

ORIGINAL ARTICLE

The impact of infrastructure investment on economic growth in the United Kingdom

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ABSTRACT

Infrastructure investment has long been held as an accelerator or a driver of the economy. Internationally, the UK ranks poorly with the performance of infrastructure and ranks in the lower percentile for both infrastructure investment and GDP growth rate amongst comparative nations. Faced with the uncertainty of Brexit and the likely negative economic impact this will bring, infrastructure investment may be used to strengthen the UK economy. This study aims to examine how infrastructure funding impacts economic growth and how best the UK can maximize this potential by building on existing work.

The research method is based on interviews carried out with respondents involved in infrastructure operating across various sectors. The findings show that investment in infrastructure is vital in the UK as it stimulates economic growth through employment creation due to factor productivity. However, it is critical for investment to be directed to regional opportunity areas with the potential to unlock economic growth and maximize returns whilst stimulating further growth to benefit other regions. There is also a need for policy consistency and to review UK infrastructure policy to streamline the process and to reduce cost and time overrun, with Brexit likely to impact negatively on infrastructure investment.

Keywords: *infrastructure; economic growth; investment; construction*

1. Introduction

Well-designed infrastructure is shown to have economic benefits by raising economic growth and productivity (Pereira and Pereira, 2018), while impacting positively on other areas socially and economically. Infrastructure can be used as an accelerator to stimulate the growth of the economy. Earlier studies by the World Bank (1994) suggest that infrastructure drives economic activities, as it is used in the production process of nearly every sector, such as telecommunications, electricity, water, and transport. More recently, studies have shown the positive effect of infrastructure, which acts as an input for every production process, resulting in a positive impact on economic growth, productivity, and growth rates (Palei, 2015). However, investing wisely in infrastructure is important, as over-investment can also result in projects which are unproductive or inefficiently large (Palei, 2015). Insufficient infrastructure investment is found to constrain other areas of investment (Arclean, Glomm and Schiopu, 2012), while excessive infrastructure

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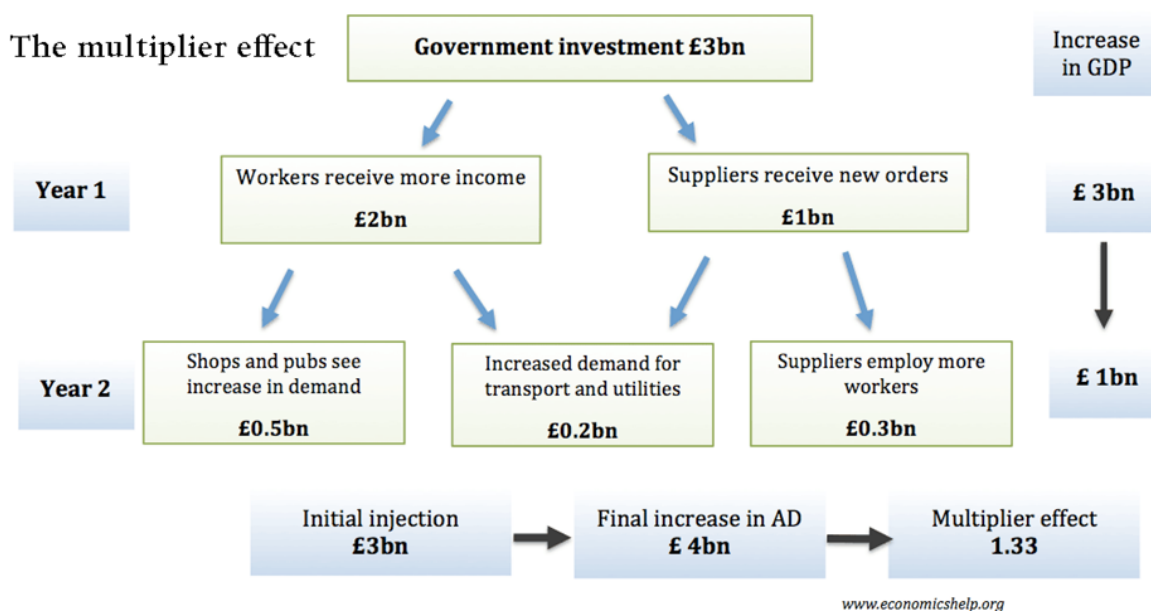
investment is shown to have the opposite effect with no added value (Romp and de Haan, 2007). Conceptually, infrastructure is defined as the “social overhead capital” that supports the production process and affects output via sector contribution to GDP formation by raising productivity through reducing transaction costs (Palei, 2015).

Infrastructure is consistently underfunded, as its demand is generally higher than supply (Macdonald, 2008). The UK is no exception and performs relatively poorly on the international stage, ranking 24th for “quality of overall infrastructure” in a global competitiveness report published by the World Economic Forum in 2012 (Rumfitt, 2017). Although rising to the 9th position in 2019, despite this upward shift, the UK still experiences some attrition in its performance (World Economic Forum, 2019) and is not in the top ten economies that provide suitable social safety net in the area of digital infrastructure (skills and legal framework), including flexibility at the workplace (World Economic Forum, 2020). There are therefore strong arguments for a restructuring of the current funding system and the use of devolution to give cities and regions more power in terms of decision making and allocation of funds (Helm, 2013). However, the cost-to-value analysis for establishing infrastructure projects that are best to pursue is sometimes problematic, with better-off regions attracting investment (Vashakmadze *et al.*, 2018), while other less attractive regions fall further behind (The Economist, 2017), resulting in an imbalance of infrastructure funding in the UK. Furthermore, the UK Government’s intervention exposes investment bias, which is reflected in terms of political risks and policy, political ideologies, differing project appraisals, and the limitations in the planning system (Rumfitt, 2017). This paper examines the drivers for infrastructure funding in the UK, its impact on economic growth, and how best the UK can maximize the potential from infrastructure investment.

2. Review of literature

2.1. Infrastructure and economic growth

There is a positive relationship between infrastructure and economic growth in the medium term (Organisation for Economic Co-operation and Development (OECD), 2018a), with a correlation between increased investment in fixed capital and growth, following the financial crisis during the recovery period from 2008 (Rutherford, 2018; Coenen, Straub and Trabandt, 2013). There are a few theories relating to the cause and effect of infrastructure investment. Macroeconomic modeling has developed over time as the economic model with which to study the productivity effects of infrastructure (Lakshmanan, 2011), tracking the annual percentage changes in total factor productivity as a result of public capital estimated from the coefficients of production function (Pereira and Pereira, 2018). Munnell and Cook (1990) followed the same method using different data and found comparable output elasticities of 0.31–0.39 for core public capital. Cobb and Douglas’ (1928) production function is the most common approach to analyzing data. Alternatively, there are behavioral approaches, with estimates of a cost or profit function including capital stock and taking account the differing characteristics of public versus private capital (Romp and de Haan, 2007; Chatterjee and Mahbub Morshed, 2011). Each approach has strengths and weaknesses but there is more consensus that public capital has an effect on economic growth (Chatterjee and Mahbub Morshed, 2011), with most of the debate over the causality and output elasticity or multiplier rather than the effect itself (Sturm, Jacobs and Groote, 1999). However, the overarching



Source: Pettinger, 2017

Figure 1. The multiplier effect.

explanation as to what drives economic growth is the multiplier effect (Haughwout, 2002). This refers to an influx of investment into a sector driving further growth as a result of trickle-down effects, resulting in a pattern of infrastructure lowering fixed costs, which attracts companies and thereby raises the factors of production (Egger and Falkinger, 2003; Yu, 2017). When comparing infrastructure investment with other forms of fiscal intervention, the output multiplier (see **Figure 1**) is substantially higher (Bivens, 2017).

The media and political figures often overestimate the economic power of the multiplier effects to result in faster output growth, which allows for increased public investment (Domański and Gwosdz, 2010; Chatterjee and Mahbub Morshed, 2011). Earlier studies found a relatively strong growth rate when increasing infrastructure investment, with a 1% increase in the public capital stock raising total factor productivity by up to 0.4%. According to Weisbrod (1997), the multiplier effect across most US industries ranges from 1.5 to 3.0 depending on the localized level. If the level of infrastructure falls below a critical level, productivity suffers, resulting in a contraction of the economy, as accumulation of transport infrastructure grows but the positive impact of that growth decreases (Pereira and Pereira, 2018). Infrastructure also has inverse multiplier effects during periods of reduced investment (Vashakmadze *et al.*, 2018). Infrastructure does not instigate growth but rather it can stimulate growth in positive economic conditions (Domański and Gwosdz, 2010). One-percentage-point increase in infrastructure investment relative to GDP will lead to average long-term output gains of 1% to 5% (International Monetary Fund, 2014; Coenen, Straub and Trabandt, 2013). Sustained investment stimulus in infrastructure by one percentage point of GDP would lead to higher percentage increases relative to GDP (Office of the Chief Economic Advisor in the Scottish Government, 2018).

Investment in public infrastructure is also subject to “threshold effects” (Démurger, 2001), with Agénor (2010) and Romp and de Haan (2007) arguing that as the size and quality of public stock increases, the impact diminishes when adding to the stock. Rosewell (2012) also refers to “spare

capacity” as a method of maximizing the impact of infrastructure—i.e., production which results in an excess supply. For example, the spare capacity to be generated by Crossrail, which will provide 35,000 people the necessary access to Central London jobs by 2035 due to crowding issues, will translate into £80bn worth of additional output.

The characteristic of a city or region determines the ability of the city or region to prosper from multiplier effects (Domański and Gwosdz, 2010; Yu, 2017). Better developed areas with more diversified economies are found to allow for larger multiplier effects than those which do not have the industry to take advantage of additional infrastructure investment (Arclean, Glomm and Schiopu, 2012; Yu, 2017). Measuring multiplier effects is to view incremental changes to an industry and compare them alongside the overall economic activity in a geographic area or by comparing the total economic activity of the region with the economic base, known as the economic base theory (Domański and Gwosdz, 2010).

2.2. Level of investment in infrastructure

Earlier studies have shown that there has been an increase in spending over the last ten years to compensate for the neglect of public capital spending during the 1990s (Romp and de Haan, 2007). The renewal and improvement of infrastructure across Europe are seen as necessary to regional development strategies (European Investment Bank (EIB), 2019), which is particularly important to regions which are peripheral to the core economic and industrialized region (Vashakmadze *et al.*, 2018; Turnovsky, 2015). The UK National Infrastructure Delivery Plan 2016–2021, the European Union Trans-European Networks for Energy (TEN-E) strategy, and the G20 have developed “the Roadmap” to define infrastructure as an asset class. The Roadmap is divided into three pillars: improving project development, improving the investment environment for infrastructure, and promoting greater standardization. It will be achieved by transforming infrastructure into a tradeable product by packaging an infrastructure project into a form of stocks and shares, encouraging private investment in infrastructure projects (OECD, 2018b).

The number of opportunities in commercial infrastructure projects are limited, with infrastructure historically showing relatively low returns. Investors will want to avoid taking on the risk involved in these projects, which may result in large risk guarantees provided by the governments (EIB, 2019). Large-scale “mega-projects” may be prioritized over necessary infrastructure in order to promote private investment. This would be particularly damaging for lower-income countries that need the investment (Luo and Xu, 2018) but do not need this form of projects to be prioritized (Romero, 2018). The imperfect competition allows for infrastructure improvements to boost the economy (O’Brien and Pike, 2015) and the UK government have increased spending on transport infrastructure to boost GDP, productivity, and employment as a result of this flow of investment (UK Trade & Investment, 2013; Raikes, 2018). The UK economy is relatively strong in comparison with other European countries. However, with the UK losing up to £110bn (\$182bn) of European infrastructure investment by 2025, there is potential for an economic slowdown (PwC, 2019). This will be exacerbated should the UK continue to prioritize large-scale politically attractive schemes such as High Speed 2 (HS2) over road schemes with average benefit-cost ratios of up to 6.8, which are much higher in comparison with HS2 with an estimated benefit-cost ratio of 1.2 (Bourne and Zuluaga, 2016). There are other factors, as noted by governments across the globe, such as efficient allocation and utilization of resources (Coenen, Straub and Trabandt, 2013), good project selection

and investment prioritization, and successful cost-benefit analysis (OECD, 2018b).

Lack of enough funding (Halstead and Deller, 1997; Hulten and Peterson, 1984; Walzer and Chicoine, 1987) rather than focus is the main feature of a slowdown in infrastructural funding (Deller and Walzer, 1993; 1996). Rosewell (2012) concurs with references to spare capacity being a driver of growth, with lack of funding limiting the potential positive effects of infrastructure (Luo and Xu, 2018). Disregarded current stock results in reduced production capacity, arguably offsetting increases relating to new stock. Thus, investing in the current stock can have a positive effect on GDP (Romp and de Haan, 2007; Coenen, Straub and Trabandt, 2013). There will be a significant gap following Brexit, which has seen a decline of 87% following the triggering of Article 50 in 2016, including loss of expertise, unless there are alternative sources of funding established (European Union Committee, 2019). This has resulted in an open consultation infrastructure finance review in 2018 currently awaiting further deliberation (Infrastructure and Projects Authority, 2019).

3. Methodology

The research method is based on a two-stage process. Following the literature in the first stage, the second stage is a semi-structured exploratory interview conducted on a one-to-one basis with selected respondents with different perspectives—a service provider, a contractor, a researcher in the public-sector think tank involved in fund allocation, and a Member of Parliament. The interviews, which focused on the key drivers of infrastructure investment, were audio-recorded to ensure the accuracy of data. The semi-structured format was selected to allow for increased flexibility, while allowing for rich data to be captured (Wilson, 2006). Interviews are useful for qualitative research and are appropriate for small samples, which allows for an in-depth exploration of the key issues being explored and analysis of the subject (Collis and Hussey, 2014). The interviews were conducted with senior personnel involved in infrastructure investment across different sectors.

- Respondent A – A service provider interfacing with the government for infrastructure funding was selected due to the regional scope and the growing importance of energy and growing investment dealings with European countries via interconnector projects, which allowed for a discussion surrounding Brexit.
- Respondent B – A Tier 1 infrastructure contractor was selected to gain an insight into the contractors' view of the development of the infrastructure industry and into specific issues in sectors and regions as part of their business plan and to offer insight into the general market trends.
- Respondent C – A researcher involved in the regional allocation of funding in North England was selected to provide an insight into regional policy, specifically with regards to the North, and the advantages of investing in areas with less infrastructure.
- Respondent D – A Member of Parliament (MP) was selected to reflect the views of the government.
- Due to space restrictions, extracts, and discussions based on the findings from the interview transcripts are provided below.

4. Findings and discussion

Respondent A focused on National Grid as a case study of a major infrastructure development to maintain the supply of electricity and gas around the country. It involves the maintenance of current assets and the installation of new substations and underground cables. The construction of the Hinkley Point nuclear power station involved work by National Grid to power the construction work. This shows how all forms of infrastructure can work together to increase production in an area and create jobs. The planning process involved in this project included support from local SMEs and suppliers. When planning for such projects, the social impact needed to be considered. The respondent also cited London Power Tunnels' "electricity superhighway" to upgrade London's aging electric cabling system, allowing for a more sustainable and reliable energy supply. He commented as follows: "Going forward, maintenance to these cables will be easier due to accessibility compared with the current disruptive method of excavation and repair." London is always identified as a focus for projects due to its network requirements. He argued that "National Grid is not driven by government ideas as to where funding should be allocated but is instead driven by network requirements." In response to arguments for increasing funding to regional areas of the UK, he argued that if new highway systems were constructed in certain regions, allowing for further development and urbanization of those areas, the energy requirements for those areas would become critical and in turn diverting energy investment to these areas. Therefore, it appears energy cannot be a driver of growth under the current structure unless the government makes a conscious decision to increase supply to certain areas as part of a concerted effort to further develop those areas.

Respondent B argued that transformative transport systems have a great impact on the UK economy, with the Eurotunnel improving links to Europe and links from the South Coast into London. The respondent stated, "Infrastructure keeps society moving; without infrastructure, society stops. Crossrail is a prime example—look at the urban regeneration at any Crossrail station." An influx of people and businesses looking to make use of these links to Central London results in a requirement for housing and commercial spaces, which follows onto requirements for shops and schools. This is the multiplier effect in action. Transport was highlighted as having the ability to transform areas and promote growth. Crossrail stations are an example, as are other areas close to urban centers "such as Liverpool Parkway or Bristol Parkway". However, it is clear in Northern cities that there is a lack of growth in areas which do not have links to other urban centers. "Cities with good transport links thrive; Northern cities have been disenfranchised," the respondent noted.

Respondent C echoed the thoughts of Respondent B and stated that "without infrastructure, there is no economy." An example given for the short-term impact is in the capital expenditure on construction work (i.e., increases in labor and opportunities for plant and material suppliers), whilst the long-term impact is more with large-scale projects, which is hard for economists to quantify. There are international examples, such as China, which has shown and proven that infrastructure can drive redevelopment (Chen, Matzinger and Woetzel, 2013). London was also used to illustrate as one of the best examples as to how a city can benefit from infrastructure. However, it is noted that infrastructure alone will not result in economic growth: "Research shows that transport alone will not produce growth, but a larger plan including education, skills, and research and development all need to come together," the respondent noted.

Respondent D believes that major infrastructure has a significant and positive impact on the UK

and local economies by boosting production and creating jobs. The example of Crossrail 2 was identified as a major project, which the government should focus on. The respondent stated that “Crossrail 2 could unlock tens of thousands of new homes and jobs in the West Anglia Main Line corridor alone”—West Anglia Main Line being a train line which runs from Hertfordshire into North and Central London. It was identified that services on the West Anglia Main Line (WAML) are severely hampered all the way along the line because the section between Coppermill Junction (just south of Tottenham Hale) and Broxbourne Junction in Hertfordshire, which passes through the Eastern side of Enfield North, consists of only two tracks. It was the view of this respondent that providing four tracks could offer the solution and would pave the way for Crossrail 2, which would allow about 30 trains per hour in each direction through Central London and connect into the region’s existing transport network: “The delivery of four-tracking will ensure that this growth can be kick-started ahead of Crossrail 2. This would provide a step change in accessibility in my area and unlock growth in the Upper Lea Valley, one of London’s largest opportunity areas.” Strategic options for future investment in large-scale transport infrastructure improvements would maximize the return on investment by targeting areas with high growth potential, such as the example given above in the Upper Lea Valley. These areas have the opportunity to unlock economic growth that can pay back the original investment, securing a stable economy.

An analysis from the views of the key stakeholders interviewed resulted in the following key findings:

(i) *Positive impact on economic growth through job creation and productivity*

There is a consensus that there is a positive effect of infrastructure investment on economic growth. Overall, well-considered investments in infrastructure can have a positive effect on economic growth, which is supported by the data gathered from the respondents from various infrastructure sectors. The respondents highlighted key features of infrastructure as being the ability to provide employment opportunities, increase productivity due to faster and more accessible transport links, and promote areas of opportunity. The increasing activities in the infrastructure sector is a way of stimulating the economy and promoting growth via increased productivity and the creation of jobs. Infrastructure creates opportunities for local labor and material suppliers (Turnovsky, 2015), which shows that infrastructure can increase the sustainable labour supply to areas, allowing for those areas to take advantage of the multiplier effects. It would result in increased demand for new homes due to the influx of people who would seek to utilize the links to the city center.

(ii) *Location matters*

There is usually a debate as to whether the largest impact is seen in urbanized centers or those with lower levels of infrastructure in place and therefore with higher opportunity cost. However, there is a consensus among the respondents that “while it is important to invest in cities around the UK, this cannot be at the expense of London. It does not only need investment but can also provide the greatest return on that investment, growing the national economy. Growth is not a zero-sum game.” These investments are necessary and do not represent an imbalance. For example, Respondent D argued that “strategic options for future investment in large-scale transport infrastructure improvements would maximize the return on investment by targeting areas with high growth potential” and opportunity to unlock

economic growth that can pay back the original investment (Arclean, Glomm and Schiopu, 2012). However, there is a recognition of equity consideration, as investment is needed for improvement in less attractive regions, which can stimulate economic growth and generate jobs, leading to increased returns on investment (Yu, 2017). Political and social considerations also need to be taken into account. The traditional method of economic appraisal cannot be applied to transformative projects, such as the example provided, which was the Borders Railway in Scotland. This was not solely based on economic appraisal but has turned out to be a success. This could be achieved through increased devolution to regions and cities in order to allow greater investment from the private sector and collaboration between local stakeholders.

(iii) *Spare capacity and threshold effects*

Spare capacity and threshold effects were raised as important factors to consider when increasing investment levels, as there appears to be a level at which maximum effects can be achieved but also a point at which investment becomes unnecessary or even damaging to productivity growth. London was given as an example of the reactionary nature of the industry, with transport projects often based on relieving congestion. While this is required to keep cities running, it is not a sustainable way to run an economy. The need for non-reactive and transformative projects, such as HS2, is critical but this lack of proactive approach is a weakness of the UK industry.

(iv) *UK infrastructure policy and impact of Brexit*

There is a need for increased value for money, which requires more streamlining of the process. Policy consistency is also critical as changes in government also mean that decisions can be changed or delayed, resulting in even higher costs to the project, such as contractors' cost for labor and plant or material suppliers already engaged. Tight government budget and time constraints often result in expensive and delayed projects, as well as delays in decision making, with HS2 cited as a prime example. For instance, the level of process involved before the capital costs on projects even commence results in a high cost-per-mile on rail projects on completion. The respondents recognized that "the biggest risk to infrastructure is the volatility of government." This refers to changes to the government's infrastructural policy, given the current challenges facing the UK government on agreeing upon a settlement for Brexit and the post-effect of its exit from EU membership. There is also the potential for nationalization under a Labour government based on manifestoes under previous Labour leader, except there is a change of course with the present leader. The relationship with the EU and the UK infrastructure industry will change depending on the government in place. There needs to be continuity and commitment to the UK infrastructure, which allows for proper plans to be put in place and projects to be delivered successfully. Brexit poses a serious problem to infrastructure development and economic growth. As one respondent put it: "Far from Brexit freeing up money to invest in new transport systems and public services, as the Brexiteers claimed; the reality is that leaving the European Union will leave us with even less to spend." With economic growth slowing and tax receipts falling, the Government will look to cut spending even further.

5. Conclusion

The findings demonstrates that investment in infrastructure is vital to the UK, as it stimulates economic growth through employment creation because of the multiplier effect and factor productivity. However, it is critical for the investment to be directed to areas or certain regions where there is “the potential to unlock economic growth” and to maximize the returns on investment necessary to increase productivity and stimulate further growth to benefit other regions. Investing in areas without “spare capacity” can result in unproductive and waste of investment. However, increasing devolution to regions and cities requires strategic investments, such as HS2, to unlock certain regions and allow infrastructure investment collaboration between local stakeholders to stimulate growth and create jobs in other less attractive regions of the UK. There is also a need for policy consistency and to review UK infrastructure policy to streamline the process, to reduce cost and time overrun, and to increase predictivity in cost and time. Brexit is likely to impact negatively on infrastructure investment. As an exploratory study, the sample is small, and the research would therefore benefit from a larger sample with more participants in the next stage.

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