Maison des Sciences Economiques*, **56**, ISSN : 1624-0340 <halshs-00195890>
[67] Boulhol, H. (2005) 'The convergence of price-cost margins', *Cahiers de la Maison des Sciences Economiques*, **56,** ISSN : 1624-0340 <halshs-00195890>, p. 15.

5 Cost pass-through and elasticity of demand

This sections looks at the underlying assumptions behind two additional components of the current OCICM parameter – cost pass-through due to a change in marginal cost, and aggregate elasticity of demand. More specifically, we consider:

- whether the assumption that the cost pass-through due to a change in marginal cost (k) is 'very close to 1'[68] is still appropriate with more recent evidence;
- whether average economy-wide elasticity of demand of 0.5 is still appropriate in this calculation with more recent evidence.

5.1 Recap of the current OCICM parameter

Recall from section 1 that the 10% uplift factor in the current TAG is based on the following formula:

$$V = \frac{P - MC}{P} \times ED$$

where

- V = imperfect competition uprate factor;
- $\frac{P-MC}{P}$ = price-cost margin;
- ED = elasticity of demand.

This formula comes from the 2005 DfT Paper and is derived from an expanded formula as follows:

$$WB3 = [V] \times Q \times dMC$$

or

$$WB3 = \left[k \times \frac{P-MC}{P} \times ED\right] \times Q \times dMC$$

Where

- k = cost pass-through
- Q x dMC = Value of business user benefits

Thus the uprate factor is defined fully as $[V] = k \times \frac{P-MC}{P} \times ED$.

[68] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', para. 202-204 p.46.

The DfT Paper assumes that the cost pass-through parameter *k* is 'very close to 1' and thus 'the uprate factor is simply the product of the price cost margin and the elasticity of demand'.[69] In other words, since $k = 1$, the imperfect competition uprate factor *V* becomes:

$$V = \frac{P-MC}{P} \times ED$$

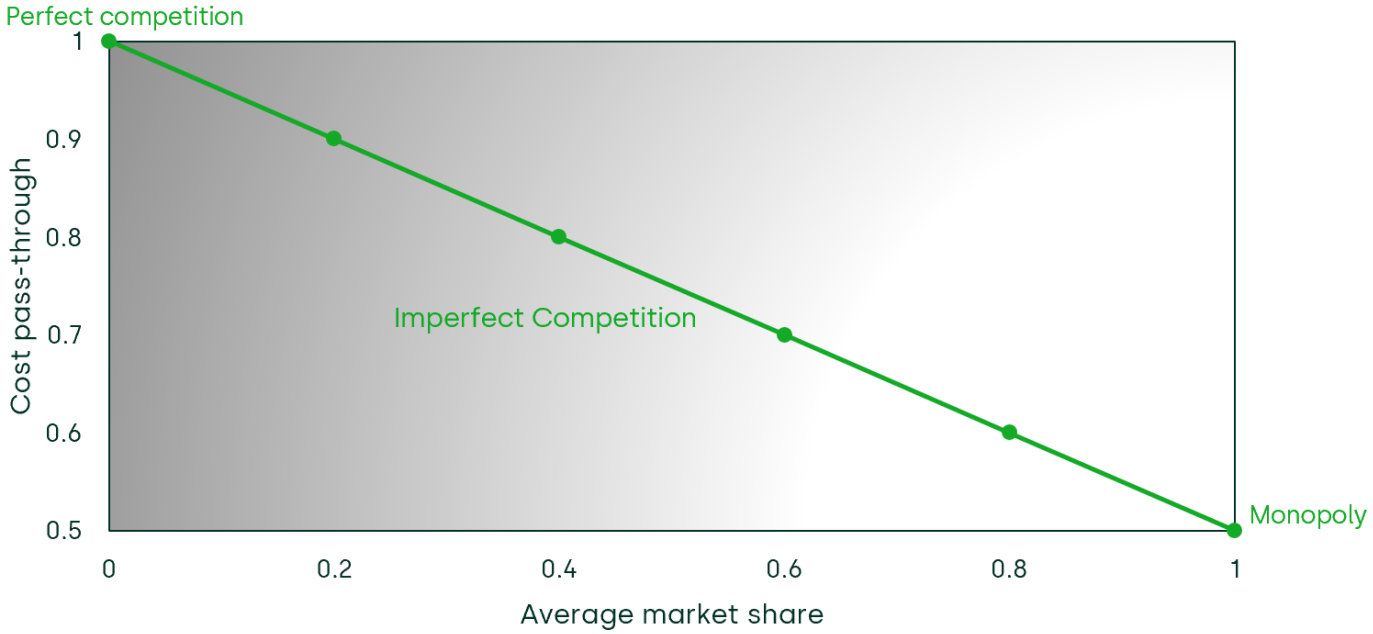
5.2 Cost pass-through—theory and starting assumption in the TAG

According to basic economic principles, firms operating in a perfectly competitive market pass through 100% of cost increases, while a monopoly would pass through only 50%.[70] This is, however, based on a number of simplifying assumptions, such as linear demand and constant marginal costs. In practice, however, markets are neither perfectly competitive or have perfectly linear demand curves, and these assumptions are unlikely to hold.

As discussed in section 1.1 above, the DfT paper underpinning the TAG wider economic benefit of OCICM assumes that pass-through is 'very close to 1'. However, we believe that as a starting assumption, this is not aligned with economic theory. An imperfectly competitive market would imply that the pass-through rate should be greater than in a monopoly (i.e. greater than 0.5) and less than in perfect competition (i.e. less than one), as shown in figure 5.1 below.

[69] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', p. 46, paras 202–204.
[70] RBB (2016), 'Study on the passing-on of overcharges', para. 126.

Figure 5.1 Theoretical relationship between market share and cost pass-through



Source: Oxera.

While it is difficult to know exactly where the pass-through should be between 0.5 and one, the DfT paper does not provide justification or evidence for why pass-through is assumed to be very close to one. Even if it was assumed to be just under one (for example, 0.95), and thus aligned with theoretical principles, there is a lack of evidence supporting why this is the case. A more suitable approach may be to take the mid-point between 0.5 and one, so 0.75, as the cost pass-through. This is a typical approach when trying to find a point within a range without sufficient evidence, and would have slightly more justification than the current assumption of 'very close to 1' in an imperfectly competitive market.

5.3 Empirical evidence on market concentration on cost pass-through

As demonstrated through the literature considered in section 2.1 on market concentration, there is sufficient evidence to conclude that concentration has increased in the UK over the last two decades. Standard economic theory, in line with Cournot models with constant marginal costs (i.e. marginal costs which do not vary with the level of output), suggests that pass-through increases with more competition (if it lies below one initially). This would imply that cost pass-through should decrease towards 0.5 as concentration increases.

However, in our review of the literature on cost pass-through trends, there is mixed evidence on the impact of market concentration on cost pass-through. We show below that there is evidence from the literature that in reality, pass-through depends on a number of assumptions, including the assumed relationship between firms' costs and output, and in some cases, may increase as market concentration increases.

First, if marginal cost is an increasing function of output (i.e. marginal costs are not constant), Ritz (2022) shows, through theoretical proofs, that market power increases cost pass-through[71] with corroborating evidence from studies spanning from 1980 to the late 2010s. For instance, Ritz (2022) references a study by Stolper (2018) which shows that market power in the gasoline retail sector in Spain was 'strongly associated with higher pass-through'.[72] He notes, however, much of this depends on the firm's demand function, elasticity of demand, whether market power is due to softer competitive conduct or higher market concentration. He also notes that 'this finding applies to the 'normal' case where pass-through is incomplete, i.e., lies below 1'.[73]

Ritz and Neuhoff (2019) look at the level of pass-through as a result of a carbon tax. As with the above cited literature, their paper builds a theoretical framework that demonstrates that under certain demand conditions (i.e. depending on the shape of the demand curve), less competition can mean higher pass-through. They use the empirical evidence base to demonstrate that 'the empirical evidence on the role of market structure as a drive of cost pass-through is mixed. Some papers find evidence for the traditional results that competition intensifies pass-through and others find the opposite'.[74]

In research for the Federal Reserve Bank of Boston, Brauning et al. (2022) find that increasing concentration in the United States in the context of high-inflationary pressure has led to an increase in cost pass-through. Their

[71] Ritz, R. (2022), 'Does competition increase pass-through?', Judge Business School & Faculty of Economics, Cambridge University, p. 3.
[72] Ritz, R. (2022), 'Does competition increase pass-through?', Judge Business School & Faculty of Economics, University of Cambridge , p. 21.
[73] Ritz, R. (2022), 'Does competition increase pass-through?', Judge Business School & Faculty of Economics, University of Cambridge, p. 3.
[74] Neuhoff, K. and Ritz, R. (2019), 'Carbon cost pass-through in industrial sectors', Energy Policy Research Group, University of Cambridge, p. 18.

method uses data at the three-digit NAICS level and is similar to concentration studies discussed in section 2.1.1 in the UK context, using HHI to estimate concentration, with other sensitivity checks to ensure data is representative, etc. Their analysis constructs 'a measure of industry-specific cost shocks and estimate[s] how concentration affects the pass-through of these cost shocks into producer prices'. They find that the 'US economy is at least 50 per cent more concentrated than it was in 2005' and that this level of increased concentration has resulted in an increase in cost pass-through in response to industry-specific cost shocks by about 25 percentage points in the last two decades.

Taking this evidence together, there is a body of evidence to support the correlation between more concentration (less competition) and higher cost pass-through in some specific contexts. With that said, some empirical work aligns with standard economic theory which states that higher concentration actually leads to lower cost pass-through.

The literature on the trends of cost pass-through, and its links to concentration, appears to be inconclusive and dependent on several features of the market (the shape of the demand curve, productivity levels of firms, starting level of cost pass-through being 'incomplete', i.e. less than 100%). It is difficult, therefore, to ascertain how these results can be extrapolated to the TAG assumptions, because on an economy-wide level, the shape of the supply curve and demand curve are unknown.

Given the empirical evidence is mixed but the economic theory is clear, we recommend departing from the 2005 DfT paper assumption of k=1 and adopting an approach that is consistent with economic theory with k equal to 0.75 for imperfectly competitive markets, as this reflects the midpoint between 0.5 (monopoly pass-through) and 1 (perfect competition pass-through).

5.4 Price elasticity of demand

As discussed in section 1.1, the 2005 DfT paper, which underpins the TAG's assumptions, concludes that the aggregate elasticity of demand can be estimated as

approximately 0.5.[75] This is based on research done by Newbery, Harris and Venables for the Standing Advisory Committee on Trunk Road Assessment (SACTRA) report. The 2005 DfT paper noted that the evidence was not very robust but due to the lack of empirical evidence it highlighted that 0.5 was the best estimate that could be obtained[76]. We have reviewed the underlying evidence but are unable to ascertain a rationale for why 0.5 is assumed.

We have also been unable to identify more recent robust empirical studies of an aggregate elasticity of demand that may replace the current assumptions underpinning the TAG as described above.

Gorman (2005) discusses the limitations of the evidence base on estimates of elasticity of demand in the transportation sector. These arise 'from three broad sources of error: the type of data used (i.e. time series, cross sectional or panel), the selection and measurement of the relevant variables for supply and demand identification, and specification of the functional form of the demand curve'.[77]

In the absence of sufficient evidence of economy-wide aggregations of elasticity of demand in the literature, we turn to microeconomic theory which suggests that price-cost margins and elasticity of demand move in opposite directions. Gorman (2005) summarises theoretical views of the behaviour of implied elasticity of demand based on the relative values of price and marginal cost. In short, when prices exceed marginal cost (P>MC), as is the case in imperfectly competitive markets, elasticity of demand is less than negative one (ED< -1). Conversely, when prices are equal to marginal costs (P=MC) as is the case in perfect competition, elasticity of demand is undefined.[78]

As noted by Boulhol (2005), the classical pro-competitive story is that 'increased competition… lowers concentration and induces an increase in the perceived elasticity of demand faced by firms, triggering a fall in desired

[75] Department for Transport (2013), 'Transport analysis guidance', 29 October, Link (last accessed 17 April).
[76] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', p. 46.
[77] Gorman, M. (2005), 'Estimation of an implied price elasticity through current pricing practices', *Applied Economics*, **37**:9, p. 1028.
[78] Gorman, M. (2005), 'Estimation of an implied price elasticity through current pricing practices', Applied Economics, 37:9, p. 1030.

markups'.[79] We assume that the opposite, therefore, also holds. That is an increase in concentration would induce a decrease in elasticity of demand, which would lead to an increase in markups.

This relationship between elasticity of demand, concentration and price-cost margins is also noted by Davies in the 2005 DfT paper:

> However, there's a close theoretical relationship between (P-C)/P, ED and a third variable; industry concentration. Davies finds that, under certain assumptions, any two of these variables would determine the third. He therefore uses estimates of (P-MC)/P and the Herfindahl index of concentration to produce estimates of the uprate, V, of 0.1. He finds this estimates to be consistent with an ED of about 0.5.[80]

Noting the unclear rationale for the current assumption of 0.5 for the elasticity of demand, there may be some justification to reduce the current assumption in light of the higher concentration and markups which the evidence supports, as demonstrated in earlier sections of this report. If we assume that price-cost margins have increased to 0.31 (from 0.2), as we explain in section 2.3, this would mean that if elasticity decreased to 0.32 from the current 0.5, the uplift factor would remain at 10%, all other parameters being equal. If it decreased any more than that, the uplift factor would have to be revised downwards, and vice versa. Further work would need to be undertaken to determine if the elasticity of demand should decrease, and if so, by how much.

An important caveat to this is that elasticity of demand—at least related to goods markets—may be highly subject to regional considerations of where a transport investment takes place. As noted by Desmet and Parente (2009) in a study on trade and productivity, in line with textbook competition theory, the size of a market can raise price elasticity of demand and lower markups. Larger markets (for example, cities) lead to more differentiated products,

[79] Boulhol, H. (2005) 'The convergence of price-cost margins', *Cahiers de la Maison des Sciences Economiques*, **56**, ISSN : 1624-0340. 2005. <halshs-00195890>, p. 15.
[80] Department for Transport (2005), 'Transport, Wider Economic Benefits, and Impacts on GDP', p. 49.

and more product varieties, which results in higher substitutability between products, which can raise the price elasticity.

6 Recommendations and areas for further research

Based on the evidence presented in this report, we are able to draw conclusions about the trends in concentration, markups and price-cost margins that have taken place in the UK economy in the last two decades, and how those trends inform our three core recommendations for the updated OCICM uplift factor in TAG.

First, it is clear that markups have increased between the late 1990s and mid–late 2010s by at least 36%, and up to 75%, with an average of a 58.4% markup increase between the four key studies we have reviewed. These markups translate to a 21.4%–53.9% increase in margins, or an average of 41%. Concentration has also increased which lends further support to margins having increased, since they tend to move in the same direction.

We therefore recommend that TAG should be updated to reflect the margin assumption based on the average of the four sources above, and use the associated margin conversion of 0.31. By this rationale, the current price-cost margin in TAG should increase from 0.2 to 0.31.

All of the above is highly dependent on sectoral heterogeneity and therefore consideration should be given to regions where there is a higher representation of sectors, such as services, which have witnessed higher concentration and markups.

Second, we recommend that the TAG methodology's assumption of cost pass-through of one in imperfectly competitive markets is not aligned with economic theory. It is difficult to know exactly where the pass-through should be between 0.5 (monopoly) and one (perfect competition). We recommend that the mid-point between monopoly and perfect competition, 0.75, be used as the cost pass-through in imperfectly competitive markets is more justifiable than the current assumption of one.

Finally, with respect to elasticity of demand, we have been unable to find an economy-wide estimate of elasticity of demand that could replace the current 0.5 estimate. We believe there is some justification to decrease elasticity of demand, because elasticity tends to be negatively

correlated with concentration and markups/margins, which have increased. However, given the lack of sufficient evidence, we believe the current assumption of 0.5 for elasticity should be retained unless further, robust evidence and analysis can prove otherwise.

Therefore, the revised uplift factor should be 12% as per the following:

$$k \times \frac{P-MC}{P} \times ED = 0.75 \times 0.31 \times 0.5 = 0.116$$

It is important to note that any recommendations made in this report focus on amendments to TAG as per the current methodology. However, as discussed in section 4 of this report, there may be some countervailing effects that temper these results due to fixed costs having increased or trade effects not being taken into consideration, but the literature has not provided sufficient, relevant evidence to adjust for this.

Should further research demonstrate sufficient evidence of these countervailing effects, there is an argument that economic profits may not have increased as much as price-cost margins or markups may imply. As such, the TAG methodology may need to be amended to be less focused on price-cost margins as the key parameter, and instead incorporate a variable (or variables) that account for economic profits.

6.1 Suggested areas for further research

Throughout this report, we have noted areas for further research that would better inform changes to the OCICM parameter but that were outside the scope of this report. These include the below:

- The impact of fixed costs on economic profits is inconclusive in a UK context and warrants further research. Similarly, the exclusion of import/export data may impact concentration in some sectors which may in turn impact markup/price-cost margin trends, and may warrant further research as to its relevance on the OCICM parameter.
- We note that as of 2016, values of time in TAG for business trips are based on WTP, rather than wages. As such, further consideration should be given to the extent to which WTP will encapsulate the OCICM benefit and

whether any adjustments to the uplift factor are necessary.

- With respect to regional displacement in welfare from one area to another due to a transport project, while this effect is considered within the wider economic benefit of agglomeration, further research may be required to consider whether the OCICM parameter warrants some inclusion of this opportunity cost as well. We also note that this agglomeration elasticity may have been impacted due to COVID-19, and further research would need to be undertaken to determine if it was still valid and to what extent
- Further research would also be needed to confirm whether impact of higher markups in the services sector may be partially offset in transport appraisal by lesser weighting of this sector, due to it being less transport intensive. The determination of 'heavy transport using sectors' could be done by analysis of ONS' supply and use tables, and/or National Transport Survey and Domestic road freight activity data.
- We have also been unable to identify more recent robust empirical studies of an aggregate elasticity of demand that may replace the current assumptions underpinning the TAG as described above. There may be some justification to reduce the current assumption in light of the higher concentration and markups, which the evidence supports. Consequently, further work would need to be undertaken to determine if the elasticity of demand should decrease, and if so, by how much.

A1 Glossary

Accounting profit: Accounting profit is the official profit or 'net income' of a firm as is reported in its financial statements. It measures total revenues less total explicit costs. Accounting profits are normally based on 'hard' data, which can be audited and checked very easily.

Cost pass-through/pass-on: The proportion of a cost change that is translated into a change in the final price. It is usually represented as a percentage pass-on rate: the change in price expressed as a percentage of the change in the marginal cost.

Economic profit: Economic profit is more of a theoretical concept, which goes beyond accounting profit. It considers total revenues less total explicit and opportunity costs. It also accounts for the time value of money (by discounting future revenues and costs to the present day).

Marginal cost: The increase in cost incurred in producing an additional (marginal) unit of a good or service option.

Markup: A markup is a measure of market power which reflects the differential between price and the marginal cost. It is expressed as a proportion of price or marginal cost. In a perfectly competitive market, markups are zero, while markups are positive in imperfectly competitive markets. Markups are calculated as the price less the cost divided by the cost *(P-C)/C.*

Price-cost margins: The price-cost margin is another measure of the differential between the price and marginal costs, but are measured slightly differently than markups. Put simply, price-cost margin is estimated as the price less the cost divided by the price (*P-C)/P.*

Profit margin: The profit margin is an accounting measure of the profitability of the firm. It is computed by dividing a firm's pre- or post-tax profit by its revenue.

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