University of Strathclyde Business School

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The relationship between infrastructure and inclusive economic growth: evidence review

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The report was commissioned in July 2019 by The Infrastructure Commission for Scotland (ICfS).

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Executive Summary

- This report reviews the literature on the links between infrastructure investment and economic outcomes, with a particular focus upon inclusive growth.
- Inclusive growth lies at the heart of the Scottish Government's approach to the economy. The government defines inclusive growth as – 'growth that combines increased prosperity with greater equity; that creates opportunities for all and distributes the dividends of increased prosperity fairly'.
- Inclusive growth is fast becoming a new mantra in economic policy across many countries. But the relatively 'new' nature of the terminology means that there is little in the way of formal studies that have explicitly sought to capture the links between infrastructure and inclusive growth.
- We therefore also review the evidence for any links between infrastructure investment and key components of 'inclusive growth'.

Evidence on inclusive growth and outcomes

- Inclusive growth is a powerful new economic policy agenda. However, it remains in its infancy in terms of evidence base. Unfortunately, many of the pay-offs from new policies that are designed to promote 'inclusive growth' will take years to materialise.
- There is, however, a longer history of debate about the relationship between growth and income inequality more generally.
- For decades, the accepted wisdom was that as a country moved through different stages of development, inequality would initially increase (as new, well-paid jobs are created for only a few workers), but then fall as others catch up.
- But the experience of the UK, Scotland and other advanced economies suggests that whilst faster economic growth *can* benefit those on low-incomes and different parts of the country, this is far from guaranteed.
- As a result, the inclusive growth literature poses a challenge to the definition of 'economic prosperity' typically used to help prioritise infrastructure investments.
- Looking forward, being clear about how different metrics capture not just growth but wider economic welfare outcomes will be crucial for any assessment of the impact of infrastructure on inclusive growth. Traditional metrics – such as GDP, employment rates etc. – will only ever give a partial picture of inclusive growth performance.
- The Scottish National Performance Framework highlights some such metrics, providing a broad set of outcomes to evaluate performance. Examples of these include educational and environmental outcomes, as well as the prevalence of poverty and fair work practises.

Infrastructure and economic outcomes

- Investment in infrastructure is one of the most important levers that the government has at its disposal to shape both the direction and type of growth in the Scottish economy.
- But in our review, we found no study that had attempted to formally test for a link between investing in infrastructure and inclusive growth (however defined).
- Whilst there is a literature on infrastructure and inequalities, most of the work relates to developing countries.
- The debate over the link between infrastructure and growth is much more developed.
- Somewhat surprisingly, whilst economic theory clearly sets out the links between infrastructure and growth, the empirical evidence is not as clear cut – or as significant – as one might expect. This holds true both at an aggregate level and by sector. This reflects a number of factors including the simple fact that the correlation between infrastructure investment and growth runs in both directions (i.e. infrastructure can help boost growth, but rich countries can fund better infrastructure).
- The strongest effects appear to occur when a lack of infrastructure – or none at all – acts as a break on growth. The impact is greater the more efficient and cost effective such infrastructure spend is.
- At a more micro level, we find that – not just in Scotland or the UK, but internationally – there tends to be a lack of formal evaluations examining the distinct contribution of individual infrastructure programmes on economic outcomes. This appears to be an area for improvement.

Key implications for policymaking

1. A strong case can – and should – be made for better evaluation of infrastructure programmes in Scotland. This will not be easy but building in key inclusive growth metrics from the start, tracking performance over time and then evaluating the long-term impact will help develop a better evidence base of 'what works'. In turn, this should help future decision making.

2. That being said, technical evaluations of infrastructure projects are not easy to do. This is particularly true in the case of interventions targeted at inclusive growth outcomes, given their focus upon prevention and long-term change. The importance of the appraisal phase is therefore hugely significant, both in terms of providing a robust logic chain for why investments are being undertaken and the outcomes targeted.

3. If inclusive growth is the objective, then appraisals will need to be informed by a broader suite of 'outcomes' than in the past. Whilst incorporating metrics to capture the distributional or welfare impacts of policy initiatives is not new, their relative weight over other metrics might need to be scaled-up. This can involve incorporating a wider measure of 'economic welfare' rather than solely focussing upon economic growth. Alternatively, it could involve broadening-out growth metrics to include features that capture levels of inequality.

4. The metrics available to 'capture' inclusive growth remain however, in their infancy. Measures of wellbeing and 'good' growth are controversial and suffer from a number of statistical challenges. A dashboard approach – like the NPF – is in our view more desirable, however even then, measures of performance may be driven by what data is available as

opposed to what data is actually the most useful. The Scottish Government is investing in developing better data and information to support inclusive growth.

5. Any consideration of infrastructure issues should also take into consideration some of the complexities and constraints underpinning 'inclusive growth'. The innovative nature of this agenda means that many of these are only now being worked through. For example, given the broad nature of the term 'inclusive growth' there is a risk that any policy can be 'badged' as helping to support inclusive growth. The importance of robust appraisal and evidence gathering is therefore crucial to guard against such a risk.

6. Effective investment in infrastructure has the potential to improve economic and social outcomes. However, the literature also reveals that there is no one 'magic area' for policymakers to focus upon. There also needs to be a degree of realism about the pace in which change can be delivered. The scale of inequalities, and the different dimensions, means that it will take time to turn these around. Moreover, whilst infrastructure has a key role to play, a great many other factors – i.e. labour market structures, fair work, ownership models etc. – and education and health outcomes are just as crucial. Careful consideration of how all these elements, with infrastructure a key enabler, interact with each other is necessary.

7. Many of the avenues through which infrastructure can improve inclusive growth outcomes are likely to be indirect and to take effect over a long-period of time. Indeed, in reality, certain infrastructures – such as those linked to transport and digital – are far more likely to have a short-term and significant impact upon traditional metrics of economic performance, such as growth and employment. Others, but arguably more important for overall economic welfare and inclusive growth in the long-run, such as more social infrastructure elements – including in health and education – much less likely to drive major improvements in short-term economic indicators.

8. Finally, in a world of inclusive growth the concept of what is classified as infrastructure may need to be re-considered. In particular, there is a strong case for broadening out the definition of infrastructure to no longer just be about physical infrastructure but to also include 'social infrastructure' (that is, the institutions and structures that develop the capacities and capabilities of individuals, families and communities to participate more fully in society and economic growth).

1. Introduction

The purpose of this report is to review the evidence on the relationship between infrastructure investment and inclusive economic growth.

Given the timescales involved, the nature of this review is relatively high-level, focussing upon key trends and sources of debate in the literature. We do however highlight where further evidence can be obtained.

The aim is to help inform the work of the Infrastructure Commission for Scotland (ICfS). The Commission has been established to provide independent advice on the long-term strategy for infrastructure in Scotland.[1]

This short report is structured as follows.

In Section 2, we summarise the debate on inclusive growth and highlight in what ways this differs from traditional approaches to economic policymaking. We also review the evidence on 'inclusive growth' and different economic outcomes.

In Section 3, we review the empirical work that has been undertaken to test the relationship between infrastructure and inclusive growth. Given the relatively 'new' nature of the inclusive growth terminology, there is little in the way of formal studies that have explicitly sought to capture the links between infrastructure and inclusive growth. We therefore also review the evidence for any links between infrastructure investment and key components of 'inclusive growth'.

We find little in the way of ex-post evaluation examining the links between infrastructure and such outcomes. We explain in the report why this might be the case. This conclusion is not that unusual, and is consistent with the findings of the 'What Works' reviews[2] that have been undertaken.

What this emphasises therefore, is the importance of building in inclusive growth metrics and indicators into the ex-ante appraisal process from the outset of any infrastructure programme. In doing so, it is crucial to be transparent about the assumptions and methodologies used. In Section 4 therefore, we discuss possible approaches to incorporating quasi-inclusive growth indicators into appraisals for infrastructure. We also provide a summary of recent reports into inclusive growth and the views of the authors as to what role infrastructure may play.

Section 5 concludes.

1 See https://infrastructurecommission.scot/
2 See https://whatworksgrowth.org/

2. Inclusive Growth

A quick recap

Inclusive growth lies at the heart of the Scottish Government's approach to the economy.

The government defines inclusive growth as –

'Growth that combines increased prosperity with greater equity; that creates opportunities for all and distributes the dividends of increased prosperity fairly'

Inclusive growth is fast becoming a new mantra in economic policy across many countries.

The OECD has for example, been a key driver of making the case for inclusive growth at an international level, as part of its wider work into promoting economic wellbeing.

In the UK, there have been a number of key pieces of work including the report of the Inclusive Growth Commission of the Royal Society of the Arts (RSA)[3] and various outputs of the Joseph Rowntree Foundation.[4]

In academia, a new research centre – the "Inclusive Growth Analysis Unit" – has been established at the University of Manchester.[5]

The Scottish Government has been at the forefront of this agenda and has done much to drive it forward.[6]

Broadly speaking, there have been two aspects to the government's approach. Both are clearly linked to each other:

1. Tackling levels of inequality within society – gender, ethnicity, social background etc – no matter the location
2. Differences in economic performance based upon geography – i.e. the regional inclusive growth agenda

The economic literature on inequality and growth

There is a long history of debate about the relationship between growth and income inequality.

For decades, the accepted wisdom was the so-called Kuznets (1955) curve[7]. This concluded that as a country moves through different stages of economic development, inequality initially increases (as new, well-paid jobs are created for only a few workers), but then starts to fall as other workers and sectors catch up. Over time, this has been replaced with a more nuanced view that each country's development may not follow a similar or consistent pattern.

Much of this work has concentrated upon developing countries.

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3 See Inclusive Growth Commission Making our Economy Work for Everyone, https://www.thersa.org/action-and-research/rsa-projects/public-services-and-communities-folder/inclusive-growth-commission

4 See for example "An inclusive growth monitor for measuring the relationship between poverty and growth. York: Joseph Rowntree Foundation", www.jrf.org.uk/report/inclusive-growth-monitor

5 https://www.mui.manchester.ac.uk/igau/

6 See for example the Scottish Government's Centre for Regional Inclusive Growth https://www.inclusivegrowth.scot/

7 Kuznet (1955), "Economic growth and income inequality", American Economic Review, Vol. 45, No. 1, pp. 1-28.

In advanced economies, there has been growing concern that economic growth has been leading to increased inequality, and that this has become more apparent since the financial crisis. Indeed, whilst inequality between countries has fallen, certain inequalities within many countries have been on the rise.

In the UK, income inequality remains toward the higher end in comparisons with other OECD countries[8]. This shows up in a number of different guises. For instance, whilst we have near record numbers of people in employment in Scotland and the wider UK, levels of in-work poverty continue to rise[9].

In the UK, income inequality – as measured by the Gini Coefficient – rose through the late 1970s and 1980s, but has remained relatively constant since then[10]. Levels of absolute poverty are at their lowest ever level – 16 percentage points lower than in 1997–98. But rates of relative poverty – i.e. the gap between those at the bottom of the income distribution and those in the middle – after falling for a period have flat-lined (and have actually risen in recent years)[11].

Based upon recent trends in earnings and welfare benefits, most predictions are that levels of income inequality will rise over the next few years[12].

Wealth in the UK is even more unequally divided than income. The latest data shows[13]:

- The wealth held by the top 10% of UK households is around five times greater than the wealth of the bottom half of all households combined
- The wealthiest 10% also had more total wealth than the aggregate wealth of the first eight deciles put together

Of course, underneath these aggregate measures of income and wealth inequalities are inequalities in outcomes. Outcomes in fuel poverty, housing quality and health all vary greatly across society. For example, in 2017, the premature mortality rate in the most deprived areas was 4 times higher than the rate in the least deprived areas[14].

On a regional basis, levels of inequality in economic performance are stark.

Regional GVA per head in London was 179% of the UK average in 2017. In contrast, Regional GVA per head in Wales was just 73% of the UK average[15]. In Scotland, the figure was 93% of the UK average.

Some care should be exercised when interpreting this data. Firstly, inequalities within regions – particularly in London – can be just as stark (if not starker) as those between regions. Secondly,

8 See Institute for Fiscal Studies (2019), "Living standards, poverty and inequality in the UK: 2019", https://www.ifs.org.uk/publications/14193

9 See Scottish Government (2019), "Poverty and income inequality in Scotland: 2015-2018 ", www2.gov.scot/Topics/Statistics/Browse/Social-Welfare/IncomePoverty

10 Source: Office for National Statistics (2019), "Households below average income: 1994/95 to 2017/18", https://www.gov.uk/government/statistics/households-below-average-income-199495-to-201718

11 It is estimated that 20% of Scotland's population (1.03 million people) are living in relative poverty after housing costs. The number of people in relative poverty after housing costs in Scotland had been falling since the late nineties, but data of recent years shows a continuous increase since 2009-12. Source: https://www.gov.scot/publications/poverty-income-inequality-scotland-2015-18/

12 See for example: https://www.resolutionfoundation.org/publications/the-living-standards-outlook-2019/

13 Source: Office for National Statistics (2018), "Wealth in Great Britain: 5th Wave: 2014 -2016", www.ons.gov.uk/peoplepopulationandcommunity/personalandhouseholdfinances/incomeandwealth/bulletins/wealthingreatbritainwave5/2014to2016

14 Reference: "Long-term monitoring of health inequalities: December 2018 report", Scottish Government, www.gov.scot/publications/long-term-monitoring-health-inequalities-december-2018-report/pages/5/

15 Office for National Statistics (2018), "Nominal Regional Gross Value per head and income components", www.ons.gov.uk/economy/grossvalueaddedgva/datasets/nominalregionalgrossvalueaddedbalancedperheadandincomecomponents

GVA per head measures are influenced by where economic activity is 'booked'. In this regard, London benefits heavily from the City of London although many of the financial and economic benefits of this activity might not actually impact upon people living in London. Notwithstanding these caveats, many would argue that this data – and other measures such as household incomes, earnings, labour market outcomes etc. – shows that the pattern of UK economic performance is not inclusive.

Whilst the scale of regional variation might not be as large as across the UK as a whole, Scotland has substantial levels of inequality in economic outcomes. For example, Regional GVA per head in Edinburgh was £44,228 in 2017 compared to £13,703 in North and East Ayrshire[16]. In the year to March 2019, the employment rate in Glasgow was 65.8% compared to 81.4% in Perth and Kinross.[17]

The experience of the UK, Scotland and other advanced economies suggests that whilst faster economic growth can benefit those on low-incomes and different parts of the country, this is not guaranteed.

The economic literature underpinning inclusive growth

The inclusive growth agenda goes further than focussing upon how the benefits of growth are distributed across society.

Particularly in the Scottish context, the argument is put forward that inequality itself can act as a barrier to long-term growth (or to turn it around, tackling inequalities in society – from differences in health outcomes through to educational attainment and improved 'fair work' practices – can boost a country's growth rate).

It is hard to disagree with this viewpoint. An economy is likely to be more successful if all of its citizens to fulfil their economic potential. At the same time, helping to support regions which have perhaps underperformed in the past provides an opportunity to boost growth at a national level.

The OECD and the IMF have argued that, particularly in light of the 4th Industrial Revolution and limited scope for population growth in most advanced economies, tackling inequalities can help deliver more sustainable growth over the long-run.[18]

However, many economists still believe that some inequality can help propel growth if it is linked to incentives. They believe that without the carrot of financial rewards, entrepreneurship, innovation and rates of employment participation might be weaker than would otherwise be the case.[19]

Interestingly – and we will return to this later – much of the policy action that has been put forward to support inclusive growth has tended to focus upon 'softer' elements of infrastructure than more traditional elements of 'physical' infrastructure.

For example, the OECD's "Framework for Policy Action on Inclusive Growth" identifies three building blocks that they believe will help sustain and more equitably share the gains of economic

16 Source Office for National Statistics (2018) Op. cit.

17 Scottish Government (2019), "Statistics from the Annual Population Survey: Results for year to 31 March 2019", www2.gov.scot/Resource/0054/00547590.pdf

18 See OECD (2019), "What Works in Innovation Policy? New Insights for Regions and Cities: Developing Strategies for Industrial Transition", www.oecd.org/cfe/regional-policy/Audretsch(2018)DevelopingStrategiesForIndustrialTransition.pdf

19 The Economist (2015), "How inequality affects growth", www.economist.com/the-economist-explains/2015/06/15/how-inequality-affects-growth

growth[20]:

1. Investing in people and places that have been left behind through (i) targeted quality childcare, early education and life-long acquisition of skills; (ii) effective access to quality healthcare services, education, justice, housing and infrastructures; and (iii) optimal natural resource management for sustainable growth
2. Supporting business dynamism and inclusive labour markets through (i) broad-based innovation, fast and deep technology diffusion; (ii) strong competition and vibrant entrepreneurship; (ii) access to good quality jobs, especially for women and under-represented groups; and (iv) resilience and adaptation to the future of work
3. Building efficient and responsive governments through (i) aligned policy packages across the whole of government; (ii) integration of equity aspects upfront in the design of policy; and (iii) inclusive policy-making, integrity, accountability and international coordination

Whilst the inclusive growth argument appears at first glance to be a powerful new economic policy agenda, it remains in its infancy in terms of evidence base.

In reality, with scarce resources there can be often be challenging trade-offs between policies that promote 'growth' and those that support 'greater inclusive growth'. For example, a cut in Air Passenger Duty might boost growth in the short-run by leading to an increase in air traffic, but it may rub-up against objectives around climate change. A tax policy that cuts stamp duty for house building might support the construction industry, but the opportunity cost of doing so might be further investment in affordable housing. An inward investment subsidy may encourage a large investor to locate in a particular locality, but they might only create relatively low-paid work: how might these two objectives be traded off against each other?

At the same time, many of the policies that are designed to promote 'inclusive growth' will take years to materialise and their pay-offs are uncertain. Delivery will be challenging.

There have been respectful critiques of the inclusive growth agenda. See for example, Lee (2019)[21] and Fraser of Allander (2019)[22]. These reports highlight that whilst the agenda is underpinned by good intentions – and offers an important attempt to link economic development to the distribution of any gains – there are risks that it may become a policy 'buzzword'. In particular, there is a risk that policies are simply badged as promoting 'inclusive growth' with little in the way of analysis or evidence to underpin them. At the same time, policies that are referred to as 'supporting inclusive growth' may not be appraised or evaluated as strongly as they should for fear of not being seen to be consistent with the good practice.

It is also important to note that re-distribution is likely to remain a crucial avenue through which inequalities in economic opportunity and outcome can be improved. Inclusive growth initiatives may help at the margin and over the long run, but if structural changes in levels of income, wealth and regional are to be delivered, it is still likely to require a significant shift in the way in which the proceeds of growth are shared.

The inclusive growth agenda has much to commend it and it is based upon a core underpinning that in order for a country to fulfil its full economic potential, then all assets – both individuals

20 See www.oecd.org/economy/opportunities-for-all-9789264301665-en.htm
21 Lee (2019) "Inclusive Growth in cities: a sympathetic critique", Regional Studies, 53:3, 424-434
22 Fraser of Allander, "Where next on inclusive growth? 6 steps to build upon" https://fraserofallander.org/scottish-economy/where-next-on-inclusive-growth-6-steps-to-build-upon/

and regions – must have the opportunity to succeed. However, it is important to note that in reality there can be important trade-offs between promoting greater inequality and growth (at least in the short-term). Similarly, some pro-growth policies that are based upon tackling inequalities may not – again at least in the short-turn – have the same impact upon economic activity as other policies.

What does the evidence say?

There is a significant body of evidence which highlights the damaging implications that certain inequalities can have on an individual's economic outcomes.

For example, poor public health outcomes can have an impact on an individual's ability to secure stable and well-paid employment. At the same time, there is also evidence that points to poor economic outcomes can have major implications for long-term health outcomes, social outcomes and personal wellbeing[23].

At a macroeconomic level however, the evidence remains relatively mixed.

In 2014, two papers published by the IMF and OECD had an important impact upon the debate[24][25], . For example, Cingano concluded, "income inequality has a sizeable and statistically significant negative impact upon growth" and "redistributive policies achieving greater equality in disposable income has no adverse growth consequences".

In other words, tackling inequality is not only an important objective in its own right, it could also be an important driver of faster economic growth.

However, such a conclusion has not been universally accepted. The research findings have been challenged, including by Feuest et al. (2018)[26]. They argue that such conclusions depend, in part, upon the starting position of a country, the countries included in the sample and the time period used.

A review by Neves at al. (2016) of 28 studies over two decades found "an elasticity of inequality on growth which varies between -0.14 and +0.16[27]. This is, greater equality may be positively or negatively correlated with growth.

A slightly more nuanced approach is taken in Berg et al. (2018)[28]. They find that (1) lower net inequality is robustly correlated with faster and more durable growth, controlling for the level of redistribution; (2) redistribution appears benign in terms of its impact on growth, except when it is extensive; and (3) inequality seems to affect growth through human capital accumulation and fertility channels.

A final important point to recognise is that many of these studies are effectively searching for correlations between inequality and growth rather than causal effects. This means that at a

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23 See Health Scotland (2019), "Income inequality", www.healthscotland.scot/health-inequalities/fundamental-causes/income-inequality/income

24 Cigano (2014), "Trends in income inequality and its impact on economic growth", OECD Working Paper 163, www.oecd.org/els/soc/trends-in-income-inequality-and-its-impact-on-economic-growth-SEM-WP163.pdf

25 Ostry et al. (2014), "Redistribution, inequality and growth", IMF Staff Discussion Note, SDN/14/02, www.imf.org/external/pubs/ft/sdn/2014/sdn1402.pdf

26 Fuest et al. (2018), "Why the IMF and OECD are wrong about inequality and growth", European Network for Economic and Fiscal Policy Research Policy Brief, www.econpol.eu/publications/policy_brief_7

27 Neves, Afonso and Silva (2016), "A Meta-Analytic Reassessment of the Effects of Inequality on Growth", World Development, Vol. 78, pp 386-400. https://www.sciencedirect.com/science/article/abs/pii/S0305750X15002600

28 Berg, Ostry, Tsangarides and Yakhshilikov (2018), "Redistribution, inequality, and growth: new evidence", Journal of Economic Growth, Vol.23, pp 259 – 305. https://link.springer.com/article/10.1007/s10887-017-9150-2#citeas¬¬¬

macroeconomic level, bold over-generalizations like "inequality is good/bad for growth" must be viewed with caution.

The empirical evidence on whether inequality is good or bad for long-term economic growth remains an – as yet – unresolved debate.

Why does all this matter?

Firstly, it suggests that there is no 'magic area' for infrastructure to focus upon in an effort to boost inclusive growth.

Secondly, the evidence raises the possibility of trade-offs between pro-growth and pro-inequality infrastructure measures, at least in the short-run. There are also likely to be trade-offs in certain inclusive growth measures as well (e.g. are scarce resources invested in tackling regional inequalities or income inequalities).

Thirdly, and following on from this, these conclusions would point to the importance of looking at interventions that promote growth and then assess desirability of distributional effects; and looking at investments that will tackle inequalities and then assess their effect on growth. This will help identify complementary policy approaches and/or help identify policy approaches that might shape/mitigate/strengthen distributional or growth impacts.

Fourthly, the scale of inequalities – and the different dimensions – means that there needs to be a degree of realism about how the possible impact that individual policy interventions could have. This includes infrastructure. Whilst there is a possibility to shape growth at the margin – e.g. 'where' growth is concentrated or to assist the shift to a net zero economy – individual policies can only play one part. In reality, a great many other factors including taxes and welfare, the nature of the economic system – i.e. labour market structures, fair work, ownership models etc. – and education and health outcomes will be crucial. A system-wide approach is necessary if the structural inequalities that exist in society are to be tackled.

3. Infrastructure and Inclusive Growth

The Evidence Base

Introduction

Investment in infrastructure is one of the most important levers that the Scottish Government has at its disposal to shape both the direction and type of growth in the Scottish economy[29].

It therefore has a key role the inclusive growth agenda.

There is evidence to suggest that the UK spends a lower share of its economic output on national public infrastructure than many of its international competitors[30].

Infrastructure acts as the basic structure that supports economic activity: transport networks connect producers and consumers to markets & workers and employers to labour markets; utilities provide essential inputs for production; and communication networks facilitate exchange and dissemination of knowledge. Infrastructure can often generate positive externalities, so that the social return from any investment exceeds the private returns[31].

There are many practical issues that underpin the funding and operation of infrastructure projects that, in turn, will have an impact on the inclusive growth agenda. For example, in many instances, infrastructure investments are 'natural monopolies' and would be under-provided if left to the market. Large up-front costs, but benefits accruing over a long period of time, can make it difficult to obtain private finance. As a result, the role of the public sector is often crucial giving government(s) the opportunity to shape the priorities, pace and distributional impacts of infrastructure investment in an economy.

Of course, there can be some challenges. There is the potential for bubbles to be created if there is over-investment in a particular sector of the economy and/or regional economy. Not all infrastructure projects deliver the desired benefits. Indeed, like any government policy, there is the possibility for wastage should the cost of investment and interest charges exceed the economic benefits. Finally, investing in infrastructure – particularly over the long-term – commits the government to sustained fiscal investment which may (or may not) always be affordable.

From a theoretical point of view, the avenues through which infrastructure can deliver greater inclusive growth tend to be through indirect channels. For example, investing in infrastructure could (amongst other things) –

- Improve the 'supply side' of an economy over time – primarily through boosting productivity
- Lead to better environmental outcomes (through reducing regional disparities, reducing emissions, improving environmental quality and health and wellbeing)

29 The Scottish Government regularly sets out their vision for infrastructure and progress on key projects in an Infrastructure Investment Plan. The latest progress report for 2018-2019 is available here: www.gov.scot/publications/infrastructure-investment-plan-2015-progress-report-2018-19/pages/2/

30 ONS (2018), "An analysis of investment expenditure in the UK and other OECD nations", https://www.ons.gov.uk/economy/grossdomesticproductgdp/articles/ananalysisofinvestmentexpenditureintheukandotherorganisationforeconomiccooperationanddevelopmentnations/2018-05-03

31 See LSE (2017), "LSE Growth Commission", www.lse.ac.uk/researchAndExpertise/units/growthCommission/documents/pdf/LSEGC-Report.pdf

- Correct market failures which may lead to an under-provision of certain activities –e.g. education – and which can often be concentrated upon the most vulnerable in society

But many of the links are not clear cut. For example, better schools may improve the quality of educational attainment at the margin, but the impact is likely to be relatively small (particularly if the school estate is relatively good in the first instance).

In our review of the literature, we found no study that had attempted to formally test for a link between investing in infrastructure and inclusive growth (however defined).

We did not identify any analysis by the Scottish Government to evaluate the extent to which the government's overall infrastructure investment programme as a whole, contributed to changes in inclusive growth outcomes (at a macro level). Nor did we come across any studies by the government testing or monitoring how individual infrastructure projects have had an impact upon inclusive growth outcomes[32].

Most of the evaluation work that we found focussed upon particular user outcomes of projects. For example, in the case of the Borders Railway, the focus was upon metrics such as number of trips, purpose of trip and satisfaction with service[33]. For road projects, the key 'economic' metrics tend to be journey times or volume of traffic[34].

Alternatively, the focus is upon the impact upon 'output' or the scale of investment. That is, the amount of activity that will be supported in the building of the infrastructure as oppose to the benefits/costs once it is being used – see for example, the Scottish Government's Infrastructure Investment Plan or Draft Budget[35].

As mentioned above, the Scottish Government is not unique in this regard. But it is something that the Infrastructure Commission may wish to ask the government if they have undertaken such analysis either at the overall strategic policy/programme or for individual projects.

In what follows therefore, we summarise the literature on the links between infrastructure investment and growth; infrastructure investment and inequality; before, ending this section with a brief overview of the links between different 'types of infrastructure' and economic outcomes

Infrastructure and economic growth

There is an extensive literature on the links between infrastructure development and growth. For an excellent review, see Docherty and Waite (2018)[36].

The authors – having reviewed a wide variety of evidence on the links between infrastructure and productivity growth (particularly on transport and broadband) – conclude that the "literature is inconclusive [and] there is very significant disagreement about the causal linkages between the outputs of infrastructure investment and economic gains".

A similar conclusion was reached by the European Commission in 2014 who stated: that "The

32 This is of course not to say that such work has not been undertaken. Rather it is not readily accessible for us to review for the purposes of this report.
33 See for example, Transport Scotland (2018), "Borders Railway Year 2 Evaluation", www.transport.gov.scot/media/41659/scto2189915561.pdf
34 See https://www.transport.gov.scot/transport-network/roads/project-evaluation/
35 See https://www.gov.scot/publications/scottish-budget-draft-budget-2018-19/
36 Docherty and Waite (2018) "Evidence Review: Infrastructure. Productivity Insights Network, https://productivityinsightsnetwork.co.uk/app/uploads/2018/07/Evidence-Review_Infrastructure-1.pdf

literature has not produced a clear convergence in views on the quantitative size of the growth impact of infrastructure and has not observed any common effects of infrastructure on growth. The results largely depend on the country, the existing capital stock, the time frame and type of infrastructure considered"[37].

There are a wide variety of approaches to conceptualising and measuring the impact of infrastructure investment on growth and productivity.

Two highly cited studies are from – once again – the IMF (2014)[38] and the OECD (2016)[39] . Both studies find a positive link between increased investment in infrastructure and faster economic growth.

Bom & Ligthart (2013)[40] conducted a meta-review of 578 sets of results from 68 studies of the data. This found that the short-run elasticity of national public capital of 0.083, which rises to 0.122 in long run (gets better for local government). Melo, Graham and Brage-Ardao (2013) provide another detailed review. They find that a 10% increase in infrastructure (transport) is associated with a 0.3-0.5% increase in output[41].

There are a number of points to note from this literature.

Firstly, many studies struggle to find robust evidence of correlation over causation. That is, 'rich' countries can often afford high quality infrastructure. Indeed, one of the benefits of faster growth is the ability to invest more in public services (including transport, housing and energy infrastructure).

Secondly, the term physical infrastructure can mean a wide variety of different things – ranging from transport through to housing through to energy. In reality, there can be a significant difference in terms of economic impact, and timing of economic impact, between types of infrastructure projects. For example, one would not expect to see much in the way of an improvement in the short-term from any investment in education infrastructure, as the benefits are likely to be indirect and take well over a decade to materialise. In contrast, a transport project that unblocked a crucial road hold-up in a strongly growing part of the economy is likely to lead to a much measurable and observable improvement[42].

Thirdly, a lot of the evidence suggests that the biggest gains stem from improvements in 'poor' infrastructure, suggesting that there might be diminishing returns in some areas. The evidence that infrastructure investment is good for growth is at its strongest for developing countries as oppose to advanced economies[43].

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37 European Commission (2014), "Infrastructure in the EU: Developments and Impact on Growth", https://ec.europa.eu/economy_finance/publications/occasional_paper/2014/op203_en.htm

38 IMF (2014), World Economic Outlook October: "Is it time for an infrastructure push? The macroeconomic effects of public investment", www.imf.org/external/pubs/ft/weo/2014/02/

39 OECD (2016), "Can an increase in public investment sustainably lift economic growth? Working Paper: 1351, https://www.oecd.org/eco/Can-an-increase-in-public-investment-sustainably-lift-economic-growth.pdf

40 Born & Ligthart (2014), "What have we learned from three decades of research on the productivity of public capital?" Journal of Economic Surveys, Vol. 28, Issue 5, pp. 889-916. https://econpapers.repec.org/article/blajecsur/v_3a28_3ay_3a2014_3ai_3a5_3ap_3a889-916.htm

41 Melow, Graham and Brage-Ardao (2013), "The productivity of transport infrastructure investment: A meta-analysis of empirical evidence", Regional Science and Urban Economics, Vol. 43, pp. 695 -706, https://www.sciencedirect.com/science/article/pii/S0166046213000537

42 See for example, Gramlich (1994), "Infrastructure Investment: A Review Essay", Journal of Economic Literature, Vol. 32, No. 3, pp. 1176-1196, https://www.jstor.org/stable/2728606?seq=1#page_scan_tab_contents

43 See for example, Crafts (2009), "Transport infrastructure investment: implications for growth and productivity", Oxford Review of Economic Policy, Volume 25, Issue 3, pp. 327–343, https://academic.oup.com/oxrep/article-abstract/25/3/327/422816

Fourthly, the efficiency of investment is crucial. The level or growth in investment is only likely to have a sustained positive impact it is being invested in the right things and in a manner that is efficient. Moreover, the Eddington Review (2006) of transport infrastructure in the UK concluded that the cumulative impact of several relatively small improvements to the transport system can often be at least as big as large projects that often steal the limelight[44].

More generally, the evidence suggests that it is important not to look at any infrastructure investment in isolation, but how it fits alongside other strategic investments designed to improve economic outcomes[45]. For example, growth in an urban area – particularly of a more inclusive kind – is likely to be heavily dependent upon investment across a range of areas from housing, transport and wider public realm initiatives. There are numerous examples (not least the experience of Glasgow in the post-war period) of investments in isolation – e.g. new housing developments but inadequate transport networks or public and community assets and services – actually leading to long-term economic challenges.

Finally, and a crucial point to bear in mind, is that one reason why the evidence on the link between infrastructure and growth is difficult to measure is simply the challenge of directly attributing changes in economic outcomes to particular interventions when a great many other factors are also likely to have an impact[46]. This, in part, explains why the level of evidence and policy analysis into the implications of investment in infrastructure is perhaps not as clear cut as one might expect.

Infrastructure and inequality

There is literature on the causal links between infrastructure and inequality – including at a regional level – but these typically focus upon developing countries[47]. These studies find very strong evidence that investment in infrastructure, quite often basic infrastructure such as telecommunications and transport, can have a strong impact on reducing inequalities.

Their relevance to the Scottish case, however, is limited.

Dinkelman (2011)[48] found evidence that investment in electrification programmes within rural areas of South Africa had an impact on employment, in particular female employment, which saw a near 10% increase. Access to electricity allows individuals and business to take advantage of technological advances and so can boost productivity. Brenneman and Kerf (2002)[49] claim that by improving access to electricity or other modern energy sources, projects can help improve productivity of small businesses that are owned by or employ the most deprived, leading to increases in income, employment and entrepreneurial opportunities.

Turning to more relevant comparisons, the evidence is relatively weak. The EU's briefing on

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44 Eddington Review (2006), "The Eddington Transport Study - The case for action: Sir Rod Eddington's advice to Government", https://webarchive.nationalarchives.gov.uk/20090115123503/http://www.dft.gov.uk/162259/187604/206711/executivesummary.pdf

45 See Infrastructure and Projects Authority, "Transforming Infrastructure Performance" (2017) https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664920/transforming_infrastructure_performance_web.pdf

46 For instance, studies of individual projects struggle to fully capture the full externality effects of such investment and/or general equilibrium effects (such as the long-term implications for the public finances). Much larger – so-called macro studies – are so broad that they often have to group a lot of different things together.

47 See for example, World Bank (2014), "Infrastructure, Growth, and Inequality An Overview", World Bank Policy Research Working Paper, Number 7034, http://documents.worldbank.org/curated/en/322761468183548075/pdf/WPS7034.pdf

48 See Dinkelman, Taryn. "The effects of rural electrification on employment: New evidence from South Africa." American Economic Review 101, no. 7 (2011): 3078-3108. https://pubs.aeaweb.org/doi/pdfplus/10.1257/aer.101.7.3078

49 "Infrastructure & Poverty Linkages A Literature Review", Brenneman and Kerr (2002). See https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_policy/---invest/documents/publication/wcms_asist_8281.pdf

regional inequalities (2019)[50] identified that low-income regions have basic gaps in their infrastructure, whilst low growth regions struggle to access infrastructure. They put this down to these regions having underdeveloped innovation systems and large skill gaps. In the low-income regions this was emphasized by the outmigration of the younger generation and more educated members, causing a decrease in the population, with reductions in public and private investment to blame in low-growth regions. They argue investment at a regional level, as opposed to a national level, could allow regions to invest in infrastructure that is relevant to them. This has the potential to boost human capital and improve interconnectivity between industries and businesses. But once again, the arguments are based upon 'theory' rather than hard 'evidence'.

It is important to consider that, contrary to standard economic theory, investment into traditional economic measures does not always aid the reduction of regional inequality. Brakman et. Al (2002)[51] found that an increase in government spending in Europe, in fact, increased regional disparities.

Components of infrastructure and economic outcomes

The majority of studies that we have cited above have tended to look at infrastructure as a single entity.

Infrastructure investments can vary significantly in both scale and form.

The most frequently looked at area is transport infrastructure. There are three broad methods used to assess the links between transport infrastructure and the economy – i) engineering assessments; ii) metrics such as time saved – time savings translated into greater output; and iii) 'wider economic benefits'.

These 'wider economic benefits' are increasingly thought to be important and include issues such as the potential gains from agglomeration economies, the gains to consumers operating in imperfectly competitive markets and improved employability. This can in turn, lead to an extension of labour market catchments, stimulation of inward investment and a 'catalytic' effect whereby transport investment unlocks further growth[52].

As with the overall literature on infrastructure investment and economic outcomes, the evidence is mixed. Initial studies back in the late 1980s and early 1990s – such as Aschauer (1989) and Munnell (1990) – found strong and large payoffs from investing in transport infrastructure. However, these findings have since been challenged and the evidence appears to be more nuanced[53].

In short, the literature concludes that effective transport investments that address a key need, that are efficient and delivered effectively, can have a positive impact upon economic performance. However, simply spending more money on any form of transport infrastructure project is not a robust approach to improving economic outcomes[54].

Transport Scotland typically evaluate the 'economic impact' of any major project through activity

50 See http://www.europarl.europa.eu/RegData/etudes/BRIE/2019/637951/EPRS_BRI(2019)637951_EN.pdf

51 See Brakman, Steven, Harry Garretsen, and Charles Van Marrewijk. "Locational competition and agglomeration: The role of government spending." (2002).

52 See Standing Advisory Committee on Trunk Road Assessment (1999), ISBN: 0117535079

53 See Romp and De Haan (2007), "Public Capital and Economic Growth: A Critical Survey", Perspektiven der Wirtschaftspolitik, Volume 8, Issue 1, pp. 6-52, https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1468-2516.2007.00242.x

54 See Gibbons (2015), "Planes, trains and automobiles: the economic impact of transport infrastructure", Spatial Economics Research Centre Policy Paper 13, London School of Economics, https://ideas.repec.org/p/cep/sercpp/013.html

indicators. For road investments, this includes measures of time-saved[55].

The 'What Works Centre for Local Economic Growth' [56] has conducted a number of reviews of the evidence on local policy initiatives and economic outcomes. See Box 1.

What Works Centre for Local Economic Growth

The 'What Works Centre for Local Economic Growth" is an Economic and Social Research Council (ESRC) initiative designed to help inform local policymaking. As part of their work, they have conducted a series of evidence reviews to test for the links between economic policy and outcomes.

As with any evaluation study, there are degrees of robustness. To help inform readers they make use of a 5-point robustness score (based on adjusted Maryland Scientific Methods Scale) – 1 being of limited robustness up to 5 which is the highest quality of analysis.

In 2015, they conducted a review of transport investments to find evidence of the link between transport infrastructure and economic outcomes[57].

Interestingly, and based upon the scale set out in Box 1, of 95 major studies of transport infrastructure across the UK and internationally, only 12 were deemed to be 'robust' enough for their conclusions to inform policy.

Across these 12 studies they found –

- 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
- Rail projects – tend to have a positive effect on property process, however, no high-quality evaluations provide evidence on the impact of rail on employment
- Other modes - "we found no high-quality evaluations of the impacts of trams, buses, cycling and walking schemes on any economic outcomes"

An important consideration in any discussion of transport infrastructure is that of economic displacement – that is whether any investment actually leads to improved productivity performance at the national scale or whether it simply moves it from somewhere else.

Venables et al. (2014) have reviewed the evidence on this[58]. They conclude that for non-tradeable sectors such as retail, any growth as a response to a transport change is likely to move the activity from another location and therefore be a zero-sum game.

Of course, from an inclusive growth perspective displacement might be something that is not necessarily always viewed as a negative. Should activity be shifted from a stronger part of the country to a weaker part, then an objective to re-balance the economy might be achieved. Of course, this might be at the expense of a degree of efficiency.

55 See https://www.transport.gov.scot/transport-network/roads/project-evaluation/
56 https://whatworksgrowth.org/policy-reviews/
57 See "Evidence Review 7 Transport", https://whatworksgrowth.org/policy-reviews/transport/
58 Venables, Laird and Overman (2014), "Transport investment and economic performance: Implications for project appraisal", Department for Transport, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/386126/TIEP_Report.pdf

The debate on whether or not transport infrastructure should be directed toward weaker or stronger parts of the economy is double-edged.

On the one hand, because infrastructure is durable, places that have seen slow growth will tend to have relatively large amounts of infrastructure per person (e.g. low congestion in struggling regions). Economic theory suggests that adding further transport investment in those places may not do much to improve productivity. In contrast, investing in congested places will tend to deliver higher returns.

On the other hand, investing in transport infrastructure within weaker regions can help to increase the effective size of local economies and agglomeration economies.

Ahrend and Schumann (2014)[59] find that reducing travel times to large metropolitan areas can be a significant driver of higher GDP growth per capita at the regional level. More people having access to jobs also can mean a reduction in labour market imbalances as labour market commuting areas are extended.

However, there are two challenges with this.

- Firstly, as the 'What Works' reviews identified the available empirical evidence suggests that agglomeration economies may attenuate quite quickly with distance. It is not clear, therefore, that simply connecting different regions more effectively will always generate significant agglomeration benefits
- Second, lowering transport costs may encourage firms to move into the richer market and serve their customers from there. This is the so-called 'two-way roads problem' where increased competition may actually prove a challenge for a local area

'What Works' "….urges caution in assuming that [transport] 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."[60]

The other most studied area of infrastructure in recent times has been digital.

The UK National Infrastructure Commission reports that roll-out of broadband infrastructure in OECD countries from 1997 to 2007 increased per capita GDP growth by 0.9 to 1.5 percentage points for a 10-percentage point increase in broadband penetration[61]. Similar values were found in a study for the OECD in 2012. Here a 10 percent increase in digital activity is thought to have boosted GDP growth in the region of 0.2% to 1.6% (a wide range)[62].

Another key area of research has been housing. It is generally accepted that housing of the right type, in the right place, and to an acceptable standard, is essential to the economic health of cities and their surrounding regions - and by extension the national economy – see for example, Gibb et

59 Ahrend, Rudiger, Catherine Gamper, and Abel Schumann. "The OECD Metropolitan Governance Survey: A quantitative description of governance structures in large urban agglomerations." OECD Regional Development Working Papers 2014, no. 4 (2014), https://www.oecd-ilibrary.org/docserver/5jz43zldh08p-en.pdf?expires=1566467968&id=id&accname=guest&checksum=2430BE04C88013F0A7AAFCC4CA2145A3

60 What Works (2015) op cit

61 National Infrastructure Assessment (2018), www.nic.org.uk/wp-content/uploads/CCS001_CCS0618917350-001_NIC-NIA_Accessible.pdf

62 OECD (2012), "The Impact of Internet in OECD Countries", OECD Digital Economy Papers, Number 200, https://www.oecd-ilibrary.org/docserver/5k962hhgpb5d-en.pdf?expires=1566160380&id=id&accname=guest&checksum=9BAC367E31D96CADFD0A9D7E5321CD7B

al. (2008)[63].

Interestingly however, investment in housing infrastructure has generally been viewed differently – and separately – from investments in other forms of infrastructure, such as transport and utilities. A recent report by the City Futures Research Centre at the University of New South Wales makes the case for effective housing policy and productivity . They argue that investing in housing can have two major impacts upon productivity[64]. Firstly, and as per standard transport case studies, a travel time boost where the time taken to travel to work is reduced. Secondly, a wage effect channel flowing from the fact that employers can be better matched with their employees.

Similarly, a number of institutions argue that coordinating climate change and growth policy can lead to benefits. The 2017 OECD report "Investing in Climate, Investing in Growth"[65] highlights that instead of separating climate and growth agendas, if aligned, it could contribute 1% to average economic output in G20 countries by 2021, rising to 2.8% by 2050. Factor in the economic benefits from infrastructure that avoids climate change impacts such as coastal flooding or storm damage, and the net increase would be around 5% by 2050.

In terms of individual infrastructure 'types' and inclusive growth outcomes the evidence is relatively limited.

One such piece of analysis is a report – again by the What Works Centre for Local Growth – titled "Evidence Review 10 Area Based Initiatives"[66]. Here the authors considered more than 2,100 policy evaluations and evidence reviews from the UK and other OECD countries. They found only 58 impact evaluations that met the Centre's minimum standards (see Box 1).

In summary, they found that –

EU programmes (Structural Funds):

- Support has +ve impact on GDP per capita in a little under half of evaluations (similar results for jobs)
- Evidence on a range of other outcomes was mixed

Enterprise Zones:

- A little over half the reviews find positive impacts on employment & poverty
- But big questions around 'displacement'

Public Realm & Regeneration

- Higher house prices (and rents) but not clear that benefits existing residents
- Limited impacts on income, employment, health or wellbeing

One reason for the lack of evidence on the links between infrastructure and inclusive growth outcomes is that when consideration is given to the key levers through which economists believe that poverty and inequalities can be tackled, what is found is that a number of other factors beyond infrastructure are likely to be more important.

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63 Gibb, O'Sullivan and Glossop (2008), "Home Economics: How Housing Shapes City Economies", Project Report, Centre for Cities.

64 City Futures Research Centre (2019), "Strengthening Economic Cases for Housing Policies", https://cityfutures.be.unsw.edu.au/research/projects/strengthening-economic-cases-housing-productivity-gains-better-housing-outcomes/

65 OECD (2017), Investing in Climate, Investing in Growth, OECD Publishing, Paris. http://dx/doi.org/10.1787/9789264273528-en

66 See https://whatworksgrowth.org/public/files/Policy_Reviews/16-01-04-Area-Based-Initiative-Summary.pdf

For example, the JRF identify a number of key causes of poverty in the UK today (these are not the only ones but are some of the most significant)[67] –

- unemployment and low-paid jobs lacking prospects and security (or a lack of jobs):
- low levels of skills or education
- an ineffective benefit system
- high costs in key areas such as housing and essential goods and services (e.g. credit, gas, electricity, water, Council Tax, telephone or broadband)
- discrimination
- weak family relationships
- abuse, trauma or chaotic lives

In many of these areas, physical infrastructure may only have a relatively indirect link through to changes in these outcomes.

Arguably the most significant are through housing and energy infrastructure clearly have an impact on costs. Similarly, transport infrastructure provides an opportunity to broaden out a commuting area. But even here, a greater many other factors will also be playing a key role.

Summary

Despite there being over 50 years of academic and policy research into the links between infrastructure investment and economic outcomes, there remains only limited evidence of strong positive (or negative) links.

Some of this would appear to stem from political economy reasons. That is, whilst there are many government reports highlighting the supposed benefits of new projects and initiatives, there are much fewer studies testing to see ex-post whether these benefits were realised. Policymakers and politicians appear to be reluctant to evaluate their promises.

However, it would be unfair to conclude that the sole reason for this lack of clear evidence-base is politics or the political process. As the discussion above has highlighted, testing for links between infrastructure and economic outcomes is fraught with difficulties. Not least the fact that causality can often be difficult to ascertain, whilst economic outcomes are often influenced by a whole host of different factors. By their very nature, major infrastructure projects cannot be as easily evaluated as other policy interventions. For example, it is easy to roll-out a new employability scheme to certain unemployed workers and not to others; and then to test for any differences in outcomes. But it is simply not possible to do that with a major national infrastructure programme.

In our view, whilst a strong case can – and should – be made for better evaluation of infrastructure programmes in Scotland, there will necessarily be limits in how far this can go.

Technical evaluations of infrastructure projects are not easy to do. This is particularly true in the case of evaluating interventions which are targeted at inclusive growth outcomes, given their typical focus upon prevention and structural, long-term change.

This suggests that the importance of the appraisal phase is hugely significant, both in terms of providing a robust logic chain for why investments are being undertaken and the outcomes that are being targeted.

67 See https://www.jrf.org.uk/our-work/what-is-poverty

4. Infrastructure and Inclusive Growth

The Appraisal Process

Introduction

As highlighted above, the evidence points to certain infrastructure investment being correlated with better economic outcomes (albeit the causality may be marginal).

However, the direction of this correlation and its significance remains an open debate. As we have argued above, this is understandable both from an economic theory perspective and a technical analytical perspective.

The evidence on the link between infrastructure investment and inclusive growth appears to be relatively undeveloped. This reflects, in part, the lack of data that is collected on inclusive growth indicators but also the underlying nature of the outcomes that are being targeted.

For both reasons, this suggests that the importance of a robust mandatory appraisal process that captures inclusive growth outcomes is all the more significant.

In this section, we highlight a number of important lessons that can be drawn from the literature.

Distributional impacts have always been a key part of the appraisal process. In the UK, HM Treasury's Green Book approach explicitly requires project proposals to include an assessment of the distributional impact of interventions[68].

However, in recent times there has been a growing demand for both a greater weight to be applied to distributional impacts and a wider assessment of economic gains to be incorporated.

For example, in 2017, the RSA's final report on inclusive growth called for the "mainstreaming of inclusive growth in all public investments including physical infrastructure projects."

The country that has taken into account a broader set of outcomes in their approach to policymaking – and cost benefit analysis for appraisals – is New Zealand. Here a broad suite of 'wellbeing' measures are utilised, each with a financial value, to help organisations monetise impacts and do return on investment analysis[69].

Definition of 'economic success'

Before turning to measures of inclusive growth per se, an important point for any appraisal process – and wider strategy to guide infrastructure investment – is to be clear upon what the objectives of any investment are.

At the heart of any appraisal is a clear statement of goals.

It does not necessarily follow that the only focus should be on rates of growth or levels of economic activity. Wider measures of economic success can be justified as being equally important.

Economists define this as 'economic welfare' and this may not necessarily be perfectly correlated with economic growth. There is a large literature on welfare economics and the concept of social

68 See "The Green Book: appraisal and evaluation in central government", https://www.gov.uk/government/publications/the-green-book-appraisal-and-evaluation-in-central-governent

69 See CBAx Spreadsheet Model: https://treasury.govt.nz/publications/guide/cbax-spreadsheet-model-o

choice[70]. This has largely been bypassed in recent years, but this makes clear that society has a choice between different outcomes – such as equity and efficiency – and different outcomes can be obtained depending upon society's preferences.

In a recent report, PwC (2019)[71] contrast economic growth measures with possible 'welfare' definitions such as leisure time to individuals, the values of associated externalities, any value customers enjoy from consumption over and above price they pay for a good/service and commuter journey times.

This means that decisions over infrastructure priorities may look quite different if they focus upon 'economic welfare' measures rather than economic growth.

As we discuss when referring to specific inclusive growth metrics, a broader definition of economic welfare helps to capture values that traditional measures of aggregate growth and employment effects do not. However, we reiterate, this requires a policy decision on what society values rather than being a purely technical economic exercise.

In practice, these decisions about what outcomes to 'weight' more than others can be controversial. For example, in the New Zealand framework outlined above, making a new friend is almost twice as valuable as not having to go to the emergency department. Or getting on better with your neighbours is twice as valuable as avoiding diabetes.

Understanding the difference between metrics that capture growth and wider economic welfare is crucial for any future evaluation. Using GDP and employment metrics can only ever give a partial picture of economic performance.

Inclusive growth metrics

An alternative – but related – approach to the above discussion of economic welfare, is to adjust traditional measures of growth to better capture objectives about how it is distributed.

The inclusive growth agenda aims to do just that. It attempts to shift the balance from focussing solely on measures of growth to wider measures of economic success – such as the distribution of such gains (both within society and between regions).

As we highlighted above, there remain debates about the evidence-base underpinning this and the extent of any complementaries or trade-offs between objectives.

Setting that aside, what this does suggest however is that – if some form of inclusive growth outcome is indeed the objective (however defined) – then it follows that the metrics used for appraising projects should reflect that.

Traditional metrics of economic performance, such as GDP or employment rates are imperfect guides to social and economic welfare. Whilst they can often be highly correlated with improvements in living standards, this correlation is imperfect.

Neither aggregate measures of economic activity or labour market outcomes, tell us everything about how the opportunities and benefits of growth are distributed across different spatial areas and social or income groups[72]. It follows therefore, that if the priority of policymakers is to better capture broader measures of social and economic prosperity then any assessment of the links between

70 See "Welfare Economics: Introduction and Development of Basic Concepts", Yew-Kwang, Macmillan Publishers.
71 PwC (2019), Squaring the circle – Reconciling the GDP and welfare impacts of transport interventions
72 For example, a locality may see a rise in economic output but if this growth is driven by commuters or low-pay and insecure employment, it is not necessarily clear that this growth is beneficial for local residents.

infrastructure and economic outcomes must capture these impacts.

As we highlighted above, assessing the case for investing in infrastructure via metrics such as employment or GVA, may tilt investment towards already successful areas or sectors where the immediate economic impact is likely to be larger. Arguably this approach, misses opportunities for investments which are necessary to spark new growth and share its benefits across regions – although as we also highlighted earlier – the evidence that this approach can act as a catalyst at scale for generating growth within regions is unclear.

In 2018, the Scottish Government published the first in a series of 'regional inclusive growth diagnostics' which are designed to help localities identify what are the barriers to them achieving better outcomes.

The table below highlights some of the metrics that are used.

Inclusive Growth Indicators

	Example indicators	Examples of advantages & disadvantages
Productivity	■ GVA ■ GVA per head ■ GVA in key sectors ■ Productivity (GVA per hour worked)	■ GVA measures the value added to the economy ■ Estimates are transparent and published regularly ■ Challenges include – measurement (including revisions); contrasts between workplace and residence metrics; and they do not capture inequality, wellbeing or environmental sustainability
Participation	■ Employment ■ Unemployment & economic activity ■ 'Occupation type' ■ Part-time/full time ■ Underemployment ■ Earnings ■ Source of income – e.g. % in receipt of social security ■ Earnings distribution	■ Employment key income source for most households ■ Viewed in round, unemployment, occupation type, part-time/self-employment, underemployment can indicate 'health' of labour market ■ Earning information helps to illustrate how much of any improvement in the economy is captured by households ■ Information on distribution helps to illustrate levels of inequality in an economy ■ Challenges include – margins of error particularly within sub-groups; difficulty measuring underemployment and job security; correlation between qualification, skills and outcomes are not as strong as in the past
Population	■ % With level of qualification ■ Life expectancy by area, household distribution	■ Information on skills and skills gap helps to indicate effectiveness and vibrancy of policy. ■ Life expectancy is a good indicator of the population's health ■ Challenges – margin for error can be high except for big cities.
Place	■ CO_2 emissions ■ Air quality	■ Such indicators help to capture the 'outcomes' we want from our economy ■ Challenges – outcomes can be influenced by a great many factors, so attribution tricky; many 'wellbeing' metrics of interest – e.g. mental health outcomes – remain difficult to collect on a consistent basis at a regional level.
People	■ Poverty rates ■ Child poverty rates ■ Fuel poverty rates ■ SIMD16 - housing, access to services etc.	■ Poverty measures typically correlated with 'economic opportunity' ■ Scottish Index of Multiple Deprivation (SIMD) useful tool for outcomes in housing, health, access to services, crime etc. ■ Challenges – SIMD data published infrequently; poverty measures suffer from measurement issues at a local level.

Of course, a key challenge that immediately arises is how to prioritise particular indicators. This remains a weakness of the inclusive growth approach. Unlike GDP etc., there is no accepted single measure of 'inclusive growth' that can be tracked over time.

Broadly speaking, there are three broad approaches to building a broader measure of economic welfare –

- A dashboard approach
- An 'good economy' measure
- Indicators of 'happiness' or 'wellbeing'

The first approach – the so-called dashboard approach – pulls together a range of indicators that each capture objectives that a society is trying to improve. These could be measures of inequality, reductions in pollution levels, household incomes, falling crime rates etc.

This is the approach adopted in the National Performance Framework (NPF)[73].

Such an approach clearly has a number of advantages.

What goes into each dashboard will vary from country to country depending upon their own values and priorities. It is transparent and can help show any synergies and trade-offs that can emerge from time-to-time. It can also give a comprehensive indication of a nation's progress, which can be updated on a regular basis as and when new information becomes available.

But it also has some disadvantages. Chief amongst these is usability. A large dashboard of indicators necessarily includes a wide variety of objectives.

An alternative approach is to construct a single estimated figure for 'good' economic performance by combining a number of measures into one simple comparable metric. This is the approach taken by PwC (2018)[74] and the Good Economy (2019)[75].

In short, what this approach attempts to do is to 'stick together' different indicators of 'good' indicators of economic progress. This may still include things like GDP per head but will also include other things such as measures of wage inequality, household incomes, levels of poverty etc.

This approach has a number of advantages. Firstly, it takes head-on the challenge that GDP only measures economic output and nothing else. Secondly, it gets around the lack of clarity issue that can sometimes be a challenge for the dashboard approach by consolidating everything into one or two simple numbers.

But unfortunately, there are a number of serious statistical weaknesses with such an approach so as to make it almost meaningless.

Firstly, the values have little in the way of meaning as they are purely a technical construction by the authors rather than being based upon some agreed principle. Differences in what is and is not included in the index can have a significant bearing on the results.

Secondly, any assessment of statistical robustness is thrown out the window. All indicators are

73 See - National Performance Framework, https://nationalperformance.gov.scot/

74 PWC (2018), "Good Growth for Cities 2018: A report on urban economic wellbeing from PwC and Demos", www.pwc.co.uk/government-public-sector/good-growth/assets/pdf/good-growth-for-gities-2018.pdf

75 The Good Economy (2019), "Business-led inclusive job growth in the south of Scotland", http://thegoodeconomy.co.uk/content/reports/Business_Led_Inclusive_Job_Growth_in_the_SoS.pdf

measured with a degree of measurement error – some large and some small. But on most composite indicators – such as the two examples cited above – all this gets ignored. This can give rise to misleading results.

Finally, and most importantly, combining different indicators necessarily requires you to embed an equivalence between certain indicators (e.g. median pay vs. child poverty vs. fuel poverty etc.) to produce these composite indices. This is always a tricky and potentially sensitive thing to do as it implies comparability between particular measures no matter the subjective judgement that society places on each indicator.

The third and final approach is to measure 'wellbeing'.

These typically take the form of a survey of individuals and households asking questions about life satisfaction happiness or wellbeing[76].

Unfortunately, the evidence so far suggests that such measures are not robust either to allow comparisons between groups of individuals or over time.

The clear advantage of measuring wellbeing directly or life satisfaction is that it measures what we should care most about as a society. Policies can then be traced directly to whether or not they improve wellbeing or life satisfaction both at an aggregate level and on an individual basis.

Unfortunately, such an approach suffers from a number of challenges.

An individual's response may differ according to different personality traits, whilst when a question is asked can also have a significant impact upon an individual's subjective assessment of their wellbeing. From a technical statistical perspective, a number of concerns have been highlighted – Bond and Lang (2019)[77].

Moreover, from a statistical point of view, it has been shown – including in a recent Journal of Political Economy paper – that comparisons of wellbeing or happiness are virtually impossible to do robustly.

For all its challenges, the best approach – particularly for infrastructure investment – is likely to be some form of dashboard.

A streamlined version, and one that focusses upon a small number of objectives – which can change over time depending upon the economic climate or wider socio-economic conditions – is likely to be preferable.

The RSA suggested the development of a dashboard that provided a Quality GVA metric.

This included –

- Change in output over time
- Local workplace productivity
- Local household incomes (such as Gross Disposable Household Income per head), including mean and median rates
- Distribution of earnings
- Earning trends in low-pay occupations

76 The Office for National Statistics have been experimenting with developing a regular metric of 'wellbeing' across the UK for a number of years now: https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing

77 Bond and Lang (2019), "The sad truth about happiness scales", Journal of Political Economy 2019 127:4, 1629-1640, https://www.journals.uchicago.edu/doi/pdfplus/10.1086/701679.

- Growth of quality employment in low and high pay sectors
- Levels of economic inactivity and unemployment

Incorporating a dashboard of outcomes is not uncommon.

The Australian Infrastructure Audit (2019)[78] determines 6 social infrastructure metrics: health and aged care, where measures include the number of full time GP's per 10,000 people as well as overweight and obesity rates; Education, which considers the cost of childcare as well as the number of students enrolled in schools; Green, blue and recreational infrastructure, which explores access to green spaces within regions, as well as those participating in physical recreation; social housing which considers those without homes and those within social housing; and finally arts and cultural infrastructure, with measures including percentage of Australians attending arts and cultural venues and events, as well as, those visiting museums or art galleries.

The New Zealand Treasury[79] approach looks at five outcomes – alongside economic growth - that they believe contribute to higher quality of life. They highlight bonding people and communities, bridging gaps between societal groups and linkage across boundaries of power. They deem that any investment or policy intervention should seek to build capabilities and opportunities in these areas.

The definition of infrastructure

Throughout this review, we have focussed upon physical infrastructure – e.g. roads, housing etc.

But as we highlighted above, many of the main areas in which policy for inclusive growth is targeted tend to be on non-infrastructure areas. This includes issues like employability and public health outcomes.

A number of authors – including the RSA's Inclusive Growth Commission – have started to question whether policies to promote infrastructure should broaden out the definition of infrastructure to no longer just be about physical infrastructure but to also include 'social infrastructure'.

Social infrastructure refers to institutions and structures that develop the capacities and capabilities of individuals, families and communities to participate more fully in society and economic growth.

Examples include –

- Early years support
- Education, skills and lifelong adult learning, including support for labour market inclusion
- Early intervention and prevention-oriented public services, including public health and mental health initiatives
- Community development and capacity building

Clearly physical infrastructure – e.g. buildings – has an important role to play here[80]. But this approach views infrastructure as a much wider concept than is traditionally the case. This has implications for funding as on a purely practical basis, much of the funding for social infrastructure would come

78 Infrastructure Australia (2019), An Assessment of Australia's Future Infrastructure Needs. https://www.infrastructureaustralia.gov.au/sites/default/files/2019-08/Australian%20Infrastructure%20Audit%202019.pdf

79 NZ Treasury (2018), Living Standards: A Short Guide to 'Social Infrastructure'. https://treasury.govt.nz/sites/default/files/2017-12/hls-ag-socinfr-jan13.pdf

80 Of course, there is a close link to certain types of physical infrastructure. For example, much of the investment that the Scottish Government undertakes each year is directed toward areas that aim to help promote social inclusion – such as in education, housing, health, and justice.

through revenue rather than capital funding. For example, paying a teacher would originate from the Resource DEL budget of the government, whereas the building of a new school would stem from the Capital DEL budget.

The RSA argues that "current approaches to spending and investment are based on big investments in 'hard infrastructure' (such as HS2 and HS3) but undervalue the large-scale, long-term investments that are needed to develop the 'social infrastructure' for growth: human capital, an integrated learning infrastructure, innovation and Research and Development, healthy communities and sustainable public services.

Indeed, the role that the local public sector can play in creating the long-term conditions for growth is being neglected by current funding and policy priorities."

Whether or not this approach will succeed has yet to be tested. At the very least, it does once again emphasise the importance of viewing any investment in physical infrastructure in the round and the crucial importance of how it links to other policy interventions (or barriers) that have significant impacts on inclusive growth.

5. Conclusion

There is a significant body of work examining the links between infrastructure investment and economic outcomes.

In this short report we have attempted to summarise some key themes.

The first conclusion that we make is that, somewhat surprisingly, whilst economic theory is quite clear on the links between infrastructure and growth, the actual empirical evidence is not as clear cut – or as significant – as one might expect.

There are a number of reasons for this, including the fact that often the correlation between infrastructure investment and growth runs in the opposite direction. The strongest effects appear to occur when a lack of infrastructure – or none at all – acts as a break on growth. Unsurprisingly therefore, the role of infrastructure in developing countries is the source of much of the evidence base.

The literature also makes clear that lumping all 'types' of infrastructure together and hoping to find some form of correlation or causation is doomed to fail. In reality, certain infrastructures – such as those linked to transport and digital – are far more likely to have a short-term and significant impact upon traditional metrics of economic performance, such as growth and employment. Others, but arguably more important for overall economic welfare and inclusive growth in the long-run, such as more social infrastructure elements – such as in health and education – are much less likely to drive major improvements in short-term economic indicators.

The evidence on infrastructure investment and inequalities is relatively weak, at least for non-developing countries.

Our second conclusion is that there is no magic link between inequality and growth. Inequalities can harm growth potential in the long-run. But equally, there can be challenging trade-offs between investments that may boost growth but may widen inequalities. Similarly, investments that seek to tackle inequalities may not be the most efficient in terms of traditional measures of economic performance. This is particularly true in the case of tackling regional inequalities.

Our third conclusion is that, with little in the way of hard ex-post evidence as to the links between infrastructure and inclusive growth, the importance of a robust appraisal process in advance of any investment decision is all the more important. Incorporating metrics to capture the distributional or welfare impacts of policy initiatives is not new. But their relative weight over other metrics can be scaled-up. A number of countries are actively considering doing this. This can involve incorporating a wider measure of 'economic welfare' rather than solely focussing upon economic growth. Alternatively, it could involve broadening our growth metrics to include features that capture levels of inequality as part of the inclusive growth approach. Ultimately however, this is a policy decision and may require trade-offs with other outcomes.

Finally, if wider inclusive growth outcomes are believed to be important, then the concept of what is classified as infrastructure may need to be re-considered. Traditional the focus has been upon physical infrastructure funded by large government capital budgets. But many of the drivers of inclusive growth outcomes, such as narrowing the educational attainment, are likely to require greater investment in social infrastructure – such as levels of education funding – not all of which will be in the form of buildings or physical assets.

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