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The Imperial Treasury: appraisal methodology and regional economic performance in the UK

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ABSTRACT

The disparity between the least and most productive regions in the UK is extreme by the standards of most other OECD economies. While there are many contributory factors, this paper argues that an important one is the concentration of public investment in and around London and the South East. The appraisal process for infrastructure investment projects follows the procedures set out in the Treasury's Green Book, with major funding allocation decisions almost wholly centralised. In this paper we argue that the official methodology has reinforced the regional imbalance of the UK economy; that recent changes to the appraisal methods are welcome but unlikely to redress the London bias in infrastructure decisions; and that although evidence-based appraisal is important, infrastructure investments also need to be based on a strategic view about economic development for the whole of the UK.

Keywords: Infrastructure; spatial disparities; cost benefit analysis

JEL codes: H54, O18, R11

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Introduction

The Mayor of Greater Manchester, Andy Burnham, commented in 2017 on his experience as chief secretary to the Treasury a decade earlier: “Officials took me through the cost-benefit analysis used by the Department for Transport and the Treasury to assess the viability of transport projects. This was almost exclusively an economic test and projects were judged by the economic value they created. In short, projects in parts of the country where the economy was strongest were more likely to score highest. What about areas with higher social need that required better transport to grow their economy? No weighting was given to that, I was told.”²

Project appraisals of the kind the then-Minister was shown follow the guidance set out in the Treasury’s Green Book. The Green Book has recently been updated in important ways, with the new version published in March 2018. Official appraisal methods have for some time formally allowed cost-benefit analysis (CBA) assessments to consider wider benefits, where there is good evidence available. For example, in 2011 the Green Book was amended to include “valuing non-market impacts” for value, utility, welfare and well-being (pages 57-58 HM Treasury, 2013, Green Book). This methodology takes into account social costs and benefits and attempts to quantify non-market impacts of health, educational success, family and community stability and environmental assets.

However, the 2013 Green Book also insisted that market prices must be used as far as possible in appraisals. In principle, using market prices gives rise to a ‘Matthew Effect’ whereby further infrastructure investment occurs in places that are already productive.³ As Merton (1968) observed, this feedback effect means there is a self-fulfilling character to many policy interventions. Current UK methodology uses estimates of people’s willingness to pay to value travel time savings in transport infrastructure projects; it is unlikely such valuations are unrelated to average incomes. In this paper we discuss the potential skew delivered by the CBA methodology as set out in the Green Book, including the latest (2018) updated version; and

² Quote from the Guardian (22/8/17), accessed from: <https://www.theguardian.com/commentisfree/2017/aug/22/north-powerhouse-infrastructure-andy-burnham>

³ “Matthew 13, 11-12: “For whosoever hath, to him shall be given, and he shall have more abundance.”

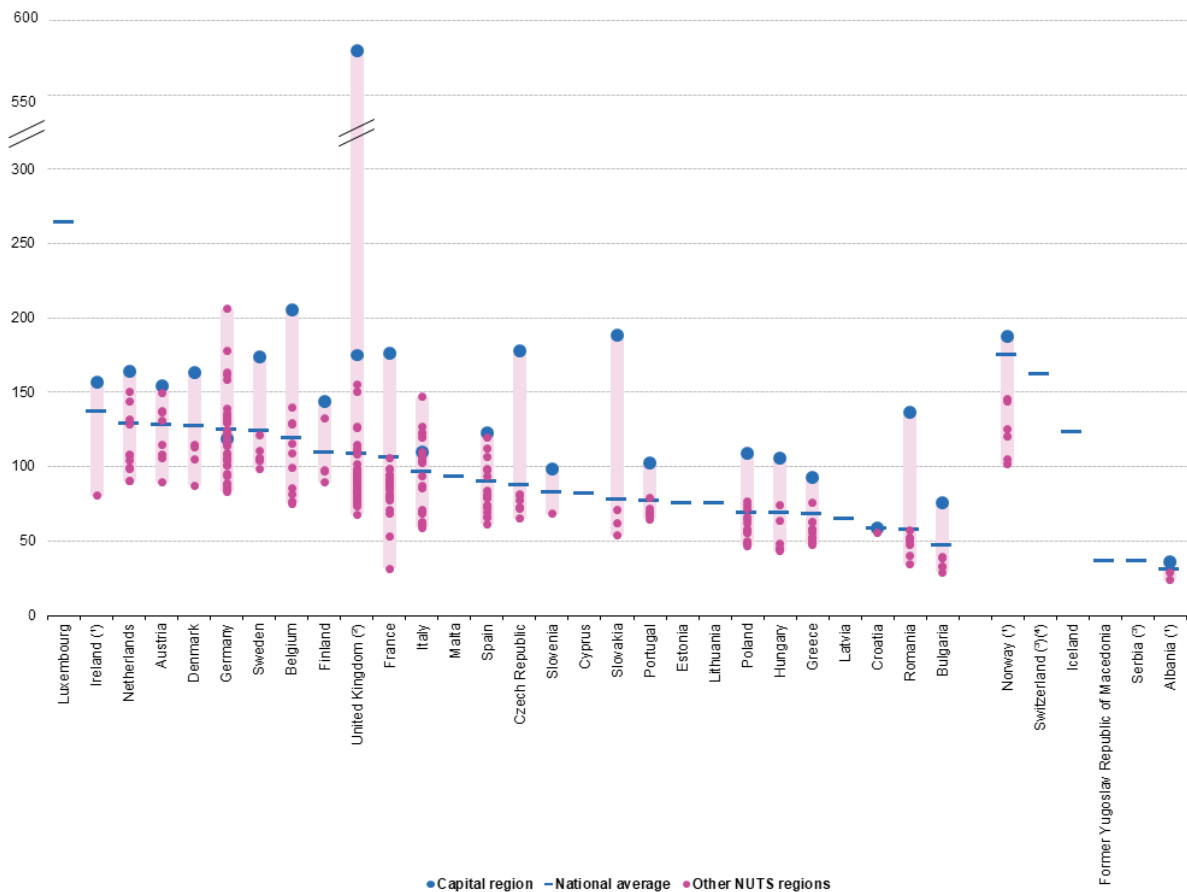
discuss the flaws in the methodology that mean it is a poor tool for taking a long term view about the economy and in particular the spatial aspect of growth.

The next section will describe the data on transport infrastructure spending in the UK, and its skew. We then consider the CBA methodology infrastructure comparisons used in the UK, and why that may inevitably result in an increasing regional skew. We argue that the recent Green Book revisions will not overcome this feature of the CBA method. This can change, however, if decisions about significant investments explicitly incorporate a strategic view about economic development for the whole of the UK, as the economic theory underpinning CBA implies should be the case. Rather than only investing in already highly productive places, this would enable public infrastructure investment to reflect the government's strategic view about potential productivity gains – potential that such government actions could themselves help realise, given the self-realising character of some major projects. We conclude by discussing the need for a revised approach to infrastructure investment in the context of both the case for an Industrial Strategy to raise national productivity, and the political dynamics of English city devolution and the 'left behind' places.

Regional disparities and transport infrastructure spending in the UK

There is wider regional economic disparity in the UK compared to other European countries, as measured by indicators such as GDP or income per head. Figure 1 shows a snapshot for 2015 demonstrating that this is mainly a London effect (albeit the disparity between boroughs in London itself is also very wide).

Figure 1: GDP/inhabitant in PPS* in relation to the EU-28 average, 2015



Note. Ranked on national average. The light lilac shaded area shows the range of the highest to lowest region for each country; the blue bar shows the national average; the blue circle shows the capital city region; the lilac circles show the other regions.

(*) 2014.

(*) Note there are two capital city regions: Inner London - East and Inner London - West.

(*) National data.

(*) Provisional.

Source: Eurostat (online data codes: nama_10r_2gdp and nama_10_pc)

Source: Eurostat http://ec.europa.eu/eurostat/statistics-explained/index.php/GDP_at_regional_level.

GDP by NUTS 2 regions, 2015. *PPS is purchasing power standards. % of the EU-28 average, EU-28 = 100.

Living standards and productivity are affected by many variables, and there is a large literature on the possible explanations for the UK's regional imbalance; patterns of infrastructure spending are only one possible contributory factor (McCann, 2016). International comparisons of this form of spending are not straightforward. However, noting the importance of infrastructure – both new investment and maintenance – for productivity and well-being, the OECD has observed that the UK has been spending less on infrastructure than other of its member economies for some decades, and also that its perceived quality was lower than in the other G7 countries (Pisu *et al* 2015). Crescenzi *et al* (2016) assess the connection between regional quality of government and returns to road infrastructure in EU regions. They find that investment in secondary roads, rather than motorways, improves within-region connectivity, and is correlated with economic growth, particularly where the quality of government is high. They suggest that improvements in the efficiency of public spending, and particularly transport infrastructure investment, will only come about with the development of local institutions (which can identify local needs). There is a consensus that, particularly when it comes to transport, there has been too little infrastructure investment in the UK.⁴ Across the OECD, fiscal devolution is correlated with infrastructure investment where institutional quality is high.⁵

That the level of investment is unsatisfactory, and that a strategic view is important, was also tacitly acknowledged both by UK governments with the creation of the National Infrastructure Commission in 2015 and in recent modest increases in funding for infrastructure. In 2018 the National Infrastructure Commission published its annual 30 year horizon strategic assessment.⁶ The November 2017 Budget also announced some spending increases including: expansion of the National Productivity Investment Fund to more than £31 billion; a £1.7 billion Transforming Cities Fund for improving transport links within cities; investment of £500 million in a range of technological initiatives ranging from artificial intelligence to 5G and full fibre broadband; £400 million investment in a network of electric car charging points – a combination of public and private investment; £76 million additional funding for flood and coastal defence schemes over

⁴ For example, <https://www.weforum.org/reports/the-global-competitiveness-report-2016-2017-1> and <https://www.tuc.org.uk/news/uk-languishing-near-bottom-oecd-rankings-investment-vital-infrastructure>

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[http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP\(2016\)54&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP(2016)54&docLanguage=En)

⁶ See <https://www.nic.org.uk/our-work/national-infrastructure-assessment/>

three years. Looking at the National Infrastructure and Construction Pipeline (2017), transport spending has the largest share of funding. Between 2017-2021 this is projected to be £78.5bn (32% out of a total of £244.7bn). This includes central government spending on transport (£60bn), local government (£8bn), private sector (£6bn) and mixed funding (£4.5bn).

The former head of the National Infrastructure Commission and former transport minister, Lord Adonis, stated in evidence to a Parliamentary committee that the interpretation of cost-benefit ratios had been problematic in past policy decisions.⁷ He said improving rail links east to west in the North of England had been on the agenda since he was Transport Secretary 10 years earlier, arguing that the way cost-benefit ratios are calculated puts too much weight on journey time savings, always favouring London: “All the cost-benefit analysis, and the work that has been done in the Department, doesn’t place a high enough premium on significant transformational transport investment in the North. This has been a long running thing. The Government accepts it now which is why it set up Transport for the North.”

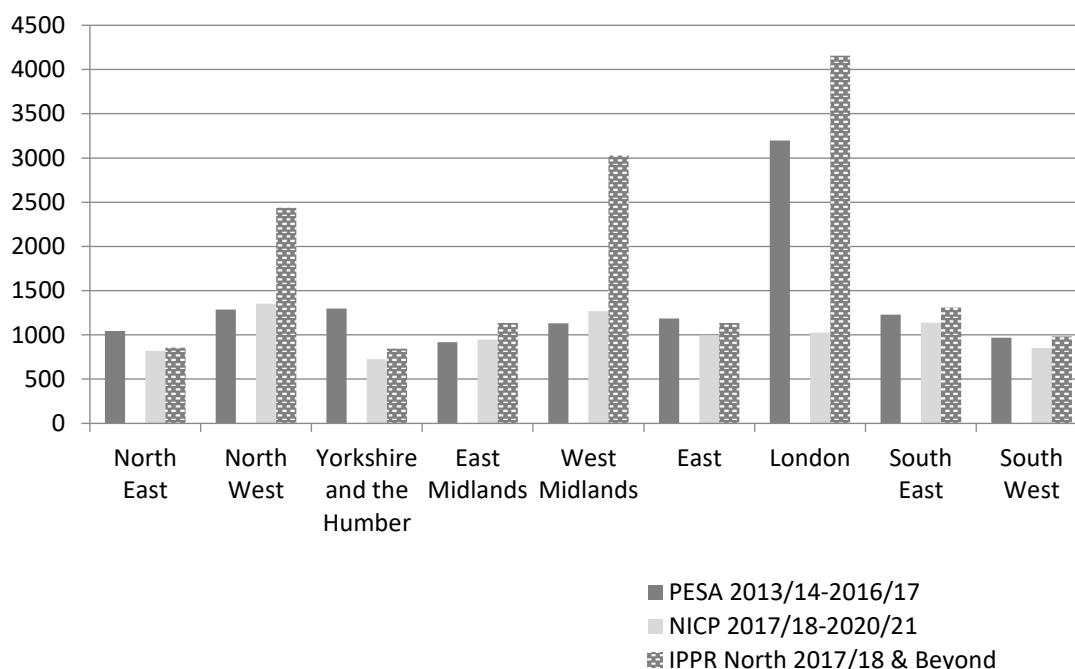
The skew to the capital in public funding to date is clear. Raikes (2018) calculated that the North West of England is due receive transport spending of £2,439 per head, the North East £855 per head and Yorkshire and Humberside £844 per head, compared to London’s £4,155 per head. One frequently-heard defence of this imbalance is that London makes a net contribution in tax revenues to the rest of the UK and therefore needs higher spend *per capita* to continue to deliver productivity and growth benefiting the whole of the UK. This is somewhat circular: if the capital needs infrastructure to enable it to grow faster and have higher productivity, surely the same reasoning applies to other regions?

The Treasury publishes an annual record of the Public Expenditure Statistics Analysis (PESA) including a regional allocation of public spending (by central government, local government and public corporations). It also sets out spending by functions. Figure 2 compares the PESA figures for actual public expenditure on transport over the past four financial years with the projected regional spending figures in the National Infrastructure and Construction Pipeline published by the Infrastructure Projects Authority (IPA), IPA 2017, and those calculated by IPPR North, Raikes

⁷ See The Department for Business, Energy and Industrial Strategy (BEIS) select Committee on Industrial Policy: Sector Deals and Productivity on 28/2/18 at: <https://www.parliamentlive.tv/Event/Index/380f32b4-5f92-4d9e-8215-ec06a56c4450>

(2018). The IPA's NICP figures are lower than the latter because the regional analysis counts only central government expenditure and does not include local government spending when provided jointly with central government (for example Crossrail £2.3bn and Thameslink £0.8bn); local government spending (for example London Underground renewal £1.1bn and line upgrades £1.1bn); private sector spending when central or local government is the co-funder (for example: Barking Riverside extension £61mn) and any spending beyond 2021/22 (for example HS2 and Crossrail 2 £31 billion). The IPPR North figures include all of these in their analysis, and hence their figures show (like the actual PESA totals for the past four years) a more pronounced skew toward London (Figure 2). In addition, some formerly directly government-funded spend in London is now funded from the capital's retained business rates, and is no longer classified as capital expenditure.⁸ This switched funding, which therefore no longer is included in the investment figures, amounts to £240m in the current year.

Figure 2: Transport capital spending per head, actual 13/14-16/17 (PESA), projections 17/18 on (IPA and IPPR)



⁸ <http://content.tfl.gov.uk/tfl-funding-agreement-letter-march-2017.pdf>

It has been argued that decisions to fund major infrastructure projects are inevitably not made wholly on economic grounds. For instance, many economists have challenged the notion that the HS2 project is justified by economic evidence. While the then chair of the Treasury Select Committee said: “HS2 has the weakest economic case of all the projects within the infrastructure programme, yet it is being pushed through with the most enthusiasm.”⁹

In terms of the regional distribution of investment, an inspection of benefit-cost ratios (BCR) of public transport schemes assembled for the 2006 Eddington Review and a number of subsequent schemes indicates that London projects or those serving London with relatively low BCRs (less than 2) have routinely been approved, whereas outside London there is a more mixed picture (see Table 1 and Figure 3). Some projects with far higher initial BCRs in the English regions have not gone ahead. This is suggestive of a non-economic process for the allocation of funds, at least at some aggregated level (Forth 2017). That major transport project decisions are political decisions is the received wisdom among many officials. There are many ways such decisions can appear to be supported, *ex post*, by CBA analysis. The scope in Department for Transport appraisal guidance to take into account benefits that cannot easily be expressed in monetary terms can help nudge low BCR but desired projects as nevertheless value for money. The way projects are split, and the timing of revisions to BCR estimates, can also be deployed to justify desired decisions. For instance, the original HS2 assessment had far better BCRs for its northern than its southern phases, and the latter – the first – was more easily justified using a combined BCR for the whole project. (Recent revisions show a BCR for Phase 2 which is lower than the – upward revised – BCR for phase 1.)¹⁰ The BCR for the cancelled Midlands rail electrification scheme (on grounds of rising costs) would have been higher if considered as part of an upgrade of the whole route from Bristol to the North of England. On the other hand, the Thameslink upgrade in London did see its BCR revised down (from over 2 initially to 1.24) due to cost escalation, but not until after the work had begun (NAO 2017).

There is certainly not a clean sheet of paper when it comes to prioritising investment decisions and the allocation of public funds. It seems that a CBA process, justified with reference to the

⁹ See the open letter from Andrew Tyrie to Chris Grayling, Transport Minister, here: <https://www.parliament.uk/documents/commons-committees/treasury/Correspondence/Chairman-to-Transport-Secretary-Airport-Expansion-and-HS2-15092016.pdf>

¹⁰ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/634196/high-speed-two-phase-two-economic-case.pdf

need for economic efficiency and delivering productivity growth, may be used to deliver schemes that are desired for other reasons. The reason BCRs are capable of being used in this way is due to their methodological bias toward already-productive regions, discussed in the next section; the deck is stacked providing enough cover for essentially politically-motivated decisions.

Table 1: Public transport schemes, BCRs

SCHEME	BCR	Funded?	
Local public transport schemes			
Altrincham Interchange, Greater Manchester	1.0	Yes	
Bletchley Link 2 Public Transport Scheme	3.1	Yes	
Bradford Interchange	1.0	No	
Cambridge Guided Bus	2.0	Yes	
Coleshill Multi Model Interchange	4.8	Yes	
Coventry Rapid - Preferred scheme	1.9	Yes	
Doncaster QBC	1.7	Yes	
Greater Bristol Bus Network	3.2	Yes	
Haxby Station	3.0	No	
Leeds Supertram	2.3	No	
Mansfield Interchange	4.4	Yes	
Newcastle - Eldon Square Concourse	1.2	Yes	
North West Taunton Package	1.8	Yes	
Nottingham Express Transit Extension	2.0	Yes	
South Hampshire Rapid Transit	3.6	No	
SPARK Leamington Spa and Warwick	2.8	No	
Surrey Pegasus, Guildford Area	1.4	?	
Warrington Interchange	2.0	Yes	
Wolverhampton Town Access and Interchange	2.2	Not yet	
MyBus, West Yorkshire	4.0	Yes	
Rail schemes			
Crossrail Hybrid Scheme	1.6 to 2.6	Yes	
Thameslink Upgrade	2.1 to 3.0	Yes	
Electrification from London to Cardiff	2.3	Yes	
Electrification of the Midland mainline	4.1 to 13.1	No	
Electrification from Cardiff to Swansea	1.4	No	
Electrification from Oxenholme to Windermere	2.3	No	
Castlefield Corridor (Ordsall Chord), Manchester	2.14 to 2.55	Yes	
Electrification Leeds-Harrogate-York line	3.61 to 4.27	Not yet	
Schemes from external sources			
A228 Main Road to Ropers Lane	Local Road	2.4	?
A66 Tees Valley Gateway Study	Local Road	3.2	?
Canal Towpath	Walking/Cycling	24.5	?
DLR London City Airport Light Rail		1.7	Yes
DLR Woolwich Extension Light Rail		1.1	Yes

Table 1 - continued

Glasgow Airport Rail System Rail	1.1	No
Heysham to M6 Link Local Road	7.4	Yes
High Speed Line London-Glasgow Rail*	1.9	Yes
High Speed Line London-Manchester Rail	1.9	Yes
High Speed Line London-West Midlands Rail	1.9	Yes
Jubilee Line Extension	1.7	Yes
Stansted Surface Access HA	11.7	Yes
TFL Rail Vision	2.5	

Additional modelling commissioned by Eddington

ECML Additional inter-peak services Leeds -London.	1.3	?
ECML Additional WAGN Peak commuter capacity.	2.2	?
HP-Leeds to Sheffield Highway Improvements	1.3	?
HQ-Leeds Urban Area Highway Improvements	3.6	Yes
HR-Leeds Urban Area Major Public Transport Investment	2.7	?
HU-Intra Leeds Bus Fare Reduction and Frequency Increase	2.6	No
HV-Leeds to Bradford Improved Highway Connections	2.8	?
HW-Leeds to Bradford Public Transport Improvements	4.0	No
IF-West Yorkshire Bus Fares Reduction Frequency Increase	3.0	No
IJ-S/W Yorkshire Bus Fares Reduction Frequency Increase	2.7	No
IH-S Yorkshire Bus Fares Reduction, Frequency Increase	3.2	No
M6 Active Traffic Management	1.8	Yes
MML Time savings along MML between Mill Hill & Sheffield	11.0	No

Others

Mersey Gateway Bridge	1.55	Yes
Kirkstall Forge, Leeds	3.6 to 4.5	Yes
Northern Hub Option 1 (£860m)	3.1 to 5.6	No
Northern Hub Option 2 (£560m)	4.0	Yes
HS2 (full network)	2.1 to 2.7	Yes
HS2 (phase 2b)	2.5 to 3.1	Yes
Crossrail 2	2.1 to 2.7	Yes

In the National Infrastructure Pipeline for 16/17 and 17/18

Out of London:

- Great Western capacity and electrification
- Bromsgrove electrification
- Hull – ECML electrification

In London:

- Gospel Oak to Barking
- London Overground asset renewals/enhancements

Table 1 notes and sources

* BCRs subsequently revised down

Including use of part of existing network from Manchester to Glasgow. The BCR for phase 1 of HS2 was 1.7, compared to the 3.1 for the second phase.

BCR cited in each case includes 'wider' effects eg the NATA BCR from Eddington, WebTAG for HS2.

Sources:

Most BCRs are from Eddington Data Annex, 2006,

<http://webarchive.nationalarchives.gov.uk/20080804142919/http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/>

From RAC report notes that Post Opening Project Evaluation (POPE) of Major Schemes (2002-2009) carried out by Highways Agency, for 2011:

http://assets.highways.gov.uk/our-road-network/pope/major-schemes/POPE_meta_2011_main_report_final.pdf

2013: <http://assets.highways.gov.uk/our-road-network/pope/major-schemes/pope-meta-2013-final-report.pdf>

2014:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/408060/POPE_LN_MS_Annual_Evaluation_Report_2014.pdf

2015:

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/497241/POPE_Meta_2015_Final_210116_-_FINAL.pdf

Also:

Tom Forth: <https://www.tomforth.co.uk/investmentispolitical/>

Yorkshire Post: Yes to Nottingham and Edinburgh trams but no to Leeds Supertram:

<https://www.yorkshirepost.co.uk/news/supertram-decision-doesn-t-add-up-1-2420953>

Network Rail document http://bailey.persona-pi.com/Public-Inquiries/Manchester-Piccadilly/Applicant-Documents/Proofs-of-Evidence/1/PoE_NR_1.1%20Need%20Summary.pdf

https://www.wymetro.com/media/1634/harrogate_business_case_final.pdf

Kirkstall Forge:

<https://www.wymetro.com/uploadedFiles/WYMetro/Content/news/projects/projectdetails/Local%20Authority%20Major%20Schemes%20-%20Revised%20Full%20Approval%20Form.pdf>

Mersey Gateway Bridge BCR estimate from:

http://www.merseygateway.co.uk/publicinquirydocs/HBC_docs/Rebuttals/HBC-8-16R.pdf

Mansfield Interchange:

<https://transportknowledgehub.org.uk/case-studies/mansfield-public-transport-interchange/>

Coventry: <https://www.bbc.co.uk/news/uk-england-coventry-warwickshire-16180361>

Electrification schemes in National Infrastructure and Construction Pipeline 2016 (Figures for 2016/17 onwards in £millions constant).

Great Western Capacity Programme and Electrification, England and Wales £2,964m (public spending)

Gospel Oak to Barking, London, £90m (public spending)

Bromsgrove Electrification, West Midlands, £44m (public spending)

Hull (via Selby) to East Coast Mainline electrification, Yorkshire & Humberside, £6m (public/private spending)

Electrification schemes in National Infrastructure and Construction Pipeline 2017 (Figures for 2017/18 onwards in £millions constant).

London Overground asset renewals and enhancements including electrification works and investment in stations transferred to TfL in 2015, London, £120m [funding source Local Govt so not counted in regional figures]

Bromsgrove Electrification, West Midlands, £16m (Central Govt spending, counted)

Gospel Oak to Barking, London, £1m (Central Govt spending)

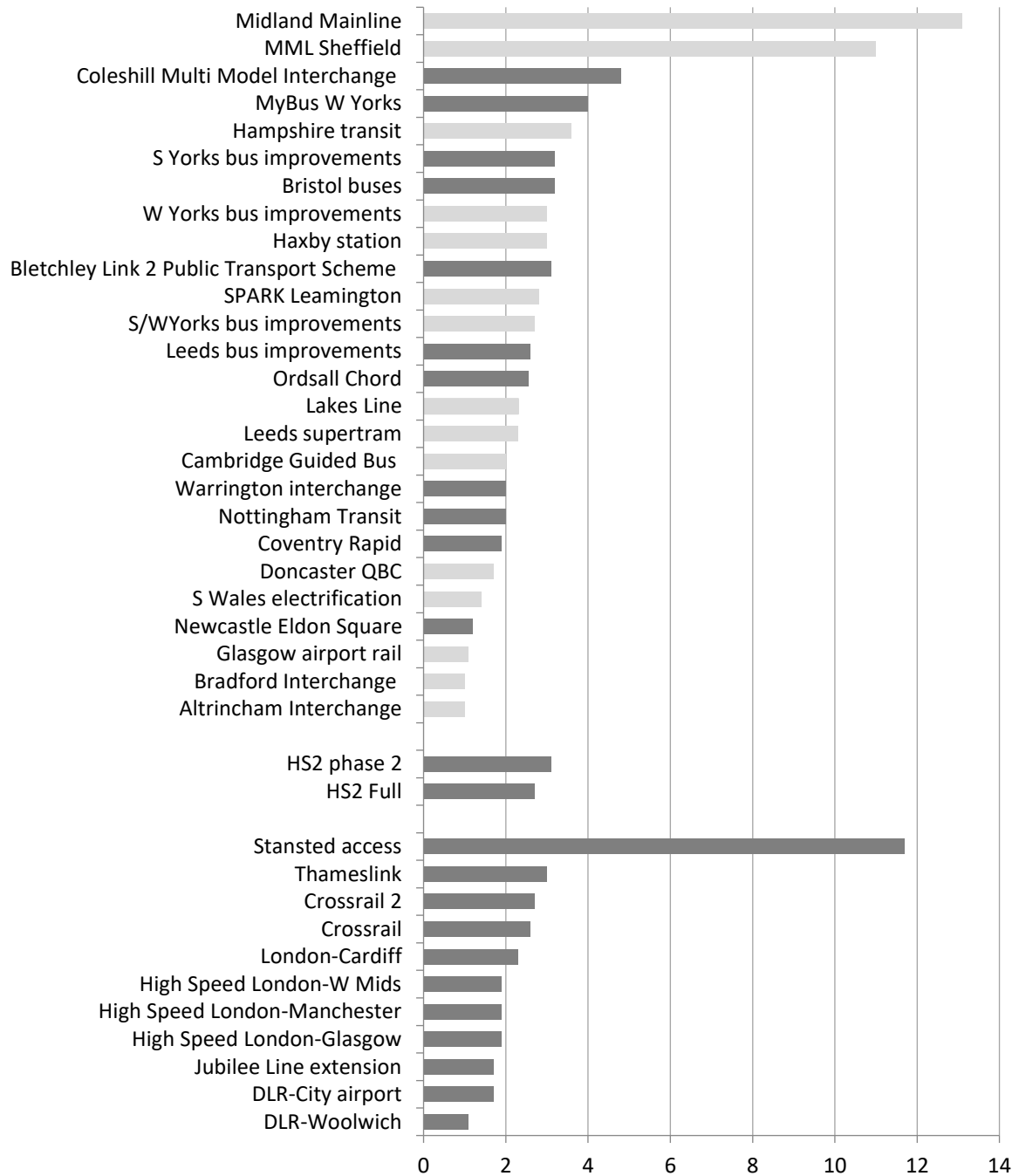
Great Western Capacity Programme and Electrification, England and Wales £1,652m (Central Govt spending)

Benefits-cost ratio (BCR) for Crossrail 2, page 27 of 'Crossrail 2: regional and national benefits', September 2015, from: https://consultations.tfl.gov.uk/crossrail2/october2015/user_uploads/g8.pdf

Department for Transport (2016). "High Speed Two Phase 2b Strategic Outline Business Case Economic Case: Moving Ahead Britain". BCR for full network and then Phase 2b (the Northern completion of the Y-network) page 15:

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/570845/hs2-phase-2b-sobc-economic-case.pdf

Figure 3: Public transport schemes ranked by initial BCR, approved (dark) and not approved (light).
 Upper panel – out of London. Lower panel – in/to London. HS2 presented separately.



Application of CBA methodology in the UK

The use of CBA in the UK has long focused on efficiency and the allocation of scarce resources. The Treasury insists on a “thorough, long-term and analytically robust approach,” (2011 Green Book, Preface). In other words, although the challenges posed by the presence of externalities and ‘wider’ costs and benefits has been acknowledged for some time, government spending and investment decisions have been – at least in principle – dependent on a quantitative assessment motivated by economic efficiency considerations. One specific consequence has been the use, where possible, of prevailing market prices to assign values to future costs and benefits.

This economic philosophy was particularly clearly set out in the 2006 Eddington review of transport infrastructure. Although he also noted the importance of trying to incorporate external environmental effects, Eddington forcefully recommended concentrating scarce investment funds on, “Places where transport constraints have significant potential to hold back economic growth” (p6). The report cites the importance of agglomeration effects in driving economic growth, adding: “Transport’s contribution to such effects is most significant within large, high productivity urban areas of the UK. London is the most significant example.” (p15). This approach means benefit-cost ratios for London projects are inevitably higher because London is a dense city whose workers earn (on average) more than people anywhere else in the country; saving their time is 30% more valuable than saving a non-Londoner’s time, according to the report. The review adds: “In areas without such clear signs [i.e. rising wages or house prices], it is unlikely that transport is holding back productivity growth.”

Although externalities such as getting people off the roads and reducing emissions in train schemes are taken into account in official CBAs, there is no scope for analysis of the limits to agglomeration. For example, the TfL 2015 report on Crossrail 2 predicts the London population will rise to 10 million by 2030 from 8.6 million in 2018. The logic is that as London is already more productive than the rest of the UK, anything removing constraints on further agglomeration must be desirable. The logical conclusion of the pure agglomeration economies approach is that all activity should be in London; indeed a recent background paper for the National Infrastructure Commission explicitly calculated, on the basis of a calibrated agglomeration model, that a more even distribution of economic activity around the UK than at present would reduce national productivity by 1.4% (Gibbons & Graham, 2018). Yet it is reasonable to question a methodological

approach that gives more weight to mitigating the effects of congestion in the already-crowded capital rather than enhancing the potential productivity and economic development gains elsewhere in the country even though those places are not manifesting the same market signals of congestion and over-crowding. Hence the cost-benefit case for Crossrail 2, an addition to an already excellent public transport network, looked as attractive on Green Book procedures as projects upgrading northern England's rail network, despite the potential for the latter to facilitate the development of a single, dense labour market across the northern English cities. The northern rail upgrade was in fact cancelled in 2017 because the Department of Transport had to implement budget cuts. According to the National Audit Office, the CBA analyses of the cancelled projects were all revised to produce lower benefit-cost ratios. The costs were revised up to a significant degree, as they often are when decisions drag on, due to factors including central government delays and procurement failures. The rationale for cancellation also stated that passenger benefits such as enhanced reliability could be delivered in other ways (NAO 2018). The House of Commons Transport Select Committee (2018) strongly criticised the delays and lack of transparency, and recommended reversing the cancellation decision.

Table 2: Cancelled public transport schemes, revision of Benefit-Cost Ratios

SCHEME	1st BCR	Final CBR	Funded?
Electrification of the Midland mainline	4.1 to 13.1	0.8	No
Electrification from Cardiff to Swansea	0.6	0.3	No
Electrification from Oxenholme to Windermere	2.3	0.6	No

Source: NAO 2018

The general limitations of cost benefit analysis have been widely aired. Some are inherent in any evidence-based approach to appraisal. The projection of future benefits and costs is uncertain (and as the above example shows liable to big revisions); it is difficult and yet surely essential to include externalities such as environmental impacts; the results are highly sensitive to the choice of discount rate; and general equilibrium effects are not included. There are also considerable implementation issues. For example, Atkins, *et al* (2017) list four:

1. The difficulty of capturing impact, particularly dynamic change in the economy.
2. Unrealistic cost estimates, prone to optimism bias.

3. Lack of consistency between project assessments. For example, impacts on health, safety and the environment are difficult to monetise and not always included consistently across projects, although this is improving.
4. Poor communication within and outside of Whitehall. Cost-benefit analysis results are not always well understood.

Of these, the failure to incorporate dynamic change in the economy is key to the issue of regional skew, as this omission is what traps investment decisions in the past geographic distribution of growth. As the CURDS iBUILD project final report (2018) noted: “The UK government accepts that approaches based solely on static analysis can favour investment and re-investment in places where development has already happened, and relatively higher current market values for wages, housing and land in prosperous places generate higher Benefit-Cost Ratios that often overlooks some of the long-term benefits that infrastructure can bring to different places” (p20). The 2013 Green Book placed strong emphasis on the use of market prices, as does the new (2018) Green Book, both as the starting point for estimating opportunity costs and in order to value project benefits. We will return below to the new update.

The obverse of the phenomenon has been demonstrated in the case of the ‘Beeching Axe’ cuts to the UK’s rail network in the 1960s. The closures affected little used and unprofitable lines. However, Gibbons *et al* (2017) show that, even conditioned on the decline of affected areas before the Beeching report, the closures accelerated the population decline, and the proportion of skilled and young workers in the population. They conclude: “An implication of these findings is that rail transport infrastructure plays an important role in shaping the spatial structure of the economy.”

Why CBA methodology is widening regional gaps

CBA is rooted in welfare economics, intended to be a quantified, monetary assessment of the total impacts of a project on the lives of those affected over the future lifetime of the investment (Laird *et al* 2014). However, in policy usage, it is almost always presented as a means of using scarce public funds as efficiently as possible to deliver higher productivity and economic growth, or in other words as a value for money exercise. 'Wider' effects are accepted as important, but maximising social welfare is not the aim of the exercise. Rather, it is a matter of comparing options (with different costs) to boost productivity, while taking account as far as possible of the externalities involved in those options.

The issue lies in the character of the CBA technique, which is a calculation of the discounted net social benefit under the often-reasonable assumption that the project is marginal. In other words, it assumes that the project being appraised does not change either relevant relative prices or the growth rate of consumption. Dietz and Hepburn (2013) have shown that where the range of net benefits could be a significant share of aggregate consumption, "It is possible for marginal CBA to provide both qualitatively and quantitatively incorrect guidance, by ignoring the impacts of projects on the underlying economic growth path" (p62). In other words, CBA is least likely to be valid for projects big enough to affect future economic outcomes, and could be positively misleading. There has been some recognition of this in the literature. Little and Mirrlees (1974) wrote, "We must know where the economy ought to be going ... before we can decide how it ought to start," but even though their textbook acknowledged that the inter-temporal profile of economic growth would affect project valuations, they did not consider how investment projects might themselves alter that inter-temporal output profile. As well as the time profile, the spatial profile can also be altered, with the same reasoning applying. The error involved in the linear approximation estimating net social benefit is likely to be large when the curvature of the utility function is sufficiently high. This could be the case when in addition to inter-temporal considerations, there is an aversion to regional inequality (Atkinson 2009).

Although the new Green Book will lead to some scope for appraisals to upweight currently lower productivity places within the current appraisal framework, the Matthew Effect will continue to operate, exacerbating the UK's regional imbalance, until investment decisions are set in the

framework of a strategic view of economic development. This is the case even though the UK's transport appraisal methodology currently uses a willingness to pay (WTP) contingent valuation methodology to value travel time savings, as there is evidence that stated WTP has a non-unitary and non-constant income elasticity. In other words, in such cases people on lower incomes will likely have lower WTP (see Barbier *et al*, 2017, for a recent overview). A true social welfare assessment of non-marginal infrastructure investments is not possible without knowing where the economy 'ought to be going'; the social welfare function is not a given, but is something on which decision makers can take a view and can affect with major investments.

The Green Book approach to valuing benefits based on current productivity has been strongly criticized by Metz (2016). Pointing to evidence from the National Travel Survey, he notes that daily travel time has stayed roughly constant at about an hour since 1970, which suggests that transport investment does not save time at all, but rather increases opportunities. In other words, in practice there is little travel time saved from transport projects. He concludes: "You cannot build your way out of congestion." The Eddington rationale of aiming to ease congestion in high productivity, over-heating places (London) as a means of removing bottlenecks on still more productivity growth is therefore set to fail. Metz advocates considering instead that land and property values are often increased by transport projects, and would be a more direct sign of successful economic development in a specific location than the projected value of time saved by travellers.¹¹

"An evidence-based approach to transport investment ought not to be contentious. However, the conventional transport economist approach is theory based, not evidence based. Their theory is that the value of transport investments can be estimated by calculating the total time supposedly saved by faster travel. But these time savings are not real. What is real and readily observed are the changes in how the land is used and valued when transport investment makes such land more accessible – which the economists disregard." (p128)

¹¹ In theory, when there are perfect markets with no transactions costs, the value of time saved and the increase in property values would be equal.

Appraisals should start with a view about where economic development could and should feasibly occur, based on local knowledge of property and land prices, skills needs and industry strengths, and wider societal aims. In other words, the prioritisation CBA methodology claims to deliver, but does not, should be the starting point. Given that framework, which inherently involves a view about the spatial distribution of activity, then CBA methods can be applied to compare relevant options and sense check assumptions. For instance, a CBA assessment could be run with several plausible assumptions about productivity uplift, as a sensitivity test. The need for integration and detailed local knowledge makes it unlikely this kind of appraisal can all be done centrally, although how to cascade the prioritisation of investment from central through regional to local decisions is not clear (Preston 2012).

There are hints of this approach being taken at sub-national level. Transport for Greater Manchester (TfGM), for example, uses productivity measures alongside CBA. It uses CBA as a 'sifting test' to decide whether an investment should be considered, but benefit-cost ratios are not used to prioritise. Instead, TfGM prioritises investments based on impact on gross value added (GVA) for every pound of investment – a metric developed following direction from Greater Manchester politicians to use the capital budget allocated to support economic growth. "Its 2014 transport strategy and investment plan (Greater Manchester Combined Authority, 2014) provides a clear overview of scheme objectives, monetised benefits, a narrative outlining the case for wider benefits, and a judgement of appraisal robustness" (Stewart, 2013, p13). The CBA exercise in this case is a hurdle a project needs to clear, after priorities – in this case, achieving productivity growth – have been established.

What is changing and why it is not enough

At national level, the new 2018 Treasury Green Book takes some welcome steps along this road taking account in CBA assessments of the productivity impacts of investments, “Where they can be objectively demonstrated” (p39), in addition to an extended scope for including non-market environmental, social and wellbeing effects. But it does not go far enough towards a framework that would tilt infrastructure investment toward regions of the UK where it could enable faster productivity growth. In addition, the 2018 revision of the Green Book, along with other recent policy announcements, has acknowledged some of the criticisms of the official appraisal methodology. Following the Industrial Strategy White Paper in November 2017, the Department for Transport also announced a Rebalancing Toolkit.¹²

This offers some (non-binding) guidelines for appraisals of investment projects where geographic ‘rebalancing’ is part of the policy objective. Although it refers to the need for a strategic ‘narrative’ underpinned by evidence, the evidence suggested includes metrics such as deprivation indices and ‘living cost challenges’ rather than any meaningful account of economic development and productivity growth. A Parliamentary report concluded: “It was not immediately clear to us what practical difference the rebalancing toolkit would make in its current form” (Transport Select Committee 2018, §63).

The 2018 Green Book does mark a significant departure from past advice, in highlighting the scope to incorporate dynamic productivity and employment effects. It states (p39):

“Productivity effects should be included in the calculation of UK costs and benefits where they can be objectively demonstrated. Productivity effects may arise from movement to more or less productive jobs, changes in the structure of the economy, benefits from dynamic clustering or agglomeration (benefits that arise through close location of businesses and/or people), private investment, product market competition or the generation and flow of ideas.”

¹²

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/669043/supplementary-guidance-rebalancing-toolkit.pdf

And

“Interventions which increase human capital, job-search activity or provide better access to jobs can have positive labour supply and macroeconomic effects. Provided they can be supported by clear, objective evidence labour supply effects can be included in appraisal.”

Setting aside the vexed question of what constitutes ‘objective’ evidence of future productivity effects, this is a significant recognition of the importance of the previously omitted dynamic effects and the scope for significant investments to make the future in some respects unlike the past. The new Green Book also includes a far broader scope for the inclusion of ‘wider’ effects such as environmental and social impacts.

However, it is unlikely to transform the landscape for infrastructure project appraisal. It will be difficult to provide ‘clear, objective evidence’ of productivity impacts in advance of their occurrence in contexts where the aim of the proposed project is to ensure the future is unlike the past. For instance, it seems reasonably likely that if the transport network in the north of England could move commuters between Leeds and Manchester as fast as between the ends of London’s Central Line (a similar distance), this could deepen the labour market in the region and enable the kinds of increasing returns spillovers observed in many large urban areas; but it is not obvious what objective evidence of this effect might be in terms of a forward looking appraisal. There is nothing in the past able to furnish such evidence precisely because the absence of connectivity has made it impossible. More fundamentally, any use of past and current market prices in appraisals in the case of major projects will be an application of a method for marginal analysis to non-marginal contexts. The use of CBA methodology will never be adequate to prioritise major investments or ‘rebalance’ the economy.

However, it could be said that this is exactly its purpose, at least in the eyes of the Treasury, which is institutionally sceptical of claims that public transport projects are non-marginal or capable of triggering self-sustaining growth and productivity dynamics. This Treasury view was clearly expressed in the 2006 Eddington Review, and in anecdotal evidence that the Treasury opposed past investments including indeed the Jubilee Line extension and the almost-complete Crossrail line in London.

Discussion

The argument we make here, for a genuinely strategic approach to major infrastructure investments, goes against the grain of more than a generation of practice in Whitehall. However, the 2018 revisions to the Green Book and the November 2017 Industrial Strategy White Paper and its subsequent implementation through local industrial strategies indicate dawning recognition at the centre of government that a different spatial distribution of economic activity around the UK is desirable and may be possible. Indeed, it may be politically essential in the context of the politics of devolution in the UK and trends in voting patterns (Rodriguez-Pose, 2018). The Industrial Strategy Commission (2017) said “further and faster devolution” to cities and regions would be essential to raise national productivity levels. The government’s Industrial Strategy White Paper (2017) accepted this, introducing local industrial strategies and a £1.7bn fund for improving transport connections within city regions, among other funding streams.

Although the use of evidence-based methods such as CBA in project appraisals is essential to try to use public funds as effectively as possible, the limitations of marginal methods for major projects have long been recognized in theory – just not in practice. One obvious response to our argument is what discipline might be applied instead to enable strategic prioritisation of infrastructure projects while guarding against all the well-known problems of major investments (Flyberg 2014). There is an evidence challenge in that it is difficult to identify empirically the contribution of infrastructure investment to productivity growth in different geographies over the long time frames relevant to economic development. In a meta-regression analysis of studies for OECD countries, Bom and Ligthart (2014) find the output elasticity of public infrastructure investment is three times higher in the long run than the short run, and higher for regional and local than for national schemes, but that there is great heterogeneity of outcomes. Donaldson (2018) uses historical data on the build out of the rail network in 19th century British India, finding large welfare gains from access to rail transport, increased regional and inter-regional trade, and decreased trade costs and inter-regional price differences. Crescenzi *et al* (2016) conclude that the American Recovery and Reinvestment Act of 2009, which provided \$48.1bn for programmes to be administered by the Department of Transportation, largely as grants to state and local government for capital expenditure on roads, transit, airports and passenger rail found a large short term increase in GDP and employment, perhaps not surprising in the business cycle context.

In a 2002 survey of the impact of transport on regional development, the OECD concluded, “There is a lack of information derived from *ex post* studies which could provide a firm, quantitative basis for claims about the impact of infrastructure investment on regional economies and regeneration.”

Caution is certainly necessary given the lack of both empirical *ex post* evidence and a firm theoretical account of the mechanisms through which transport infrastructure stimulates productivity growth. Building up a corpus of serious evaluations of past transport infrastructure investments would be highly desirable. Meanwhile, there is circumstantial evidence as described here that transport infrastructure investment in the UK has been skewed toward the capital, and that the formal methodology of CBA has not been applied consistently to London *vis à vis* other regions. Combined with the well-known theoretical limitations of CBA methodology in circumstances where there is an expectation that the path of growth might change non-marginally, we conclude there is strong justification for tilting future public investment to other parts of the UK, in the context of a strategic view about the geography of economic development. The publication of an Industrial Strategy intended to raise national productivity, in the context of the political dynamics of English city devolution and concern about the ‘left behind’ places mean it is now impossible to ignore the spatial consequences of infrastructure investments, as has been the case for decades now in the UK.

References

- Atkins G, Davies N, and Kidney Bishop T, (2017), 'How to value infrastructure: Improving cost benefit analysis', Institute for Government. Accessed on 2/3/18 from: <https://www.instituteforgovernment.org.uk/publications/value-infrastructure-september-2017>
- Atkinson G, Dietz S, Helgeson J, Hepburn C and Sælen H, 'Social Preferences for Risk, Inequality and Time in Discounting Climate Change', Economics Discussion Papers, No 2009-14, Kiel Institute for the World Economy. <http://www.economics-ejournal.org/economics/discussionpapers/2009-14>
- Barbier, E, M Czajkowski, N. Hanley, (2017), 'Is the Income Elasticity of the Willingness to Pay for Pollution Control Constant?', *Environmental Resource Economics*, 68:663-682.
- BEIS (2017), 'Industrial Strategy: building a Britain fit for the Future', HM Government White Paper. Accessed on 27/11/17 from: <https://www.gov.uk/government/publications/industrial-strategy-building-a-britain-fit-for-the-future>
- Bom P and Ligthart J, (2014), 'What Have We Learned From Three Decades of Research on the Productivity of Public Capital?', *Journal of Economic Surveys*, Vol. 28, No. 5, pp. 889–916
- Byett A, Laird J, Stroombergen A and Trodd S, (2015), 'Assessing New Approaches to Estimating the Economic Impact of Transport Interventions Using the Gross Value Added Approach', research report 566, NZ Transport Agency. www.nzta.govt.nz/assets/resources/research/reports/566/docs/566.pdf
- Crescenzi R, Di Cataldo M and Rodriguez-Pose A, (2016), 'Government Quality and the Economic Returns of Transport Infrastructure Investment In European Regions', *Journal of Regional Science*, Vol. 56, No. 4, pp. 555–582.
- Department for Transport (2006), Data on investment returns from transport schemes considered by the Eddington Study. <http://webarchive.nationalarchives.gov.uk/20080807161546/http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/pubeddingbase>
- Department for Transport (2017), Strategic Case Supplementary Guidance: Rebalancing Toolkit. Accessed from: <https://www.gov.uk/government/publications/transport-business-case>
- Dietz S and Hepburn C (2013), 'Benefit Cost Analysis of non-marginal climate and energy projects', *Energy Economics*, 40, 61-71.
- Donaldson D, (2018), 'Railroads of the Raj: Estimating the Impact of Transportation Infrastructure', *American Economic Review*, 108(4-5): 899–934
- Eddington, Sir Rod, 'The Eddington Transport Study', December 2006. <http://webarchive.nationalarchives.gov.uk/20080804142919/http://www.dft.gov.uk/about/strategy/transportstrategy/eddingtonstudy/>
- Fai F, (2018), 'Place-Based Perspectives on the UK Industrial Strategy', Institute for Policy Research, University of Bath. Accessed on 1/3/18 from: <http://www.bath.ac.uk/publications/place-based-perspectives-on-the-uk-industrial-strategy/>
- Forth T, (2017), 'Investment is Political'. <https://www.tomforth.co.uk/investmentispolitical/>
- Flyvbjerg B, (2014), 'What You Should Know about Megaprojects and Why: An Overview,' *Project Management Journal*, vol. 45, no. 2, pp. 6-19

Gibbons S and Graham D, (2018). 'Urban Capacity and Economic Output. Report for the National Infrastructure Commission'. <https://www.nic.org.uk/wp-content/uploads/National-Infrastructure-Commission-urban-capacity-report-final-1.pdf>

Gibbons S, Heblich S and Pinchbeck E, (2017), 'The Spatial Impacts of a Massive Rail Disinvestment Program: The Beeching Axe', LSE paper. http://personal.lse.ac.uk/gibbons/Papers/Beeching_June_2017_v2.pdf

Greater Manchester Combined Authority, Association of Greater Manchester Authorities, Greater Manchester Local Enterprise Partnership and Transport for Greater Manchester (2014), Greater Manchester Growth and Reform Plan: Transport Strategy and Investment Plan. <http://www.tfgm.com/ltp3/Documents/GMGRP-Transport-Strategy.pdf>

HM Government (2017), Transport analysis guidance: WebTAG <https://www.gov.uk/guidance/transport-analysis-guidance-webtag>

HM Treasury (2013), The Green Book, accessed on 12/12/17 from: <https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-government>

HM Treasury (2018), The Green Book, last accessed 28/6/18: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/685903/The_Green_Book.pdf

HM Treasury and the Infrastructure and Projects Authority (2016), National Infrastructure and Construction Pipeline Spreadsheet, Autumn 2016 update. Accessed from: <https://www.gov.uk/government/publications/national-infrastructure-and-construction-pipeline-2016>

HM Treasury and the Infrastructure and Projects Authority (2017), National Infrastructure and Construction Pipeline Spreadsheet, Autumn 2017: <https://www.gov.uk/government/publications/national-infrastructure-and-construction-pipeline-2017>

iBUILD (2018), 'Closing the Gap: local infrastructure business models to support inclusive growth', iBUILD Research Centre Final Report, Newcastle University, ISBN 978-1-9996347-0-4. Accessed on 2/3/18 from: <http://research.ncl.ac.uk/ibuild/2018finalreport/>

Industrial Strategy (2017), 'Building a Britain Fit for the Future'. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664563/industrial-strategy-white-paper-web-ready-version.pdf

Industrial Strategy Commission (2017), Final Report: <http://industrialstrategycommission.org.uk/2017/11/01/the-final-report-of-the-industrial-strategy-commission/>

Laird JJ, Nash C and Mackie PJ (2014), 'Transformational transport infrastructure: cost benefit analysis challenges', *Town Planning Review*, vol. 85, no. 6, pp. 709–30. <http://eprints.whiterose.ac.uk/87446/>

Leduc S and Wilson D. J, (2012), 'Roads to Prosperity or Bridges to Nowhere? Theory and Evidence on the Impact of Public Infrastructure Investment', *NBER Macroeconomics Annual 2012* (D. Acemoglu, J. Parker, and M. Woodford, eds.).

Little I.M.D and Mirrlees J.A, (1974) *Project Appraisal and Planning for Developing Countries*, Heinemann.

McCann P, (2016), *The UK regional–national economic problem: Geography, globalisation and governance*. London, Routledge.

Merton R. K, (1968), 'The Matthew Effect in Science', *Science*, 5 January 1968, 159(3810):56–63.

Metz D, (2016), *Travel Fast or Smart? A Manifesto for an Intelligent Transport Policy*, London Publishing Partnership: London.

National Audit Office (2017), Update on the Thameslink Programme: <https://www.nao.org.uk/wp-content/uploads/2017/11/Update-on-the-Thameslink-programme.pdf>

National Audit Office (2018), Investigation into the Department for Transport's decision to cancel three rail electrification projects, from: <https://www.nao.org.uk/report/investigation-into-the-department-for-transport-decision-to-cancel-three-rail-electrification-projects/>

National Infrastructure Commission (2017), 'Congestion, Capacity, Carbon – priorities for national infrastructure', Interim Report from: <https://www.nic.org.uk/publications/congestion-capacity-carbon-priorities-for-national-infrastructure/>

O'Brien P and Pike A, (2015), 'City Deals, Decentralisation and the Governance of Local Infrastructure Funding and Financing in the UK', National Institute Economic Review No. 233, pp. R14-R26.

OECD (2002), 'The Impact of Transport Infrastructure Investment on regional Development'. <https://www.itf-oecd.org/sites/default/files/docs/02rtrinveste.pdf>

ONS (2016), Subnational Population Projections for Local Authorities in England.

Pisu M, Pels B and Bottini N, (2015), 'Improving Infrastructure in the United Kingdom', OECD Economic Working Papers no. 1244, July 2015.
[http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP\(2015\)62&docLanguage=En](http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=ECO/WKP(2015)62&docLanguage=En)

Preston J, (2012), 'Integration for seamless transport', ITF discussion paper 1, OECD.
<http://www.internationaltransportforum.org/jtrc/DiscussionPapers/DP201201.pdf>

Raikes L, (2018), 'Future Transport Investment in the North: A briefing on the government's new regional analysis of the National Infrastructure and Construction Pipeline', IPPR North report accessed from: <https://www.ippr.org/publications/future-transport-investment-in-the-north-briefing>

Rodríguez-Pose A, (2018), 'The revenge of the places that don't matter (and what to do about it)', *Cambridge Journal of Regions, Economy and Society*, Volume 11, Issue 1, pp. 189–209.

Stewart J, (2013), 'Give the economic benefits of infrastructure a chance to breathe', *The Guardian*, 11 February: www.theguardian.com/public-leaders-network/2013/feb/11/economic-benefits-infrastructure-greater-manchester

Transport Select Committee (2018), Rail Infrastructure Investment. House of Commons: <https://publications.parliament.uk/pa/cm201719/cmselect/cmtrans/582/58202.htm>

Transport for London (2015), Cross-rail 2: Regional and National Benefits, Mayor of London and Network Rail. Accessed on 12/12/17 from: https://consultations.tfl.gov.uk/crossrail2/october2015/user_uploads/g8.pdf

World Economic Forum (2017), Global Competitiveness Report. Accessed from: <http://reports.weforum.org/global-competitiveness-index-2017-2018/>