PIN – 03

Evidence Review

Infrastructure

Professor Iain Docherty and Dr David Waite
University of Glasgow
iain.docherty@glasgow.ac.uk

www.productivityinsightsnetwork.co.uk
About PIN

The Productivity Insights Network was established in January 2018 and is funded by the Economic and Social Research Council. As a multi-disciplinary network of social science researchers engaged with public, private, and third sector partners, our aim is to change the tone of the productivity debate in theory and practice. It is led by the University of Sheffield, with co-investigators at Cambridge Econometrics, Cardiff University, Durham University, Glasgow Caledonian University, SQW, University of Cambridge, University of Essex, University of Glasgow, University of Leeds and the University of Strathclyde. The support of the funder is acknowledged. The views expressed in this report are those of the authors and do not necessarily represent those of the funders.
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1 Introduction

1.1 Infrastructure and Productivity

The overall aim of this thematic review is to identify the current state-of-the-art of our knowledge of the relationship between infrastructure and productivity. The paper focuses on two particular forms of infrastructure, namely transport and digital/broadband. This is because other basic infrastructures, such as water, drainage and electricity, are effectively ‘binary’ in their supply – i.e. individuals and firms are either connected to these networks or they’re not, and the services supplied via these infrastructures either function or they don’t – whereas the "level" of service provided by transport and digital connectivity varies. The impacts of transport infrastructure investment is also a key concern of the authors’ own research work. The paper is structured as follows: first, it reviews the longstanding debate about the links between transport infrastructure and the economy, and the recent debates about the impacts on economic agglomeration, which are seen as key to productivity enhancement. It then goes on to examine the more limited research base on digital connectivity. Finally, the issue of the level of productivity within the infrastructure sector is addressed. The paper draws on a recent review carried out by the authors for the Scottish Cities Alliance (SCA) on the relationship between transport infrastructure and the economic aspirations of City Deals, and we are grateful for the assistance of colleagues in the city authorities in developing the analysis developed here. The section on digital connectivity draws on another earlier SCA review paper produced by our colleague Prof Donald Houston, now of the University of Portsmouth.

2 The Debate on (Transport) Infrastructure and the Economy

This section briefly sets out the core arguments concerning the link between transport infrastructure and economic performance. The research evidence base and resulting literature on the links between infrastructure development and the economy has been developed over more than 50 years, and is now extensive. At the outset, however, we should note that this literature is inconclusive there is very significant disagreement about the causal linkages between the outputs of infrastructure investment and economic gains. For every study (such as the SACTRA and Eddington reviews for the UK government cited below) that signals caution about the marginal nature of the returns from much new infrastructure investment in a mature transport network, there are others (see, for example, Canning and Bennathan, 2007; Crafts, 2009; Egert et al., 2009) that continued to make the case for investment in transport infrastructure as a worthwhile and important element of any economic policy in pursuit of growth (see also Holmgren and Merkel, 2017).

2.1 Academic Research Context on Transport and the Economy

The role of transport infrastructure, and its links to land and property development, the land-use planning system, wider economic development strategies and hence key economic outcomes such as better productivity, is a key area of research. We know that the effectiveness of the strategies and investments made by individual firms in pursuit of growth is contingent on the suitability of the land-based assets and transport infrastructure available to them. Yet decades of research have not been able to pin down the causal relationships between transport investments and economic performance as effectively as policy makers might like. Even well-cited papers claiming a link between improved infrastructure, the larger markets that result and therefore improved economic performance do so at the level of the whole economy, and
acknowledge substantial caveats. For example, Crafts (2009:332) notes that “in practice, it may be thought that these arguments… are most likely to matter when there is a step change in the quality of the transport system and could generally be more relevant for developing countries with a major infrastructure deficit than for mature economies such as the UK”.

This level of uncertainty about the causal mechanisms linking transport investment and the economy helps explain why there is such a wide variety of approaches to conceptualising and measuring the impact of transport investments on growth and productivity. Although precisely quantifying the economic impact of transport investment is difficult, there is substantial empirical evidence in favour of the assertion that locations with poor quality transport are at a disadvantage when compared with those places with high quality transport infrastructure (Banister and Berechman, 2000, 2001). In the UK, the Standing Advisory Committee on Trunk Road Assessment (SACTRA), 1999) set out a series of six specific positive outcomes that empirical evidence suggested can occur as a result of transport investment, and therefore might explain the economic value of investment in improved transport:

- Reorganisation or rationalisation of production, distribution and land use;
- Extension of labour market catchments;
- Increases in output resulting from lower costs of production;
- Stimulation of inward investment;
- Unlocking previously inaccessible sites for development;
- A ‘catalytic’ effect whereby triggering growth through the elimination of a significant transport constraint unlocks further growth.

Subsequent to SACTRA, Sir Rod Eddington’s independent report on transport for HM Treasury (Eddington, 2006) noted the increasing gap in standards of connectivity between most UK cities and those increasingly commonplace across much of urban Europe. In discussion of what might be done to reduce this gap, and which investments might produce the best economic returns, Eddington went on to make two further important points: first, that the cumulative impact of several relatively small improvements to the transport system can often be at least as big as that of the large ‘megaprojects’ that often steal the limelight, especially in larger cities where the potential for dense agglomeration in key sectors such as financial and business services is most apparent. Second was the argument that even if the links between better transport and improved economic performance are hard to measure precisely, then more compelling evidence for the link might be found in those places where poor transport acts as a significant constraint on growth, e.g. where obvious bottlenecks in the transport network, such as undercapacity of heavy rail commuter routes, can seriously constrain the ability of cities to compete against places with less congestion, and better quality public transport. This is especially true for those cities where the existing level of infrastructure provision is poor enough to generate clear constraints on the functioning of key markets, such as the housing market or commercial property market, due to congestion or unreliable journey times. There are several large cities in the UK, such as Aberdeen, Bristol and Leeds that have little or no fixed public transport infrastructure and therefore stand out as the most under-supplied in Europe.

2.2 *Measuring Infrastructure Impacts*

Real-world attempts to understand and quantify the benefits of transport investment by governments and their agencies has centred, for several decades, on the concept of ‘transport economic efficiency’. The core assumption here is that the economic benefit of improved transport hinges on time savings for travellers using new or improved infrastructure, and that these time savings are translated into greater economic output. However, following on from the
analysis above, over time this approach has come to be regarded as increasingly narrow as research has explored other dimensions such as the impacts of congestion and the (un)reliability of journey times on transport choices, and the impacts these have on the myriad individual choices that structure economic activity and its level of productivity.

Much recent work on transport and the economy has focused on the so-called ‘Wider Economic Benefits’ (WEBs) of infrastructure investment, that is the impacts other than time savings benefitting those actually using the transport network at any given moment. We know instinctively and to an increasing extent empirically that the benefits of transport investments are not limited to the time saving benefits of users; on the other hand, quantifying the actual scale and impact of wider economic benefits is riddled with challenges and there remains vigorous debate on what to include and exclude¹ (Laird and Venables, 2017).

The potential Wider Economic Benefit of transport investment that has received most attention in recent years is that of agglomeration. Agglomeration, in simple terms the increased density of economic activity in space, has been said to be a critical consideration in terms of non-user effects resulting from transport interventions in urban areas (Venables et al., 2014; Melo et al., 2017). Tracing back to the Eddington report (2006), the key underpinning idea is that significant changes in the level of accessibility of key locations might lead to equally significant shifts in the locations and operations of firms and their workers. Agglomeration arguments suggest that increasing job density is beneficial for productivity because people in different firms and sectors are more likely to interact with each other so that knowledge is shared and new learning takes place (see for example, Venables, 2016; and Puga, 2010). Dan Graham’s (2007) term “effective density” reflects one version of this, underpinned by a notion of accessibility to economic mass. Despite their recent popularity with many policy makers – the ‘additional' economic benefit of transport investment ascribed to agglomeration effects has been claimed to be as much as 40% - the key problem with agglomeration analyses is, as for many of the purported links between transport and economic growth more generally, that causality is unclear, and there are significant challenges regarding the potential for double counting. In terms of the latter, there is little clarity in the literature as to whether density drives productivity or whether productivity drives density. The upshot of all of this is that whilst a broad story about density being beneficial for productivity can be assembled, there is no clear appreciation of whether this positive relationship will emerge in specific locations or what policymakers can do to effect/influence such mechanisms in practice. Indeed, in their “meta-analysis of the relationship between infrastructure and economic growth”, Holmgren and Merkel (2017) find that as the estimations of productivity enhancements due to infrastructure investments become more precise, the closer they tend to zero.

A further complication in the literature is the threshold levels at which agglomeration effects may take effect. Indeed, whilst studies on the Crossrail project, which will add 10% to London’s total rail capacity, would seem to suggest validity for London, it is another question as concerns likely agglomeration effects in context of other cities that are both smaller and have different mixes of economic activity. Given the conflicting evidence to date, it is not clear that places of modest absolute scale will present agglomeration dynamics in any meaningful form.

A further consideration is that of economic displacement, i.e. whether investment in improved transport actually leads to growth and/or productivity improvements at the regional/national scale or whether it merely shuffles it around. Venables et al. (2014) highlighted a key distinction here between tradeable and non-tradeable sectors: for sectors like retail, which serves the domestic economy, any growth as a response to a transport change is likely to move the activity

¹ Indeed, given the difficulty in accurately quantifying benefits, Vickerman (2017:5) counsels that “the desire of policy makers for precise estimates may have to be modified".
from another location within the regional or national economy. Whilst the particular place subject to an improvement in accessibility due to transport investment stands to gain, this investment is a zero-sum game from the perspective of the wider regional- or national economy because the retail spend will otherwise have occurred somewhere else. In contrast, in tradeable sectors, i.e. those where firms sell goods or services beyond their own locality, the benefit to the local or national economy from better transport is more likely to be genuinely additional, as greater accessibility serves to improve the investment prospects of the area, reduces the friction of getting goods to market, and makes it easier for business interaction to take place. It is this latter benefit that a 2013 (KPMG) report for Transport Scotland highlighted as being important in understanding the real value of improved rail connections in Scotland.

2.3 Transport Appraisal

The literature on transport appraisal highlights significant international divergence in methodological approaches. The crucial differences between different methods centre on the extent to which the central quantitative calculation of the increased transport efficiency due to an intervention (usually a benefit:cost ratio) is (a) extended by methodologies that aim to measure wider economic benefits such as agglomeration, and (b) complemented by qualitative assessments of other potential impacts of the planned project.

In reference to the first point, Wangsness et al. (2017) note that “even though the concept of Wider Economic Impacts (WEIs) has matured over the last decade, there is still relatively little consensus about their magnitude and relevance”, and further that “there is currently no established consensus on the magnitude and relevance of WEIs, or on how and which of these impacts should be taken into account in transport appraisals.” As Rothengatter (2017) states, moreover, it “is not guaranteed”, that “wider impacts are always positive”. The OECD (2017) remarks, nevertheless, that our knowledge of wider impacts, such as agglomeration, is now sufficiently robust to be reliably included in transport appraisals.

In their Transport Investment and Economic Performance report Venables et al (2014) analyse how the Department for Transport’s WebTAG has changed through various iterations. The report makes a series of recommendations, which whilst focused on the application of the DfT’s methodology in England, are nonetheless useful when considering the Scottish case:

- There should be appropriate emphasis placed on local contextual factors when undertaking transport appraisals. Reflecting SACTRA, there is concern that the extent to which transport investments interact with unique local arrangements of assets and factor conditions is often underappreciated;
- There should be a clear policy rationale for the intervention which makes an evident connection between wider strategy and the actual project proposed;
- The impacts (particularly of larger interventions) on the operation of the market and private sector firms should be fully considered;
- Changes in land use resulting from the bringing into service of the project, and the subsequent impacts of these changes on transport demand, should be analysed;
- There should be full transparency in the choice and application of appraisal techniques – there needs to be an ability for stakeholders to “critically evaluate” the approaches taken by decision makers.

Given the evident uncertainties of even the most broad-based wider economic impact assessments, both the OECD (2017) and Wangsness et al. (2017) point to the merits of setting out a range of scenarios, premised on different assumptions, when appraising possible transport
interventions, since there is a tendency to ‘believe’ the final number (usually a benefit:cost ratio) generated by any quantitative appraisal and downplay if not ignore the degree of uncertainty surrounding such numbers (see also Holmgren and Merkel, 2017). Venables (2016) also agrees, noting the importance of a scenario approach given the complex range of complementary factors (changes in land use, the property market, access to jobs and so on) required to drive real economic change from any individual transport investment.

2.4 Lessons from the ‘What Works’ Research Initiative

Recent developments in the UK have seen the emergence of What Works centres which seek to assess effectiveness in policymaking. The What Works Centre for Local Economic Growth has recently presented findings on evaluations in transport, asking what interventions have been effective and which have been less so with respect to its impact on economic performance.

The following points – based on what the What Works authors consider to be a small number of relevant (and robust) evaluations - summarise the key findings:

- Road projects – “can positively impact local employment” but most studies show “no” or “mixed” effects; can increase firm entry (though this may be from displacement); and there is “some evidence” of “positive effects” of wages and productivity. Depending on distance to the project, road projects tend to have a positive effect on property prices;
- Rail projects – tend to have a positive effect on property process, however, no high-quality evaluations provide evidence on the impact of rail infrastructure on employment;
- Other modes – the authors note: “we found no high-quality evaluations of the impacts of trams, buses, cycling and walking schemes on any economic outcomes”.

It is further pointed out that few evaluations have identified the presence of Wider Economic Benefits, though these are widely reported in appraisals. Regarding the size and scope of interventions, the authors remark: “We have little evidence that would allow us to draw conclusions on whether large-scale projects (e.g. high speed rail or motorway construction) have larger economic growth impacts than spending similar amounts on a collection of small-scale projects”. Indeed, these are the transport-related arguments heard most often from the business community in the UK, who often claim that transport in Britain’s major cities suffers from precisely these constraints, and that this is limiting their scope to grow further, or to address commonly perceived problems such as the productivity constraints argued as a result of congestion and extended travel times for intra-city travel. The Eddington report was and remains a landmark contribution, with the What Works Centre for Local Economic Growth (2015) noting that, “since the Eddington report”, “little has changed about our understanding of the interactions between transport and the economy”.

A note of caution regarding the transformative potential of transport infrastructure investment is adopted by the authors:

“…much more empirical work remains to be done on understanding the impact of infrastructure improvements on local economic growth. Theoretical analysis certainly urges caution in assuming that infrastructure investment can stimulate growth in poorly performing areas. In short, while infrastructure investment may be vitally important for growing cities, its role in stimulating growth is not as clear-cut as assumed by many decision makers.”
The *What Works* reports are useful reports for charting what has been effective – and what has been less effective – in policies to date. A further challenge, however, relates to the technological and political fluidity going forward. For example:

- How can judgements be made about infrastructure investments that will remain relevant in 20 to 30 years from now? Infrastructure is sporadically updated, so how do we future proof it?
- What will the changes brought about by Brexit imply for the role transport needs to play as an under labourer for the Scottish economy. Demand conditions in the UK economy may markedly change, leading to different calculi for firms and workers, and the spatial economies they interact with/in.

2.5 **Government Assumptions of the Links Between Transport and the Economy**

Central government is acutely aware of the difficulties in accurately modelling and forecasting the actual economic impacts of transport investment. The most recent definitive guidance on the issue, which draws on much of the academic research referenced above, the *Value for Money Framework*\(^2\), was published by the Department for Transport in 2015. The *Framework* notes that the UK Government “distinguishes between three ‘types’ of monetised impacts: established, evolving, and indicative monetised impacts” (para 3.37).

**Table 1: DfT transport investment impact ‘types’**

<table>
<thead>
<tr>
<th>Established Monetised Impacts</th>
<th>Evolving Monetised Impacts</th>
<th>Indicative Monetised Impacts</th>
<th>Non-monetised Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Included in initial and adjusted metrics</td>
<td>Included in adjusted metric</td>
<td>Considered after metric using switching values approach</td>
<td>Security, Severance, Accessibility, Townscape, Historic environment, Landscape**, Biodiversity, Water environment, Affordability Access to services, Option and non-use values</td>
</tr>
<tr>
<td>Journey time savings</td>
<td>Reliability</td>
<td>Moves to more/less productive jobs</td>
<td><strong>These are a class of models rather than a specific economic impact</strong></td>
</tr>
<tr>
<td>Vehicle operating costs</td>
<td>Static clustering</td>
<td>Dynamic clustering Induced investment Supplementary Economy Modelling*</td>
<td><strong>A widely-used methodology for monetisation exists, but this is not included in WebTAG guidance because of concerns about its robustness. Detailed guidance is found in the Supplementary Guidance on Landscape.</strong></td>
</tr>
<tr>
<td>Accidents</td>
<td>Output in imperfectly competitive markets</td>
<td>Labour supply</td>
<td></td>
</tr>
<tr>
<td>Physical activity</td>
<td>Journey quality</td>
<td>Noise</td>
<td></td>
</tr>
<tr>
<td>Air quality</td>
<td>Greenhouse gases</td>
<td>Indirect tax</td>
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</tr>
</tbody>
</table>

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The key message from this table is that the DfT regards estimates of the actual economic uplift – e.g. improved productivity and additional overall GVA – generated by transport schemes as to be at best evolving, and often indicative. This is not only because of the uncertainties about the causal mechanisms highlighted by the underpinning research, but also because the actual numbers generated in such estimations can vary significantly with relatively minor adjustments to the assumptions used, such as the cost of fuel or average vehicle occupancy. It is for this reason that the Department recommends extensive sensitivity testing of the business case for any proposed transport project. Further, as Mullen and Marsden (2015) suggest in their review of the growth-focused cases made for transport investment across England, it is very difficult indeed to find empirical data supporting the GVA uplift assumptions often made in such investment cases.

Recent reviews of the strategic case for major transport investments in England have reflected this guidance. Perhaps most important is the Northern Powerhouse Independent Economic Review published in June 2016. The IER considers the case for strategic road and rail improvements across the North of England in some detail, but – crucially – does not place a GVA value on them given the impossibility of doing so reliably as evidenced above. Instead, the IER starts from the position that insufficient supply and quality of transport could act as a constraint on future growth, and sets out a range of possible growth scenarios based on the degree of success in stimulating key sectors of the regional economy, ranging from ‘business as usual’ (the current regional growth rate) to ‘transformational’, the latter equating to a 15% improvement in absolute regional GVA over ‘business as usual’ by 2050.

Many of the same concerns are evident in the Scottish Government’s STAG process for transport project appraisal. The very latest (August 2017) update to STAG guidance is highly consistent with the DfT’s position. Paragraph 9.3.3 Characterising Changes in the Economy notes that estimates of the economic impact of transport investment are by their nature “selective”, and that “it can be difficult to be confident of the net impact of a project across the whole economy”. Further, whilst it is possible to estimate the economic impact of transport interventions at a local level, the difficulty in accurately modelling feedback processes and the absence of conditions of perfect competition in the real economy more widely mean that “it is therefore not appropriate to conclude from this (kind of) analysis that there will be additional net impacts at the Scotland level”. Indeed, the summary diagram used to explain the economic basis of STAG places productivity improvements wholly within the Wider Economic Benefits sphere, reiterating the uncertainty about the true extent of these processes in the DfT’s guidance.

Thus, although confidently modelling the GVA impacts of transport interventions remains elusive, it is possible to estimate more of the impact of transport on ‘economic welfare’. In its guidance to practitioners, current STAG Guidance (August 2017, para 9.3.3.) notes that:

“Cost benefit analysis (CBA) captures the impact of an intervention on economic welfare. This is a measure of how much people would be prepared to sacrifice in order to achieve the project outcomes. However, it can also be helpful to examine the impact of a project on other metrics such as economic activity… Some modelled impacts on economic welfare also reflect impacts on economic output.”

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3 http://www.sqw.co.uk/insights-and-publications/northern-powerhouse-independent-economic-review/
3 Digital Infrastructure and the Economy

Just as enthusiastic advocates of greater investment in physical transport infrastructure point to the potential economic gains to be had from such interventions, proponents for better digital infrastructure do similarly. Indeed, just as one last road is often argued by local politicians and business people to ‘complete the network’ and unlock substantial economic gains, so improved digital connectivity is sometimes portrayed almost as a magic bullet to capture economic gains in the modern ‘knowledge economy’.

3.1 The Impacts of ICT on Economic Activity

At the turn of the millennium fashionable analyses proclaimed ICT would bring about the ‘death of distance’ and with it the death of cities as a means of economic organisation (Cairncross, 1997; Castells, 1989). However, very quickly these assumptions were contradicted as evidence accumulated that digital connectivity complemented and corresponded with traditional physical movement such as air traffic (Devriendt et al 2010), rather than replacing movement. Other work noted that rather than provoking economic decentralisation, improved ICT seemed to reinforce the primacy of larger urban places, and therefore potentially the economic agglomeration effects seen as most likely to occur in such places (see Tranos et al 2012; Horrigan and Wilson 2002). Further research found that the majority of digital connections were made over very short distances within cities (Krings et al 2009), confounding another expectation of early commentary on the impact of ICT.

What much of the early speculation on ICTs and the economy missed was that first, the impacts of new technologies are not linear in terms of how they reshape economic activity, and second
that the key transformative type of ICT innovation would not be (just) the kind of high capacity fixed broadband connections that Tony Blair called the 'information super highway' in the 1990s, but rather the smartphone, especially after the launch of the Apple iPhone in 2007.

Attempts to capture accurately the economic impacts of digital connectivity have mirrored those for physical connectivity. Just as for transport, it is methodologically difficult to quantify the real economic benefit arising from investment in digital infrastructure for a number of reasons. First, digital communications are difficult to measure per se, with most studies relying on proxy measures such as broadband capacity or number of Internet Service Provider customers. Second, digital activity is changing rapidly (both the level of use and how ICT is used) so data are inevitably either out of date at the time of analysis and/or unreliable in the first place because it is often impossible to differentiate between economically useful and completely frivolous communications. Third, there are almost the same ambiguities in the direction of causation behind a correlation between economic growth and digital activity – economic growth may cause an increase in digital activity as much as the other way round. Fourth, when individuals or firms make a change to their ICT use, they often make simultaneous changes to other activities such as their management, production and/or marketing, just as they do in response to new physical transport opportunities such as a new direct international flight or the opening of a new. Fifth, precisely as Eddington was at pains to point out that incremental additions to a generally mature transport network were unlikely to deliver anything more than incremental gains, so there may be key thresholds in the quality of digital connections. Stryszowski’s review (2012) for the OECD highlighted empirical evidence demonstrating a range of results associated with a 10 per cent increase in digital activity in terms of impact on GDP growth – from 0.2% to 1.6%; a relatively wide range and certainly not ‘transformational’ to the extent of some of the language used to support significant ICT investment.

4 Productivity of the Infrastructure Sector

In addition to longstanding debates about the impact on the productivity of the economy of the infrastructure we build, in recent years there has been increasing attention paid to the productivity of the infrastructure sector itself in terms of the quantum of new infrastructure delivered per (public) pound spent. Since the Global Financial Crisis, and especially the change of administration in 2010, the UK government has become much more overtly concerned with the efficiency and productivity of the construction- and related sectors responsible for delivering infrastructure investment:

“Infrastructure networks form the backbone of a modern economy and are a major determinant of growth and productivity... However, historically the UK’s approach to the development of these networks has been fragmented and reactive... To remain globally competitive, the UK needs to address these failures and develop an infrastructure capable of supporting a dynamic, modern economy” (HM Treasury, 2011: 5).

This final section reviews some of the emerging evidence on the efficiency gap in infrastructure delivery in the UK, and the implications of this.

4.1 The ‘Double Whammy’ of Lower Spending, and Less Value for Money

In their book The Transport Debate, Shaw and Docherty (2013: 7) highlighted what they regarded as “the most astonishing admission” contained in the Treasury’s first ever National Infrastructure Plan, published shortly after the 2010 General Election:
The UK is one of the most expensive countries in which to build infrastructure. For example, civil engineering works cost some sixty per cent more than in Germany … If we were only to reduce public sector construction costs by 15% that would result in annual savings, or additional investment, of £1 billion. (HM Treasury, 2010: 4)

Alarmed at the continuing escalating cost of the railway under the post 1993 structure, government commissioned a report from Sir Roy McNulty in 2012 on the efficiency of National Rail, which estimated that standard railway infrastructure costs 30–40% more (Department for Transport and Office for Rail Regulation, 2011) in the UK than comparable countries. In his review work carried out at the same time as McNulty’s, Preston (2012) calculated that the cost of building high speed rail infrastructure in the UK was roughly twice as high as in mainland Europe.

Reviewing the possible reasons for this highly significant efficiency gap, Shaw and Docherty (2013) identified a number of long-discussed features of the UK governance contributing to it. These include extreme organisational fragmentation of the civil engineering and transport sectors, the legal and contractual complexity that results from this plethora of organisational interfaces, and a political culture that has successively turned the infrastructure spending off then on then off again several times over recent decades, leading to a procurement culture with a particularly negative approach to the financial risks of infrastructure construction. In conclusion, Shaw and Docherty end with one simple but alarming calculation:

“Given that Whitehall and the devolved administrations spend something of the order of £20 billion annually on transport across the UK, this efficiency gap is the equivalent of a lost Terminal 5, or HS1, or two Jubilee Line Extensions every year.”

Clearly, when multiplied over several decades when infrastructure spending in the UK has been relatively low compared to competitor countries, the combination of lower spending per se and reduced outputs per unit expenditure goes a long way to explaining both the actual state of many key networks (e.g. the public transport systems of most cities in the North of England), and at least potentially a significant proportion of the more general productivity gap in key locations.

4.2 Current Attitudes to Infrastructure Spending

In their review of future transport governance challenges in the UK, Marsden and Docherty (2018) underline the extent to which UK public expenditure on transport has fluctuated considerably over time, from 0.8% of GDP in 2000/01 to 1.5% in 2009/10 and 2015/16. These fluctuations are as much to do with changing normative policy positions – e.g. New Labour’s initial abandonment of road building and the move from managed decline to rapid expansion of the railway in the 1990s/2000s – as they are to do with the broader economics of public expenditure. Nonetheless, they have important implications for the scale and type of infrastructure delivered. For example, UK spending on roads remained around 0.2% of GDP on roads between 2004 and 2013 (around 40% lower than Germany and 50% lower than France over the same period) but increased to 0.3% by 2015 as expenditure in these two comparator countries began to fall.⁴ The new government-owned company Highways England has commitments to further expansion in expenditure as part of the new regulated 5 year ‘Road Period’ financial settlement, and the devolved administrations in Scotland and Wales also retain significant roads programmes. Rail expenditure in the UK has been higher than France and Germany over the same period, although as noted above, McNulty estimated that the cost base

⁴ Data from https://data.oecd.org/transport/infrasstructure-investment.htm
was about 40% higher in the UK, so the actual outputs in terms of infrastructure construction and renewal were much less.

Docherty et al (2018) regard these shifts as part of an underlying significant change in attitudes to transport infrastructure investment since the election of the 2010 Coalition government. Following the Global Financial Crisis, UK Ministers have explicitly promoted increased infrastructure investment in transport and broadband as a key intervention for economic development, and in response to the pressure of population and housing growth in the South East. Marsden and Docherty (2018) estimate that the planned ‘pipeline’ of transport infrastructure in the UK is now in the order of £92bn.
Bibliography


