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# The importance of transport in business' location decisions

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## Executive Summary

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## Introduction

Understanding the role of transport in decisions made by businesses on where to locate or relocate is a crucial element in our ability to assess the impact of our transport system on people's lives. The DfT have commissioned the Transport Research Institute and Employment Research Institute at Napier University, Edinburgh to review the current level evidence of the issues considered by businesses in choosing where they locate / relocate and in particular, the significance and importance to which transport is a factor within that decision-making process.

This is a complex subject area. There are many types of businesses - each with their individual transport needs and considerations - and the task of unpacking and isolating the influence of transport is a complicated and difficult process. As such, there is very little significant consensus concerning the overall effects of transport on business location and wider economic development and it is recognised that considerations need to be made almost entirely on a case-by-case basis.

Naturally, this reflects the differing needs and demands relating to different firms the various characteristics different locations provide. The review itself breaks these issues down into a number of areas - the impact of technology; by business type; firm characteristics, labour supply; spatial scale, and; growth / displacement. This summary, highlights a number of generic considerations the review has identified, inherent when thinking about the role of transport on businesses.

## Changes in the Business Environment

Firstly, the environment within which different businesses operate is complex and ever changing. Advances in ICT provision has altered this context in a number of significant ways which have an impact on the way the world - and transport - is viewed and utilised. ICT has allowed us to develop new ways of working and communicating instantaneously with a large number of people, spread across a range of physical locations and distances, and provided us with the potential flexibility to work wherever and whenever we want.

This is a complex interrelationship with better communication potentially reducing the need for travel, but on the other hand reinforcing or possibly expanding travel demand as new markets and localities are opened.

This is still a relatively nascent area of study and not surprisingly, there is little hard evidence - nor consensus - over the potential impacts that ICT has on travel demand. This study therefore, attempts to synthesise research into the influence of transport provision in this complex and dynamic process.

## A Necessary, but not a Sufficient Condition

Compiled from business surveys, important factors commonly cited as important in considering a location include:

- the quality and scope of physical and business infrastructures;
- factor cost and supply, especially labour;
- market demand and links to international markets;
- institutional infrastructure and networks;
- a 'culture' supporting 'civicness' and entrepreneurship;
- indigenous company growth;
- agglomeration economies;
- technological development;
- as well as more social factors such as climate, lifestyle, image and crime rates.

Although some of these have an element of transport within these, none *directly* relate to transport *per se*. As a general rule, studies suggest that transport is only an important factor, once the decision to set up in an area has been taken. This is thought to be attributable to a number of factors:

- The review notes that - within certain parameters, such as, access to airports or major motorway interchanges where absolutely necessary - levels of transport provision are generally seen as ubiquitous within developed countries and as such transport is seen as a necessary, but not a sufficient condition for influencing business location.
- Transportation costs are typically found to be only a very small proportion of firms' total costs -

usually less than 5%. As such, any improvements to the transport infrastructure is likely to yield small cost savings and gains to firms.

- The decision to move may be prompted by transport difficulties and inaccessibility. However, it is argued that the transactions cost to any change in transport may be too high to enable the firm to respond fully to a change in transport costs. Therefore the review notes that businesses are likely to change operations in discrete steps, and it is only when certain cost thresholds are reached that it becomes efficient to the firm to revise its number or location of depots.

It should be noted therefore that although influential, transport costs are not the primary business location driver on an international and national scale. An interesting conclusion to be drawn from the review is that on the one hand, transport being such a small proportion of a firm's costs implies that minor changes in provision and function of the infrastructure is likely to have little impact on businesses. Improvements in *transport provision* therefore are only likely to have a limited impact since firms are only making savings on a small proportion of cost. However, this assumes firms have perfect information on their costs.

The review identified that current and expected levels of services provided by transport infrastructure (e.g. the quality, reliability, time, the width of the supplier/customer market and financial costs of journeys using it etc.) are a crucial component in the actual location decisions themselves. To this end, *perceptions* of improved travel time were considered an important factor in considering business investment.

It is important to note however that research has historically tended to focus on the provision of new transport - opening up new markets and opportunities for businesses - rather than improving existing provision and this latter issue requires further investigation.

## **Transport as Part of a Package**

Where transport is of obvious importance, is where improvements in the transport system opens up new, previously untapped areas and markets. However, as noted above, improvements in the transport system in itself would not usually be thought sufficient to stimulate (re)location. It is important therefore that investment is considered as part of a wider package in support of other factors or initiatives supporting other economic or social regeneration factors and spatial policies.

The review notes that large-scale transport infrastructure policies are likely to be successful in supporting *latent* growth in under-developed regions, but is likely to be ineffective in *stimulating new* growth.

Related to this issue is that transport is important in business relocation only when the decision to move has already been taken.

New transport infrastructure may influence business location, but this can often involve displacing business from one area to another. This can be beneficial if redistribution from congested to stagnant areas; however, evidence suggests that transport investment will tend to displace business activity towards congested areas.

## The Logistics Sector

A further factor which may explain a firm's degree of responsiveness to transport is the recent expansion in the logistics market. The increased speed and complexity of distribution networks has meant a significant increase in the number of firms outsourcing many of their transport functions to specialist firms in recent years. As such, direct transport considerations have become less important and become more secondary as specialist logistics companies take on the role.

As logistics firms develop their distribution networks to incorporate practices such as *Just In Time* delivery, an issue of increasing importance is the reliability of the transport network. A number of studies noted that it was not the amount of time taken that was important to logistics firms, but being able to deliver when scheduled. For example, it was suggested that whether a delivery takes 8 hours or 5 hours is relatively unimportant. The key consideration, is that the delivery firm can rely on the journey taking 8 hours, so that it can be factored into the timing of the logistics chain.

It is argued that this is an area of increasing significance and importance although the impact and demands of the changing logistics industry is an area not currently well understood.

## Differences in Needs by Spatial Scale

It is noted that ICT and the expansion of firms allows them to have a wider geographical focus and become more dispersed as different elements of firms' business can be outsourced or relocated.

The review notes that the globalisation of the business environment, means that it is increasingly important to consider the national transport system as a whole, and its connectivity with the rest of the world. It is recognised however that the importance of transport on an area or country's *international* competitiveness is an area where little is understood.

Within this context, transport networks are becoming broader and the importance of being near transport hubs - be they air, sea, road or rail - is crucial. A key conclusion to be drawn therefore is that the reliability and connectivity of the transport system is of concern.

Studies note that good air connectivity is vital to businesses operating on an international scale, and for the development of 'world cities' as business locations. It is suggested that air transport *per se* is not a necessary condition, but what is important are: the extent to which that area is plugged directly in to other major international hubs - availability and efficiency of routes (direct, hubbed); costs and the level of competition in global transport market, and; perceived and actual interchange efficiencies. This is a key consideration in the level of foreign investment into an area and is most important for firms with international trading or contacts such as, high-tech firms, financial services and pharmaceutical firms.

It is perhaps unsurprising that air transport has a greater influence on the location of *foreign* investors and business services, whereas it is the road transport has a larger influence on *domestic* investment. The evidence suggests however that transport becomes an increasingly important factor for businesses as the geographical scale is reduced from supranational down to local.

Recent trends indicate a general movement of businesses locating away from large cities to urban fringes. This is in part at least facilitated by the development of technology, allowing the decentralisation and spread of firms, or their component parts over a wider geographical area, opening up choice of location.

It is noted that heavy industries are likely to incur the highest transport costs and are likely to be the most location dependent. However, there is growing evidence on the location dependency of light manufacture and service firms - particularly with regard to road and air access. It is recognised that high-technology *manufacturing* and service businesses often 'cluster' together. In this context however, transport is a secondary consideration to face-to-face networking, and that this - coupled with the preference for a type of location - that is a key locational factor. This 'clustering' effect is compounded by allowing firms to take advantage of location specific factors which drew the firm there in the first place - such as labour source, the cost of premises. The review notes however, that the exact effect and importance of transport to these firms is inconclusive.

At a local level, again there is limited consensus, with research highlighting that schemes can increase the attractiveness of city centre locations, whereas others show that the development potential is limited. In particular, it is noted that - for example - the impact of traffic reduction measures such as bus priority measures, charging, limiting parking and the effects of by-passes on location decisions, is not yet widely understood.

Regardless, transport policies aimed at moving business into cities are most effective if combined with other policies. Ideally, it is argued, transport planning should be *integrated within* land-use planning and regeneration policies, if it is to be effective in meeting objectives.

## Accessibility

Labour supply is often cited as the most important single factor in business location and that the ability of employee / customer access is perhaps the key transport consideration. Transport investment has an obvious role to play in reducing travel time and increasing the labour pool from which firms can draw. Transport can be used as a tool to boost labour supply, through increasing workplace accessibility and therefore labour market size.

However, it is noted that there is little literature considering evidence of the reverse effect: means of encouraging businesses to locate in accessible areas to allow wider labour market participation and reduce travel demand. Studies note however, that higher-skilled workforces are prepared - or are more able - to be more mobile and tend to 'follow' firms to areas where they are established.

This paper represents a brief summary of the key issues emerging from the review of literature on the importance of transport in business location decisions.

## 1. Introduction

The Department for Transport (DfT) has highlighted a need to better understand the role of transport in business' location decisions in order to inform future research, decision-making and policy formation. While there exists a wealth of material on this subject, there is a clear need to organise and contextualise this material in a way that can provide clearer guidance to policy makers regarding the key issues, the importance of these relative to other determinants of business location, and the influence of DfT policy

instruments. As a result the DfT commissioned the Transport Research Institute and Employment Research Institute at Napier University, Edinburgh to undertake this study.

## **Remit**

The purpose of this study is to review and organise the relevant literature on business location decisions and provide an explanation of the role and significance of transport-related factors in influencing these decisions. This will help provide a strong base from which the DfT can develop further research in this area while avoiding wasteful duplication. Hence the study:

- reviews literature on business location decisions, including the role of transport, drawing from a number of disciplines including transport policy, economics, planning and management, primarily in the UK, but also in elsewhere;
- reviews literature that focuses specifically on identifying the extent to which transport acts as a determinant of business location;
- reviews literature on the ways and the extent to which business location decisions affect transport behaviour and policy;
- identifies the knowledge gaps in relation to the issues identified above;

## **Overview**

There is no consensus concerning the effects of transport on business location and wider economic development. Changes in transport costs (including money, reliability and time costs) are influenced by new infrastructure, changes in infrastructure management or congestion/deterioration of existing infrastructure, as well as by the efficiency of transport operations. These will influence business productivity, innovation, access to knowledge and markets, regional patterns of commerce and the commuting and migration decisions of households etc. Hence they may affect the location decisions of businesses already located in an area (and their long term viability) as well as those thinking of setting up or locating there.

A key question is what is the relative importance of transport compared to non-transport factors? It has been long recognised that transport costs make up a relatively small proportion (usually 5-7%) of total costs, although this varies by industry (CBI, 1985; Diamond and Spence, 1989). The evidence generally suggests that transport is a necessary but not sufficient condition for influencing business location, especially in developed countries where transport infrastructure is generally ubiquitous. Other factors such as access to skilled labour, market changes, tax structures etc., are generally more significant. However congestion imposes great costs upon businesses and increased use of 'just-in-time' and other logistic approaches give increasing prominence to factors such as reliability of transport systems. In addition transport is often seen as an area where government can exert significant direct influence.

There are important qualifications to this general conclusion concerning the relative low importance of transport in influencing business location. The role and importance of transport will be affected, amongst other things, as:

- The business environment is changing, especially in terms of business organisation and globalisation, which is likely to lead to a greater importance of logistics and global transport links (e.g. good access to hubs of delivery company networks may become an increasingly important location factor for

some businesses).

- Different types of businesses or business functions have different transport requirements and priorities (e.g. internationally mobile firms rate air links more highly than domestic firms), and different sets of comparator locations from which to make a choice (e.g. they may compare transport services across different countries).
- Labour is usually a key location factor for businesses and transport changes may influence its accessibility through commuting (e.g. better local transport may increase the labour pool for a business, while congestion may reduce it). Although it should be recognised that locations that improve car accessibility can adversely affect lower paid and part-time workers and some social groups.
- The spatial scale of analysis is crucial. The relative importance of transport may differ when considering local, intra-regional, inter-regional or international location choices. Transport is likely to be more important in influencing a businesses' choice of location within a local area, rather than its choice between regions (e.g. transport changes may influence a business' choice as to which part of town to location, but may be irrelevant as to which region of the UK it goes to). Evidence often confuses the effects of differing scales.
- Local redistribution of businesses may have little or no effect on the growth of the regional or national economy as a whole, so it is important to distinguish transport investment that simply helps move businesses around a region rather than leads to regional or national growth.
- While most forms of transport are available across most of the UK, not all are ubiquitous (e.g. the availability of airports, and more importantly the number and destinations of flights from them, varies considerably, and while roads may be ubiquitous, their quality and levels of congestion vary greatly).

The framework used in the report seeks to unpack the differences in the impacts of and upon transport according to:

- Changing business organisation, including the effects of globalisation, technology and increased complexity, the role of transport within corporate strategies and the changing role of logistics on business location.
- Business characteristics (e.g. size, sector, ownership, function).
- Types of labour supply and also the implications for social inclusion.
- The spatial scale of analysis (international, national, inter-regional, intra-regional and local) including the characteristics of different regions.
- Economic growth versus redistribution, and the role of transport investments in generating new activity or causing the relocation of existing activity.
- The characteristics of the transport infrastructure, services using it and its management (in particular air transport, strategic networks and localised networks).

#### *Meanings of transport and business location in this report*

It is useful to set out some understanding of the main terms used in this report. First, *transport* covers both investment in new and existing infrastructure and equipment and its management (e.g. service levels, congestion charging or regulation of air travel, including taxes). Crucial to business location decisions are the current and expected levels of services provided by it (e.g. the quality, reliability, time and financial costs of journeys using it etc.) rather than simply the existence of infrastructure. Hence maintenance or improvements to existing infrastructure may be as, or more, important than providing new infrastructure.



In this report, *business location* has been taken to involve each of the various components of location change, including businesses that move all or part of their activities into or away from an area (relocation), and businesses that start up or stay in an area (location). From the perspective of a given location, on the positive side these are:

- business birth (why did the founder choose this location to start-up);
- complete business relocation (relocating the whole business to this location);
- partial relocation by moving part of the business elsewhere or setting up a new branch plant;
- *in-situ* business growth (which includes the implicit choice not to move that activity to another location).

The mirror image or negative side of these concern the components of employment decline, which again involve implicit or explicit choices affecting the location of businesses:

- business death/closure (would the business have survived if it had been in or moved to another location?);
- complete business relocation involving moving the whole business elsewhere;
- closing and/or moving part of the business elsewhere;
- and *in-situ* contraction of the business.

The definition of business can cover not just commercial businesses (which is the main focus of this report) but also other organisations (e.g. third-sector or government). Change is usually measured in terms of numbers of firms or employment (and type of employment; e.g. full- or part-time; quality of jobs etc.) but could be measured in other terms (e.g. turnover). The choice of location is only part of a much wider decision making process, involving choices of strategic direction, how opportunities can be taken through alternative production means, outsourcing etc., and whether relocation of all or part of the organisation is needed. The attraction of a new location may be due to 'push factors' (e.g. lack of space) or 'pull' factors (e.g. access to a new market), and these may influence the range of alternatives considered.

## Outline

Of course, it is not possible to consider all potentially relevant literature in a relatively short study and so attention has been focussed upon these most relevant to current policy priorities. The structure of the report is as follows:

Chapter 2 identifies some current and recent historical trends in business location, within the UK and internationally.

Chapter 3 provides an overview of some of the main theories that seek to explain the drivers of business location and the relative importance of transport in location decisions. It then presents some empirical evidence from studies that have sought to determine the degree to which transport factors influence business location.

Chapter 4 provides a review of evidence concerning the role of transport in business location decisions. As discussed above, the importance of transport depends on a number of factors including the changing business environment, the characteristics of businesses, the effects on labour markets, the spatial scale of the impacts, whether the change mainly influences growth of the economy or redistribution within an area,

and the specific type of transport change. This chapter therefore examines each of these.

Chapter 5 focuses on the link between land use planning and transport. It examines evidence on the effects of planning decisions and regulation on business competitiveness and location decisions. It then examines evidence on the influence of business location decisions upon travel, traffic volume and distribution, and the implications of this for labour accessibility.

Chapter 6 takes a closer look at some of the methodological issues emerging from the review. Some evidence is presented on the adequacy of existing modelling techniques, particularly Land Use Transport Interaction models. The need for greater *ex-post* evaluation and the accuracy of existing *ex-post* appraisals is then discussed. Finally we look at the robustness of existing evidence on the link between transport and business location - particularly in terms of data quality, scale, time period and geography.

Chapter 7 examines the policy implications and research of the findings of the literature review under a number of question headings based upon current Department for Transport and Office of the Deputy Prime Minister policy documents. It briefly: summarises the evidence related to some key questions arising from current UK government policy documents, and; identifies some major gaps in knowledge that still remain.

### 3. The Drivers of Business Location

#### Summary

- There is a wide body of literature on the theory of business location, stretching back to before the start of the 20<sup>th</sup> Century. Examples of models or approaches include: neo-classical; institutional; behavioural; economic base; location; cumulative causation; core-periphery; industrial district; innovative *milieu* and competitive advantage.
- Early neo-classical theories place importance on the need to minimise transportation costs to and from markets or inputs.
- The attractiveness of a region to business is influenced by factors such as: infrastructure quality; factor cost and supply (e.g. labour cost and quality); market demand; good communications; international links; stable political situation; entrepreneurial culture; technological development; and the nature of competition between firms. Attractive business locations are likely to score highly on a number of these measures.
- Empirical research in the UK has highlighted the access to markets and availability of skilled labour, sufficient business accommodation and transport links as key drivers of business location. Access to markets and skilled labour are generally the most important factors, especially for higher value adding firms, although transport can help this by improving local accessibility to a workforce.
- Porter's model of competitiveness highlights the interdependence of conditions necessary to attract and sustain competitive businesses, noting that the quality of the business environment, including transport infrastructure, is of high importance.
- Competitiveness theory also argues that transport provision in an area increases the effective market size of an area and therefore increases competition, thus attracting more businesses, and also increases competition.
- Transport can affect business location through: goods transport financial costs; relative time costs and savings; certainty/reliability of travel time; the need to physically meet customers and suppliers;

and staff and customer travel costs.

- Empirical evidence from the UK suggests that perceived accessibility can be as important as actual accessibility.
- Empirical research shows that road infrastructure investment can increase commercial development.
- Other research highlights the limitations of transport in influencing location:
- labour quality issues can often outweigh the impact of transport;
- transactions costs of relocation can be too high to make a move economically viable;
- transport infrastructure primarily reduces variable costs, which can be small relative to fixed transport costs (e.g. vehicle depreciation).
- In summary, although transport factors are often less important than some other factors, they may still be of some significance in influencing location. Often both transport *and* non-transport factors are necessary to attract business to an area.

### 3.1 Introduction

This chapter provides a brief overview of some of the main theories that seek to explain: firstly, the drivers of business location; and, secondly, the relative importance of transport in location decisions. It then presents some empirical evidence from studies that have sought to determine what effect transport factors have on business location.

As set out in chapter 1, business location has been taken to involve each of the various components of location change, involving businesses that move all or part of their activities into or away from an area (relocation), but also businesses that start up or stay in an area (location). The decision to locate (or relocate) will be influenced by specific pressures on the business (e.g. external factors such as the state of the economy; or internal factors such as lack of space to expand), as well as the range of alternatives that the business has (location, logistic, production, or financial alternatives etc.). Internationally mobile firms will usually have a wider range of alternative locations, while small businesses usually relocate nearby so as not to lose staff and customers.

The definition of business can cover not just commercial businesses but also other organisations (e.g. third-sector or government). Change is usually measured in terms of numbers of firms or employment (and type of employment; e.g. full- or part-time; quality of jobs etc.) but could be measured in other terms (e.g. turnover). It can be useful to disaggregate the differing effects of transport in terms of each component of change, although most of the applications of the theories or models considered below focus primarily on change in total employment or firm numbers.

### 3.2 Theoretical underpinning

#### 3.2.1 Business location and firms' decision-making processes

The determinants of business location are multifaceted, complex and interactive. However, it is necessary to provide a framework in which these can be classified. Within a national context, businesses will locate where they have best access to markets and factors of production. Access to markets and inputs (including employees, links to suppliers, knowledge of and access to production and product technology changes, market knowledge), and their availability, quality and costs, will be influenced by transport infrastructure, and increasingly by telecommunications or ICT infrastructure.

There may also be other financial factors such as taxes, government grants, or perceived or real non-economic factors influencing location such as: the quality of the physical environment (see TSU New Horizons, forthcoming); low crime rates; and access to quality school and leisure facilities etc. When faced with international location decisions, businesses are also likely to take into account factors such as current and expected political stability, regulations, exchange rates, taxation and freedom from restrictive legislation etc.

The HM Treasury report on Productivity in the UK (Treasury, 2001) states that successful cities require 'proximity factors', and those factors which are most effective in influencing the location decisions of organisations are:

- existing institutions specialising in innovations in technology and work practices;
- good transport links;
- access to risk and venture capital; and
- a lifestyle that may attract highly-mobile knowledge workers

In addition to the attraction of a location ('pull' factors), there may be 'push' factors which lead to a business moving, all or in part, from an area (e.g. due to expansion or congestion etc.). We now outline some theoretical approaches to business location.

At a policy level, emphasis has generally been given to location factors. During the last decade Porter's Competitiveness model has been prominent amongst regional development and national policy makers, although the model has been criticised (see below). Porter's model emphasises transport and communications as important factors that affect the competitiveness of a region and of businesses within the region. It gives greater prominence to one factor that has arguably been relatively neglected by policy makers - that is the effect of transport on *international* competitiveness for the UK as a whole, and also for the international competitiveness of individual regions (although it has been raised somewhat in the airport review and by regional development agencies). Of increasing importance is likely to be the effect of changing logistics on business organisations and their location, and how transport influences this, although there is relatively little published evidence on how these interact. Policy makers have also implicitly and explicitly used export base theory, as government support has generally been restricted to 'export' industries (i.e. 'exporting' from the region, which would exclude local retailers and service providers from getting assistance) although this does not necessarily have an explicit transport element.

## **Classification of theoretical approaches**

There are many overlapping approaches, theories or models concerned with the location of business and the influence of different factors on this. Some examples are:

- *neo-classical* models based upon free markets (see below and, for example, Borts and Stein, 1964, or Fujita *et al.*, 1999, on the 'New Economic Geography');
- *behaviouralist models* focusing mainly on the individual business behaviour and assuming that decisions are made with limited information, resulting in the choice of satisficing, not optimal, locations;
- *institutional models* which argue that economic activities are the result of external factors such as values and institutions. Factors such as mergers and take-overs are important in influencing the location of business (e.g. Pellenbarg, *et al.*, 2002);

- *economic base* models focusing upon industries that export from the region or locality (e.g. see Armstrong and Taylor, 2000);
- *location* theories considering different specific factors and the importance of agglomerations of economic activity and regional characteristics (e.g. see Malecki, 1997);
- *cumulative causation* theory (Myrdal, 1957) where success breeds success (or lack of success can lead to a downward spiral for an area);
- *core-periphery* models which focus on the different functions of regions and particularly the relationships between core regions and peripheral ones. Access and transport often being crucial as to whether one is within the core or determining a region's relationship to the core (e.g. Parkinson *et al.*, 1992);
- *industrial district* models focusing on the importance of networks, entrepreneurship, innovation, co-operation, flexible production and specialisation that help to make a successful regional economy - initially using the example of the success of northern Italy (e.g. Piore and Sabel, 1984);
- *innovative milieu* models focus upon the importance of the cultural and institutions (i.e. wide synergies among local actors which give rise to fast innovation processes) in successful regional economies (e.g. Campagni, 1995); and
- *the competitive advantage* theory of Porter (1990; 1998).

Useful overviews of neo-classical and behaviouralist models can be found in McCann (2001) and comparisons of theoretical approaches in McCann (1998). Some of the main approaches are now briefly considered.

## **The importance of location characteristics**

The characteristics of the region and the interaction and synergy of these characteristics are key to identifying the likely attractiveness and development of a location. For example industrial structure, the quality and scope of physical and business infrastructures, factor cost and supply, market demand including links to international markets, institutional infrastructure and networks, a 'culture' supporting 'civicness' and entrepreneurship, indigenous company growth, agglomeration economies (incorporating static and dynamic externalities) and technological development, are all important to the development of regions. In addition inter-regional relationships (e.g. in terms of transport and communication costs), and overlapping intra-regional factors such as inputs, agglomeration economies and production networks need to be fully considered.

The importance of non-economic factors, such as climate, crime rates and other quality of life measures have also been highlighted as important in attracting business investment. The pleasant working and living climate of the Mediterranean 'Arc' or 'European Sunbelt' has contributed to the attraction of new high-tech and service businesses (RECLUS, 1999; Schatzl, 1993; Hospers, 2002). Further evidence for the importance of non-economic factors is considered in Section 3.3.1. The effectiveness of regional development agencies may also be important.

The abilities to develop and utilise new technologies (products and production processes) are important for a firm and affects location choice. Research on the development of successful technological regions, such as the UK's "M4 Corridor" suggests that policy played an important role, as did institutional factors and inter-firm links (e.g. Hall *et al.*, 1987). While in the U.S. the East and West coast high-tech industries exhibited very different forms of co-operation, with considerable informal knowledge transfer even among competitors in Silicon Valley but lower levels of such co-operation among East coast firms

(Saxenian, 1995). This is discussed further in Section 4.2. Technological change includes access to new technologies and help in utilising them, propensity to innovate and opportunities for skilled staff so that they may be retained in the region.

Hence, the competitive advantages for firms and people in regions are based on various, overlapping, factors according to different authors but based around forms of agglomeration economies or clusters of industries (as discussed by Marshall in 1890, but popular currently through the work of Porter); flexible production and specialisation; competition with rival firms, pressure from customers, specialised suppliers and factor inputs such as labour and technology; economies of scale (Krugman, 1991); and also dynamic inter-industry clusters (Doeringer and Terkla, 1995).

Networks of formal and informal relations between organisations are important for regional growth (Mazzonis, 1989), as well as wider "un-traded interdependencies" such as labour markets, public institutions and locally or nationally derived rules of action, customs, understanding and values (Storper, 1995, p. 205). As an example, Pal *et al.* (2001) explore what they believe to be a neglected issue in retail store location by considering policy networks operating at the interface between retailers and central government. They argue that informal networks, together with the economic power of retailers and the legitimisation of their activities in the 'consumer interest' have provided retailers with influence to exert power over the regulatory environment within which they operate. This study draws on a case study in the UK and identifies the existence of these networks, the authors arguing that these must be recognised in the development and implementation of PPG6 in order to ensure maximum effectiveness. This implies that informal networks may currently allow retailers to circumvent planning regulation.

Further evidence is provided by Walcott (2001) in an international case study, which identifies the importance of informal networks in high-tech life science business location. Walcott discusses informal 'learning location' networks that allow these businesses to exchange information and thereby gain competitive advantage. Almeida and Kogut (1997) argue that choice of location is particularly important to manufacturing businesses that rely on face-to-face networking with suppliers and customers, citing Silicon Valley semiconductor manufacturers as an example. Transport factors in this sector are secondary to the need to be located in proximity to other firms in the 'cluster'.

This also suggests that as many employers become increasingly footloose then a key location factor is the ability to attract workers to live there, so quality of life becomes very important (e.g. Richard Florida has done recent work in the US on this and there are proposals to extend this to the UK). Florida (2002) argues that localities that attract 'creative' people will be the centres of wealth generation in the future as the economy increasingly is based upon knowledge and the exploitation of ideas. This core of key economic actors are "people in science and engineering, architecture and design, education, arts, music, and entertainment, whose economic function is to create new ideas, new technology, and/or new creative content." So the ability to attract such people, including quality of life factors relevant for such core people will be increasingly important for economic prosperity. However, this perhaps underplays the importance of the globalisation of work (e.g. transferring software design to India), underplays the creativity in good management and production of existing industries). Informal networks from former university friends etc. can help convince key staff to come to an area.

Hence policies need to address these issues as well as the physical and direct business support and labour supply issues, particularly in peripheral regions with limited levels of economic development and where large historic out migration may weaken the institutional base. The relative effectiveness of regions in

providing the necessary economic, social and physical infrastructure is important to maximise the opportunities presented by the existing and future industrial structure and development opportunities.

## Cluster Theory and Competitiveness

The nature of business competition and co-operation in an area or region will have implications for business location decisions. The level of competitiveness of different geographical areas varies considerably. A competitive environment will allow more firms to operate and therefore attract business or assist the expansion of existing or new indigenous businesses. Good transport provision in an area will increase effective market size and competition in any given area, thus allowing a greater number of businesses to operate. Without good transport links, markets are likely to become segmented (separated) (Treasury, 2001), thus reducing competition and the potential for new businesses to enter.

The DTI (1998) defined clusters as "concentrations of competing, collaborating and independent companies and institutions which are connected by a system of market and non-market links." Agglomerations or clusters of businesses, which may consist of one, or a series of interconnected industries, may be vital to a region's ability to attract and retain high productivity businesses. Clusters attract business through the potential for knowledge transfer, increased market size and inter-industry linkages and a pool of appropriately skilled labour. Porter (1990, 1998) argues that clustering allows businesses to operate in close competition with each other, thereby increasing the competitiveness of the whole cluster (and region or economy). It also allows firms to take advantages of factors such as information flows as noted above.

Porter's model of competitiveness has influenced economic development policy in a number of countries and regions. He argues that there are four broad determinants of the competitive advantage of nations -factor conditions, demand conditions, related and supporting industries and firm strategy, structure and rivalry. Government and chance also play a role. The model argues that the inter-connectedness of economic factors influences the ability of business to compete effectively; that public policy can have positive and negative impacts; and that it is firms that compete not nations. Porter (1998, p. 80) states, "the sophistication with which companies compete in a particular location, however, is strongly influenced by the quality of the local business environment. *Companies cannot employ advanced logistical techniques, for example, without a high quality transportation infrastructure.* Nor can companies effectively compete on sophisticated service without well-educated employees. Businesses cannot operate efficiently under onerous regulatory red tape". Porter (1990) argues that a demanding home market is crucial to the development of an industry, although for different products or services the 'home' market may be, for example, at the regional, national or EU level.

However, Krugman (1994) argues that there is a danger of policy makers treating nations as large firms competing on world markets, without considering the implications or validity of this hypothesis. There has also been considerable debate over the definition of competitiveness and how it can be measured (Begg, 1999; and Deas and Giordano, 2001). According to Krugman (1994, p.31-32), the most popular definition of competitiveness is "our ability to produce goods and services that meet the test of international competition while our citizens enjoy a standard of living that is both rising and sustainable". Krugman (1996) also argues that cities, as such, do not compete with one another. They are merely the locus for firms and enterprises that compete. The groups of asset which cities develop do not facilitate inter-firm competition, which is based fundamentally on cost efficiency, innovation, marketing and other factors internal to the firm. At best, the characteristics or attributes of locations are basic requirements, or

necessary conditions, for competitive success but are not sufficient conditions.

Competitiveness has influenced policy despite limited agreement on its precise meaning (e.g. the European Commission's Competitiveness White Paper, 1993). The DTI states that capabilities are the "bedrock of our competitiveness" (DTI, 1998, p.6) and that "to compete more effectively we have to collaborate more intelligently" (p.7). The White paper also stresses, "competition is the sharpest spur to improve productivity and the best guarantee of reward for talent and innovation" (p.8). The World Economic Forum (2000, p.17) states in their *Global Competitiveness Report* "successful economic development is thus a process of successfully upgrading, in which businesses and their supporting environments co-evolve, to foster increasingly sophisticated ways of producing and competing".

The issue of competitiveness was examined in considerable depth in the report on Transport and City Competitiveness (Department for Transport, 2003b). The report highlights that although city and wider regions strive to achieve 'competitiveness', there is a lack of consensus regarding the meaning of the term and how it can be achieved. It also highlights the need to identify the role of transport in creating an attractive business environment. The report concludes that there are several competing definitions of competitiveness, highlighting Porter's (1990) model. It states that research into the direct role of transport on city competitiveness is fairly scarce, but there is a wide field examining the nature of city competitiveness and the role of transport in economic development.

In many industry sectors, for example biotech and electronics, the existence of other firms in the cluster can be as, if not more important than the provision of transport infrastructure, provided that infrastructure meets a minimum standard. This implies that policies aimed at building clusters in areas with weak industrial bases may be unsuccessful if conducted through the provision of infrastructure. Transport has a role in enhancing competitiveness, but is only one of a number of contributing factors. Policies aimed at directly encouraging other business, especially 'anchor' firms in the cluster may be a better use of resources (Karlsson, 2003).

### **3.2.2. The role of transport in business location decisions**

This subsection aims to focus on the theory of transport-related drivers of business location. It provides an overview of literature examining whereby, and mechanisms by which, changes in transport infrastructure and costs impact upon business decisions.

To put this in context, SACTRA (1999) noted that changes in transport costs have economic effects through:

- the location decisions of firms;
- their influence on regional patterns of commerce;
- incentives to invest and to innovate;
- the commuting and migration decisions of households.

Transport improvements can influence location decisions through market and competitiveness changes, such as costs of delivery or increased reliability of logistics systems and lower costs of access to supplies; labour market impacts through access to a larger pool of labour, which might have efficiency benefits; land and property impacts arising through access to land for business development and expansion or the attraction of mobile investment (SACTRA, 1999).



Similarly, McQuaid (2000) argues that transport affects the characteristics of a location in terms of: transport costs (e.g. large low value goods such as insulation material); travel costs for staff, customers, (including tourists); time (which is becoming the main 'cost' in manufacturing according to Drucker (1990) but more specifically can be important when industry logistics are organised in a manner such as 'Just-in-Time'); risk and uncertainty (this relates to time in the sense that if delivery is highly reliable then the time a delivery takes need not be such a significant disadvantage); need for liaison between supplier and customer; need for supplier to access market information and innovation directly in the market. Many costs are inter-related, with for example improvements in logistics reducing storage as well as transport costs, hence improve productivity, as well as opening new market and production opportunities.

There is no simple link between transport costs and distance. Transport between nodes may be cheaper than from a node to its hinterland (i.e. costs may not be geographically linear), so parts of regions (often the capitals) may not be particularly disadvantaged. Additionally the transport of people, ideas and capital may not be closely related to the transport costs of goods, yet these are crucial to the competitiveness of organisations in a peripheral region and investment to these regions. So using standard costs of transport may not reflect the costs of different industries, and even if these are weighted by industrial structure the actual costs may differ due to the particular transport infrastructure and logistics, such as return loading, and transport costs may be non-linear and subject to varying uncertainty or risk

Looking at some of the mechanisms behind these effects, investments in transport infrastructure can have a direct economic effect by reducing transportation costs for firms and increasing the effective size of regional and local markets. This in turn creates new growth opportunities for successful companies and increases the attractiveness of an area to new businesses. The Treasury (2001) state that falling transportation costs may allow some economic activities to move to lower growth regions, as this enables firms to reorganise and outsource certain aspects of their production to take advantage of lower costs of production in peripheral, low-wage regions.

### **3.3 Empirical Evidence**

This section examines more recent empirical evidence drawn from a range of reports and academic studies. It examines the empirical evidence for the relative importance of factors that influence business location, and the specific role of transport within these. These are often behaviouralist type studies, asking businesses what factors influence their choices.

#### **3.3.1 Drivers of Location**

As stated in SACTRA (1999), firms have to determine the availability of a suitable labour force at an appropriate cost as part of their location decisions. Firms may choose a location based on the cost and quality of labour, and market accessibility, balanced against other transport costs. The AA/CBI (1998) survey of local authority economic development officers indicates that issues such as the availability of suitable sites and a skilled workforce are as important as transport, if not more so, to investors when they choose where to locate.

Cushman and Wakefield (2002) reported on London being voted the top European trading location for business by the European Cities Monitor 2002, based on the views of senior executives from over 500 European companies. The ranking was based on a broad range of issues. These included all the communications factors and the availability of qualified staff, which, for the first time, was seen as the

single most important factor in deciding where to locate. London was rated first in seven out of 12 key criteria. These were:

- availability of qualified staff;
- easy access to markets;
- external transport links;
- quality of telecommunications;
- availability of office space;
- internal transport;
- and number of languages spoken.

Another report (London First Centre, 2002) mirrors the above findings. This shows that the main factors influencing the decision to locate in the UK capital were access to European markets, London's status as a global business city, proximity of the client base, the English language, and good transport links.

Invest UK (2000) also reported on the establishment of a client service centre in Glasgow, by a major US company. The company vice-president stated that the primary reasons for locating in Glasgow were:

- the availability of a technologically skilled and customer-service-focused workforce;
- property availability at a reasonable cost was also a factor;
- the college and university systems are a definite asset to a growing company;
- and the availability of excellent public transport adds to the effective size of the labour market.

A study by the Corporation of London (2002) highlighted the importance of air travel to business in the City of London. The findings highlighted that:

- almost 70% of firms consider air services to be critical for business travel by their staff;
- 50% consider air services critical for travel by their clients to meet with them;
- video conferencing and other technologies provide useful communication aids, but are no substitute for face-to-face meetings when it comes to client relationship building.

Non-economic factors have also been highlighted as important. Studies in the UK have found that the quality of life and environment was an attraction for inward migration and inward investment, in one report 57% of executives surveyed quoted this as the most important factor in relocation decisions (Cornwall County Council, 1999). The importance of scenery in attracting investment has been noted in an extensive consultation conducted by Scottish Natural Heritage (1997), concluding that it is an intrinsic element of the package that helps to make Scotland an attractive place for inward investment. In a US survey of inward investors in North Carolina, quality of life was ranked third behind labour supply and transport as attractors (Rondinelli and Burpitt, 2000). Notably, government incentives such as tax breaks were ranked low. However, it is important to note that there may be necessary conditions (such as the profitability of the location) that may be more important than these quality of life factors. In addition, many people appear to rank their own area as having quite high quality (perhaps due to *ex-post* rationalisation).

### 3.3.2 The Role of Transport

#### Road Infrastructure

One aspect of asking firms how important transport was to their location choice is that the answers may confuse local (site choice) factors from more significant regional factors (Hall *et al.*, 1988; McQuaid and Greig, 2002). For instance, firms may say that the presence of the M4 may have been crucial to their choice of location. However, when questioned further they may say that they if their major customer relocated in another region, then they would relocate there also. Hence the Motorway is an important intra-regional location factor, but is relatively unimportant in the more significant inter-regional location choice. Many studies do not explicitly distinguish such inter- and intra-regional factors.

Halcrow Group (2002) in a case study of the M65 extension in Lancashire, used a weighted average of location determinants based on employer interviews and found that, overall, 27% of decision-making processes were influenced by factors that had some transport component. The most important factors cited by businesses when making the decision to locate at the M65 were:

- cost of premises;
- quality of site environment;
- access to customers;
- availability of suitable sized site.

The report highlights that although transport-related factors were overall less important than combined non-transport factors, they still contributed significantly to the economic regeneration of the area. What this study does not show is the interaction between different factors, for example, if there were only poor transport links would businesses consider the cost of premises at all? This is addressed in the section below on decision processes.

A study by the Welsh Economy Research Unit (1997) on economic development in Merthyr implies that improved road access has been an important factor in influencing the location decisions of recent investors. As a result, in addition to direct transport cost savings for existing businesses, there have been even greater wider benefits in terms of income and employment from new business investment. However, recent Welsh government evidence has highlighted the importance of putting transport factors in context, citing cases where labour quality issues have deterred new business investment in the valleys, despite the presence of new road transport infrastructure.

Another example is the A14 link between the A1 and M1 that is reported to have saved 30-35 minutes on journeys accessing the motorway network (Government Office for Eastern Region, 1997). Since completion of this road link, SACTRA (1999) reports that industrial and commercial development within seven miles of the road increased by 470%, although this includes expansion of existing companies. It is not clear how much of this was influenced by changes in planning policies as well as increased demand.

Ernst & Young (1996) found that congestion and the unreliability of trips adds to business costs, particularly for companies in the service sector and those serving urban areas. Although they note that through improvements in logistics, transportation unit costs have fallen in real terms over the past 5 years for many businesses. SACTRA (1999) argues that to overcome these problems, substantial investment is needed to improve the existing network in the UK to ensure competitiveness, primarily road, heavy rail,

urban public transport and airports.

## **Transport Interchanges**

McCalla *et al.* (2001) studied 196 manufacturing and wholesaling firms in the areas around eight Canadian inter-modal freight terminals - three seaports, three airports and two rail yards. They found that transportation land use dominated other industrial land use, and crucially, that linkages between industry and the transport hubs were weak, i.e. businesses in proximity to the terminals make relatively little use of the facilities and very few businesses indicated that proximity to the terminal was a primary location consideration. They found the industrial location-transport terminal relationship was indirect, business located there because of the high level of accessibility found in the terminal zones.

## **Accessibility and Labour Supply**

The OECD (2002) report concludes that accessibility is one of the wider benefits from transport infrastructure investment, and that improvements in accessibility can increase the market size for labour. This finding is backed up by Trinder (2001), who argues that this may be due to reductions in job search time, cost and accessibility (e.g. convenience, comfort, reliability and safety of travel). Trinder also states that although other factors such as planning and other urban policies have an effect, transport efficiency does influence the location of both firms and workers. SACTRA (1999) notes that transport affects not just labour as an input to production (commuting), but also as an input to other activities (social, leisure, etc.) that constitute the final demand for an increasing set of activities and therefore influence the market for goods and services. This will affect a business through direct, indirect and induced demand. There is therefore evidence that the influence of transport on labour supply can be an important component of business location.

While transport is a factor in determining labour supply for businesses, there is more debate over whether labour supply itself is elastic to changes in transport. In other words, are improvements in transport in a given area likely to induce workers to move to or from that area? If not, this makes the choice of business location all the more important. SACTRA (1999) finds that in most studies carried out, transport factors were not a major influence in causing people to move either employment or residential locations, although it may influence choice of location once the decision to move has been taken. So transport may influence local moves rather than, for instance, inter-regional moves, so it is important to distinguish the different spatial scale of choice.

Trinder (2002) argues that workers may be encouraged to migrate into an area with improved transport to take advantage of lower house prices made possible by the extension of the effective commuting area, and may also be attracted by improved living conditions (e.g. larger gardens and/or house) that the transport improvements bring. This is supported by SACTRA (1999), which states that transport acts as an input to both commuting and other (social and leisure) activities.

EEDA (2000) note that infrastructure investment might alter the *perceived* accessibility of places, thereby attracting inward investment, regardless of any change in actual accessibility. This is also noted by others in relation to air and rail infrastructure (see below). They also state that transport infrastructure can play an important role in supporting industry clusters by increasing labour catchment areas and enhancing intra-area interactions. In relation to inward investment, they find transport investment to be an important factor in firms' location decisions, and therefore a useful policy for regions competing for mobile

investment.

## **Limitations of The Influence of Transport on Location**

There is further evidence that points to the limitations of transport-related factors in influencing business location decisions, which are explored further in Chapter 4. SACTRA (1999) notes that traditional approaches have suggested that because transport costs are generally a relatively small proportion of total business costs, we can expect the response to any change in transport costs to be small, although transport costs might have a larger role if we assume that they are more variable than other costs of production, thus increasing the relative their impact. However, the transactions cost to any change in transport may be too high to enable the firm to respond fully to a change in transport costs. Therefore businesses are likely to change operations in discrete steps, and it is only when certain cost thresholds are reached that it becomes efficient to the firm to revise its number or location of depots.

Ernst & Young (1996) note that fixed costs, such as terminal and vehicle standing costs, can make up a large proportion of transport operating costs and therefore improvements to transport infrastructure will reduce only the variable (i.e. transport movement) elements of cost. This implies that transport infrastructure improvements will have a limited effect on business location decisions as other factors such as land costs, vehicle purchase price and depreciation will also be major decision criteria. Indeed, SACTRA (1999) argues that it is not sensible in general to attribute any product market benefits, and hence any price/cost margin benefits, to individual road and transport schemes. In other words, transport improvements alone are unlikely to boost the market share, turnover or profitability of businesses. An exception to this is where the new link makes possible economic activities that are inherently fixed in location and for which transport costs are a significant proportion of total costs, for example, mining, quarrying, forestry and fishing. In this case transport investments may reduce costs to the threshold where it becomes commercially viable to engage in a new activity.

Lawless and Gore (1999) argue that transport, in particular public transport, is of fairly minimal importance in explaining business location decisions, with only 7% of their Sheffield case study sample of 300 indicating that public transport was a main 'push' factor in location. In this case they were considering primarily relatively 'local' (re)location. The majority of businesses in the LRT investment area indicated that they did not believe that the investment would change the amount of business they had, and this increased only slightly in a follow-up survey 2 years later. Good road access was listed as important by over 30% of respondents; however, the study was not designed to test the impact of a new road scheme.

There is also evidence, although somewhat speculative, to support the argument that certain types of transport infrastructure development may cause businesses to relocate out of an area, especially at the micro level. For example, the Scottish Executive (2000) report highlights that many local businesses in Edinburgh blame new style bus lanes for a decrease in turnover, mainly due to parking restrictions. Similar concerns have also been raised regarding congestion charging. And this point is also raised by the STAG report (Scottish Executive, 2001).

### 3.4 Conclusions and Some Questions Arising

There is a wide body of knowledge stretching back to the 19<sup>th</sup> Century outlining the theoretical transport-related drivers of business location, taking into account a range of economic and non-economic theories. This initial review indicates that transport is a factor in business location decisions but is neither the only, nor the most important factor. There are cases where the linkages between transport investment in isolation and industrial location appear to be weak, or indirect. However, there is strong evidence to suggest that while not sufficient, adequate transport may be a necessary condition for business location. Of fundamental importance is the need to distinguish the influence of transport on long distance (re)locations (e.g., long distance intra-regional, inter-regional or international), and relatively local business location decisions where transport infrastructure changes are likely to be more influential.

It is therefore important to address in more depth the following questions regarding the precise relationship of the nature of the linkages between transport and business location. In other words, there is a need to 'unpack' the role of transport in determining business location in different circumstances.

Because the factors influencing location are inherently dynamic in nature, theories that ignore them, or treat them as static, are likely to be incomplete. Some of the questions that are raised help form the basis of our literature review in the following chapter. In particular the following factors influence the relationship between transport and business location decisions:

- Changing business organisation due to changing circumstances, globalisation and complexity, including the role of logistics to business location, technology and transport provision and requirements.
- The spatial scale that the decision is taken at (international, national, inter-regional, intra-regional and local) including the merits of different regions.
- Firm characteristics (e.g., size, sector, ownership, function).
- The issue of growth versus redistribution, i.e. do transport investments generate new activity or merely cause relocation of existing activity? This is strongly linked to the scale of the analysis, as inter-regional moves may be considered as growth for one region, but redistribution at a national level.

In summary we can say the following.

- The evidence suggests that transport is a necessary, but not sufficient condition in determining business location. Other factors such as a skilled and/or cost of workforce, the quality of the local environment and cost of premises have been shown to be equally, if not more important when considered in isolation.
- Research has also shown that climate, business environment and government assistance may be magnets for business location.
- When combined with other measures, such as up-skilling, and integrated into part of a business development programme, transport can help to influence location.
- The evidence for road transport alone to attract business is mixed, however. Road investment is unlikely to compensate for poor quality labour and some research suggests road building can have negative effects in certain circumstances.
- Research indicates that business clustering around transport interchanges is a result of the generally high levels of accessibility found in such areas, rather than the interchange itself.

- Air also appears to be important in promoting the perceived accessibility of an area - a function that motorways can also perform in some circumstances.
- Good transport links can increase the supply of labour in an area directly through easier access to the workplace, but also through increasing the attractiveness of an area to live.
- Transport costs are often a small proportion of firms' total costs and make little or no contribution to fixed costs. Also businesses change location in discrete steps. Hence (re)location responses to changes in transport costs will occur only after a substantial cost saving threshold has been reached.
- Transport infrastructure is likely to be relatively more influential at local levels of (re)location than at broader levels, where other factors may be relatively more significant.
- Evidence implies that informal networks among retail businesses may currently allow them to circumvent planning regulation when locating.

## 5. Land Use, Location and Transport

### Summary

#### *Strategic Networks*

- There can be problems integrating national transport strategies - often stipulating demand management, with local economic development policies - often concerned with maximising economic growth.

#### *Localised Networks*

- The ODPM PPGs, along with other reports by the DfT and SEU, emphasise the need for a link between land use planning and transport to promote accessibility and reduce unnecessary travel. This can be applied to retail, employment or any major new development.
- Additionally, there are recommendations on the submission of Travel Plans, workplace-parking restrictions and park and ride developments.
- Evidence from the UK suggests that linking city light rail developments with policies on business location and urban decentralisation is vital to ensure success of both. Transport investment has been shown to be effective when this is done.
- In cases where there has been poor integration between transport and urban development planning, transport schemes have had limited impact.
- Evidence exists on improving integration between policy actors. This stresses the need for early dialogue, commitment and acknowledgement of key shared objectives.
- Similarly, research has shown that urban development schemes such as pedestrianisation are most effective when linked to transport schemes such as light rail.
- Studies have shown that some transport strategies are overly focused on accommodating transport demand and promoting modal shift to ensure local economic growth. Such policies would be more effective if land use planning was integrated as a form of demand management.
- Research has shown that effective demand management of road traffic (e.g. through road user charging) can significantly push transport onto the agenda alongside planning.
- Evidence from abroad suggests that investment in road infrastructure can reduce economic activity around rail stations, leading to urban sprawl.
- There exists some evidence that carefully targeted policies of decentralisation away from the CBD

can create employment closer to residential areas, thus reducing travel distance and number of trips. However, this is only the case for high-density satellite developments with integrated public transport.

### *Key References*

PPG11 (ODPM, 2000)

PPG13 (ODPM, 2001)

ODPM (1999) *The Economic Consequences of Planning to the Business Sector*

ODPM (2003a) *Making the Connections: Final Report on Transport and Social Exclusion*, Report by the Social Exclusion Unit

Department for Transport (2002a) *10yr plan: Delivering Better Transport: Progress Report, 17 December 2002*

## **5.1 Linking Transport and Planning Policies**

### **5.1.1 The Policy Agenda**

#### *The Issue*

The issue of land use planning and its effect on transport has moved up the policy agenda in recent years. Linking transport and planning policies is necessary to ensure that transport and other developments do not produce conflicting outcomes. For example, a policy of reducing car use combined with a policy to encourage new out-of-town business developments may make sense in isolation, but can have contradictory effects. In particular, with the emergence of the proposed Growth Areas in South East England, the issue has arisen as to how developments that accommodate the growth need of the region can progress while having minimal impact on traffic growth and maintaining high levels of multi-modal accessibility.

#### *Policy Solutions*

The ODPM Policy Planning Guidance notes (PPGs) set out the need for a link between land use and planning to increase accessibility and manage growth. PPG6 (cited under ODPM, 1996) emphasises the need to develop key services and retail developments in locations accessible by foot or public transport. Because of existing infrastructure these are usually town centre locations. This will have environmental, social inclusion and economic efficiency benefits.

Similarly, PPG4 (cited under ODPM, 1992a) highlights the need for centres of employment to be located in areas accessible by walking, cycling or public transport. This will open up employment opportunities to socially excluded people and those on low incomes who do not have access to private transport.

PPG11 (ODPM, 2000) states that an integrated transport policy must be one where transport policies and proposals and land use planning are integrated at the national, regional and local levels. This can increase sustainable travel as a proportion, and also reduce travel dependence. To achieve land use planning and transport integration, the guidance recommends the development of Regional Transport Strategies (RTSs).



These aim to provide guidelines on: transport investment and management; strategic guidance on railways, airports, ports and inland waterways; increasing transport choice (partly through cross-modal integration); public transport accessibility criteria for new developments; off-street and workplace parking and; traffic demand management.

The revised PPG13 (ODPM, 2001) aims to ensure that transport implications of any planned new development are taken into account at planning stage. It stipulates that all major new developments should be accessible by walking, cycling or public transport. Among the recommendations of the guidance is that new developments should submit travel plans along with planning applications, that there should be maximum parking restrictions for new developments and that the planning system encourages park and ride developments.

The DfT (2002a) study recognises that transport has an important role in shaping and supporting new development, and likewise that the planning system must be able to respond to the need for new transport infrastructure. To ensure this, spatial planning and transport planning need to be closely co-ordinated. Policy linkage therefore often involves:

- Planning developments in a way that maximise accessibility and minimise unnecessary journeys and/or;
- ensuring that adequate sustainable transport is provided alongside new developments.

The ODPM (2003a) Social Exclusion Unit report highlights the need to co-ordinate transport, business and inclusion planning to increase accessibility, particularly for excluded groups. In particular, the report highlights the need to ensure that planning guidelines direct business towards accessible locations. It terms this 'Accessibility planning' - the co-ordination of transport, business and inclusion planning to identify those at risk and increase employment access.

The RTPI (2001) report into improving co-ordination between housing providers and planners, while not directly related to transport, draws some conclusions that could be applied to improving integrated working practices in any areas. The report particularly stresses the need for a closer working relationship at the pre-development stage, in other words the need to bring people on the ground together at the earliest opportunity. Key recommendations include the following.

- A commitment to change to build more constructive relationships.
- Understanding the pressures to deliver from the point of view of all partners.
- Invest 'up front' to promote certainty in relationships.
- Write down roles, responsibilities
- Meet early and often
- Both sides must be proactive
- Be constructive by adopting inclusive and transparent negotiation practices.
- Continual review of processes to allow constant improvement.
- Accept that there is no single route to best practice
- Reinforce the shared objective (in this case striving for better quality housing, but equally applicable to better quality transport or urban environment)

### **5.1.2 UK Evidence**

Other UK evidence includes Knowles (1996), who reviews the impacts of the Manchester Metrolink, and provides a review of impacts. The paper calls for a need to link light rail development to a policy of constraints on urban decentralisation, to increase the effective reach and impacts of the new infrastructure. Knowles (1996) also highlights the need to combine transport and business location policies, in particular those designed to reduce urban decentralisation. In terms of the impact on urban central development, Knowles finds a link between the effectiveness of LRT schemes and the extent to which they are introduced along with supporting urban planning policy.

Lawless (1999), in a study of the Sheffield tram system, found that there is a problem of lack of integration between regeneration and transport providers. They found that this can limit the benefits of public transport investment. In addition, Lawless and Gore (1999) find that empirical evidence suggests that linking transport investment to city development has had limited success. The Sheffield case showed that the regeneration benefits from transport investment were small, partly due to the failure to link with non-transport planning policy.

Goodwin (2003) notes that the success of urban initiatives such as pedestrianisation schemes is dependant on other transport and urban policies being in place. For example, he notes that large-scale pedestrianisation in conjunction with a light rail scheme appears to be an effective combination, although the direction of causality is not proven.

Bulkeley and Rayner (2001) highlight the conflict between local policy agendas aimed at economic growth, and national transport and planning policy. They review the Local Transport Plans (LTPs) of Cambridgeshire and Leicester Councils, highlighting that transport strategies are too focused upon accommodating existing transport demand through additional transport infrastructure and persuasive measures aimed at modal shift away from road, rather than a more radical attempt to reduce travel demand, of which land use planning is an important component. Similar concerns have been raised by Hine *et al.* (2000) and Vigar (2001).

### **5.1.3 International Evidence**

Priemus (1999) highlights problems in the lack of co-operation between urban and transport planning in the Netherlands, taking public transport provision in urban expansion areas as an example. He argues that the problem is an international one, and that to improve interaction between land-use and transport planning it is necessary to give public transport a competitive edge through measures such as road user pricing. This, he argues, would push public transport up the policy agenda.

Ryuzo (2000), in a study of the impact of road and rail infrastructure in Japan, highlighted the growing trend away from traditional high-density town centre developments towards US-style decentralisation of commercial activity. He identified that investment in road infrastructure in Japan is partly responsible for reducing economic activity clustered around stations as businesses relocate out of town. Felsenstein (2002) in a US study, noted the tendency for high-tech industries to locate in outer suburban areas creates urban sprawl and associated traffic and potential accessibility problems than if the same industry had located in an urban area.

Sim *et al.* (2001) review the potential for the planning strategy to develop regional employment centres outwith the CBD in Singapore. They conclude that regional centres have great potential for becoming alternative employment centres, therefore reducing commuting distances travelled and the number of trips. This will create a more sustainable approach to land use planning and reduce dependence on traffic management policies. However, they point out that this example may only be applicable to other areas of high-density development that are well served by public transport.

## **5.2 The Impact of Planning Decisions on Business Competitiveness**

Concern has been raised over whether overly restrictive planning policies, including transport planning requirements, can have a negative impact on business competitiveness. In particular, policies to restrict business development to accessible sites as recommended in ODPM (2003a) may decrease business efficiency and in some cases may deter business investment altogether. This could have negative implications at local, regional and national level.

### **5.2.1 Tightening Planning Controls**

#### *Land Use Planning*

Evidence for this impact is mixed. The DETR (2000) study showed that there was little evidence to suggest that council-led planning controls had led to a reduction in new technology-based development. In contrast, research into city centre pedestrianisation schemes in Europe by Hass-Klau (1993) and Carley and Donaldson (1997) indicate that retailers initially oppose such schemes, but become more enthusiastic over time, as the long run effect is often to increase footfall in urban areas.

There has been pressure to increase the proportion of businesses (and residential) developments on brownfield sites (ODPM, 1992a; 2001). This is encouraged to promote a more compact urban form, thereby minimising demand for transport, promote urban regeneration and to conserve existing greenfield sites. The ODPM report on the economic consequences of planning to the business sector (ODPM, 1999) highlights the following potential burdens to business associated with land use planning controls.

- The time involved in making planning applications, and in carrying this forward into permission to develop.
- Costs incurred in taking part in the plan making process.
- Costs associated with negotiating planning permission, such as planning agreements ('planning gain') and delay.

Restrictions operating on business both by the physical allocation and the permitted use of land. Research suggests this raises costs of land and rents. It can also lead to a loss of output where business operates in sub-standard accommodation, or have difficulty in obtaining premises. (ODPM, 1999).

The report concludes that hard evidence for adverse economic effects of planning on business competitiveness is tentative, but warns of complacency in ignoring business attitudes towards what may be seen as overly restrictive legislation. In addition, Gordon, in Breheny (1999) argues that restrictions on development in desirable locations is more likely to kill small business growth than to transfer it to other locations, with subsequent loss to national output.

### *Environmental Planning*

There is also evidence on the location impacts of tighter environmental planning controls. Specifically, where transport development and scale has been seen to facilitate the export of waste. Alemdar (2002) talks of trans-boundary pollution. Waste Export is an issue in areas of strict control over waste management. It may also be an issue where waste management is charged on a commercial basis - business waste. The key example of waste management causing locational difficulty is in Germany following the introduction in 1991 of the German Gruene Punkt, and 'dual system' waste separation. This scheme, and schemes similar, are predicated on an environmental benefit, and often provide a good framework toward reducing waste. The German scheme includes restrictions on packaging, and requires removal of some materials by the manufacturer. It has reduced waste production.

The impact of waste management on business location relates to the relative costs associated with participating in the requirements of one area, as opposed to competing locations, and where the burden of waste management lies. Instances of suitability and operability of schemes may also be an issue, with potential for export of waste commercially and in some instance illegally (Reynolds, 1995). Difficulty in processing profitably within Germany led to an officially sanctioned export of waste to storage in low cost neighbouring countries.

A range of 'waste market' conditions from fully private commercial waste schemes to local authority single collection schemes will differentiate between locations, as will the level of cost and charging scheme in place. Although the German system might be seen as breaking new ground, there are other Green Point type schemes. Japan commenced its own system in 2000, requiring separation and sorting of plastics and recoverable materials. Many US states have various systems.

### **5.2.2 Relaxing Planning Controls**

There is some evidence to suggest that the relaxation of planning controls would encourage business development. The DTLR (2002) study revealed that proposals to create 'Business Planning Zones' (a liberalised zone with limited planning restrictions) met with a mixed response. The CBI argued they would encourage business development, whereas some other consultees countered that they would encourage low quality and car-based developments. Previous similar schemes have been in force, most notably Simplified Planning Zones (SPZs) (ODPM, 1992b)

*Ex-post* evidence for the relaxation of planning controls can be found at Tandem (formerly Wang and Compaq) in Stirling where planning controls were overruled to encourage inward investment. This had limited success as the investment took place, as was short lived and the total number of jobs initially predicted was never achieved. The original company left after a few years and various companies moved in and out of the site, often leaving the site unoccupied. As stated earlier, the location and form of these developments often leads to the production of reverse commuting from inner cities to the outer suburban locations. In addition there is often a spatial mismatch between some labour tasks to company location.

## **5.3 Conclusions**

*What we know*

- Linking transport policy with non-transport policies (such as those connected with urban development and business location) has been shown to enhance the effectiveness of both the transport and non-transport objectives.
- Likewise, where such co-operation is absent, policies have been less successful.
- Research suggests early relationship building and acknowledgement of key objectives may help to aid co-operation.
- Transport policies that focus on infrastructure provision and modal shift at the expense of wider strategic demand management are likely to have limited success in reducing road traffic.
- Raising the profile of public transport through road traffic demand management can increase the likelihood of transport planning being put on the agenda alongside land use planning.

#### *What we don't know*

- A key concern is how might more effective co-ordination between and within bodies and agencies be achieved?
- How can more employers, especially in the private sector, be encouraged to take up government Travel Plans?
- Businesses investing in new developments are unwilling to fund transport infrastructure investments because of the uncertainty over future land prices. Where can funding for advance transport investment come from?
- Does the growth resulting from urban LRT implementation impact on the longer-term viability of centrally located businesses?
- Although we know that integrating land use and transport planning enhances transport and non-transport objectives, we do not know the direction of causality. Does transport enhance urban policy objectives, or vice-versa, or is there two-way causality?

## **6. Methodological Issues and Appraisal**

This chapter briefly considers existing modelling techniques employed to determine the effects of transport on business location decisions, particularly Land Use Transport Interaction (LUTI) models. It then discusses the need for *ex-post* evaluation and the accuracy of existing *ex-post* appraisals. Additionally it looks at the robustness of existing evidence on the link between transport and business location - particularly in terms of data quality, scale, time period and geography.

### **Summary**

- There are two basic ways in which LUTI models calculate the impact of land use on transport demand. The first type use measures of generalised costs or disutility, the second use vectors of accessibility to output vectors of future land use in an area.
- Quasi-dynamic LUTI models are not good at assessing the likelihood of development where none currently exists.
- The absence of a lag between accessibility improvement and activity location is a significant limitation in LUTI models.
- Limitations exist in LUTI models concerning changes in economic activity, for example the relocation of economic activities.
- There is inconsistency among LUTI models as to whether travel cost savings are passed on to

commuters or employers.

- There is debate concerning the value of transport costs in determining business location, and therefore what role these should have in models.
- The existence of freight hubs and charges levied by freight subcontractors are becoming increasingly important in determining business location.
- If reliability rather than mean travel time is now the most important factor in business location, new paradigms and procedures are necessary in modelling to represent their effects.
- Evidence suggests a general need to perform more *ex-post* analysis of transport impact and appraisal studies, particularly on those reflecting current and future policy.

## **6.1 Modelling of Transport**

### **6.1.1 Land Use Transport Interaction Models**

Current LUTI (Land Use Transport Interaction) models are useful in modelling the economic effects of transport on business activity, but have a number of limitations.

SACTRA (1999) reports: "We think that the Department [Transport] needs to undertake an audit to determine what is the capability of the available models for the contexts in which they might be used, and then ... needs to consider the case for investment in model development. We are also concerned that the Department has very few trained personnel with operational knowledge of these models at a time when interaction between transport and location of economic activities is a live issue in the strategic policy context".

This section examines some of the theory of and issues surrounding LUTI models, the implications of these, and offers some conclusions on how these models need to be developed to address the limitations.

### **6.1.2 Economic Theory behind LUTI Models**

LUTI models are based on a partial economic perspective on the inputs and outputs and operations of markets between various actors. These actors include residents and producers, developers and transport suppliers and also the interventionist role of government.

The principal markets within this framework are: property markets; labour markets producer markets (goods and services); financial markets; and transport markets. Transport demand can be viewed as a function of product and labour markets, producer activity and residents' travel and transport supply requirements.

Businesses as producers are engaged in a number of decisions including where to locate business investment, labour recruitment, purchasing of inputs, production of goods and services and marketing activities.

While many models are centred on transport, LUTI models are distinct through their emphasis on:

- spatial representation of producers, residents and transport supply activities
- links between transport markets and producers and residents, labour and producer markets

These models represent the main activities, which affect use and consumption of land. While there are a number of approaches in this framework, it should be noted that the urban form of such models often do not explicitly address the movements associated with goods, while the larger geographical scale region models tend to address both passenger and freight movements.

A top-level distinction can be made between:

- optimising models focused on achieving an optimum design and;
- predictive models - which are more representative of typical real world situations, where response to design is represented.

A sub-distinction can be made within the predictive group between static and quasi-dynamic models. Quasi-dynamic models include entropy and activity based approaches (e.g. DELTA and URBANSIM) and spatial economics models (e.g. the MEPLAN and TRANUS packages).

#### *Labour markets*

Specifically regarding labour markets, there is inconsistency among models as to whether travel cost savings are passed on to commuters or employers. The MEPLAN models deal with the labour market in a central spatial input-output model calculation. This allows estimates of the number and location of households and the number and location of employees in different industries. This then allows a calculation of travel to work patterns to be made. Labour costs do not therefore influence the demand for labour (i.e. number of jobs) other than through the effect on commuting.

The DELTA model operates via a series of sub-models including one for employment status. The number of households is fixed and the number of jobs is fixed for each sector. Wages are treated as exogenous to the model. This results in employment status affecting only travel to work, although housing demand and location are influenced through income in the following round of the model. Research (see section 4) has shown that part- and full-time workers, and those with dependants, lower education levels and wages all have a lower propensities to commute longer distances or times and to use different modes. Hence to understand the links between residences and workplaces and traffic and other flows, it is important to seek to disaggregate workers, potential workers (and households) by such different characteristics.

#### *Product markets*

Regarding product markets, models such as EUNET use a central spatial input-output calculation to determine both the location of production and the pattern of trade between producers and consumers. In this model a reduction in travel costs leads to a reduction in production costs, which in turn results in increased economic activity in an area. Similarly, the regional DELTA model uses a spatial input-output model.

#### *The modelling process*

There are two basic ways in which LUTI models calculate the impact of land use on transport demand. The first type use measures of generalised costs or disutility to produce a matrix of interactions in activity or economic units. These are converted into matrices of travel demand. With this given travel demand, travel choices are therefore mode, route and travel time.

Other models use vectors of accessibility to output vectors of future land use in an area. This can then be used to generate travel or modify existing matrices of travel demand.

### *Predicting Business Location*

The effects of transport investment on development and business location can be modelled through three main effects: increases in accessibility and resulting planning consent; increases in perceived accessibility; and increasing the perceived profitability of development in underdeveloped areas (confidence building). However, few, if any, existing applied techniques explicitly examine the process of investment, other than the decisions of developers.

Quasi-dynamic LUTI models use characteristics of an area to predict the effects of changes in transport. These model the market for additional development and changes in land and floor space rental prices where investment occurs in a developed area. However, these models are not good at assessing the likelihood of development where none currently exists, as there are no characteristics to extrapolate from.

Business relocation is dealt with in many models through the redistribution of production and employment between areas. However, no account is taken in these models of the benefits from redistribution in terms of productivity gains.

### *Limitations of LUTI Models*

Whilst the integrated land use/transport interaction models described above have been useful, they have their limitations. Hunt, Kriger and Miller (1999) reviewed six urban modelling frameworks (ITLUP, MEPLAN, TRANUS, MUSSA, NYMTC-LUM and UrbanSim) and the limitations they noted include:

- Most models are static equilibrium models with large time steps
- All models are zone-based, often with very large zones
- Goods movement only represented in MEPLAN/TRANUS
- All models use variations on conventional four-stage modelling systems, and so are susceptible to all the criticisms of these models

Of these, the most significant was deemed by Woudsma and Jensen (2003) to be the first, the absence of a lag between accessibility improvement and activity location. Important gaps in empirical research on the transportation/land use relationship were identified by Woudsma and Jensen (2003) to be:

- the lack of understanding of the causal links between urban form and travel behaviour;
- the lack of a common view about how to model land use response to transportation change;
- the under-representation of the movement of goods as a factor influencing the relationship.

Although choice theory is central to the development of LUTI models, in many models only a small proportion of choices are modelled explicitly. This is especially true of urban models, where production is not modelled as a function of producer choice but as a result of interaction between the decisions of customers and developers. DELTA models tend to be more realistic than MEPLAN models in this respect.

Both the above models take similar inputs regarding residents' location choice, although they differ in the modelling process. MEPLAN models include all households containing employed residents at a given point in time, whereas DELTA models locate/relocate new or mobile households irrespective of



employment status over a period of time.

Limitations also exist concerning changes in economic activity. The majority of models deal with the relocation of economic activities with fixed values for each point in time, or vary these only by marginal location change (such as the relocation of activities to "external" zones and the consequential loss of multiplier effects). However, there are exceptions, for example the EUNET application of the MEPLAN model which models endogenous increases in economic activity due to the productivity gains from cheaper transport.

Linked to the above, while the LUTI models mentioned above represent the effects of spatial changes in demand on the relocation of business activity, they do not take into account the changing spatial organisation of activities *within* firms.

Also, LUTI models have tended to focus on the behaviour of individual actors, such as residents, transport suppliers and government at the expense of analysis of the operations and features of the product and labour markets that they represent. In addition within these groups of actors there are significant differences that should be modelled if possible (e.g. difference transport patterns according to the characteristics of workers, as discussed under labour markets above). Some issues relating to these limitations are further discussed below.

#### *LUTI Models - Conclusions*

The majority of LUTI models have been applied in an urban setting, to passenger rather than freight traffic situations. This leads to emphasis is on the markets for land, transport and service industries rather than manufacturing industries.

It is important that the area modelled by LUTI is large compared with the transport impact area of the proposed scheme. This spatial requirement means that an appropriate model should always appear unusually wide by conventional transport modelling standards relative to the schemes or strategies to be examined.

LUTI models have a very limited ability to predict the degree to which road or other transport improvements can induce development in specific sites where little or no current activity exists. In order to address this a very detailed representation of the processes of development and take-up for each site within an area would be required.

We would also ask whether current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change.

There is a need to investigate more dynamic forms of model that better reflect actual business (and other) location decision-making.

In general, enhanced LUTI models must be complex and spatially very extensive compared with the projects to be examined, particularly when effects outside the immediate area are to be considered.

### 6.1.3 Isolating the Impact of Transport

There is a question of what methods can be used to isolate the impact of transport on business location from other factors such as the economic cycle, labour cost and quality, government incentives, planning policy.

#### *Transport costs*

It has been argued that because transport costs are a relatively low proportion of total costs, transport is therefore not important in determining location. However, there are several methodological issues to be considered in assessing the value of this statement. Pineda (1984) reported that regional variations in transport are very small (around 1%) found that it may be perceived accessibility that is more important in determining location decisions. Edwards (1975) argues that small regional variations in transport costs are calculated from *ex-post* evaluations. These may be swayed by the fact that firms in areas of higher transport costs (i.e. peripheral areas) react to reduce their costs, or are involved in sectors with lower transport costs or there may be an element of *ex-post* rationalisation of previous decisions.

A study by the OECD (2002) into transport and regional development noted that although the average cost of transport as a cost of production in developed countries typically varies between 2 and 4%, this is an understatement due to hidden transport costs, including: costs of own-account transport (vehicles operated by firms to deliver their own goods); costs of petrol and cars for employee travel and; the value of the time spent travelling by staff. The report states that transport is more important to business decisions than basic cost percentages suggest, and that surveys of factors affecting business location typically give a high ranking to accessibility and transport-related factors.

McCann (1998) argues that a weakness of Annual Census of Production (ACOP) figures is that they are limited to UK freight movements and do not include the costs of moving goods to or from the UK. Edwards (1970) found that ACOP figures used at the time estimated transport costs as around 3.5% of sales value, but pointed out that this did not include final distribution costs that are usually paid for by distributors. Additionally, Edwards (1970) pointed out that a more realistic measure would be transport cost / (sales - purchases) as this would remove double counting of sales. For the reasons above, it may be that transport cost percentage figures systematically underestimate transport costs.

Another possible methodological downfall is that measuring the transport costs faced by firms as a possible determinant of location is inappropriate, as an increasing number of businesses subcontract out the movement of supplies and finished product (Horner, and O'Kelly, 2001). Firms will still have to pay for these services, but it is important that transport costs are taken to be the actual cost to the business rather than a proxy measure based on distance and/or weight and volume. From this it is likely that the transport costs faced by the *freight businesses* will influence how much customer businesses are charged, and therefore their location, although there may not be a direct relationship. However, it is also possible that location in close proximity to a freight business hub may be the overriding transport-related factor.

The methodological implications from this are that:

- more account needs to be taken of perceived transport costs, possibly involving some quantification of these;
- 'hidden' transport costs need to be measured and included;
- costs of moving goods to/from the UK should be considered;

- the cost of hiring freight subcontractors may be a more appropriate measure than direct transport costs based on distance.

### *Elasticities*

Investment/performance/demand are not constant. The variable effects of increased transport provision and quality impact on the development of a location partly as a direct result of the increased accessibility of the location, and partly as a relative increase in accessibility in comparison with other competing locations. The feeling that investment in transport will necessarily lead to an increase in inward investment is not always the case.

From a demand side, the fact that increased demand is placed on a system will again only partially relate to an increase in the capacity of the infrastructure. This being dependant upon the ability and freedom to invest of infrastructure operators, and the perception of long term or short term demand peaks. Examples from nationalised railways show a tendency to discourage demand through price control as a short-term response.

Given the discussion on the specificity of many transport impacts upon industrial location, it is likely to be a mistake to assume constant elasticity over time in links between transport and economic growth and associated business location. The relationship between transport and or mobility and GDP is variable and can be influenced by policy (ECMT, 2001). So strong economic growth can result in great transport growth.

### *The Wage Equation Issue*

The way in which transport change impacts on employees and employers, i.e. the wage equation issue, is insufficiently understood. The quantification of constituent elements in the make up of a labour cost to a company is cited in some texts as its wage equation. Within this breakdown the cost of transport can be included, specifically the proportion of time and money costs allocated to accessing employment place. As the relative accessibility of a location alters, access costs change, as does the wage level necessary to attract workforce. See, for example, Manning A. (1993), Madhu and Mohanty (2001).

The wage that a worker receives is observed only when he/she is employed. The employment of the worker, however, depends on two sequential decisions: the worker's decision to work and the employer's decision to hire. Location specific costs including transport are integral to the equation as they influence the choice, and ability, of the employee to access work at an appropriate cost. Positive effects exist where access time and costs are reduced, with a potential for negative impacts where the costs and time are increased.

More empirical research is required on this matter, regardless of the modelling framework used. SACTRA (1999) states that this is an important question in relation both to projects (such as Cross-Rail) and policies (such as road pricing).

### 6.1.4 Urban and regional policies

A number of issues arise regarding the modelling of urban and regional policies.

The issue of whether infrastructure investment or transport policy will consolidate firms in their existing locations, or encourage reorganisation or restructuring. SACTRA (1999) states that the spatially differentiated production model offers a possibility of estimating this effect.

It is exceptionally difficult to measure the degree of embeddedness of an airport in its local economy and to assess the supply linkages and chains to the local economy and employment. It seems logical, however, to argue that smaller regional airports are much less capable of stimulating additional jobs in their regions. (Graham and Guyer, 2000).

We would ask what the impacts are of location development policies on the long-term market stability of the industrial company. This is considered in more detail below.

#### *Location Policies and Long-Term Market Stability*

The question of market stability is specific to impacts of policies on stability of industrial companies, and by extension to market segments. Policies that attract business to a location, through subvention or other incentive, act to influence the market for services, and the choices made by companies in location. Similarly policies that influence the location rather than the company will also have a knock on effect on the economics of the location for incoming investment. Various sources, see below, refer to this as dynamic macroeconomics, and employ equilibrium models to predict impacts for location, and 'best-location' for company operation.

A number of strands emerge in the literature; these concern concepts of Globalisation (Moshirian, 1998; Bates, 1996), Business Cycle (Ireland, 2003; Cogley & Nason, 1995), Market Stability and Equilibrium Modelling (DeJonga *et al.* 2000). In its global context, companies are increasingly seeking incentives to locate in a particular location (Bates, 1996). As the flexibility of the company increases, often technology led (Bates cites Riall and Lann) so the ability to seek financial and operation incentives increases. Regions and authorities compete to 'invest' in location attractors, in some instances modelling costs and gains against other government services. (LOCI - the Location Impact Model cited in Bates provides a review of the competing demands on investment). The situation appears inherently unstable, with companies moving in where greatest incentives are offered. Moshirian (2003) talks in terms of global financial forces, and argues that a holistic approach may be required to achieve financial stability.

Business cycle research tends toward a company-based approach. Ireland (2003) sees the concept of macroeconomic stability as linked to business cycle stability. There being a link between the stability of the company, and the stability of the location. Cogley and Nelson (1995) suggesting that GNP growth appears to have a 'trend-reverting' component. Companies seeking investment, incentive and growth.

Modelling and impact assessment appears widely in the literature, and should provide a methodological basis for assessment of policy impacts. Much analysis centres on Equilibrium Modelling (Ingram and Whiteman 1994, DeJonga *et al.* 2000) identifying correlation between inputs to a 'neo-classical' business cycle model (Greenwood *et al.* 1998) and external environment, policy application and incentive. Sudden change 'shock' to the marginal efficiency of investment, as potentially resulting from incentive or change in incentive, provides a significant catalyst to business fluctuation. Greenwood *et al.* (1998) 'shocks and

transmission mechanism...may be important elements of business cycles.' Guo (2003) 'a positive spending shock can lead to simultaneous increases in output, consumption, investment, employment and real wage.' A positive investment results in positive benefit, also noted in Aiyagari *et al.* (1992) are positive benefits from input, while uncertainty of incentive and fluctuation provide negative concerns and may result in movement or churn 'the impact on output and employment of a persistent change ... exceeds temporary change.'

Concerning variability, the impact of following one or a range of policies affecting business location varies by location and dependant upon external economic and productive factors. However, it is equally clear that policies attract businesses to a specific location will have an impact on the market, and may in turn affect the long term stability of the company and market sector, as well as impacting on the region / country concerned.

*Areas of common and generic measures for policy implications.*

Market Stability (Macroeconomic Stability) is seen to relate to any factor that influences the ability of a market to operate within a given sphere. Policies which affect business location may impact directly on markets, changing the nature of competition within the market; or indirectly, by changing the nature of markets for alternative or substitutable products. Regions with established intervention may also recognise that reduction or change in intervention may impact on market stability. An example for change in intervention is apparent in European subvention of Agriculture (Common Agricultural Policy) and as a result of trade negotiations of the GATT.

Impacts can be identified in three areas: those dependant upon type of policy being applied, those dependant upon regional characteristics, and those dependant upon company characteristics.

- Policy type and impacts
- Trends arising as a result of differences in regional and national policies:
- Transport
- Services/Infrastructure
- Investment
- Taxation
- Region Type and impacts
- Urban Planning Policy
- Zoning Restrictive access
- Compact patterns of urban development
- Local Tax Incentive
- Local Rent Incentive
- Local Services Incentive
- Industry type and impacts
- Quality Control
- Quantity Control
- Environment Control
- Training / Education Policy

There is a need to relate to issues planning policies need to consider in developing longer-term spatial patterns, specifically:

- What issues are specific to company stability
- What issues are specific to market stability
- How are they defined
- How are they measured
- How are they evaluated

### *Research Development*

The quantification of impacts resulting from corporate and market instability and the relationship between incentive/policy and markets is significant in assessing the impacts of individual policies. Literature addresses various issues pertinent to this assessment but will need to be drawn out further to establish linkages and measurable dependencies.

Two areas of common measurement exist: equilibrium analysis and business cycle analysis. Both include external factors, cost, location dependencies, and could form the basis of methodology for wider analysis. These might be seen as a bottom-up approach - what does a company seek to encourage development, and what are the impacts of location based changes in these factors?

We would suggest the following specific areas.

- A principal area of study would be to investigate the impact that continually changing incentive and counterincentive has on the ability of the company/market to function.
- Issues that planning policies need to consider in developing longer term spatial patterns
- What methodologies may be required to define, measure and evaluate these patterns?

## **6.1.5 Perception and response to information**

We would highlight the following issues as important.

- What are the current and longer term impacts resulting from real time and traffic tracking information
- What responses are likely to lead to an increased availability of transport information in parallel with a decline in the actual reliability of some elements of the transport network.

## **6.1.6 Transport and Tourism**

Our research has highlighted the need to measure the effects of transport investment on tourism, particularly in economies where this is a major industry. There are problems in measuring the effect of transport on tourism, as the tourist 'industry' is comprised of multiple sectors (SACTRA, 1999). One simple solution would be to correlate transport investment with visitor numbers, however visitors are subject to external influences, such as actual or perceived terrorism threats and exchange rate fluctuations. Also, visitor numbers are difficult to measure and give no indication of the value of tourism to an economy.

Economic impact studies have attempted to measure the value of tourism by examining spending by visitors on accommodation, transport, food and drink and shopping; sponsorship and merchandising (Crockett, 1994); public and private investment in infrastructure (e.g. new hotels). This has been done through both surveys of visitor expenditure and business surveys, examining increases in turnover in hotels, restaurants and other related businesses. Any impact needs to be offset against the economic deadweight and displacement. The issue of whether to include domestic expenditure as additional or deadweight is also a subject of debate. Felsenstein and Freeman (1998) argue that some domestic expenditure will be additional in that it will prevent local residents spending money on the same activity in alternative regions - a form of import substitution.

The values of economic multipliers in tourism are also constantly under debate. It has been argued that current multiplier analysis may overstate the economic benefit of tourist activity. This may limit the potential of tourism to regenerate low-growth post-industrial regions. (Egan and Nield, 2002). Other studies have examined the feasibility of alternative methodologies to calculate the impact of tourist expenditure. Examples include Tourism Satellite Accounts (Smith, 2000) and Social Accounting Matrices (Wagner, 1997). There is, however, no established consensus on an appropriate methodology, partly because the characteristics of individual events and regional economies differ substantially.

Even with a robust methodology to measure the value of tourism, there remains the methodological issue of isolating the impact of transport from the wider economic influences on tourist demand mentioned above. A possible solution would be to conduct a comparative study of two competing regions subject to the same economic influences, one of which has experienced a transport investment, for example a new road into a ski resort.

### **6.1.7 Further Research in Modelling**

Perhaps the most important issue for research is the lack of causal representation in the models used. Whilst it is understandable that models developed for strategic land use transport planning purposes will not need to be at the same level of detail as those that could be used to represent (or to aid) the location decision-making processes of firms, there is confidence to be gained in their performance if some degree of consistency can be assured.

For this purpose one needs to distinguish between different types of organisation in a more refined way than is conventionally done.

Call centres, whose main business is at night-time for most of their customers, may choose to locate in a different time zone so that they pay day-time rates for their staff. Retail outlets will be most heavily influenced in their location choice by the competition - or lack of it - and will run detailed models to assess sales before deciding. Firms dependent upon particular supplies (like fresh water or raw materials) or suppliers are more likely to locate near to them than to their customers. Firms whose business is the distribution of goods will most likely locate near to motorways.

Each of these differences in characteristic will be taken for granted by those making decisions within an organisation, as will certain other organisational factors, once a relocation of some activity is decided upon. This implies at the least a different disaggregation of the types of business activity than is usual. It may also imply that there could be an advantage in applying to the 'business location' decision process the approach developed by Tversky (1972) known as 'elimination by aspects'. Some locations just will not be considered, because they do not have the right transport (or other) characteristics.

To understand this one needs to understand how the 'search space' of alternative locations is defined. As Kirby (1993) remarked in relation to residential location decision-making, "distance may be no object" within the search space, but the determinant of the boundaries of that space may well be heavily influenced by distance - or rather by travel time - or rather by accessibility, not to the customer, but to a transport network that provides reliability of travel time to the customer. If it is reliability rather than mean travel time that is these days the most important factor in business location, then it is clear that new paradigms and procedures are necessary in modelling to represent appropriately their effects. Even micro-simulation models that are capable of generating many slightly different scenarios and assessing the effects of these, are rarely deployed for such a purpose - and it would be very expensive to do so.

There are a number of general points that are worth highlighting: theoretical frameworks and techniques for better micro-analysis are needed; better models or frameworks and techniques for multi-disciplinary and collaborative research should be developed; frameworks and techniques for incorporating behavioural approaches into standard economic and transport planning studies; greater incorporation of more realistic employment assumptions into Land Use and Transport models, e.g. assumptions about job characteristics (wage levels, part-time, shift work); employer characteristics (size; sector; Travel Plan); worker characteristics (childcare, access to transport); access to modes; and investigate the greater use of practical dynamic, non-equilibrium models.

## **6.2 Transport Investment Appraisal**

### **6.2.1 Ex-post Accuracy of Appraisals**

Evidence from this study suggests that there is a general need to perform more *ex-post* analysis of transport impact and appraisal studies, especially those that reflect current and future policy. Virtually every piece of transport investment takes place after an *ex ante* appraisal of the likely impact, however only some of these are followed up with an *ex-post* evaluation. We concur with the Department that there is a requirement to compare appraisal predictions of projects with their outcomes. There is a need to research why schemes have particular impacts, how this takes place and who is affected. Linked to this, we need to know if transport investment schemes had wider unanticipated impacts and if they can provide guidance for future appraisals and policy development.

An *ex-post* evaluation will not only give an evaluation of the project, but also of the accuracy of the initial appraisal. For this reason it is important that the methodology used in *ex-post* evaluations is appropriate. A number of key recommendations are set out below.

The first key point relates to planning *ex-post* evaluation before the project commences. There is a need to incorporate *ex-post* analysis into a range of current projects, so that relevant data can be collected from the start of the project. This would require setting up a system to track key indicators as the project progresses.

Secondly, *ex-post* research must be conducted while controlling for the presence or absence of complementary measures. For example, this would have to be carefully designed to isolate the effect of the transport investment against a background of other possible determinants, such as cyclical economic change and industrial restructuring.



Thirdly, for some investment projects where the impacts are not immediate (e.g. traffic calming schemes on town centre retail location) *ex-post* longitudinal evaluations should be conducted over several years to determine the scale and longevity of any effect.

Lastly, as mentioned earlier, there is a potential problem when using *ex-post* evaluations to measure transport costs. These may be altered by the fact that businesses in areas of higher transport costs (i.e. peripheral areas) react to reduce their costs, or are involved in sectors with lower transport costs.

## 6.3 Some Methodological Issues

The research reviewed in Chapters 3-6 relies on some contrasting methodological approaches, which can make comparison of results difficult. In this section we aim to highlight some of the differences in key pieces of research that we have reviewed and show how these may contribute to differences in findings. For example, a conclusion based on a case study in a single city area may have relevance to that area, but a similar national study may offer information that can be applied more widely. Therefore analysis of any contradictions in findings between these two studies would have to take the methodological differences into account and policy makers should be aware of these before using findings from a piece of research to inform policy.

Analysis of the literature has shown that differences in methodology have been found to exist in a number of areas including: geographical scale of analysis (e.g. Knowles, 1996; Lawless 1999; Lawless and Gore, 1999); characteristics of nation or region; whether qualitative (e.g. case study) or quantitative (e.g. large scale survey); the time scale of the survey (e.g. work on land use planning controls by DETR (2000); Hass-Klau (1993) and Carley and Donaldson, 1997); whether based on *ex ante* or *ex post* evidence (e.g. work on traffic calming by Scottish Executive, 2000; Gerrard *et al.*, 2002); and alternative methods to measure the impact of tourist expenditure (Smith, 2000; Wagner, 1997) although the latter two studies did examine the consequences of the methodologies employed.

A relevant example to examine in more detail is the case of light rail investment in urban areas. Studies by Knowles (1996), Lawless (1999) and Lawless and Gore (1999) have investigated the impact of similar investments. A brief summary of the findings and approach is given below.

Knowles (1996)

- *Findings*: Reviews the impacts of the Manchester Metrolink tram scheme and finds urban LRT in Manchester increased the attractiveness of city central locations to users from the south of the city. The link increased the attractiveness of central businesses most where existing infrastructure was weakest. Draws a correlation between policy in place, and the effectiveness of LRT schemes to impact on central development
- *Methodology*: A case study based paper, reporting findings of the Metrolink Impacts study completed by the University of Salford. Reviews economic and land use impacts of the Metrolink using before and after data provided from research in Salford, together with patronage and car commuting comparisons.

Lawless (1999)

- *Findings*: Investment in transport had a minimal effect on business confidence and regeneration, with road investment being more beneficial than the tram. There is a problem of lack of integration between regeneration and transport providers.
- *Methodology*: Before and after survey of the effects of new tram system and enhanced road provision on image, property, land use, business (re)location and labour mobility.

Lawless and Gore (1999)

- *Findings*: Investment in a tram system in Sheffield has led to minimal business investment and regeneration impacts in the local area,
- *Methodology*: Based on an empirical case study to develop a theoretical framework in which transport investment implications can be measured. Land use and land values are given in a before and after scenario. Breaks down impacts of investment into 5 areas (image, property, land use, business location & operations and labour market) and explores effects on each

On initial examination the Knowles study suggests that LRT developments can make an area more attractive to business, whereas Lawless and Lawless and Gore argue the opposite. However there are a number of differences: Knowles uses accessibility as a proxy for development potential, whereas Lawless and Lawless and Gore use several measures. Additionally, Knowles is concerned with the CBD, whereas Lawless and Lawless and Gore are examining the effects on a range of areas throughout the city. While all these studies are valid and useful, the range of application of each differs.

## 6.4 Conclusions

In summary there is a need to improve modelling, in terms of challenging basic assumptions and utilising different methodological approaches, especially more multi-disciplinary approaches.

Some of the factors to consider include: current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change; measuring transport costs faced by firms as a determinant of location may be inappropriate, as an increasing number of businesses subcontract out movement of supplies and finished product. Transport costs are increasingly a function of proximity to, and charges by, subcontractors rather than directly proportional to distance, volume and weight. It is likely to be a mistake to assume constant elasticity over time in links between transport and economic growth and associated business location. Given the variety of factors influencing the role of transport, there is a need for greater use of multidisciplinary, micro-focused studies looking at specific issues, and an improvement of the associated research tools. Transport is more influential in location decisions than basic cost figures would suggest. Spatially differentiated production models may be able to estimate the effect of transport investment or policy on location decisions. New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location. There is a need to perform more *ex post* analysis of transport impact and appraisal studies.

Specifically regarding Land Use Transport Interaction (LUTI) models, LUTI models are useful in modelling the economic effects of transport on business activity, but have a number of limitations. The majority of urban LUTI models have been applied to passenger rather than freight traffic. This leads to emphasis is on the markets for land, transport and service industries rather than manufacturing industries. It is important that the area modelled by LUTI is large compared with the transport impact area of the proposed scheme. In general, enhanced LUTI models must be complex and spatially very extensive

compared with the projects to be examined, particularly when effects outside the immediate area are to be considered.

*What we know*

- Transport may be more influential in location decisions than basic cost figures would suggest.
- Transport costs are increasingly a function of proximity to and charges by subcontractors rather than directly proportional to distance, volume and weight.
- Spatially differentiated production models may be able to estimate the effect of transport investment or policy on location decisions.
- The majority of urban LUTI models have been applied to passenger rather than freight traffic. This leads to emphasis is on the markets for land, transport and service industries rather than manufacturing industries.
- It is important that the area modelled by LUTI is large compared with the transport impact area of the proposed scheme.
- In general, enhanced LUTI models must be complex and spatially very extensive compared with the projects to be examined, particularly when effects outside the immediate area are to be considered.
- New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location.
- There is a need to perform more ex post analysis of transport impact and appraisal studies.
- Given the variety of factors influencing the role of transport, there is a need for greater use of multidisciplinary, micro-focused studies looking at specific issues, and an improvement of the associated research tools.
- New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location.

*What we don't know*

- Do transport basic percentage costs underestimate the true cost of transport to businesses?
- To what extent should models reflect that business location decisions are determined by the existence of freight hubs?
- There is a lack of causal representation in the current models used.
- LUTI models have limited ability to predict the degree that transport improvements can induce development in sites where little or no current activity exists.
- An understanding of the causal links between urban form and travel behaviour;
- A common view about how to model land use response to transportation change;
- The significance of the movement of goods as a factor influencing the transport-land use relationship.
- Can current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change.
- Is reliability more important than mean travel time as a determinant of location?

## 7. Key Messages and Gaps in the Evidence

### 7.1 Introduction

This chapter: briefly summarises the evidence related to these questions; sets out some key questions arising from current UK government policy documents; identifies the major gaps in knowledge that still remain; and makes suggestions on future research to fill these gaps.

Some key current policy issues include:

- Changes from a '*predict and provide*' system towards the management of road traffic levels in the 1990s arguably reduced the push for increased levels of road infrastructure to match changes in the demand for transport by road. Clearly a balance between both is required in an era of rising travel demand, although where this balance lies is uncertain.
- The link between *infrastructure investment* and business location is still unclear, as discussed earlier in this report. There is a need for more evidence about the specific types of infrastructure and services needed to promote regional and national competitiveness (e.g. air services).
- The issue of *congestion* affects both the transport of goods and in-work travel, and commuting to work. In city areas in particular the perception of congestion has led to the development of policy agendas to reduce the dependence upon private vehicles through an increased importance being placed on public transport, and the development of traffic management schemes, including road pricing.
- The links between transport and *land use planning, regeneration and social inclusion* is seen as important. The desire to link public transport investment to city development has not, however, proved entirely successful, as some evidence has observed that despite a strong commitment to transport investment, linked regeneration has not been strong. There is a danger that policies may be based upon relatively simplistic notions of causal links between transport and regeneration (see Chapter 5 for a discussion on policies).
- Changes in the *control and regulation* of transport have been at the forefront of transport policy in the United Kingdom, and in other EU states. Resulting changes in ownership of railways, bus companies and utility services have affected the provision of transport significantly. The UK operates a predominantly privately owned public transport system that can have an impact on the perceived quality and expectations of service levels. However, the degree of monopoly power in both infrastructure and service provision is very high in many parts of the transport industries (e.g. airport ownership or railways).
- Many of the issues raised concerning transport and the *environment*, such as: 'decoupling' the links between traffic and economic growth; the need to reduce traffic congestion; encouraging modal shift away from road transport; cutting down on unnecessary journeys through planning policy; the link between global environmental changes (e.g. global warming and the potential higher transport costs, possibly higher rainfall, rising sea levels and higher winds) and the implications for Scottish transport and the economy (as well as wider influences of course).

To assist in cross-referencing, and as so many policies are inter-connected, this chapter follows the structure of the rest of the report:

- The Drivers Of Business Location (Chapter 3)
- Business Organisation And Technology (Chapter 4.1)
- Business Characteristics (Chapter 4.2)
- Labour Supply, Travel To Work And Social Inclusion (Chapter 4.3)
- Spatial Scale (Chapter 4.4)
- Growth versus Displacement (Chapter 4.5)
- Land Use, Location And Transport (Chapter 5)
- Methodological Issues And Appraisal (Chapter 6)

## 7.2 Key Evidence, Policy Questions and Gaps

This section highlights key evidence, policy questions, gaps in knowledge.

### 7.2.1 The Drivers Of Business Location (Chapter 3)

#### *Key evidence*

- The evidence suggests that transport is a necessary, but not sufficient condition in determining business location.
- Other factors such as a skilled and/or inexpensive workforce, the quality of the local environment and cost of premises have been shown to be equally, if not more important when considered in isolation.
- When combined with other measures, and integrated into part of a business development programme, transport can help to influence location.
- The evidence for road transport alone to attract business is mixed, however and some research suggests it can have negative effects in certain circumstances.

#### *Policy questions and gaps in knowledge*

How important is transport relative to other factors in determining location?	
Evidence	Gaps

<p>Huws and O'Regan (2001): empirical study - the skills of the workforce and technical expertise in a region are the most important drivers of location and that this leads to a clustering of similar firms. Transport factors play a minimal role.</p> <p>Button et al. (1995): Poor transport infrastructure does not induce firm migration but will influence location decisions for firms on the move.</p> <p>Linneker and Spence (1996): when the component of accessibility change caused by the construction of the M25 motorway is isolated, then it can be demonstrated that such changes are positively related to changing levels of economic development.</p> <p>Ryan (1999): property prices of business locations found to be higher around transport hubs indicating a higher demand by businesses to locate there.</p> <p>Lawless (1999): Investment in a new tram system in Sheffield had a minimal effect on business (re)location and regeneration.</p> <p>Ellison and Glaeser (1997): observe that the presence of one firm in a location reduces transport costs for subsequent firms and this forms a driver for geographic concentrations.</p> <p>Welsh Economy Research Unit (1997): on economic development in Merthyr which implies that improved road access has been an important factor in influencing the location decisions of recent investors. As a result, in addition to direct transport cost savings for existing businesses, there have been even greater wider benefits in terms of income and employment from new business investment.</p> <p>McCalla et al. (2001): linkages between industry and transport terminals are weak, i.e. businesses in proximity to the terminals make little use of the facilities and proximity to the terminal was not a prime location consideration. The industrial location - transport terminal relationship is indirect, business located there because of high accessibility found in the terminal zones.</p> <p>Goodwin et al. (1998): measures to reduce traffic capacity can result in a reduction in traffic volume in the long run as people change jobs, location or mode of travel.</p> <p>McCann (1998): transport costs, although central to classical location theory, are empirically of very little significance in explaining overall costs faced by firms.</p> <p>Button and Costa, 1999: changes in the control and regulation of transport been at the forefront of transport policy in the United Kingdom, and in other EU states, which will affect the infrastructure and its management and may influence business location.</p>	<p>What are the drivers of change - what needs to be done to influence location decisions?</p> <p>How does transport provision influence business relocation, and how can this be forecasted?</p> <p>How important are transport costs to business location decisions? Are perceived costs more relevant?</p> <p>What is the role of transport in international, as well as regional, competitiveness?</p> <p>How does the distribution and services provided (e.g. flight destinations) of the airport system influence business location and competitiveness? What specific role do airports play in this?</p>
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## 7.2.2 Business Organisation and Technology (Chapter 4.1)

### *Key evidence*

- Changes in business operations affect the role of transport in influencing location.
- The outsourcing of many transport functions to third party firms and the increased demand for part-assembled components has elevated the importance of logistics businesses in determining the location of other firms, and reducing the direct effect of transport infrastructure on manufacturing and service firms.
- Technology has influenced the effect of travel, partly through allowing virtual communication to substitute for physical travel, e.g. telecommuting, and partly through improved efficiencies in logistics.
- Technological change has increased the need for travel and carriage over distance and therefore boosted the role of air transport in business location.

### *Policy questions and gaps in knowledge*

The role of logistics in changing business location	
Evidence	Gaps
<p>Taniguchi <i>et al.</i> (1999, 2001): centralising delivery functions to the city periphery and providing local scale deliveries within the city, will impact on the ability of the city scale to compete for larger business locations.</p> <p>Tibbet and Britten (2003): smaller firms, and those further downstream in the production process, are more likely to subcontract out movements of supplies or produce, making transport infrastructure less of a direct influence on location.</p> <p>Adam and Putz (1999): in Germany additional transport implications are resulting from the 'GrÃ¼ner Punkt' requirement to remove additional packaging and returned materials. This has had an impact on locational decisions specific to city and surrounding area.</p>	<p>The influence of transport infrastructure and management on the location of international and national distribution companies.</p> <p>The extent of the influence that networks of freight companies have on location decisions of other business.</p> <p>What are the significance of transshipment and information-exchange costs (time and money) at transport hubs?</p> <p>To what extent is the merging of assembly/supply and transport functions influencing the location of depots?</p> <p>Can we develop a more logistics-based model of business location?</p> <p>"If e-commerce is able to capture elements of traditional business processes and to develop a comprehensive and integrated service industry, what traditional logistics service providers might be supplanted and what changes are occurring in the European logistics industry as a direct consequence to the introduction of e-logistics?"</p> <p>How are current and future trends in logistics likely to influence business location?</p>
Is technology changing location requirements?	
Evidence	Gaps

<p>Freeman (2002): ICTs have had a significant impact on the location and transport choices through lower costs of communication and can lead to improved efficiencies both in terms of production and in terms of logistics.</p> <p>Graham (1998): workers in lighter industries are more able to engage in e-work, i.e. telecommute, work from home or split work between locations, reducing transport requirements of these firms.</p> <p>Greenaway and Nelson (2000), Venables (1998): Changes in the firm, use of automated production, differing patterns of labour forces, and fragmentation of the production process has increased the need for carriage over distance in some elements of the production process, and led to the development of new trade theories.</p> <p>Weber (1929), Castells (1993, 1996), Cairncross (1997): the rise of ICTs will diminish the importance of business location as communication over distance becomes easier.</p> <p>Shen (2000): increasing ICT use has two major effects on transportation: (1) telecommunications partially substitute for travel to the workplace and to some other destinations; (2) often indirectly, telecomms stimulate new activities and generate <i>extra</i> travel.</p> <p>European Commission (2002): results of the EU EMERGENCE project imply the dominant forms of eWork have become use of remote offices, e.g. call centres, and employment of multi-locational workers, rather than fully home-based eWork. The largest and fastest growing proportion of eWork is outsourcing looking for technical expertise, cost and quality. Under current trends, approximately ten million new eworkers are likely by 2010, however, if changes in technology continue, this is likely to reach 27.12 million.</p> <p>HOP Associates (2000): Government (DETR) policy may be overly focused on modal shift at the expense of eliminating journeys altogether through ICT. Information age working practices must be linked to transport policy to take advantage of changes in technology.</p> <p>DETR (1997): uptake of teleworking in the Cambridge area could result in traffic reduction of 4% to 8%, mainly in the morning peak.</p> <p>Amárach Consulting (1999): traffic reduction figures from telecommuting in Dublin estimated at around 1 to 1.5%. However the study does recommend telecommuting as a policy due to the low cost of implementation compared with modal shift.</p> <p>HOP Associates (2000): problems expanding telecommuting result partly from an industrial age culture, i.e. an inherited a model of work that involves belonging to a company, owning a designated workplace and commuting. Other problems are social isolation, quality issues, and lack of employer support.</p> <p>Polèse and Shearmur (2002) provide Canadian evidence that ICT leads to greater concentration of business location in metropolitan areas and their hinterlands and reductions in remoter rural areas.</p>	<p>Have technological advances in telecoms diminished the role played by face-to-face agglomeration economies such as wages, transport and proximity to concentrations of services in determining the metropolitan location of firms?</p> <p>There is a lack of empirical data on the effect of changes in ICT on business location. This has resulted in a lack of consensus.</p> <p>Will the role of telecommuting expand to influence physical commuting and location decisions?</p> <p>Will ICT lead to greater concentration of business location in metropolitan areas and their hinterlands?</p>
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### 7.2.3 Business Characteristics (Chapter 4.2)

#### *Key evidence*

- In the UK, air transport has a greater influence on the location of foreign investors and business services, whereas road transport has a larger influence on domestic investment, light manufacturing and commercial businesses such as retailers.
- In the UK, air transport has a greater influence on the location of foreign investors and business services, whereas road transport has a larger influence on domestic investment, light manufacturing and commercial businesses such as retailers. Air transport investment can be used attract foreign inward investment, particularly electronics and business services, and to boost the tourism sector. It also appears to be important in promoting the perceived accessibility of an area - a function that motorways can also perform.

#### *Policy questions and gaps in knowledge*

<b>Evidence</b>
Corporation of London (2002): good air transport in particular is important for attracting business service firms as average
Gillis and Casavant (1994): highlight that investment in road infrastructure is a key to the location values of light industrial
SACTRA (1999): business location is usually determined by fixed natural assets - transport costs are borne by the consumer
Button <i>et al.</i> (1995): road and air infrastructure have a greater impact on inward investors than endogenous firms, with road
Almeida and Kogut (1997): transport factors among some high-tech manufacturing businesses are secondary to the need to
Smyth (2003): the manufacturing sector only accounts for around 15% of demand for inter-industry air services in N. Ireland

### 7.2.4 Labour Supply, Travel To Work and Social Inclusion (Chapter 4.3)

#### *Key evidence*

- Transport investment has been shown to increase workplace accessibility and therefore the labour market size and reduce job search costs (hence affecting the productivity of businesses).
- As labour supply is often one of the most important factors in business location, transport can be used as a tool to boost labour supply.
- The implications for social policy are also centred on accessibility, and certain groups (e.g. those with dependants, part time or low paid workers etc.) are less able and willing to travel far to work.
- Improvements to public transport services can help promote access to employment and services to vulnerable groups, particularly those without private transport.
- However, in addition to transport improvements it is important to consider business location - employers must be also encouraged to locate in accessible areas.
- Business relocation to decentralised areas can result in accessibility problems. It is also difficult to 'retro-fit' public transport solutions into these locations.

*Policy questions and gaps in knowledge*

<b>The importance of labour accessibility</b>	
<b>Evidence</b>	<b>Gaps</b>
<p>OECD (2002): improvements in accessibility follow from transport investment; this can increase the market size for labour.</p> <p>Trinder (2001): transport investment may also reduce job search cost and time, thus increasing the potential labour supply.</p> <p>Invest UK (2000, 2002): labour supply can be the most important factor in business location decisions. Availability of qualified staff, easy access to markets and external transport links were the 3 most important criteria.</p> <p>SACTRA (1999): firms have to determine supply and cost of the labour force as part of their location decisions. Transport infrastructure also affects the overall level of economic activity and therefore the demand for goods and services.</p> <p>McQuaid <i>et al.</i> (2001): socio-economic factors such as gender, dependent children and education were more influential in determining potential travel times of job seekers (and hence the chance of gaining employment) than provision of public transport, accessibility or access to private transport.</p> <p>Scottish Executive (2003): availability of good quality housing and safe and attractive residential environments are factors in attracting business investment.</p> <p>Department for Transport, (2001b): the take up of Travel Plans has been limited among private sector businesses, but more successful in certain areas of the public sector.</p>	<p>How does the need to attract different types of employees affect location decisions?</p> <p>Can businesses locate to facilitate linked trips (e.g. work, school, shopping) by employees?</p> <p>How can road design be altered to take into account the existence of linked trips? Are more radial roads required?</p> <p>How do the factors of transport improvements, improved planning regulations and suitable development policies effectively and efficiently interact?</p> <p>What factors are behind the urban to ex-urban shift of business?</p>
<b>The effect of business location and transport on social inclusion</b>	
<b>Evidence</b>	<b>Gaps</b>

<p>ODPM (2003a): social exclusion can be a barrier to accessing employment and services, particularly when reliant on public transport. Transport is a barrier to getting a job; accessing training and further education and accessing medical help.</p> <p>ODPM (2003a): transport and the location of services can reinforce social exclusion by preventing access to employment and services.</p> <p>ODPM (2003a): road traffic externalities, for example pollution and accidents, have a disproportionately large effect on socially excluded areas and people.</p> <p>Hine and Mitchell (2001a,b): transport policy often fails to include the needs of all individuals. Improvements to transport services can help promote social inclusion. Groups who stand to benefit are disabled (physical, fear, space, time), the elderly (physical, time), those without a car who live in peripheral estates (geographical), low income (economic, time), bus users (time) and women (fear, time).</p> <p>Houston (2001) firms relocating to decentralised locations create difficulties for workers that cannot relocate, particularly lower paid and low skilled workers and those dependent on public transport, especially women. There is also a problem that decentralised locations are more difficult to service by public transport.</p> <p>Grant (2001): transport for those who do not have access to a car is most effective if addressed at a community level.</p>	<p>What employment potential do major developments such as airports offer to excluded groups?</p>
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## 7.2.5 Spatial Scale (Chapter 4.4)

### *Key evidence*

- Much transport investment is likely to influence business location at local or intra-regional level, rather than generating regional or national growth.
- There is evidence to suggest that transport policies are more influential at influencing intra-regional and city level location decisions than those on a wider scale.
- Congestion is a major problem to be tackled in urban areas - it leads to unreliability of trips, adds to business costs and can drive business out of city centre locations.
- Transport policies aimed at moving business into cities are most effective if combined with other urban policies.

### *Policy questions and gaps in knowledge*

In which areas is congestion the biggest problem?	
Evidence	Gaps

<p>Ernst &amp; Young (1996): found that congestion and the unreliability of trips add to business costs, particularly for companies in the service sector and those serving urban areas.</p> <p>Scottish Executive (1999): congestion in urban areas can damage the viability and vitality of city centres by discouraging visitors and encouraging relocation to out-of-town areas.</p> <p>McKinnon (1998) effects of congestion on logistics are difficult to quantify, most companies found the effect on operating costs, inventory levels and investment in materials handling and IT to be weak or non-existent. Congestion did have some effect on labour costs and was a factor behind strategic decisions to increase depot numbers.</p>	<p>A need to conduct a wide-ranging survey of the impact of congestion on logistic operations across a wide range of companies and supplement this with direct observation and measurement.</p> <p>Are measurements of congestion in different areas actual or perceived? For example is perceived congestion in Middlesborough as severe as in London? There is a need for reliable, comparable measures of congestion.</p> <p>The longer-term effects of city bypass schemes on business location and traffic levels within the bypassed area</p> <p>Do traffic calming and pedestrianisation measures lead to an increase or a decrease in business activity? Will this vary between the short and long run?</p>
<b>The role of aviation infrastructure in attracting regional investment</b>	
<b>Evidence</b>	<b>Gaps</b>

<p>EEDA (2000): infrastructure investment is an important factor in firms' location decisions and a useful policy for regions competing for mobile investment.</p> <p>Adams and Raeside (2001): tourism and electronics industries are very dependent on air transport - investment in airport infrastructure with supporting public transport infrastructure would provide economic benefits to Scotland.</p> <p>Corporation of London (2002): almost 70% of firms consider air services to be critical for business travel by their staff and 50% consider air services critical for travel by their clients to meet with them. Videoconferences etc. are no substitute for face-to-face meetings for client relationship.</p> <p>Scottish Executive (2002): the majority (over 80%) of inward investment decisions are triggered by factors other than the desire to physically relocate operations, therefore the potential of transport to attract FDI is limited.</p> <p>Department for Transport (2001): <i>good air transport links to and from regional airports are</i> an important factor in decisions about inward investment and location of business; and airports brought in tourism and inward investment.</p> <p>Department for Transport (2003): air links are particularly important for peripheral regions such as Scotland and Northern Ireland due to the limitations posed by physical geography and distance on surface transport and the reliance of key industries (financial services, high-tech manufacture and tourism) on aviation.</p> <p>Department for Transport (2003): air services attract inward investment, particularly from overseas and open up new markets and supply chains for local firms. In Scotland alone, air services support 15,000 jobs indirectly.</p> <p>Department for Transport (2002b): regional air services have an important role to play in attracting mobile inward investment, tourism, increasing existing industry competitiveness and supporting wider regeneration and development, although it is difficult to quantify this.</p> <p>COFAR (2001): airport infrastructure is a factor to attract increasingly volatile business activities and inward investment and act as a business generator for the whole region. Part of the benefit comes indirectly from enhancing the image of the region.</p>	<p>Balancing the economic and environmental impacts of air infrastructure investment.</p> <p>The extent to which regional airport developments increase or displace jobs.</p>
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Does devolved government lead to differing outcomes?	
Evidence	Gaps
There is little evidence on the differing effects of devolution upon transport policies as they affect business location. Partly this is due to the limited remit of devolved governments and partly due to the limited time scale.	To what extent do changes in the regulatory framework of transport across the devolved nations impact on the location of businesses?

## 7.2.6 Growth versus Displacement (Chapter 4.5)

### *Key evidence*

- Policies aimed at inducing business to move from high to low growth areas can have positive effects for both areas. However, there is a lack of consensus on whether building transport infrastructure into low growth areas would be significantly helpful.
- Evidence suggests that large-scale transport infrastructure policies are likely to be successful in supporting growth in under-developed regions, but may be relatively ineffective in stimulating new growth.

### *Policy questions and gaps in knowledge*

<b>The issue of growth versus redistribution (displacement) of activity - balancing excess growth in some areas with decline and market failure in others.</b>	
Evidence	Gaps
<p>SACTRA (1999) It may be desirable to induce business to locate in some areas rather than others; there may be efficiency gains from inducing businesses to locate in industry or market clusters.</p> <p>DfT (2000): congestion is high in urban areas and is forecast to grow by 15%. Congestion is worst in London - large parts of the Underground are overcrowded in peak times &amp; demand is forecast to grow, also 4/10 commuter rail operators exceed overcrowding standards. Road congestion in London is 3½ times average for England.</p> <p>Scottish Executive (2001): relocation of economic activity to areas in need of regeneration at a local level may have social inclusion benefits.</p> <p>OECD (2002): any benefit will be dependent on the nature of the areas in question - a redistribution of activity from a congested area to a less well developed area will help spread growth evenly and help ease inflationary or capacity pressures.</p> <p>Treasury (2001): falling transportation costs may allow some businesses to move to lower growth regions, as this enables firms to outsource and take advantage of lower production costs in peripheral, low-wage regions.</p> <p>Treasury (2001): large-scale investments in transport infrastructure, e.g. Sicily and Mezzogiorno in Italy have failed to <i>stimulate</i> economic growth in the long run and have resulted in underutilisation of resources. However, when infrastructure is used to <i>support existing growth</i> it can be an effective catalyst for development, e.g. airports in Crete to support the growing tourist industry, inter-regional motorways in Abruzzo (Italy) to improve market access to local industry. Hence, transport is, not surprisingly, not a sufficient condition for development, but it is unclear what level of transport infrastructure and services is a necessary condition for different forms of development and business.</p> <p>ECOTEC (1999): attention must be given to where firms would relocate from and where their competitors and markets are located.</p> <p>Goodwin (2003) An investment in transport infrastructure in a region or local area may lead to a displacement of growth <i>away</i> from that area, depending on the market characteristics of that area.</p>	<p>There is a need to greater understand the growth versus redistribution debate.</p> <p>What is the best way to accommodate and sustain the growth of London and the South East?</p> <p>The extent of the 'Appalachian' or 'two-way road' effect, where new road developments suck activity out of an area they were designed to help.</p> <p>How the effects of transport investment depend on the market structure of industry in the recipient area.</p> <p>The balance between the growth and the redistribution effects of different forms of transport investment.</p>

## 7.2.7 Land Use, Location And Transport (Chapter 5)

### *Key evidence*

- Policies in the 1980s of encouraging out of town developments has lead to increased traffic and reduced accessibility for many.
- Transport policy can be used to reverse some of the negative aspects of this.
- While transport investment can be used as a stand-alone tool to help influence business to locate in accessible areas, for example by providing better bus services to city centres, it is most effective when used in partnership with other policies, such as labour market, inclusion and land-use planning.
- Ideally, transport planning should be *integrated within* land-use planning to ensure that both are effective in meeting objectives.

### *Policy questions and gaps in knowledge*

Do planning decisions influence business competitiveness?	
Evidence	Gaps



<p>ECOTEC (1999): Attention must be given to where firms would relocate from and where their competitors and markets are located.</p> <p>Scottish Executive (2000): many small local businesses in Edinburgh blame new style bus lanes for a decrease in turnover, mainly due to parking restrictions. Similar concerns have also been raised regarding congestion charging.</p> <p>Blackburn and Clay (1991): while the bypass of a town centre often removes the undesirable traffic congestion, truck traffic and reduces the number of traffic accidents in the town, the economic viability of many businesses located along the old route is often dependent upon the flow of traffic.</p> <p>Gerrard <i>et al.</i>, (2002): survey of business attitudes indicates that road user pricing and workplace parking levies will reduce profitability.</p> <p>DTLR (2002): proposal to create relaxed 'Business Planning Zones' met with mixed response. CBI stated they would encourage business development, some other consultees that they would encourage low quality and car-based developments.</p> <p>DETR (2000): There is little evidence that planning controls are restricting technology-based development. Research shows that there were few examples where council planning controls had constrained development</p> <p>Weisbrod (2001): road bypasses neither drastically reduce nor add to use of commercial premises in affected towns and cities. Shift in traffic throughput can correlate to business relocation, although data are not apparent on the extent of this relocation. Conversely, established city centres appear to benefit from the diversion of through traffic away from the area.</p> <p>Handy <i>et al.</i> (2001, 2002): Bypasses may have both positive and negative impacts on small communities. Communities benefit from a reduction in traffic externalities through the heart of the area. However, the reduction in through traffic may also have negative impacts on businesses in the community, particularly highway-oriented businesses located along the old route. At the same time, new development may occur along the relief route corridor. Empirical evidence on this is inconclusive.</p>	<p>What is the relative importance of planning compared to other factors on business location at a local level?</p> <p>Hard data on the influence of planning regulations on business location.</p> <p>Does the growth resulting from urban LRT implementation impact on the longer-term viability of centrally located businesses?</p>
<p><b>Development of key services and employment in accessible centralised locations</b></p>	
<p>Evidence</p>	<p>Gaps</p>

<p>Kawamara (2001): distinct differences between the transport and logistics needs of the city centre and suburban business.</p> <p>Kawamara (2001): typically mass retailing has seen a move away from city centres where access for private vehicles may be restricted to peripheral locations where access is increased for private motorists.</p> <p>Felsenstein (2002): the tendency for high-tech industries to locate in outer suburban areas causes more urban sprawl and greater potential accessibility problems than the same industry in an urban location <i>or</i> a number of alternative industries in the outer location.</p> <p>Knowles (1996): urban LRT in Manchester increased cross-city accessibility and the attractiveness of city central locations to users from the south of the city. The link increased the accessibility of central businesses most where existing infrastructure was weakest.</p> <p>Banister and Berechman (2000): additional rail investment where transport infrastructure is well-developed has little effect on accessibility.</p> <p>DfT (2002a): 1980s planning policies resulted in much major new development moving to out-of-town locations, often readily accessible only by car. This had the effect of increasing traffic, reducing access and choice - particularly for those without use of a car -and starting a spiral of decline in many of our town centres.</p> <p>ODPM (2003a): tackling accessibility problems involves planning the location of key services and centres employment where they are most accessible to those on low incomes. Transport provision alone is not the answer.</p> <p>Banister (2000): in Japan, rail infrastructure and high population density contribute to centralised patterns of development.</p> <p>Ryuzo (2000): identified that investment in road infrastructure in Japan is reducing economic activity clustered around stations as businesses relocate out of town.</p> <p>Walmsley and Perret, (1992) The development of the Tyne and Wear Metro had minimal impact on business location demand in specific local areas.</p> <p>Gerrard <i>et al.</i> (2002): road user and workplace parking charges in urban areas may encourage suburbanisation of business activity.</p> <p>Scottish Executive (2003): new development adjacent to existing community facilities can reduce the need for travel in general, particularly car journeys.</p>	<p>What is the impact of new transport management policies, including congestion pricing?</p>
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Linking transport and planning policies	
Evidence	Gaps
<p>Lawless and Gore (1999): the desire to link public transport investment to city development has not proved entirely successful - despite strong commitment to transport investment, regeneration has not been strong.</p> <p>Lawless (1999): Sheffield tram system - there is a problem of lack of integration between regeneration and transport providers that hinders the benefits of public transport investment.</p> <p>Knowles (1996): study of Manchester LRT tram link makes reference to interaction between transport and business location policies, specifically those intended to reduce or prevent urban decentralisation. Draws a correlation between policy in place, and the effectiveness of LRT schemes to impact on central development.</p> <p>DfT (2002a): transport has an important role in shaping and supporting new development. The planning system also needs to be able to respond to the need for new transport infrastructure. Spatial planning and transport planning therefore need to be closely co-ordinated.</p> <p>Goodwin (2003): the success of urban initiatives such as pedestrianisation schemes is dependant on policies being in place. e.g. pedestrianisation in conjunction with a light rail scheme, although the direction of causality is not proven.</p> <p>Bulkeley and Rayner (2001): transport strategies have been less effective if too focused upon accommodating existing transport demand through additional infrastructure and modal shift, rather than reducing travel demand via land use planning and other demand management policy.</p> <p>Priemus (1999): to improve interaction between land-use and transport planning it is necessary to give public transport a competitive edge through measures such as road user pricing. This would push public transport up the policy agenda.</p>	<p>A key concern is how might more effective co-ordination between and within bodies and agencies be achieved?</p> <p>Does the growth resulting from urban LRT implementation impact on the longer-term viability of centrally located businesses?</p> <p>What types of firms take up travel plans in new developments? Can we generalise this? Is take up linked to planning consent?</p> <p>Businesses investing in new developments can be unwilling to fund transport investments because of uncertainty over future land prices. Where can advance funding for transport investment come from?</p> <p>Does transport enhance urban policy objectives, or vice-versa, or is there two-way causality?</p>

## 7.2.8 Methodological Issues And Appraisal (Chapter 6)

### *Key evidence*

- LUTI models are useful in modelling the economic effects of transport on business activity, but have a number of limitations.
- LUTI models are likely to be most effective when integrated with other policy planning tools.
- When considering the impact of transport investment it is important to look beyond the Transport

Economic Efficiency (TEE) impacts on traffic and transport, and include other costs and benefits.

- The wider Economic Activity and Location Impacts (EALIs) need to be considered in impact studies.
- There is a need for more *ex-post* analysis of transport impact studies.
- Given the variety of factors influencing the role of transport, there is a need for greater use of multidisciplinary, micro-focused studies looking at specific issues, and an improvement of the associated research tools.
- New modelling paradigms and procedures are necessary if reliability, rather than travel time, is the most important factor in business location.

*Policy questions and gaps in knowledge*

Land Use Transport Models and Data Measuring Issues	
Evidence	Gaps

<p>SACTRA (1999): current LUTI models are useful in modelling the economic effects of transport on business activity, but have a number of limitations.</p> <p>Smyth (2003) LUTI models are likely to be most effective when integrated with other policy planning tools.</p>	<p>Whether current land use elements of transport models could be extended or integrated to provide indications of impacts of industrial change?</p> <p>There is a need for models to account for the effect of the business cycle, e.g. development of short run tracking models to look at traffic growth and GDP.</p> <p>Current models do not allow accurate forecasting of land use and transport.</p> <p>Improved reliability modelling - forecasting improvements in reliability.</p> <p>Can a 'portfolio' model of transport needs by industry cluster be developed to assess potential reduction in transport movements?</p> <p>There is a need for more time-series data on the impact of transport on business location at a micro (firm) level.</p> <p>Need for data on the relative importance of transport for each sector at firm level.</p> <p>Current multiplier analysis of the impact of large-scale transport infrastructure investment is dated, alternative techniques need to be investigated - what?</p> <p>Need to measure the gains from transport infrastructure investment in terms of reduced costs.</p> <p>Need to employ a meta-analysis of previous studies and re-run data from these to test their validity.</p> <p>There is a need for reliable, comparable measures of congestion.</p>
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Transport investment appraisal	
Evidence	Gaps
<p>Scottish Executive (2001): it is necessary to look beyond the immediate Transport Economic Efficiency (TEE) impacts on traffic and transport, into the wider economy Economic Activity and Location Impacts (EALIs) in a variety of sectors, when considering economic impacts.</p> <p>OECD (2002): traditional cost-benefit approaches to appraisal measure only the direct user benefits such as travel time and cost, while ignoring the wider socio-economic impacts. These benefits might include increased accessibility, employment, business efficiency, social inclusion and environmental improvements.</p> <p>Hine and Mitchell (2001a) Transport policy often fails to include problems common across different groups of society: physical, temporal, economic, spatial and psychological. Transport policy appraisal should incorporate these social factors in cost-benefit analysis.</p>	<p>Evaluation of the wider economic impacts of transport investment.</p> <p>Current cost/benefit analyses underestimate economic productivity gains from public sector transport infrastructure investment.</p> <p>A need for further research into understanding the processes by which transport investments produce positive impacts, and the level of these impacts</p> <p>Most appraisal work has been done on passenger transport. There is a need for more research on freight.</p> <p>Need to perform more <i>ex-post</i> analysis of transport impact and appraisal studies.</p>

## Annex 1: Methods Used in Literature Review

### Approach to Review

#### Methodology

We adopted a combined methodology incorporating extensive secondary research of existing work, and a focused phase of primary research designed to capture current practice and innovation.

This study differs from similar analyses principally by incorporating primary research methods throughout the process of the review. It was designed to combine the evidence presented from reviews of academic and other literature with discussion and comment from subject specialists and practitioners. The rationale behind the primary research was to: set a framework for analysis by identifying key issues in detail; to gather new material on theories and practice of the role of transport in business location and; to act as a 'sounding board' to confirm or otherwise interim findings of the secondary desk-based research. The methodology consisted of three key stages:

- The literature review
- Interviews held with key policy actors
- Two round tables -one with academics, the other with transport practitioners.

## Secondary Research

### Scope of Literature Review

The review examined academic literature, both UK and internationally sourced, and relevant literature from government and other public and private sector organisations. We organised the academic trawl by discipline focusing initially on transportation, economics, planning and management. The trawl of non-academic sources examined sources from local and regional government and LSCs/LECs, UK national government departments, EU and OECD sources, along with research by private consultancies. The trawl made use of electronic literature databases such as BIDS, Scirus, EconLit, the OECD TRANSPORT database, and individual university library catalogues. We also consulted international research through databases such as the EU's *Transport RTD Programme Knowledge Centre* - <http://www.europa.eu.int/comm/transport/extra/home.html> - and the American *Transportation Research Board (TRB-TRIS)* - <http://www3.nas.edu/rips>.

The tables below highlight the key academic journals covered in the trawl of literature.

Date Range Of Journals	
Journal Name	Date Ranges
Journal of Economic Literature (JEL)	Dec 1994 to September 2002 (direct access to JEL Web Site). 1998 -2002
Regional Studies	Journal first issued in 1967  From 1997
Urban Studies	Journal first issued in 1967  From 1995
Journal of Business Research	Journal first issued in 1974  From 1974
Journal of International Economics	Journal first issued in 1971  From 1971
Journal of Political Economy	Journal inception 1892
Journal of Public Economics	Journal first issued in 1972  From 1972
Journal of Transport Geography	Journal first issued in March 1993  From 1993

Regional Science and Urban Economics	Journal first issued in 1975  From 1975-1986 it was formerly known as Regional and Urban Economics. From 1975
Economic Development Quarterly	Journal first issued in 1970 by Sage  From 1999
Journal of Economic Geography	From 1999
Oxford Review of Economic Policy	Journal first issued in 1985  From 1985
ITE Journal (Institute of Transport Engineers)	Journal first issued in 1972
Oxford Economic Papers	Journal first issued in 1947  From 1996
The Annals of Regional Science	1984 - Current  From 1995

<b>Journal</b>	<b>Date Range Searched</b>
Standort	<i>1997 - 2003</i>
Environmental Planning	<i>1995 - 2003</i>
Environment and Planning (A)	<i>1990 - 2003</i>
Technovation	<i>1981 - 2003</i>
Urban Studies	<i>1995 - 2003</i>
Journal of Regional Science	<i>1997 - 2003</i>
European Urban and Regional Studies	<i>1999 - 2003</i>
Growth and Change	<i>1997 - 2003</i>
German Politics	<i>1998 - 2003</i>
Journal of Transport Geography	<i>1993 - 2003</i>
Journal of Materials Processing Technology	<i>1990 - 2003</i>
International Journal of Production Economics	<i>1991 - 2003</i>



International Journal of Information Management	1986 - 2003
Jahrbuch für Wirtschaftswissenschaften	1995 - 2003
European Journal of Operational Research	1995 - 2003
Regional Science and Urban Economics	1975 - 2003
Journal of Political Economy	1982 - 2003
Economic Development Quarterly	1992 - 2003
The Annals of Regional Science	1995 - 2003
Regional Studies	1996 - 2003
Transportation Research Record	1982 - 2003
ITE Journal (Institute of Transport Engineers)	1994 - 2003
Progress in Human Geography	1997 - 2003
Oxford Review of Economic Policy	1985 - 2003
Journal of Economic Geography	2001 - 2003
Oxford Economic Papers	1996 - 2003
Journal of Applied Behavior Analysis	1968 - 2003
Journal of Socio-Economics	1991 - 2003
Recherche - Transports - Sécurité	1988 - 2003
Trends in Cognitive Sciences	1997 - 2003

## Inclusion Criteria

The literature search developed a significant base of pertinent information relevant to the needs of the project. Much of the information has provided an input to the analysis. The following criteria have been adopted in order to identify evidence that is robust and directly relevant to current policy issues. Emphasis has also been placed upon more recent studies.

### *Article Overview*

Keyword searches based on the overview and structure indicated in the research proposal provided a preliminary overview of journal articles and academic papers for further review. In addition, papers cited within identified articles were also included in the initial trawl.

### *Descriptive, Case Study and Analytical Base*

Literature reviewed varied between studies and findings of an analytical or modelling nature, case study reviews, and descriptive analysis. This included a comparison against a detailed checklist (see below) including:

- Matching Discipline
- Matching Keywords
- Stated Geographical Area
- Transport Mode(s)
- Presentation of Findings
- Methodological Description
- Data within publication
- Availability
- Related Publications
- Impacts of Transport on Business Location
- Geographical scale
- Impacts of Business Location on Travel
- Overview of the Role of Policy
- Overview of Gaps apparent from this article

A fine level review also included summarising and internal discussion of data fit and appropriateness. A detailed listing of literature included, together with tabulation of further papers reviewed but not included, is given in Annex 2.

## **Primary Research**

The primary research consisted of interviews with key transport and planning policy makers in the DfT and ODPM, followed by two separate round table sessions, one with academics and one with practitioners.

### **Interviews**

Interviews were held with key personnel at the two departments to obtain views on trends and policy direction. Specifically, we discussed the following points.

0. are the current trends in business location
0. in your opinion are the main factors driving the location decisions of business
0. example labour costs, transport, corporate centralisation)
0. does the importance of transport influence location decisions made at a
0. How has it changed/ how is it changing
0. have the following changed the role of transport in location decisions
0. does the importance of transport differ by type of business?
0. are transport improvements most likely to lead to an increase of economic activity?
0. is current Department/Government policy regarding the use of transport to influence business location

We interviewed the following people.

<b>Name</b>	<b>Division</b>	<b>Responsibility</b>
Helen Bullock	Transport Research Unit, DfT	Head of Branch undertaking cross-cutting research in DfT
Kenneth Cameron	Planning Policies Division, ODPM	Developing planning obligations policies in transport and land use planning
Sarah Fielder	Urban Policy Unit, ODPM	Responsible for the analytical support to the Urban Policy Unit.
Liz Ketch	Planning Policies Division, ODPM	Head of Branch developing transport and land use planning policies
Paul Martin	Planning Policies Division, ODPM	Developing transport and land use planning policies
Jason Teal	Transport Research Unit, DfT	Undertaking research into cross-cutting issues in the DfT
Jeff Thompson	Economics, Aviation, Maritime and International Division, DfT	Appraisal methodology for airports, production of air transport forecasts at UK airports and airports allocation model.
Mike Walsh	Economics Local Transport and General Division	Head of division offering economic advice on transport appraisal techniques and project appraisal for local transport schemes and Local Transport Plans
Tom Worsley	Integrated Transport Economics and Appraisal	Head of division responsible for developing the National Transport Model. The division also provides advice on projects / scheme appraisal and on traffic and transport modelling

## Round Tables

The round tables were designed to bring together experts within the fields of transport and business development and allow a more varied discussion and cross-fertilisation of ideas than would have been possible in a one-to-one interview situation. The academic round table acted as a forum for exchange of ideas and comments on findings from the first phase of research, The practitioner round table was held at a later date and was a more confirmatory session, designed to test if the findings from the report to date were in line with their experiences as professionals in the field.

The round table works as a group discussion, but in a more structured format, with the initial discussion allowing each member of the group a set time to speak about the topic. The advantages of this over a general group discussion are to allow equal participation by all round table members, avoid intimidation by dominant personalities, and assure that the full range of all possible ideas is revealed. This is followed by a more open group discussion designed to explore in depth the issues that have been highlighted as

particularly important in the first stage.

#### *Academic Round Table*

Participants were selected to reflect a wide range of subject specialisms in transport, logistics and urban policy. This effectively covered all the bases in the process of planning and understanding business location. We selected people who we either knew could make a meaningful contribution or whose work we knew, implying that they would be able to make a contribution. Participants brought experience from the UK, Europe and the USA, and were briefed in advance to consider:

- the relative importance of transport in business location decisions;
- the relationship between land use planning and transport;
- the impact of changing technology on the role of transport in business location;
- other issues arising.

Attendees for the academic roundtable on 13 March 2003 were:

<b>Name</b>		<b>Organisation</b>	<b>Responsibility</b>
David	Banister	University College London, UK	Transport Planning
Alan	Brown	ODPM	Urban policy
Kenneth	Button	George Mason University, USA	Transport and public policy, air transport
Graham	Gudgin	Freelance consultant, UK	Industrial location, geography of employment
Alan	McKinnon	Heriot Watt University, UK	Logistics
Eddy	Van de Voorde	UFSIA, Belgium	Logistics and maritime economics

In addition to the above, we invited a number of people who were unfortunately unable to attend, although we anticipated some drop out when deciding on numbers to invite as is usual for such events. Those unable to attend included the following specialisms.

- Transport infrastructure and regional development
- Economic impacts of transport and transport appraisal.
- Regional and spatial economics
- Planning policy
- Effects of transport on industrial location and labour mobility, logistics.
- Transport modelling

### *Practitioner Round Table*

Participants were selected to represent practical expertise in the transport, business location and economic development fields in both the UK and Europe. We selected people to represent a wide range of subject areas to ensure that input was given on as many sections of the report as possible. Participants were given the same advance brief as for the academic round table.

Attendees for the practitioner roundtable on 20 March 2003 were:

<b>Name</b>		<b>Organisation</b>	<b>Responsibility</b>
Mario	Aymerich	European Investment Bank	Projects Directorate
Rachel	Burns	British Retail Consortium	Environment & Transport Policy Executive
Randall	Faulkner	NITL, Dublin	Director
Gareth	Leigh	DTI	Director for Innovation Research and Technology Policy
Mary	MacLaughlin	Scottish Enterprise	Head of Transport Team
Robin	Shore	National Assembly for Wales, Welsh Assembly Government	Transport Director
Ursula	Huws	Institute for Employment Studies / EU EMERGENCE project	SUSTEL Project, teleworking and commuting. EMERGENCE - technology and employment location.
Richard	Elliott	Manchester City Council	Transport Policy
Nigel	Dotchin	DfT	Strategic lead on planning and regional aspects of the 10 Year Plan Review
Sarah	Fielder	ODPM	Responsible for the analytical support to the Urban Policy Unit

Additionally, we invited people from the following organisations, who were unfortunately unable to attend.

- Manchester Airport
- Teesland Regeneration
- Freight Transport Association
- CBI
- Invest UK
- English Regional Development Agencies
- Scottish, Welsh and Northern Irish Executive/Assemblies

### *Assessment of Round Table Methodology*

Overall, we were pleased with the outcome of the round tables and felt that they contributed usefully to the study. We would highlight the following specific issues.

- What worked well:
  - - Balanced discussion in both sessions with every participant making a useful contribution;
    - Every subject raised at the academic session was discussed in a useful level of detail;
    - Gaps in research highlighted at the academic session;
    - The issues felt to be of most importance were picked up at both sessions.
    - The two separate sessions were necessary in terms of participants and focus of discussion.
- What worked less well:
  - - Some areas that we would like to have discussed at the academic session were not covered due to the limited number of participants and lack of time;
    - Likewise, the number of topics and depth at the practitioner session was slightly limited due to time constraints.
- What we would do differently next time:
  - - Invite slightly more participants to the academic round table, although we would want to keep this to fewer than 10;
    - Invite slightly fewer participants to the practitioner session, or extend the time available for discussion;

## **Acknowledgements**

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## **Annex 2: References**

AA/CBI (1998) *Transport Links and the Economy*, Automobile Association and Confederation of British Industry

Abraham, J.E. and Hunt, J. D. (1999) *Firm location in the Meplan model of Sacramento* Transportation Research Record 1685

Adam, B., and Pätz, T. (1999) "Angewandte geographie: Räumliche Arbeitsteilung in Großstadtregionen" *Standort*, Vol. 23/3, pp12-20

- Almeida, P. and Kogut, B. (1997) "The exploration of technological diversity and the geographic localisation of innovation" *Small Business Economics* Vol. 9, pp21-31
- AmÃ¡rach Consulting (1999) *Telecommuting: The shortest route to work*. Dublin Transportation Office.
- Amin, A. and Malmberg, A. (1992) "Competing structural and institutional influences on the geography of production in Europe" *Environment and Planning A*, Vol. 24, pp401-416
- Amirahmadi, H. and Wallace, C. (1995) "Information technology, the organisation of production, and regional development" *Environment and Planning A*, Vol. 27, pp1745-1775
- Amiti, M. (1998) "New trade theories and industrial location in the EU: A survey of evidence" *Oxford Review of Economic Policy*, Vol. 14/2, pp45-53
- Armstrong, H. and Taylor, J. (2000) *Regional Economics and Policy* 3<sup>rd</sup> Edition. Philip Allen
- Arnold, U. and Bernard, K. (1989) "Just-in-time: Some marketing issues raised by a popular concept in production and distribution" *Technovation*, Vol. 9/5, pp401-430
- ASPECT 2001 Case Studies Report EU Intereg II
- Audretsch, B. (1998) "Agglomeration and the location of innovative activity" *Oxford Review of Economic Policy*, Vol. 14/2, pp18-29
- Aiyagari, R., Lawrence J. and Eichenbaum, M. (1992) The output, employment, and interest rate effects of government consumption *Journal of Monetary Economics* Volume 30, Issue 1, October 1992, pp. 73-86
- Banai-Kashani A. R (1990) "Dealing with uncertainty and fuzziness in development planning: a simulation of high-technology industrial location decision-making by the analytic hierarchy process" *Environment and Planning A*, Vol. 22, pp1183-1203
- Bates, L. (1996) "Evaluating the cost of development" presented at The Public Symposium on revitalisation of the local economy using Information Technology, Ogaki, Japan, 2-4 Sept 1996
- Blackburn, S. P. and Clay, J. W. (1991) *Interstate 40 economic impact study: impacts of highway bypasses on community businesses* North Carolina University, Research Report
- Borts, G. H., Stein, J. L. (1964) *Economic Growth in a Free Market*. New York Columbia University Press
- Breheny (1999) (Ed.) *The People: Where Will They Work*, Town and Country Planning Association, London.
- Commission Of The European Communities (CEC) (1993) *White Paper on Growth, Employment and Competitiveness*. Brussels: Commission of the European Communities
- Brenner, N. (2000) "Building 'Euro-regions': locational politics and the political geography of neoliberalism in post-unification Germany" *European urban and regional studies*, Vol. 07/04, pp319-346

Brown, D. M. (1999) *Highway investment and rural economic development. an annotated bibliography* Research Report of US Economic Research Service

Brown, W. M and Anderson, W. P. (1999) "The influence of industrial and spatial structure on Canada-U.S. regional trade" *Growth and Change*, Vol. 30, pp23-47

Bruinsma, F.R., Rienstra, S.A., and Rietveld, P. (1997) "The economic impacts of the construction of a transport corridor: a multi-level and case study for the construction of the A1 highway in the Netherlands" *Regional Studies*, 34, 4, 391-402

Button, K., Leitham, S., McQuaid, R.W., and Nelson, J.D. (1995) "Transport and industrial and commercial location" *The Annals of Regional Science*, **29**, 189-206

Button, K. and Costa, A. (1999) "Economic efficiency gains from urban public transport regulatory reform: two case studies of changes in Europe" *The Annals of Regional Science*, Vol. 33/4, pp425-438

Camacho, A. and Persky, J. (1990) "Variability and location" *Environment and Planning A* , Vol. 22, pp69-77

Campagni, R. P. (1995) "The concept of innovative *milieu* and its relevance for public policies in European lagging regions" *Regional Science*, Vol. 74, pp317-340

Campion, A. Larwin, Schuman and Wolsfield (2000) *Light Rail Transit, future opportunities and challenges* TRB A1E12

Carley, M., and Donaldson, S. (1997) *Sustainable development and retail vitality: state of the art for towns and cities* Historic Burghs Association of Scotland and Transport 2000, London

Carter, C. and Grieco, M. (2000) "New deals, no wheels: social exclusion, tele-options and electronic ontology", *Urban Studies*, Vol. 37/10, pp1735-1748

CBI (1995) *Moving Forward: A Business Strategy for Transport*, London, Confederation of British Industry

Chakrabarti (2001), *Determinants of FDI: A Comment on Globalisation-Induced Changes and the Role of FDI Policies*, UWM, report to the World Bank

Chisholm, M. (1971) "Freight costs, industrial location and regional development" in Chisholm, M. and Manners, G. (eds.) *Spatial Policy Problems of the British Economy*, Cambridge University Press.

Cogley, T. and Nason, J. (1995) "Output Dynamics in Real-Business-Cycle Models" *American Economic Review* Volume 85, Issue 3, June 1995, pp. 492-511

Commission for Integrated Transport (2003) *10 Year Transport Plan: Second assessment report*, London

Cooke, P. (ed.) (1995) *The Rise of the Rustbelt*, London, UCL Press



Cooke, P. (2002). *Knowledge economies: clusters, learning and co-operative advantage*. London: Routledge

Core Cities (2002) *Cities, regions and competitiveness*, interim report from Core Cities Working Group, Birmingham, UK

Cornwall County Council (1999) *A Socio-Economic Profile of Cornwall*

Corporation of London (2002) *The Use of Aviation Services in the City of London and the Central London Business District and the Implications for Future Aviation Policy*

Crampton, G. R. (1991) "Residential density patterns in London -- any role left for the exponential density gradient?" *Environment and Planning A*, Vol. 23, pp1007-1024

Deakin, E. A. (1991) Jobs, housing and transportation: theory and evidence on interactions between land use and transportation. transportation, urban form, and the environment proceedings of a conference, Beckman Center, Irvine, California, December pp9-12, 1990 Transportation Research Board Special Report 231

Cushman and Wakefield (2002) *European Cities Monitor 2002*, Cushman & Wakefield Healey & Baker, London

DeJonga, D N, Ingram D, and Whiteman, C (2000) "A Bayesian approach to dynamic macroeconomics" *Journal of Econometrics*, Volume 98, Issue 2, October 2000, Pages 203-223

Department for Transport (2001a) *Government's consultation document on air transport policy: A report on the response to the public consultation*, 12 Nov 2001

Department for Transport (2001b) *Take Up and Effectiveness of Travel Plans and Travel Awareness Campaigns*, February 2001

Department for Transport (2002a) *10yr plan: Delivering Better Transport: Progress Report, 17 December 2002*

Department for Transport (2002b) *The Economic Contribution of Aviation to the UK :Part 2 - Assessment of Regional Impact*, Oxford Economic Forecasting

Department for Transport (2003a) *The Future Development of Air Transport in the United Kingdom: Scotland  
A National Consultation Summary Document*

Department for Transport (2003b) *Transport and City Competitiveness*, forthcoming.

Diamond, D. and Spence, N. (1989) *Infrastructure and industrial transport costs in British industry*. Department of Trade and Industry, London: HMSO.

Doeringer, P. B. and Terkla, D. G. (1995) "Business Strategy and Cross-Industry Clusters" *Economic Development Quarterly*, Vol.9, pp225-237

Drucker, P. F. (1990) "The emerging theory of manufacturing" *Harvard Business Review*, Vol. May-June, pp94-102

DTI (1998) *Our Competitive Future: Building the Knowledge Driven Economy*, Cmnd 4176, London, HMSO.

DTI (2001a) *Ernst and Young figures show that UK is Europe's favourite place to invest* Department of Trade and Industry report, 2 May 2001

DTI (2001b) *UK inward investment continues to rise*, Department of Trade and Industry Report, 11 July 2001

ECMT (2001) *Conclusions of Roundtable 119: Transport and Economic Development*, European Conference of Ministers of Transport Committee of Deputies CEMT/CS(2001)37

Eberts, D., and Randall, J. E. (1998) "Producer services, labor market segmentation and peripheral regions: the case of Saskatchewan" *Growth And Change*, Vol. 29, pp401-422

ECOTEC (1999) *Review of methodology for assessing the economic development impacts of new highway infrastructure*.

Edwards, S.L. (1970) "Transport costs in British industry" *Journal of Transport Economics and Policy*, Vol. 4

Edwards, S.L. (1975) "Regional variations in freight costs" *Journal of Transport Economics and Policy*, Vol. 9, No.2

EEDA (2000) *Infrastructure benchmarking study* Report by Steer Davies Gleave to East of England Development Agency, Cambridge

Ellison and Glaeser (1997) "Geographic concentration in U.S. manufacturing industries: a dartboard approach" *Journal of Political Economy*, Vol. 105/5, pp889-927

Ernst & Young (1996) *'Transport Infrastructure, Business Costs and Business Location'*, Ernst and Young, Beckett House, 1 Lambeth Palace Road, London SE1 7EU,.

Fleischhauer, D., Märker, O., Pipek, V., and Schmidt, D. (1998) "Planungsbeteiligung durch Informations- und Kommunikationstechnik" *Standort*, Vol. 22/4, pp19-25

Florida, R. (2002) *The Rise of the Creative Class: and How It's Transforming Work*, New York, Basic Books.

Forkenbrock, D., Foster, N. (1996) "Highways and business location decisions" *Economic Development Quarterly*

Forslid, R. Haaland, Midelfart, I., and Knarvik, K. I. (1999) "A U-shaped Europe? - A simulation study of industrial location" *Journal of International Economics*, Vol. 57/2, pp273-297

Freeman, R. B. (2002) "The labour market in the new information economy" *Oxford Review of Economic Policy*, Vol. 18 pp288-305

Fujita, M. Krigman, P.R., and Venebles, A.J. (1999) *The Spatial Economy: Cities, Regions And International Trade*, MIT Press, Cambridge, Mass.

Fuller-Love, N. and Cooper, J. (2000) "Deliberate versus emergent strategies: a case study of information technology in the Post Office" *International Journal of Information Management* , Vol.20/3 209-233

Gillis, W. R. and Casavant, K. L. (1994) *Linking transportation system improvements to new business development in eastern Washington*, Washington State Department of Transportation

Goldenberg, L., Zhang, J. and Dickson, C. (1998) *Assessment of the joblinks in demonstration projects: connecting people to the workplace and implications for welfare reform*, TRB Paper Number 980813

Goodwin, P. (2003) *Unintended effects*, UCL Working Paper

Gore, C. G. (1991) "Location theory and service development planning: which way now?" *Environment and Planning A*, Vol. 23, pp1095-1109

Government Office for the Eastern Region (1997) *Transport Investment, Transport Intensity and Economic Growth* submission to SACTRA

Graham, S. (1997) "Cities in the real-time age: the paradigm challenge of telecommunications to the conception and planning of urban space" *Environment and Planning A*, Vol. 29, pp105-127

Graham, S. (1998) "The end of geography or the explosion of place? Conceptualizing space, place and information technology" *Progress in Human Geography*, Vol. 22/2, pp165-185

Graham, B. and Guyer, C. (2000) "The role of regional airports and air services in the United Kingdom" *Journal of Transport Geography*, 8, 249-262

Grant, M. (2001) *Addressing social exclusion in Liverpool: the role of public transport* WHO Centre for Urban Health, WHO Regional Office for Europe

Gray, M. and Parker, E. (1998) "Industrial change and regional development: the case of the US biotechnology and pharmaceutical industries" *Environment and Planning A*, Vol. 30, pp1757-1774

Greenwood, J. Hercowitz, Z; and Huffman, G W. (1998) Investment, Capacity Utilization, and the Real Business Cycle *American Economic Review* Volume 78, Issue 3, June 1988, pp. 402-417

Grieco, M. (1994) *The Impact of transport investment projects upon the inner city* Avebury

Grieco, M., Kirby, H.R. and Turner, J. (2000). "A new enlightenment: transport, telematics and the reduction of social exclusion". *Scottish Transport Review*, Vol. 8, pp 8-9

Grovdahl, D. H. and Hill, E. T. (2000) *Regional Planning And Intelligent Transportation*

Guo, J.T. (2003) "Increasing returns, capital utilization, and the effects of government spending" *Journal of Economic Dynamics and Control Article in Press*

Gutiérrez, J. (1996) "Location, economic potential and daily accessibility: an analysis of the accessibility impact of the high-speed line Madrid-Barcelona-French border" *Journal of Transport Geography*, Vol. 4/1, pp15-25

Haag, G., Munz, M., Pumain, D., and Sanders, L. (1992) "Interurban migration and the dynamics of a system of cities: 1. The stochastic framework with an application to the French urban system" *Environment and Planning A*, Vol. 24, pp181-198

Hairault, J. (1997) *Public Policies, Business Cycles and Macroeconomic Stability: Should we Rebuild Built-in Stabilizers?* Kluwer

Halcrow Group (2002) *C07: Regeneration Case studies 1<sup>st</sup> case study report*, Highways Agency

Hall, P. Breheny, M. McQuaid, R. W. and Hart, D. (1987) *Western Sunrise - The Genesis and Growth of Britain's Major High-Tech Corridor*. London: George Allen & Unwin

Hamilton, K. and Jenkins, L. (2000) "A gender audit for public transport: a new policy tool in the tackling of social exclusion" *Urban Studies*, Vol. 37/10, pp1793-1800

Hass-Klau, C. (1993) "Impact of pedestrianisation and traffic calming on retailing: a review of the evidence from Germany and the UK". *Transport Policy* 1, Vol.1 October

Handy, S. Kubly, S. and Oden, M. (2002) *Economic impacts of highway relief routes on small communities: case studies from Texas* Transportation Research Record 1792

Handy, S. Kubly, S. Larsen, D. Sralla, J. Vanka, S. and Oden, M. (2001) *Economic impacts of highway relief routes on small- and medium-size communities: case studies* Texas Department of Transportation

Harding, R. (1999) "Standort Deutschland in the globalising economy: an end to the economic miracle?" *German Politics*, Vol. 8/1, pp66-88

Haughwout, A. F. (1999) "State Infrastructure and the geography of employment" *Growth and Change*, Vol. 30/4

Hayter, R., Patchell, J. and Rees, K. (1999) "Business segmentation and location revisited: innovation and the terra incognita of large firms" *Regional Studies*, Vol. 33, pp425-442

Henry, M. S., Schmitt, B., Kristensen, K., Barkley, D. L., and Bao, S. (1999) "Extending Carlino-Mills models to examine urban size and growth impacts on proximate rural areas" *Growth And Change*, Vol. 30/4

Hine, J. and Mitchell, F. (2001) "Better for everyone? Travel experiences and transport exclusion" *Urban Studies*, Vol. 38/2, pp319-332

Home Office Partnership & Hague Consulting Group (1997) *Assessing the Impact of Advanced Telecommunications on Work-related Travel*. Study commissioned by the Department of the Environment, Transport and the regions, under the Seedcorn programme

HOP Associates (2000) *Telecommuting 2000*, HOP Associates, Cambridge, UK

Horner, M. W. and O'Kelly, M. E. (2001) "Embedding economies of scale concepts for hub network design" *Journal of Transport Geography*, Vol. 9/4, pp255-265

Hospers, G.J, (2002) "Beyond the blue banana? Structural change in Europe's geo-economy" Paper presented at 42 European Congress of the Regional Science Association, Dortmund, Germany, 2002

Hotelling, H. (1929) "Stability in competition" *Economic Journal*, 39, pp.41-57

Houston, D. (2001) "Testing the spatial mismatch hypothesis in the United Kingdom Using evidence from firm relocations" in Pitfield, D. (Ed.) *Transport Planning, Logistics and Spatial Mismatch, European Research in Regional Science No.11*, Pion, London

Hughes (a) (2001) *Guide to Good Practice, Aspect, EU*, EU Intereg II

Hughes, G. (2001) *Final synthesis report, analysis of spatial planning and emerging communications technologies* EU Intereg II

Hunt, J., Kriger, D. and Miller, E. (1999). Current operational urban land-use transport modelling frameworks. *Proc 79th Annual Meeting of the Transportation Research Board (CD-ROM)*. TRB, National Research Council, Washington DC

Huws U, and O'Regan S. *eWork in Europe: Results from the Emergence 18-Country Employer Survey* Institute for Employment Studies Report 380, for EU Emergence project

Huws U, Jagger N, and Bates P. (2001) *Where the butterfly alights : the global location of Ework* , Institute for Employment Studies Report 378, for EU Emergence project

Immergluck (2001) "The financial services sector and cities: restructuring, decentralization, and declining urban employment" *Economic Development Quarterly*

Ingram, B. and Whiteman, C. (1994) "Supplanting the 'Minnesota' prior: Forecasting macroeconomic time series using real business cycle model priors" *Journal of Monetary Economics* Volume 34, Issue 3 , December 1994, Pages 497-510

Invest UK (2000) *Exult To Establish UK Client Service Centre*, Press Release, 10 Feb 2000

Invest UK (2002) *London Voted Best European Business City*, Press release, 18 October 2002

Ireland, P. (2003) "A method for taking models to the data" *Journal of Economic Dynamics and Control In Press*

Juchelka, R. (2002) "Angewandte geographie: Bahnhof und Bahnhofsumfeld - ein Standortkomplex im Wandel" *Standort*, Vol. 26/1, pp12-16

Karlsson, C. (1999) "Spatial industrial dynamics in Sweden: Urban growth industries" *Growth and Change*, Vol. 30/2

Karlsson, C. (2003) "Spatial ICT Clusters in Sweden - An Empirical Method to Identify a Necessary Condition for Existence", JÄrnköping International Business School JÄrnköping University, Sweden, Paper presented at European Regional Science Association, 43 Congress, Jvaskyla, Finland.

Kawamura, K. (2001) *Empirical examination of relationship between firm location and transportation facilities* Transportation Research Record Transportation and Public Policy 1747

Keeble, D. Tyler, P. (1995) "Enterprising behaviour and the urban-rural shift" *Urban Studies* Vol. 32/6, pp975-997

Kelly, P. F. (1999) "The geographies and politics of globalization" *Progress in Human Geography*, Vol. 23/3, pp379-400

Kirby, H.R. and Raji, F.A.O. (1993). Location behaviour and the journey to work. In: *LYON'92, Selected Proceedings of the 6<sup>th</sup> World Conference on Transport Research, Vol. II: Demand, Traffic and Network Modelling*. France, pp 715-726. ISBN 2-908558-03-03

Knowles, R. D., Law, C. M., Senior, M. L., Grime, E. K. and Fairweather, E. A. (1994) *Metrolink impact study*

Knowles, R. D. (1996) "Transport impacts of Greater Manchester's Metrolink light rails System" *Journal of Transport Geography*, Vol. 4/1, pp1-14

Kohlhase J. E. and Ohta, H. (1990) "LÃschian spatial competition and the related labor market" *Environment and Planning A*, Vol. 22, pp1223-1238

Kokko, A (2000) *Globalisation and FDI Incentives*, Stockholm School of Economics, report to the World Bank

Kozul-Wright, R. and Rowthorn, R (1998) "Spoilt for choice? multinational corporations and the geography of international production" *Oxford Review of Economic Policy*, Vol. 14/2, pp74-92

Krugman, P. (1991) "Increasing returns and economic geography" *Journal of Political Economy*, Vol. 99, pp483-499

Lawless, P. and Gore (1999) "urban regeneration and transport investment" *Urban Studies*, Vol. 36/3, pp527-535

Lindsay, C., McCracken, M. and McQuaid, R. (2003) "Unemployment duration and employability in remote rural labour markets" *Journal of Rural Studies*, 19, pp.187-200

- Linneker, B. J. Spence, N. A. (1996) "Road transport infrastructure and regional economic development : the regional development effects of the M25 London orbital motorway" *Journal of Transport Geography*, Vol. 2/4, pp77-92
- Lo, L. (1991) "Spatial structure and spatial interaction: a simulation approach" *Environment and Planning A* , Vol. 23, pp1279-1300
- Lo, L. (1992) "Destination interdependence and the competing- destinations model" *Environment and Planning A*, Vol. 24, pp1191-1204
- London First Center (2002) *London Voted Europe's Best Business City*, Press Release, 17 October 2002
- Losch, A. (1944) "Die Raumliche Ordnung der Wirtschaft, Fischer, Jena" trans. by. Wolgom, W.H (1954), *The Economics of Location*, Yale University Press, New Haven.
- Love, L. L. and Crompton, J. L. (2000) "The Role of Quality of Life in Business (Re)Location Decisions" *Journal of Business Research* , Vol. 44/3, pp211-222
- Madhu S. and Mohanty (2001) "Testing for the Specification of the Wage Equation: Double Selection Approach or Single Selection Approach", *Applied Economics Letters*, 2001, Vol. 8, 8, pp. 525-29
- Malecki, E. (1997). *Technology and Economic Development*, Longman
- Manning A. (1993). "Wage Bargaining and the Phillips Curve: The Identification and Specification of Aggregate Wage Equations". *Economic Journal*, **103**, 98-118
- Maurel, F. and SÃ©dillot, B. (1999) "A measure of the geographic concentration in French manufacturing industries" *Regional Science and Urban Economics*, Vol. 29/5, pp575-604
- Mazzonis, D. (1989) "Small Firm Networking, Co-operation and Innovation in Italy Viewed by an Agency Engaged in Actions for Stimulating the Technological Upgrading of Industry" *Entrepreneurship and Regional Development*, Vol. 1, pp61-74
- McCalla, RJ, Slack, B, and Comtois, C (2001) "Inter-modal freight terminals: locality and industrial linkages", *Canadian Geographer*, Vol.45, No.3, pp.404-413
- McCann, P. (1998) *The Economics of Industrial Location: A Logistics-Costs Approach*, Springer, Berlin
- McCann, P. (2001) *Urban and Regional Economics*, OUP, Oxford
- McCracken, C. and Casavant, K. L. (1994) "Methodology for Estimating Impact of Transportation Infrastructure on Business Location in Rural Northwest Communities" Official Report TNW94-02, TransNow, Washington State University
- McDonald, J. F. and McMillen, D. P. (1990) "Employment subcenters and land values in a polycentric urban area: the case of Chicago" *Environment and Planning A*, Vol. 22, pp1561-1574

- McGregor, A., Fitzpatrick, Z. and Glass, A (1998) *Regeneration areas and barriers to employment*, Edinburgh, Scottish Executive, Central Research Unit
- McMullen, B. S., Casavant, K. L. (1992) *Methodology for estimating impact of transportation infrastructure on business location in rural northwest communities* Final report
- McQuaid, R.W. (2000) "Implications of European Union Expansion for Peripheral Regions" in Nijkamp, P., Kohno, H., and Poot, J. (eds) *Regional Cohesion and Competition in the Age of Globalisation*, (Edward Edgar, London) pp284-308
- McQuaid, R.W., Greig, M. and J. Adams (2001) "Unemployed Job Seeker Attitudes Towards Potential Travel-to-Work Times," *Growth and Change*, Vol. 32, 4, pp.356-69
- McQuaid, R.W., and Greig, M. (2002) *Transport and the Scottish Economy - Key Issues*, Scottish Economic Policy Network, Stirling and Glasgow
- Miller, H. J. and O'Kelly, M. E. (1991) "Properties and estimation of a production-constrained Alonso model" *Environment and Planning A*, Vol. 23, pp127-138
- Minner, S. (2003) "Multiple-supplier inventory models in supply chain management: A review" *International Journal of Production Economics*, Vol. 81/82, pp265-279
- Monk, S., Dunn, J., Fitzgerald, M. and Hodge, I. (1999) *Finding work in rural areas: barriers and bridges*, Joseph Rowntree Foundation, York
- Moses, L.N. (1958) "Location and the theory of production" *Quarterly Journal of Economics*, 78, pp.259-272
- Moshirian, F. (1998) "National Financial Policies, Global Environmental Damage and Missing International Institutions" *International Journal of Social Economics* Volume 25, Issue 6-7-8, 1998, pp. 1255-1270
- Moshirian, F. (2003) "Globalisation and financial market integration" *Journal of Multinational Financial Management* Article in Press
- Myrdal, G. (1957). *Economic Theory and Underdeveloped Regions* London, Duckworth
- Nijkamp, P. and Baaijens, S. (1999) "Time Pioneers and Travel Behavior: An Investigation into the Viability of 'Slow Motion'" *Growth And Change*, Vol. 30, 2
- O'Brien, J. P. and Shieh, Y. N. (1990) "Quantity-discounted transportation rates, location, and the theory of production" *Environment and Planning A*, Vol. 22, pp1487-1496
- ODPM (1992a) *Planning Policy Guidance Note 4: Industrial and Commercial Development and Small Firms*, Office of the Deputy Prime Minister (and predecessors), London
- ODPM (1992b) *Planning Policy Guidance Note 5: Simplified Planning Zones*



ODPM (1996) *Planning Policy Guidance Note 6: Town Centres and Retail Development*

ODPM (1999) *The Economic Consequences of Planning to the Business Sector*

ODPM (2000) *Planning Policy Guidance Note 11: Regional Planning*

ODPM (2001) *Planning Policy Guidance Note 13: Transport*

ODPM (2003a) *Making the Connections: Final Report on Transport and Social Exclusion*, Report by the Social Exclusion Unit

OECD (2002) *Impact of Transport Infrastructure Investment on Regional Development*, OECD Publications, Paris

O'Farrell, P. N. (1998) "Internationalisation by business service firms: towards a new regionally based conceptual framework" *Environment and Planning A*, Vol. 30, pp109-128

Pal, J., Bennison, D., Clarke, I. and Byrom, J. (2001) "Power, policy networks and planning: the involvement of major grocery retailers in the formulation of Planning Policy Guidance Note 6 since 1988" *International Review of Retail, Distribution and Consumer Research*, Jul 2001, Vol. 11, 3, pp.225-246

Parkinson, M., Bianchini, F., Dawson, J., Evans, R. and Harding, A. (1992) *Urbanisation and the Functions of Cities in the European Community*. Brussels: European Commission

Peeters, D., Thisse, J. D., and Thomas, I. (2000) "On high-speed connections and the location of activities" *Environment and Planning A*, Vol. 32, pp2097-2112

Pellenbarg, P.H., van Wissen, L.J.G. and van Dijk, J. (2002) Firm migration, in McCann, P. (ed.) *Industrial location Economics*, Edward Elgar, Cheltenham

Phelps, N. A., Fallon, R. J. and Williams, C. J. (2001) "Small Firms, Borrowed Size and the Urban-Rural Shift" *Regional Studies* Vol. 35, 7, pp613-624

Pickup, L. (1989) "Women's travel requirements: employment, with domestic constraints" in Grieco, M., Pickup, L. and Whipp, R (1989) *Gender, Transport and Employment: the impact of travel constraints*, Aldershot: Gower

Pieda Consulting (1984) "Transport costs in peripheral areas" *ESU Research paper No.9*, Industry Department for Scotland

Piore, M.J., Sabel, C.F. (1984). *The Second Industrial Divide: Possibilities for Prosperity*, Basic Books

Polese, M. and Shearmur, R. (2002) *The Periphery in the Knowledge Economy*, The Canadian Institute for Research on Regional Development, Quebec

Porter, M. (1990) *The Competitive Advantage of Nations*, Free Press, New York

Porter, M. (1998) "Clusters and the New Economics of Competition" *Harvard Business Review*, Vol. 76, 6, pp77-90

Predhol, A. (1928) "The theory of location in its relation to general economies" *Journal of Political Economy*, Vol. 36, pp.371-390

Pull, K. (2001) "Standortfaktor Arbeitsrecht: Die Bedeutung von sunk costs für Investitionsentscheidungen" *Jahrbuch für Wirtschaftswissenschaften* Vol. 2, pp190-201

Puu, T. (1991) "Hotelling's migration model revisited" *Environment and Planning A*, Vol. 23, pp1209-1216

Qing Shen (2000) "New telecommunications and residential location flexibility" *Environment and Planning A*, Vol. 32, pp1445-1463

RECLUS (1989) *Les Villes Europeennes: Rapport pour la DATAR*, RECLUS, Montpellier

Reynolds (1995) "The German recycling experiment and its lessons for United States policy". *Villanova Environmental Law Journal*, Volume VI, 1

Robinson, F. and Stokes, G. (1987) "*Rapid Transit and Land Use: The Effects of the Tyne and Wear*" Metro Discussion Paper 88, Centre for Urban and Regional Development, University of Newcastle upon Tyne

Rondinelli, D.A. and Burpitt, W.J. (2000) "Do government incentives attract and retain international investment? A study of foreign-owned firms in North Carolina" *Policy Sciences*, Vol.33, 2, pp.181-205

RTPI (2001) *Working Together: A Guide for Planners and Housing Providers*, September 2001, Royal Town Planning Institute, London

SACTRA (1999) *Transport and the Economy* Standing Advisory Committee on Trunk Road Assessment, DETR

Saxenian, A. (1994) *Regional Advantage: Culture and Competition in Silicon Valley and Route 128*, Cambridge: Harvard University Press

Sayer, R. A. and Morgan, K. J. (1985) *The electronics industry in the M4 Corridor*

Schatzl, I. (ed) (1993) *Wirtschaftsgeographie der Europäischen Gemeinschaft* Uni-TB, Stuttgart

Scottish Executive (2000) *Comparative Analysis of Greenways and Conventional Bus Lanes*, Scottish Executive Development Department Research Programme Research Findings No. 83

Scottish Executive (2001) *Scottish Transport Appraisal Guidance A draft consultation document* Produced for the Scottish Executive with the assistance of Steer Davies Gleave in association with SIAS WS Atkins, July 2001

Scottish Executive (2002a) *Scotland: A Global Connections Strategy*

Scottish Executive (2002b) *Inward investment figures released*, Report 7 August 2002, Edinburgh

Scottish Natural Heritage (1997) *National Scenic Areas: Scottish Natural Heritage's Advice to Government*

Segal and Steinmeier (1982) "Location in a congested City" *Regional Science and Urban Economics*, Vol. 12/3, pp405-423

Select Committee on Education and Employment (1998) *Education and Employment -7th report: Overcoming Barriers to paid employment for lone parents*[online]:  
<http://www.parliament.the-stationery-office.co.uk/pa/cm199798/cmselect/cmduemp/646/64602.htm>

Slowe, P.M. (1981) *The Advance Factory in Regional Development*, 1981 Gower, Aldershot

Smith, T. E. (1991) "A simple decision theory of spatial interaction: the Alonso model revisited" *Environment and Planning A*, Vol. 23, pp1247-1268

Smyth, A. (2003) *Developing all Island Air Services in the Island of Ireland*, Inter Trade Ireland, Newry.

Spence (1992) "Motorway infrastructure and regional development in Britain"

Stafford, B., Heaver, C., Ashworth, K., Bates, C., Walker, R., McKay, S. and Trickey, H. (1999) *Young men's experience of the labour market*, Joseph Rowntree Foundation, York

Stein, E *et al.* (2002), The Cyclical Nature of North-South FDI Flows

Stein *et al.* (2001), Regional Integration and the Location of FDI, Inter-American Development Bank, Integration and Regional Programs Department, Research Department Paper

Storper, M. (1995) "The Resurgence of Regional Economics, Ten Years Later, The Region as a Nexus of Untraded Interdependencies" *European Urban and Regional Studies*, Vol. 2, pp191-221

Suda, M. (1997) "Office and Plant Location with Transport Costs of Information" *Journal of Regional Science*, Vol. 37/1, pp23-34

Systems: Effects On Land Use And Society ITE" *Institute of Transportation Engineers*, Vol. 70/3, pp34-38

Tayyaran, M. R., Khan, A. M. (1997) *Factors for the Study of Long-Term Impacts of Telecommuting and Intelligent Transportation Systems on Residential and Business Location Choice*, Urban Design, Telecommuting and Travel Forecasting Conference

Tomkins, J. and Twomey, J. (1990) "The changing spatial structure of manufacturing plant in Great Britain, 1976 to 1987" *Environment and Planning A* , Vol. 22, pp385-398

Treasury (2001) *Productivity in the UK: 3 - the regional dimension*, HM Treasury, November 2001

Trinder, D. (2001) *Transport Infrastructure and Economic Growth*, Structural Issues Development Group Working Paper 01(06)

Trinder, D. (2002) *Economic Growth and Transport Infrastructure Appraisal*, Structural Issues Development Group Working Paper 02(04)

Turner, T., Niemeier, D., 1997. Travel-to-work and Household Responsibility: New Evidence. *Transportation*, 24, 397-419

Tversky, A. (1972). Elimination by aspects: A theory of choice. *Psychological Review*, 79, 281-299

UNCTAD. 1996. *Incentives and Foreign Direct Investment*. Current Studies, Series A, No.30. New York and Geneva: United Nations

United Nations (2000) *UN and business join hands to promote stability* Press Release, UN, Paris 11.Jan 2000

Vasconcellos, E. A. (1997) "The making of the middle-class city: transportation policy in Sao Paulo" *Environment and Planning A*, Vol. 29, pp293-310

Venebles, A. J. (1998) "The Assessment: Trade And Location" *Oxford Review of Economic Policy* Vol. 14/2, pp1-6

Vis, I. and de Koster, R. (2003) "Transshipment of containers at a container terminal: An overview" *European Journal of Operational Research*, Vol. 147, 1, pp1-16

Waddell G.F. and Ulfarrson, G.W. (2003). *Accessibility and agglomeration: discrete choice models of employment location by industry sector*. TRB 2003 Annual Meeting CD-ROM

Walcott, S. M. (1999) "High Tech in the Deep South: Biomedical Firm Clusters in Metropolitan Atlanta" *Growth And Change*, Vol. 30, 3

Walcott, S. (2001) "Growing global: learning locations in the life sciences" *Growth and Change*, Fall 2001, Vol.32, No.4, pp.511-532

Weber (1909) *Theory of the Location of Industries* Translated by CJ Friedrich, University of Chicago Press, Chicago, Illinois

Weisbrod, G. (2001) *Highway bypasses of small communities: review of findings on their economic impacts* Economic Development Research Group, Inc. Research Report

Welsh Economy Research Unit (1997) *Turning the Corner - Road Improvements and Economic Development in Merthyr*, Report to the British Road Federation, Cardiff Business School

Williams, H. C. W. L. and Kim, K. S. (1990) "Location-spatial interaction models: 3. Competition between organizations" *Environment and Planning A*, Vol. 22, pp1281-1290

Woudsma, C. and Jensen, J.F. (2003). Transportation's influence on land use development: a historical spatial-temporal approach

Xiao-Ping Zheng (1990) "The services sector and urban spatial structure: equilibrium versus catastrophe" *Environment and Planning A*, Vol. 22, pp1169-1182

Zax, J.S., and Kain, J.F. (1996) "Moving to the Suburbs: Do Relocating Companies Leave Their Black Employees Behind?" *Journal of Labour Economics*, Vol. 14, 3, 472-504

Zenou, Y. (2000) "Urban unemployment, agglomeration and transportation policies" *Journal of Public Economics*, Vol. 77, pp97-133