Modelling the Impacts of Inter-City Connectivity on City Specialisation

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ABSTRACT

There is a high level of interest in investing in inter-city connectivity schemes. The rationale for these schemes is improved economic performance through increased productivity, jobs, and output. The mobility costs of switching between sectors for labour and capital may limit the level of sectoral specialisation achieved and the associated positive productivity impacts through localisation effects. To investigate these impacts, a stylised stock and flow model of two cities has been developed. The model has two business service sectors and a 20-minute reduction in rail travel times is introduced to understand the dynamics and the extent of barriers to localisation benefits due to labour and capital mobility costs, and to understand the degree to which these can be unlocked through inter-city transport. The results show that mobility costs limit the potential for increased specialisation through investment in inter-city transport and that further specialisation is more likely to arise when the scheme effects differ between sectors and between cities.

KEYWORDS

Agglomeration, Inter-City Transportation, Localisation, Productivity, Specialisation, Urbanisation, Wider Economic Impacts

1. INTRODUCTION

There is a high level of interest in investing in inter-city connectivity schemes. The rationale for these schemes is improved economic performance through increased output and jobs and also through increased productivity which is currently a key focus of policymakers in the UK (HM Treasury (2015)) and several other countries including Japan (Government of Japan (2018)) and Australia (Australian Government Department of Finance (2017)). Current economic appraisal guidelines focus on direct cost savings and over the last 10 to 15 years methods have been developed to evaluate urbanisation effects within city regions but there has been much less focus on the effects of linking urban areas (Rosewell and Venables (2013)). In addition to urbanisation effects there may be significant localisation effects as a result of inter-city transport schemes if they can promote increased trade and specialisation (Venables (2017)).

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There is no complete method currently available for assessing inter-city connectivity benefits. Many of the modelling tools available focus on city regions rather than links between places. Many of the impacts are likely to take place over long timeframes which are currently modelled coarsely in many models and some of the more detailed modelling methods which take account of the microfoundations of trade and specialisation such as Spatial Computable General Equilibrium (SCGE) models are based on static rather than dynamic frameworks. Many inter-city transport schemes require significant capital investment and without dependable methods to assess their impact it raises policy questions about whether it is beneficial to invest in improving links between places.

For inter-city transport to induce increased specialisation the gains to labour and capital must outweigh any costs associated with switching sector. Sources of costs for inter-sectoral labour mobility include the time and monetary costs of searching for a new job (Fuller et al. (2014)). Other costs for labour of changing sector include the potential loss of human capital accumulated in the previous sector (Lee and Wolpin (2006)) and there may also be psychological costs of switching sector (Dix-Carneiro (2014)). Capital is also not perfectly mobile between sectors as there are costs involved in transferring it between sectors (Mussa (1978)). The presence of these costs of switching sector may limit the potential for gains from specialisation as a result of a transport scheme.

This paper contributes by investigating the impacts of inter-city transport on city specialisation using a stylised stock and flow model of two cities and two service sectors. The sectors are based on business services which are known to be particularly disposed to agglomeration effects (Graham (2006)) and a reduction in the rail travel time between the cities is introduced to test the impacts. The objectives of this paper are to:

1. Evaluate the extent to which barriers to localisation impacts due to factor mobility costs can be unlocked through inter-city transport;
2. Estimate the length of time adjustment to a new steady state; and
3. Estimate the relative size of urbanisation and localisation benefits.

The paper is organised as follows. Section 2 presents the literature review and the methodology is outlined in Section 3 including the structure of the model and the data inputs. In Section 4 the results are outlined for model simulations under different assumptions and this is followed by the conclusion.

2. LITERATURE REVIEW

There are two ways to look at the issue of how inter-city connectivity can impact on city specialisation: modelling and empirical.

2.1. Modelling

There have been several attempts to model agglomeration processes within clusters using the system dynamics approach. These studies show how the interdependence of variables can lead to efficiency gains for firms within a geographical area which over time can lead to the development of a competitive advantage. Many of these studies including Buendia (2005) and Dangelico et al. (2010) have focussed on the importance of knowledge spill overs rather than pecuniary externalities and the role of transportation has not been central to the analysis. In a more recent exception to this Diaz et al. (2016) modelled the interactions of transport infrastructure, population and GDP but inter-city connectivity was not considered. Other studies that have examined similar problems include Baporikar (2016) and Byambasuren et al. (2015) who assessed the impact of transport on economic development and Battini et al. (2013) who explored the effects of improving logistics in the healthcare market.

The system dynamics approach has also been used to model linkages between transport and the economy in models such as ASTRA (Assessment of Transport Strategies). In ASTRA transport
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