Gateways, Corridors and Competitiveness: An Evaluation of Trans-European Networks and Lessons for Canada

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INTRODUCTION

The development of transport infrastructure as a means of enhancing both national and regional competitiveness has a long, but not always convincing, history. Its use in the European Union as an explicit agent of policy dates back to the early 1990s when it became enshrined in the Maastricht Treaty. The policy to develop a series of Trans-European Networks (TENs), which would cover all the main modes of inland transport, but also include the major gateways of seaports, inland ports and airports, was later extended to include short-sea shipping through the so-called Motorways of the Sea. In addition the proposed extension of the EU required that the networks be developed to embrace both the candidate countries and a number of neighbouring countries. The claim was made that the development of such a pan-European set of networks would enhance both overall competitiveness by reducing the costs of transport within the EU enabling greater integration of the European economy and its cohesion by reducing national and regional disparities arising through inequalities in infrastructure provision and transport quality. This has become more critical with globalisation as the development of seamless connections between transport modes is a major factor in determining both trade flows and the location of footloose industries.

In this paper the basis of these claims will be reviewed from a conceptual and theoretical perspective in the light of the evidence of the development of the TENs. The theoretical development will outline the nature of the wider economic effects of infrastructure, but the particular issues, which arise here, are the way in which these benefits arise in the development of corridors and networks. This raises key questions of the nature of agglomeration economies and the balance between core and peripheral regions. This evidence will be drawn from a number of studies of the impact of the TENs. The key issues which arise are the balance between the local, regional and national impacts and the wider European impact of the networks, the extent to which the TENs lead to concentration rather than cohesion, and the slow progress in the development of the TENs given the costs involved (€600 billion) and the general failure to harness the private sector funding seen as essential.

One of the principal areas of concern is the balance between the local and regional impacts of such infrastructure developments on the one hand and the benefits to the EU as a whole on the other. In some cases the former may well be negative as corridors are developed through border regions; in other cases there
may well be a substantial transfer to the regional level. The size and direction of these flows cannot easily be identified on an a priori basis. This issue is compounded by the problems, which arise when decisions on investment are in the control of lower level jurisdictions, but the main benefits depend on network effects, which can only be raised at a higher level. Thus the economic appraisal of corridor development is critically dependent on the structure of decision-making.

The progress of the development of the networks will be summarised and lessons drawn for the development of other large-scale network developments and in particular the potential role of Asian-Pacific Corridors for Canada. One of the critical issues to emerge is the problem, which arises when decisions on investment are in the control of lower level jurisdictions, but the main benefits depend on network effects, which can only be raised at a higher level. Thus the economic appraisal of corridor development is critically dependent on the structure of decision-making.

Decisions on infrastructure investments in one part of the world cannot be taken independently of a global network which itself depends on changes in global trade patterns.

THE CONCEPTUAL BACKGROUND: INFRASTRUCTURE, ACCESSIBILITY AND ECONOMIC DEVELOPMENT

Accessibility, transport costs and wider benefits

Accessibility and transport costs lie at the heart of our analysis of the spatial economy. Traditional approaches to the role of transport costs as determinants of regional development have been put under increasing scrutiny. These emphasised the importance of distance as a deterrent and hence the disadvantage of more peripheral locations. However, improved transport, which reduced the deterrence effect of distance coupled with equilibrating market forces, would gradually remove these disadvantages (Rietveld and Vickerman, 2004). Hence improving transport would be an unambiguously good thing to do.

Several strands of work over the past two decades have led to more mixed messages about the role, which improved accessibility, and investment in infrastructure can have on the economic fortunes of both core and peripheral regions. Following the seminal work of Aschauer (1989), numerous macro-studies have explored the relationship between aggregate infrastructure investment and regional growth.

More recent work has tried to capture the lags and spatial spillovers, which exist in these relationships (see Quinet and Vickerman, 2004, for a fuller discussion). In particular, the development of major transport corridors can have mixed effects. As well as the core-periphery implications of a corridor linking centres of different sizes, corridor developments can also have impacts around the end nodes and at different points along the corridor. For example, whatever the relative distribution of benefits between the end nodes, economic activity may concentrate into the nodes from the areas around the nodes and move towards the nodes from places along the corridor. This is emphasised where there are no access points to the corridor (e.g. limited access highways or high-speed rail lines).
or where the level of service is reduced through lower frequencies (e.g. high-speed rail lines) (Vickerman, 1997).

This is consistent with work in the new economic geography, which has explored the way in which transport cost, scale and agglomeration economies interact to produce ambiguous predictions for regional convergence (e.g. Fujita et al, 1999; Fujita and Thisse, 2002). Venables and Gasiorek (1999). Thus there is likely to be an interplay between the development of more efficient transport corridors and the competitiveness of the major nodes on those corridors. Some nodes will gains from the corridor development and some may lose. Although this approach initially concentrated on the implications for the markets for goods and services, recent work has begun to focus more on the impact on labour markets, especially in larger urban areas (Graham, 2007). But since major international and inter-regional corridors can also serve intra-regional or more local needs this impact on the thickening of local labour markets also has wider implications.

At the core of this approach is the recognition that in imperfectly competitive markets for transport-using activities, there will not be an unambiguous predictable response to changes in transport costs. Thus changes in user benefits will not be a complete measure of the change in total economic benefit as they will not include these wider economic benefits (Jara-Diaz, 1986). Wider economic benefits do not, however, just constitute a simple add-on or multiplier effect to the user benefits (SACTRA, 1999). Moreover, the distribution of those benefits between the affected regions is an empirical question.

**Measuring wider benefits**

Wider economic benefits can be viewed in two ways. On the one hand they involve an increase in total welfare, which is greater than the measured increase in consumers’ surplus to users through timesavings, reductions in accident rates etc. On the other hand these benefits can be seen as the increase in GDP, which occurs as a result of the changes in economic activity, which result from the transport change. These represent different ways of measuring benefits and typically give different numerical results. For example, timesavings accruing in the course of commuting or leisure travel are welfare gains to the user, but do not have a direct effect on GDP unlike timesavings in the course of work. However, where such timesavings lead to an overall gain in productivity because people can access more productive jobs more easily, this will be recorded as a change in GDP. For the economy as a whole the overall impact will be broadly similar, but the ratio of total benefits to user benefits will differ. There could also be important differences in the impact on individual regions such that the welfare gain accrues in one place but the GDP benefits accrue in another. If improved transport infrastructure leads to greater concentration of employment this could have different relative impacts on central and more peripheral regions.

Wider benefits are those, which typically cannot be recouped from users through direct charging for transport services. They arise in a number of ways, through impacts on the labour market, through direct impacts on productivity and competition in product markets and through changes in patterns of agglomeration. In each of these cases the main reason for wider benefits occurring is the absence of perfect competition. As Jara-Diaz (1986) has shown, where there is perfect
competition in transport using markets then user benefits will be an accurate and sufficient measure of total benefits from transport improvements.

We stress the importance of the labour market, because it has frequently been ignored in studies of wider benefits. Labour market effects in imperfectly competitive labour markets arise in three possible ways: changing participation rates, increased working hours and moves to more productive jobs (Department for Transport, 2005). Improved transport can enable access to jobs, which would not otherwise have been possible. If this enables workers from employment-deficient regions to access jobs in labour-deficient regions there will be gains to the workers, to employers and to the public sector, which gains tax revenue, and faces lower social security payments. Similarly if easier commuting encourages existing workers to work longer hours there will be potential gains to all three groups, although it might seem more likely that in practice workers would takes the gains in increased leisure rather than increased work. Possibly of greatest importance, however, is the impact on productivity, which arises thorough workers being able to move more easily from less productive to more productive jobs. Transport improvements have the important effect of creating a potential step-change in the size of labour markets, not just for daily commuting, but also increasingly for reinforcing the possibility of long-distance weekly commuting where the constraints of housing or personal circumstances prevent job-related migration. Thus it becomes a debateable matter whether changing preferences for work in the household require different patterns of transport or changes in transport provision have lifted the constraint on members of the same household needing to search for jobs in the same spatial labour market.

**Imperfect competition**

Jara-Diaz (1986) recognised that if the degree of monopoly was different in the two regions connected by a new infrastructure there could be differential effects. In an imperfectly competitive world there will be agglomeration forces, which enable firms, which have larger markets and enjoy scale economies to take more advantage of any reduction in transport costs. Hence reductions in transport costs can lead to more agglomeration and to unequal impacts on regions connected by the same infrastructure (Venables and Gasiorek, 1999). However, the nature of this approach is that the impact of any particular reduction of transport costs cannot be determined a priori. It will depend on the initial level of transport costs, the degree of agglomeration already present, the size of each market, the extent of scale economies and of the backward and forward linkages within that market (Fujita et al, 1999; Fujita and Thisse, 2002). The key factor is the extent of the mark-up over marginal cost in the transport-using activities. In perfectly competitive sectors there is no mark-up and hence changes in transport costs will be passed on directly to the final activity, so the extent of the impact on the wider economy is dependent on the elasticity of demand for that final activity. Since the amount of transport demanded depends directly on the demand for the final activity the direct user benefits capture all the economic benefits. As mark-ups increase there is in effect a wedge driven between the markets for the transport-using activity and the transport associated with it. Any reduction in transport costs arising from the improvement of infrastructure does not need to be passed directly
on to the customers of the final activity, but firms can use the opportunity to increase or reduce the mark-up. Reducing the mark-up by passing on more than the reduction in transport costs could be a way of increasing a firm’s market area and gaining market advantage over firms in a more competitive market. On the other hand firms may use the fall in transport costs to increase the mark-up, for example to invest so as to reduce other costs and gain from potential scale economies. It is also possible that the net impact can be negative. If the mark-up is negative, for example where there are industries with significant subsidies, such as in economically lagging regions, then the direct user benefits may over-estimate the total economic benefit. Hence the ultimate impact from any infrastructure project is likely to be unpredictable, both in terms of magnitude and sign.

Where infrastructure and transport service are supplied separately, rather than by a single vertically integrated operator (vertical unbundling), there is further scope for deviation between costs and consumer prices. Indeed where line infrastructure and terminal infrastructure are supplied separately this adds a further complication for modelling, but also identifies a further source of the inability of the direct user benefits from a specific transport improvement to provide an accurate measure of total economic benefit.

**Total economic Impact**

How can the total economic impact be assessed? There are three main elements to this. First is the impact on competition in the affected regions, secondly there is the impact on the ability to gain benefits from the change in market power through agglomeration, and thirdly is the impact on the linkages and in particular on backward linkages such as the labour market. Once these have been assessed we have to identify how to include them in a full cost-benefit framework.

The impact on competition is ambiguous. In perfectly competitive markets, as we have seen, the impact of increased competition is essentially neutral and should be adequately captured by the direct user benefits. In imperfectly competitive markets, the direct effect of any increased competition resulting directly from lower transport costs is also likely to be essentially neutral in its impact. It is traditionally argued that monopoly power is derived from the effective barriers to competition provided by higher transport costs so that reductions in such barriers are pro-competitive, reducing monopoly mark-ups and hence there is a wider benefit resulting from the reduction of prices. On the other hand such competitive pressures if they do exist may also drive firms out of the market and the effect of lower transport costs is to reduce the number of firms able to compete in the market in the long run. It is likely that such effects cancel each other out in most cases and thus there is little in the way of wider economic benefits, which can be added.

There may be some exceptions to this where new links are created which have such a significant impact on transport costs (which are already very high) that significant market restructuring takes place introducing competition to previously protected local monopolies. This is the ‘unlocking’ argument advanced by SACTRA (1999) and reaffirmed in its latest guidance by the Department for Transport (2005). These are likely to be rare in most developed market economies,
but may be more relevant in some peripheral regions and in some regions in the new member states of the EU.

Much more significant than the market competition effects are the agglomeration benefits which may result from the change in transport costs. The argument here is that the rise in output, which follows from the lower transport costs, has cumulative effects through the way in which firms interact in a market. This involves both localisation economies, in which firms within the same industry benefit from proximity to each other through such factors as specialised labour pools or shared R&D, and urbanisation economies, in which firms obtain a form of public goods benefit from the existence of an urban infrastructure including knowledge, research and culture as well as the physical infrastructure. The larger the market the greater the likely net additional impact which arises because there is an additional impact on productivity. There has been a long debate over the extent to which urban size and productivity are related, and the direction of causality, but there is an increasing consensus that there is a strong positive relationship, which can have a significant additional impact on the benefits from transport improvements (Fujita and Thisse, 2002; Venables, 2007; Graham, 2007). This argues that although the lower transport costs may cause firms to increase the size of their market, that increased size provides an incentive for the firm to enjoy scale economies and to benefit from proximity to other more efficient firms. Typical productivity elasticities are in the range 0.01 to 0.1. Ciccone (2002), using data for EU regions, finds an elasticity with respect to employment density of 0.05. Graham (2007) finds for UK industries a weighted average elasticity of 0.04 for manufacturing, but significant variations between industries with some as high as 0.2, and an average of 0.12 for service industries. Graham also identifies some important variations between regions reflecting different degrees of localisation of industry groups.

A further element of this output benefit under imperfect competition is that because productivity is increasing, the direct user benefits will also be greater than would be the case under an assumption of perfect competition. The largest direct user benefits form most projects are time savings, valued relative to the wage level assuming that wages reflect productivity. The increase in productivity implies that a higher value of timesavings should be applied. But the increased productivity enables firms to increase output (or produce the same output with fewer workers), which implies an uplift needs to be applied to the timesavings.

The basic advantage, which some regions obtain in an imperfectly competitive world, derives from a larger market size, which enables firms to increase both output (scale) and productivity. However, it is useful to break that larger market size effect up into a pure market size effect and the backward and forward linkages, which are associated with agglomeration. One of the key backward linkages relates to the labour market. As transport costs are reduced labour markets become larger as commuting times are reduced and firms have access to a larger labour supply. This enables firms to benefit both from wage levels, which might be lower than they might be as result of more competition in the larger market, but access to more skilled labour, which will be more productive for the reasons, discussed above.

Normally it would be expected that there would be a wage premium at the market centre reflecting its greater accessibility, scale and productivity effects, but
also to reflect the wage necessary to attract labour to commute in from across the wider region. As transport is improved more workers find it attractive to work in the market centre, both in terms of there being a larger catchment area for which commuting is feasible and more people at each location find it worthwhile to seek work in the centre rather than elsewhere (or not at all), or if they are working in the centre to be prepared to work longer hours. Hence there is an output effect, which arises because of the increased size of the labour market. Where there is also a productivity effect due to agglomeration effects at the market centre the output effect from the expansion of employment is added to by the increased output of all existing workers.

Note that it is not the size of the infrastructure project, which determines the scale of the wider economic benefits. Large projects are likely to have a wider impact in terms of greater direct user benefits, but the wider benefits are not simply proportional to the direct user benefits. Some relatively minor projects, the ‘unlocking’ projects, can have disproportionately larger wider benefits, whereas some very large projects may have relatively little impact on the key scale, productivity and linkage effects. This is why there is no a priori reason for applying a simple wider benefits multiplier. It also demonstrates that seeking a simple output elasticity as in the macro analyses can be misleading. In the context of the development of the TENs this may imply that very large international projects may have less of an impact than those, which act directly on the agglomeration potential of some of the major urban regions.

THE TENS PROGRAMME

EU transport policy and the TENs

Transport has long been recognised as a potential agent of economic integration, promoting both competitiveness and cohesion. The EU has had a Common Transport Policy (CTP) since the Treaty of Rome, but under the concept of subsidiarity, the competence of the EU is only in those matters affecting cross border issues, most of transport remains a national competence. This raises a particular difficulty in achieving a common approach to investment and appraisal since responsibility for final decisions rests with individual member states who would also be responsible for raising (or guaranteeing) funds and for granting necessary permissions.

Trans-European Networks (TENs) were first formally identified in 1989 (European Commission, 1989) and the Treaty on the European Union (Maastricht Treaty) (European Commission, 1992a) established the legal framework for their development. The idea was a simple one, defining a core network for the EU in a way, which is not dissimilar to that seen in the US with the development of the Interstate Highway network from the 1950s (Mohring and Harwitz, 1962). However, in the EU case it was not in most cases a question of defining a new single mode network to be laid on top of an existing network, but rather of defining, for a series of existing different modal networks, those elements which constitute part of a trans-European network and identifying within these the key gaps. The exception was the emerging high-speed rail networks of a number of member states.

1 This section draws on Vickerman (2006)
To some extent the TENs were seen as a panacea for many of the problems being faced by the EU, designed to achieve the twin objectives of increasing the competitiveness of the EU through more efficient transport and enhancing cohesion through providing links to disadvantaged regions. That these goals were typically mutually exclusive (see Vickerman et al. 1999, Vickerman 1998, for a critique) was not important for the immediate policy needs. Construction is a good sector to stimulate short-term economic growth. Increasing congestion was perceived as a problem out of which it was still possible to build one’s way through new infrastructure. Moreover, physical assets are a clear demonstrable measure of policy success; any problems are too far in the future to be considered.

The TENs policy is thus only partly transport policy; it is also an element in the macroeconomic policy for growth and employment, and an element in cohesion policy. The main problem in the EU situation was that designating parts of an extant network as part of a TEN immediately led to lobbying by regions and local authorities to be included on the network. The networks which emerged were therefore excessively large, lacked strategic focus at a trans-national level and were clearly unaffordable if the objective was to bring the entire network to a common standard.

Development of the TENs

There are three phases in the history of the development of the TENs. A set of 14 priority projects was defined at the Essen European Council meeting of 1994. The primary basis for selection was that the project should already be clearly defined and under way. All modes were represented (except for sea), all member states had a link, however tenuous, and there was a clear steer towards the involvement of private sector finance, recognising that under the Maastricht criteria for monetary convergence to a single currency, public finances could not support this level of investment. The total cost estimated in 1996 was €400 billion.

The second phase was a consolidation of the Essen list of projects with a separate group of rather more strategic corridor developments for Central and Eastern Europe. The so-called TINA (Transport Infrastructure Needs Assessment) projects for the countries in transition differed in philosophy by trying to identify corridors, rather than specific networks, in a more strategic way for the development of trade and communications (TINA, 1999). This produced a set of networks by 2001 amounting to 75200 km of roads, 78000 km of railways, 330 airports, 270 international seaports and 200 inland ports (Figure 1).

By 2003 it was becoming clear however that the TENs initiative was running out of steam. Not only had relatively few projects been completed; only 2 of the original 14 Essen projects were in operation, and only 5 were expected to be in full operation by 2007 (Table 1). Of the remainder only certain sections were due to be complete by 2010 (Table 2). The total bill for the TENs was continuing to rise and the expected filling of the funding gap by the private sector had largely failed to emerge. The response to this was to add a further 16 priority projects together with an additional network, the ‘motorways of the sea’, following the 2001 White Paper (European Commission, 2001). The Commission launched a through review of the TENs (European Commission, 2003), which produced a set of
recommendations to confirm the TENs, but also to identify and provide new forms of finance.

**Figure 1: Trans-European transport network: priority axes and projects**

*Source: European Commission (2005)*
Table 1: Priority projects completely finished by 2007

<table>
<thead>
<tr>
<th>Projects or sections of projects completed in 2007</th>
<th>Date for start of operation</th>
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<tbody>
<tr>
<td>PP2 High Speed Train Paris-Brussels-Cologne-Amsterdam London</td>
<td>2007</td>
</tr>
<tr>
<td>PP5 Betuwe Line</td>
<td>2007</td>
</tr>
<tr>
<td>PP9 Rail Line Cork-Dublin-Belfast-Stranraer</td>
<td>2001</td>
</tr>
<tr>
<td>PP10 Malpensa Airport (finished)</td>
<td>2001</td>
</tr>
<tr>
<td>PP11 Öresund fixed link (finished)</td>
<td>2000</td>
</tr>
</tbody>
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Table 2: Priority projects of which several sections will be completed by 2010

<table>
<thead>
<tr>
<th>Projects or sections of projects for completion by 2010</th>
<th>Date for start of operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>PP1 Berlin-Verona - Nürnberg-München - Kufstein-Innsbrück</td>
<td>2006 - 2009</td>
</tr>
<tr>
<td>PP6 Lyon-Torino-Trieste - Torino-Venezia</td>
<td>2010</td>
</tr>
<tr>
<td>PP7 Greek Motorways - Via Egnatia - Pathe</td>
<td>2006 - 2008</td>
</tr>
<tr>
<td>PP12 Nordic Triangle - Road and rail projects in Sweden - Road link Helsinki-Turku - Rail line Kerava-Lahti</td>
<td>2010 - 2006 - 2010</td>
</tr>
<tr>
<td>PP13 UK/IRL/Benelux road link</td>
<td>2010</td>
</tr>
<tr>
<td>PP14 West Coast Main Line (UK)</td>
<td>2007</td>
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The time horizon has been extended to 2020, but the costs of realisation of the full set of networks has risen to €600 billion, of which €225 billion is for the priority projects. This is expected to come variously from national funding, European funding (TEN-budget, ERDF, Cohesion Fund), a new guarantee instrument, EIB loans, a Structured Finance Facility, the private sector and an increasing use of a direct user contribution through charging. Table 3 shows the sources of EU financing. Note that most of the funding comes not from a specific transport budget, but from the Structural and Cohesion Funds, thus highlighting the dominant belief in transport as a cohesion instrument. In addition to the finance identified in Table 3, the European Investment Bank has made annual loans of the order of €6.6 billion (2000 value).

**Table 3: EU Funding for TENs**

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</thead>
<tbody>
<tr>
<td></td>
<td>EU15</td>
<td>EU25</td>
<td></td>
</tr>
<tr>
<td>TEN Budget</td>
<td>2.2</td>
<td>4.2</td>
<td>4.4</td>
</tr>
<tr>
<td>Cohesion Funds</td>
<td>7.6</td>
<td>9.0</td>
<td>12.8</td>
</tr>
<tr>
<td>ERDF*</td>
<td>5.0</td>
<td>6.0</td>
<td>6.0</td>
</tr>
<tr>
<td>ISPA</td>
<td>--</td>
<td>2.1</td>
<td>na</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>14.8</td>
<td>21.3</td>
<td>23.2</td>
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* DG TREN estimate of share of ERDF allocated to TEN-T

**Source:** European Commission (2003)

**Difficulties in realising the TENs programme**

Perhaps the real problem with the TENs however is the failure to establish a clear framework for appraisal in which the EU can demonstrate the added value to the EU as a whole from the development of the networks and the size of any spillover impacts between member states. This starts from the potential conflicts built into the governance structure for the TENs. Although the EU has a responsibility for the designation of TENs, and provides a small, though significant when the contributions of the Structural and Cohesion Funds and the EIB are taken into account, financial contribution to their development, the primary responsibility for all transport infrastructures remains with the member states and in some cases with sub-national or regional authorities. Transport thus provides a perfect case study of the potential conflict between two models of development of the EU (Hooghe and Marks, 2001). The ‘intergovernmental’ or ‘state-centric’ model argues that only those matters on which cross-border agreement is needed (i.e. the strictly international elements of the TENs) should be resolved at EU level. In this model a strict version of subsidiary is applied. On the other hand the ‘supranational’, ‘federal’ or ‘multi-level governance’ model would seek to assign specific functions to different levels on the basis of where they could be most efficiently administered and, most importantly, to establish institutional structures which would enable both multi-level decision-making and the policing of such decisions.

Because transport has a specific status as far as the Treaties are concerned, and this applies particularly to the TENs, which represent a particular aspect of building the European Union, transport more than most policy areas has a
fundamentally multi-level governance character. The EU defines the broad parameters of policy: defines networks, establishes principles such as ‘fair and efficient pricing’, and attempts to ensure inter-operability. Member states, and in many cases their regional or local governments, are left to implement the policy. TENs are little more than concepts at EU level for which member states (together with the private sector) are expected to secure necessary permissions and legislation and, above all, finance.

At the EU level, transport policy, and the TENs in particular, appear to address two fundamental concerns of the EU: the development of a world-class competitive economy (especially as conceived under the Lisbon Agenda) and the drive for increased cohesion within and between the member states. In this there are two inherent dangers. One is that the ubiquitous nature of transport leads to expectations that policy initiatives in transport can secure objectives that are more directly the concern of other policy areas: macroeconomic policy, spatial development policy or microeconomic policies towards enhancing competitiveness. The second is that policy implementation at lower levels ‘refracts’ the intention of policy at the EU level in order to secure particular advantages or to meet specific perceived needs. Here we refer to these two concerns as horizontal and vertical conflicts (for a fuller discussion see Vickerman, 2008).

Horizontal issues arise at the EU level to some extent because of the intergovernmental character of the EU. Policy-making depends on the interaction of the Council, the Commission and the Parliament and whilst the Commission is able to take a concerted view of the way that policies in different policy areas may overlap or conflict such concerns are often less pronounced in the Council. As well as these horizontal issues arising at the EU level, it is also clear that such concerns can also arise within member states.

Similarly, the existence of vertical conflicts is heightened by the intergovernmental character of the EU. The blurring of responsibilities between the different levels of government provides scope for the blurring of policy objectives and their manipulation to suit the particular needs of each level of government. In the absence of the sort of controls, fiscal and other, which would exist within a more formal federal structure, this requires policy to be articulated effectively and in a way which enables lower level policy makers to implement clear policy rules consistent with higher levels of policy advice with less scope for refraction.

However, such clarity of purpose does not exist. Individual member states and regions seek to gain influence over the definition of TENs in the hope of securing access to funding. Except in assisted regions or Cohesion Fund countries the opportunity for significant funding is extremely limited and in these areas it is not clear that TENs designation is critical. The large majority of all trips are within a local area, typically less than 50 km. Even for road freight transport only 25 per cent of tonne-km in the EU15 involve international movements. To some extent the apparent lure of finance may distort a region’s evaluation of a project, whilst the rules concerning that finance may lead to a less ideal (from the region’s perspective) project being adopted. This situation again highlights the problem of the lack of a transparent appraisal framework for TENs.
THE IMPACT OF THE TENS: SOME EVIDENCE

Appraisal of the TENs raises a number of difficult issues. Although they should be appraised on the same basis as any other major investment project in the EU, there are some significant problems. The first problem is that they are large investments and more likely to involve network effects (Laird et al, 2005). But it is unlikely that any one element of the network, let alone the network as a whole, will be appraised by a single authority since most of the finance comes from individual member states. This raises four main questions: EU wide issues, spillover issues, objective issues and performance issues.

EU-wide issues

The EU-wide issues are perhaps the most difficult to assess: this asks the question what is the contribution to integration and cohesion? Thus appraisal has to establish the added value to the EU of the TENs network and of any link within it. That added value can be expressed in terms of competitiveness and growth at the EU level or of contributions to cohesion. The implicit assumption is that improved infrastructure can provide both of these. This is based on the idea that the rate of return to investment in public infrastructure is potentially much higher than that to private investment and hence that infrastructure is a valuable tool to boost economic growth. This result has been subject to considerable retesting in the interim and, although not disproved, we have to be much more circumspect about assuming an automatic link (see Vickerman, 2000, 2002, for a fuller discussion).

It cannot be assumed that TEN developments will always lead to time and other cost savings to transport users and providers, which are equivalent to an exogenous increase in productivity. Transport improvements are not always pro-competitive in a way that passes on the benefits to end-users. The potential improvement in welfare thus does not get passed on the final user, being used instead to affect the mark-up over marginal costs, and estimates of total economic benefits, which assume this, will thus over-estimate the wider benefits of transport improvements. Furthermore, there may be cases where, for example because of subsidies to the main transport using sectors in a region, the prices charged in these sectors are below marginal costs and hence any wider ‘benefits’ may actually be negative and the total social benefit from a project is below the estimated transport benefits (see SACTRA, 1999; Vickerman, 2007a).

Empirical analysis based on a spatial computable general equilibrium model, which allows for some of these effects, has shown that the increase in welfare arising from the completion of the TENs may be typically less than 2 per cent of regional GDP (Bröcker et al, 2004). Although the pattern of regional benefits from the completion of the full set of priority projects suggests these are broadly in favour of the more peripheral regions, especially in the new member states where infrastructure was generally poor, the level of growth occasioned is not likely to lead to rapid convergence (Figure 2).

In an earlier analysis of specific TEN projects, Bröcker (2000) showed that the proportion of total benefits captured by the regions connected by the link could vary from as little as 10 per cent to well over 100 per cent where the project implied shifting economic activity away from other regions.
Figure 2: Changes in regional welfare from implementation of TENs programme


Hence regions may often campaign for projects, which could actually do them harm and the EU may be promoting projects, which ultimately promote economic
divergence. This possibility was clearly identified in the case of high-speed rail by Vickerman et al (1999). The policy structure fails to establish a clear dialogue between the different levels of government to ensure that this potentially asymmetric informational situation is corrected.

**Spillover issues**

Spillover issues relate to the more direct impacts, which decisions in one region have on adjacent regions. We can identify four elements to this: interoperability, transit traffic, budget shifting and risk shifting. Interoperability has been key to the development of TENs since new infrastructures in particular are more likely to be built to a set of common standards (although this clearly has not happened in the case of high-speed rail where each main national developer has tended to develop its own technical package).

Transit traffic, i.e. traffic with origins and destinations outside a region, but which contributes a significant share of traffic within the region, particularly where this involves congestion, is a clear case where there is a spillover effect between regions.

Thus regions may often attempt to deflect new developments of networks onto other regions to avoid these negative effects and others such as pollution, noise and landscape intrusion. However, transit traffic does not only have negative effects, it could also lead to positive, economic growth impacts on the region. Hence there can sometimes be incentives for regions to attempt to ‘capture’ these new developments in the hope that they bring such benefits. Where there are tolls or other charges regions may attempt to discriminate against transit traffic in order to capture tax revenue (see De Borger, 2001). A simple way of doing this is through the use of ‘vignettes’, which require an annual payment for the use of a network. This will clearly tend to produce lower costs per trip for residents than for non-residents.

An emergent issue for some regions is that improvements to their accessibility is outside their own control since it depends on improvements to infrastructure in other regions. This particularly affects peripheral regions, which face either, a lack of effective infrastructure or congestion in the regions through which their traffic has to pass to reach core regions. It also affects some border regions, which may find that their natural hinterland is reduced by the lack of infrastructure in the neighbouring region across a national border (Vickerman, 2008).

As a way of illustrating these issues more specifically we take one example of a key element in the TENs, the North-west Europe high-speed rail network. This the most developed network of high-speed rail connections in Europe (Figure 3). The network is due to be completed and in operation by the end of 2007. It involves five EU member states and links five main metropolitan regions and thus has clear implications for both EU-wide effects and cross-border spillovers. As well as providing high-speed rail links between the major cities, the network has opened up new opportunities for other possible nodes, particularly Lille, but at the same time has removed or reduced access to international rail services from other towns and cities.
As will be clear from Figure 3, the development of the network has required a number of compromises in terms of route choice. For example, the London-Paris route is significantly longer than the more direct route between the Channel Tunnel and Paris, made necessary by the economic considerations of combining the infrastructure with that between Paris and Brussels (which route is also longer than the more direct traditional route via Maubeuge and Mons). Here the commercial consideration of serving the Lille metropolitan area with a population of well over 1 million was critical. Less clear from the map, but also important was the decision to place the route through the main railway station of Antwerp, involving a very expensive tunnelling operation, but ensuring that rail penetrated the heart of the city. Similar decisions surrounded the location of stations in Lille and Rotterdam.

Locations on or close to other borders have faced various problems. Intermediate stops on high-speed rail lines impose significant delays, which reduce the value of the service to the majority of end-to-end passengers. The stations at Calais-Frétun and Ashford compete with other locations (Lille and a new station at Ebbsfleet) for services to stop. Similarly, the Dutch border town of Breda lobbied effectively for a separate stopping service to avoid being completely by-passed by the new services.

This case study shows clearly a number of tricky issues for evaluation. First, it is clear that accessibility change along a high-speed rail route is not continuous. Secondly, service levels are as important as best or average times. Thirdly, as a consequence, high-speed rail is centralising.

The effect of shifting infrastructure development onto other regions, or conversely of attracting it at the expense of such regions can also imply budget shifting. Particularly where Structural and Cohesion Fund money is involved there is a perceived incentive to develop new infrastructure if that is likely to bring with it additional external funding. The problem is that such investment requires a degree of matching funding from within the regions and may also cause future costs through maintenance expenditure etc. which will impose a future fiscal burden on the region.

As well as this budget shifting effect there is scope for risk shifting between regions. Part of this is related to the fiscal burden effect, if a region can benefit from a strong positive spillover from infrastructure developed in a neighbouring region then it can shift the financial and environmental risks associated with the project to that region. Of course this can work in reverse in that relying on other regions to deliver the appropriate infrastructure carries the sort of risk we identified with transit traffic above.

**Objective issues**

This raises again the question of the objectives of TENs policy. There are different views of this at different levels of policy making. At the simplest level is the objective of improving accessibility. This has the advantage of being easily measurable, although care has to be taken in considering questions of absolute and relative changes, whether it is measured on single mode or multi-modal basis and what weight is placed on access to networks, frequency of service etc. (see Mathis et al., 2004, for a detailed discussion). Accessibility as an objective raises a
number of difficulties, however, when we move away from a definition of accessibility measures for a location to that for individuals, households or firms: accessibility to whom, to where, for what? Have we considered adequately the ‘two-way road’ effect? How does a given change in accessibility impact on industries under different degrees of competition? What we really need is a measure of the impact on economic performance, output, productivity or competitiveness of firms, and ultimately on economic welfare. As the attempts to measure these have shown (e.g. Bröcker et al., 2004) very large changes in accessibility of up to 40 per cent may lead to extremely small changes in economic performance. This suggests that some of the growth and employment claims made for the TENs (e.g. European Commission, 1997) might have been a little exaggerated. Simply setting objectives towards a greater equality of accessibility do not make sense in isolation from other factors contributing to economic performance.

Figure 3: North-West European HSR Network

Source: European Commission (2005)

Performance issues

A final issue is the reminder that although the TENs have principally been about investment in new capacity, measures to improve the performance of the existing network could be equally as important. The 2001 White Paper (European Commission, 2001) did go someway towards identifying these issues in terms of identifying the need for a consistent pricing systems and the use of new technology to assist in network management if concerns such as congestion are to be addressed. This management is a significant ingredient in ensuring that the TENs network contributes to both sustainability and intermodality.

Thus there is a complex set of issues, which affects all governments when approaching the problems of high-level transport network development. The argument here is that this complexity is compounded by the multi-level government structure of the EU where competence for elements of transport
policy reside at all levels. It is clear that the traditional ‘predict and provide’ mode of transport planning can no longer be justified, even in areas with a clear deficit of transport infrastructure.

GLOBAL ISSUES, LOCAL IMPACTS: SOME LESSONS FOR CANADA

Global networks and mainports

We have concentrated thus far on the way in which the internal transport networks of the EU can have mixed impacts at different levels of evaluation. Increasingly, however, transport networks have to be seen as part of global networks. The TENs have concentrated on the need to integrate national networks to ensure increased competitiveness of the EU. This is in part about reducing the transport costs of European economic activity in order to reduce its overall production costs both through using less transport (or more efficient transport) and through agglomeration effects. However it is also about ensuring efficient transport to the main ports which link the European network with the rest of the world. This involves both main seaports and main airports which themselves form elements of the TENs (Vickerman, 2007b).

Such mainports are increasingly part of global networks in terms of their ownership as the need for investment and competition between port owners has led to such concentration (Meersman and Van de Voorde, 2006). Similar trends can be identified in the airport sector. Thus for both passengers and freight integration of global networks of such mainports thus poses a question of how to integrate the landside transport to increasingly large hinterlands. Since the landside transport is typically under the control of national or regional authorities this can result in attempts to capture larger shares of traffic through the mainport by decisions regarding the landside transport. Hence there is competition between the mainports of Antwerp and Rotterdam, which is underwritten by parallel developments of freight rail routes to Germany in the Betuwe Line (Rotterdam) and Iron Rhine (Antwerp).

The global potential significance of the TENs as a means of enhancing both the competitiveness of European industry and the competitiveness of European mainports as hubs has not gone unnoticed in other parts of the world. The globalisation of the ownership of mainports is one part of this process. Attempts to begin the process of integration of networks in Eastern Asia is also seen as a way of ensuring an appropriate stake in the development of Japan, Korea and China. Similarly Russian interests seek to capture a share of the Europe-Asia shipping trade by the enhancement of the trans-Siberian route to ensure faster transit and the potential for double-stacking containers. This raises the prospects for competition between a Eurasian landbridge and a North American landbridge with traditional deep-sea routes. In this it may be the relative efficiency of the way the networks interact which will be the critical determinant of success.

Trade flows and transport change

Changing trade flows are clearly part of this story. The flow of Asian trade (excluding Japan) to North America increased more than seven-fold in the period
1981-2000 and to the EU eight-fold. These figures are almost twice the growth in trade flows from Japan to these two areas. Asian trade flows to North America are now 50 per cent higher than those from the EU and growing much faster. Similarly Asian trade flows to the EU are more than 20 per cent greater than those from North America to the EU and the growth over the past 20 years has been three times greater (Ono et al. 2007).

Changing patterns of flows lead to changing patterns of demand for transport between these areas. This has in turn led to changing patterns of competition between networks and the infrastructure and transhipment points, which serve them. Meersman and Van de Voorde (2006) identify the importance of both horizontal and vertical integration in the deep-sea shipping and port sectors with the increasing importance of international capital sometimes conflicting with the desire for control by locally based port authorities. However this can enable ports and shippers to capture significant rents. Francois and Wootton (2006) have identified that as industry becomes more concentrated and effective tariffs lower, shipping margins increase so that the more liberal trade regimes become the more serious is the lack of competition in the transport sector. Thus it is possible that the promotion of competing networks, although it may appear potentially wasteful of resources, may actually be beneficial in the long term by exercising control over the shipping mark-up.

Vertical integration is also present in manufacturing leading to an increasing trade intensity of production. This may increase the power of shippers and ports by making firms more dependent on transport. Hummels (2006) has shown that manufacturing exports embody a growing share of foreign inputs and this vertical specialisation accounts for one-third of all trade growth and up to one-half of trade growth for smaller and developing countries. Thus although the figures for Japan and the US are 6 per cent and 14 per cent respectively, those for the larger EU economies are 20 to 30 per cent, but 40 per cent for Mexico and 50 per cent for Canada and Taiwan. Half of Chinese exports by value are imported inputs.

How do these global trends impact on local areas? One we have already identified is the competition between ports and transhipment points. In the EU much of the early emphasis of the TENs was on the removal of physical barriers such as mountains or sea channels by the construction of bridges or tunnels. But this has had potentially negative impacts on the ports and ferry routes displaced. Later emphasis on the development of “motorways of the sea” to promote short-sea shipping as an alternative to congested land routes does not necessarily benefit these ports, but may add to congestion at the main ports where greater transhipment potential and economies of scale and scope (including network economies) are major attractors. Just as the development of high-speed rail has frequently diverted traffic flows away from existing centres towards those, which may be greater traffic generators, so new global trade routes have similar impacts.

In many cases the development of TENs is about favouring one region against an adjacent region because it provides a better transport solution, which contributes to the overall competitiveness objective. Much of the policy response has been to lobby for competing routes to be equally represented on the TENs map so as to avoid too much negative impact on cohesion. This may involve making comparisons (and compensation) across national borders. The development of global routes may lead to much more serious competition in which the market
structure of both transport and shippers may overcome the pure distance deterrence effect. Shorter routes will only be cheaper if they command sufficiently large flows to gain scale economies, but so large relative to the capacity to cause congestion. Being able to combine different flows to many destinations may be both an advantage (scale) and a disadvantage (conflicting movements and congestion) where global and local flows conflict.

**Lessons for Canada**

There are two main issues, which emerge from this discussion. One is the recognition that the development of transport networks in a globalised world has to recognise the global competition both between production locations and between the networks that carry the resulting trade flows. In this world there is no captive trade for individual networks. The second is that the development of networks (and nodes) to compete for these global flows can have unpredictable regional impacts within countries.

From a Canadian perspective the competition issues relate to the global flows it is reasonable to bid for. These are in three dimensions (summarised diagrammatically in Figure 4):

- flows with Canadian origins or destinations where the development of transport enables Canadian firms to compete more effectively (Flow A);
- flows to and from outside North America with origins and destinations in neighbouring countries (essentially the US) which can be diverted through Canadian ports because of the greater efficiency of those nodes or of the transport links to them (Flow B);
- flows between points outside North America (e.g. East Asia-Europe) which can be diverted through Canadian ports and overland routes because of the greater efficiency and reliability of those ports and land transportation than the competing sea routes or overland routes across Asia and Europe (Flow C). This implies complementarities being developed with the ports in the other regions to ensure the best possible links avoiding problems of congestion etc.

The potential costs arise where there are conflicts between the needs of these three different flows and with entirely internal flows (Flow D) using the same infrastructure. Thus intermediate nodes in the Canadian network could suffer negative impacts from the need to accommodate larger through flows of goods.

Nodal development will also be affected by these changes. The concentration of activity in node V may lead to its being able to achieve scale economies which increase its competitiveness. This increased competitiveness as a node can have positive impacts on the various agglomeration economies induced by backward and forward linkages, which can also lead to a thickening of labour markets. Intermediate nodes T and M may suffer adverse effects as may competing transhipment node H.

There is one further dimension, which is not addressed in the stylised example of Figure 4. Can small-specialised nodes compete with the mainport transhipment node V? In the European example it is clear that there has been fast growth in some of the nodes, which are located in a geographically advantageous position to capture passing global trade. Gioia Tauro and Algeciras are oft-cited examples, which contrast with Marseille, which has shown virtually no growth over
the past 20 years (Vickerman, 2006b). The largest European port, Rotterdam, has also shown less rapid growth and has slipped in the world rankings.

**Figure 4 Diagrammatic representation of competing flows**

This demonstrates that being on the way to somewhere can sometimes be an advantage even when located away from the main centre of economic activity.

The policy dilemma is which links of the network to prioritise and which nodes to invest in supporting. The key link for capturing traffic could be that between V and the neighbouring country for flow B, alternatively the weak link in capturing flow C could be that between intermediate nodes T and M where competition with internal traffic is greatest. It then remains an empirical question as to which of the various flows is potentially greater and which has the greatest potential elasticity to improvements in service quality or reductions in price. The answer to the empirical question depends on predictions of both global trade flows and their responsiveness to transport changes. The impact depends on the extent to which the internal transport system can respond to increases in demand and economic activity in the affected nodes can take advantage of the opportunities.

**CONCLUSIONS**

This analysis of the impact of TENs at both the aggregate EU-wide level and the local level has highlighted three main issues relevant for the development of gateways and corridors in Canada:

- The fragmentation of the policy making framework for transport in the European Union which fails to identify and balance the interests at different spatial levels;
- Incoherence in the formulation of policies towards transport infrastructure and the efficiency of transport markets using that infrastructure;
Inconsistencies in investment appraisal methods which fail to recognise imperfectly competitive markets in the transport-using sectors and the interactions between different regions affected by new infrastructure.

This has important implications for the appraisal of major transport investments. These fall into three broad areas: the implications for modelling the transport impacts, the evaluation of the wider benefits and improving consistency in the policy process.

Modelling the transport impacts requires recognition that the transport market and the markets for activities using transport are closely inter-related. In an imperfectly competitive world it is not possible to assume that changes in transport costs simply pass neutrally through into activity decisions. Thus forecasts of transport demands for new or improved links in the network need to take into account the competitive structures of the regions, which will be affected by the improvement. This is one source of the inaccuracies in demand forecasts, which have increasingly been identified as problematic for major infrastructures. The development of CGE models has enabled a start to be made on this process, but there is still much to be done to make these genuine planning tools rather than research tools (Gunn, 2004).

The evaluation of the wider benefits requires both a consistent approach to the cost-benefit process and an acceptable means of placing values on changes in markets outside the transport sector when it is accepted that the transport benefits are not a true measure of the total benefits (SACTRA, 1999; Department for Transport, 2005). Much research effort has been expended in European research projects to give guidance on improving this process (e.g. Bröcker et al, 2004; Laird et al, 2005). Implementing this guidance in a consistent way across the EU remains a major challenge.

However, the biggest challenge is ensuring consistency in the policy process itself, which reveals both vertical and horizontal conflicts. Vertically, decisions made at different jurisdictional levels are frequently inconsistent with one another. Whilst it may often be the case that local costs need to be incurred for the achievement of benefits at a higher level, this needs a transparent process to evaluate these costs and benefits and to ensure appropriate compensation where this is implied. Horizontally, decisions made at each level come into conflict with policies in other jurisdictions at the same level, or in other policy areas in the same jurisdiction. This may simply require coordination of policy, but again may also imply some redistribution of welfare. What is required here is greater clarity of purpose in policy objectives. To some extent this can be derived from a better understanding of the total economic benefits of projects. Much of the current lack of clarity derives from the political pressure to deliver projects and to find a means of justifying these. This is an easier task when the methodology for estimating the wider impacts is imprecise. But this is a two-way effect; better methodology requires a better understanding of the way that policy alternatives and policy objectives can be incorporated into the decision process.

The analysis here suggests that whilst the wider economic effects of major investments in transport corridors such as the TENs could be very significant, they are not always obvious or predictable and can vary significantly between different networks and projects. The analysis needs, however, to go further. Most of the analysis does not yet deal adequately with the dynamic effects, which the
development of a completely new network could have on patterns of trip making and economic behaviour. The joining up of national networks into a genuine international European network could imply a step-change in effects greater than that experienced so far. This implies a need to go back to appropriate definitions of accessibility change in the light of our better understanding of the links between accessibility change and the indirect benefits stemming from TEN developments. Such effects may however miss the very real challenges, which such high-level infrastructure poses for local areas, which may have poorer access to the new infrastructure or be largely by-passed by it.

Overall therefore the story of the TENs is a story of a strong policy objective, with considerable political will drive it forward, but an inadequate set of tools to analyse and justify individual decisions. In such circumstances it is not surprising that the delivery has been less effective than hoped for. Changing this lack of direction and imposing greater structure for the future development of the TENs remains a considerable challenge. This provides an important lesson for those seeking to learn from the TENs programme: how to implement the sort of international infrastructure improvements, which are seen as critical for global competitive advantage. Within such a drive individual regions may find they may finish up winners or losers, but which side of the line may be unpredictable without a much fuller understanding of the way in which both transport affects regional economic change and global trade trends affect global transport provision.

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