On the wider economic impacts of transport projects

Roger Vickerman
Professor of European Economics
Dean, Brussels School of International Studies
University of Kent

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Introduction and motivation

- Transport as a determinant of land use and economic development (wider economic impacts -WEI) the subject of much controversy
- Formal appraisal techniques tend either
  - to exclude the possibility of wider economic impacts because of the fear of double counting
  - or simply include an arbitrary add on
- Recent work has improved our understanding of the way in which accessibility
  - affects the performance of firms,
  - labour markets.

Introduction and motivation

- However, the empirical evidence remains problematic
  - endogeneity and causality questions
  - conflicts between macro-and micro-based estimates
  - the interrelationship and spillovers between different areas
- Recognition of the potential of wider impacts to be important in appraisal
- Little progress in their formal inclusion in official appraisal guidance
  - But UK does have a formal estimation procedure

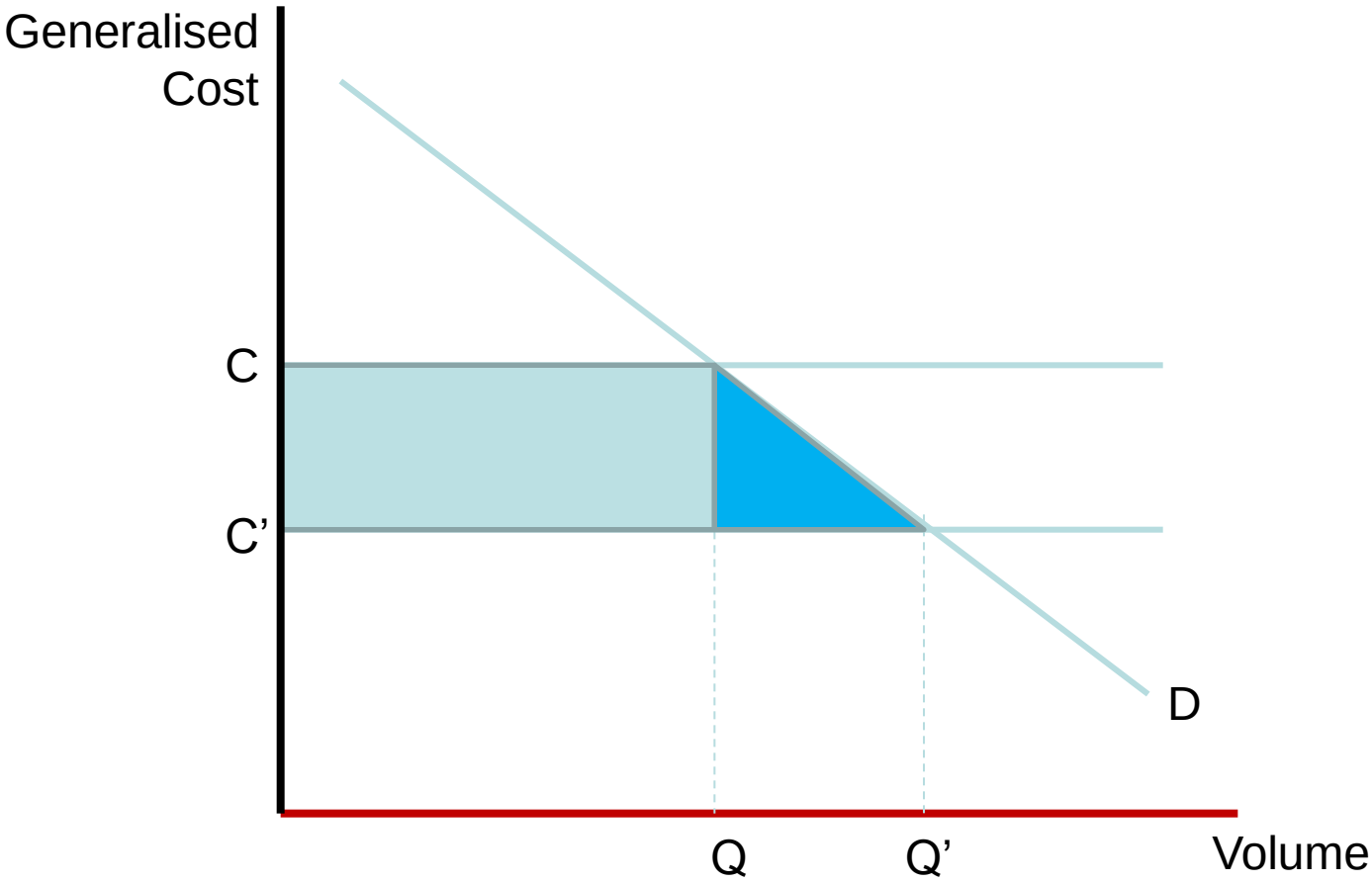
Transport and the local economy

- The multiple nature of transport
  - Transport as a derived demand
  - Transport as a substitutable input
  - Transport as an engine of growth
- The role of accessibility
  - External accessibility and the ‘two-way’ road
  - Internal accessibility and efficiency
- Accessibility, the cost of transport and economic growth
  - If transport costs are reduced industries become more competitive
  - Improved transport contributes to productivity growth.
  - Changes in the location of activities
  - Employment growth

The agglomeration issue

- ‘New Economic Geography’ provides the necessary linkages
  - Transport costs as determinant of the price of an urban location
  - And hence of the real wage
  - Thus going beyond the simple value of time savings as a transport benefit
- The theoretical basis of agglomeration
  - Increasing returns, transport costs and market size
  - Linkages in the local economy
  - The role of real wages in cumulative causation
  - Labour market impacts

CBA: the standard approach



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CBA: the standard approach

- But what are the assumptions lying behind this?
  - Perfect competition so that p=mc
  - No externalities so that mc=smc
  - No returns to scale so mc constant
  - Demand is only responsive to a change in price, not a change in supply (i.e. a fixed trip matrix)
- Suppose we change these assumptions
  - mc is upward sloping and smc>mc
  - But with increasing returns mc could slope down
  - p≠mc
  - And D could shift outwards in response to changing opportunities
  - But suppose that agglomeration also caused mc to shift downwards
  - Is the outcome now so determinate?

The UK Approach

- The five objectives of appraisal
  - Environment
    - To protect the built and natural environment
  - Economy
    - To support sustainable economic activity and get good value for money
  - Safety
    - To reduce the loss of life, injuries and damage to property
  - Accessibility
    - To improve access to facilities and reduce severance.
  - Integration
    - within and between different types of transport,
    - with the environment,
    - with land-use planning,
    - with policies for education, health and wealth creation.

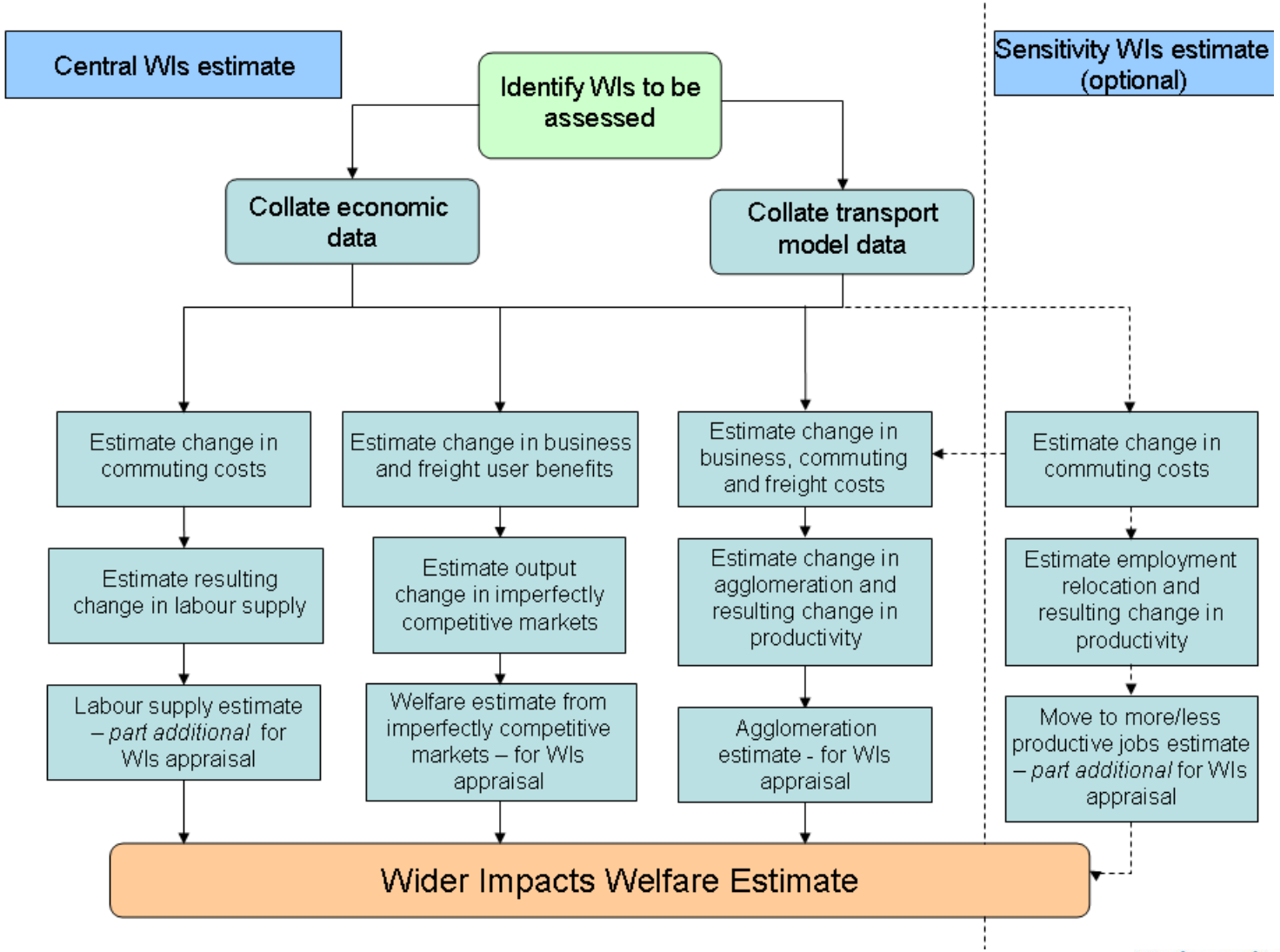
The economy objective

- Five elements:
  - to obtain value for money in relation to impacts on public accounts;
  - to improve transport economic efficiency for business users and transport providers;
  - to improve transport economic efficiency for consumer users;
  - to improve reliability;
  - to provide beneficial wider impacts through productivity and wider welfare gains and to support the regeneration of an area.

The wider impacts objective

- Four elements:
  - Agglomeration Impacts
  - Output change in imperfectly competitive markets
  - Labour supply impacts
  - Move to more or less productive jobs
- Guidance is that output change and labour supply impacts should be assessed for all schemes greater than £20m
- Agglomeration impacts assessed if the investment increases accessibility in an area close to an economic centre or large employment centre (defined on basis of FURs)
- Employment relocation only assessed where such relocation is shown to be likely on basis of detailed LUTI model

Estimating wider impacts



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Measuring wider impacts

- The labour supply impact:
  - The change in commuting costs affects the benefit individuals obtain from working (change in net wage)
  - The change in labour supplied based on applying an elasticity to the net wage change.
  - The additional productivity determined by multiplying the change in number of people working by the average economic contribution (GDP) of a new worker.
- The 'output change in imperfectly competitive markets' impact
  - The difference between the (higher) willingness of consumers to pay for increased output and the (lower) cost of the extra production, in imperfectly competitive markets. Estimated by up-lifting the estimate of conventional travel time and travel cost benefits to business users and to freight (current uplift factor =10%).
- The agglomeration estimation:
  - The impact on accessibility of firms and workers to each other from the estimated change in user travel time and costs
  - Each fractional change in agglomeration is estimated to lead to a change in productivity

Measuring agglomeration effects

$$WI1_i^{k,f} = \left[\left(\frac{d_i^{A,k,f}}{d_i^{B,k,f}}\right)^{\rho^k} - 1\right] GDPW_i^{B,k,f} E_i^{B,k,f}$$

- Measures wider impacts in terms of changes in density *d,* given GDP per worker *GDPW* and employment *E*
- For each area *i*, each sector *k*, for each forecast year *f,* given the elasticity of productivity with respect to density, ρ^k, in sector *k*, comparing the effects of scheme *A* with the base case *B*
- Effective density for scenario *S*, depends on the generalised costs, *g*, for mode *m*, and the rate of distance decay, *α*, for sector *k*, given total employment *E* in area *j*

$$d_i^{S,k,f} = \sum_{j,m} \frac{E_j^{S,f}}{\left(g_{i,j}^{S,m,f}\right)^{\alpha^k}}$$

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Regeneration impacts

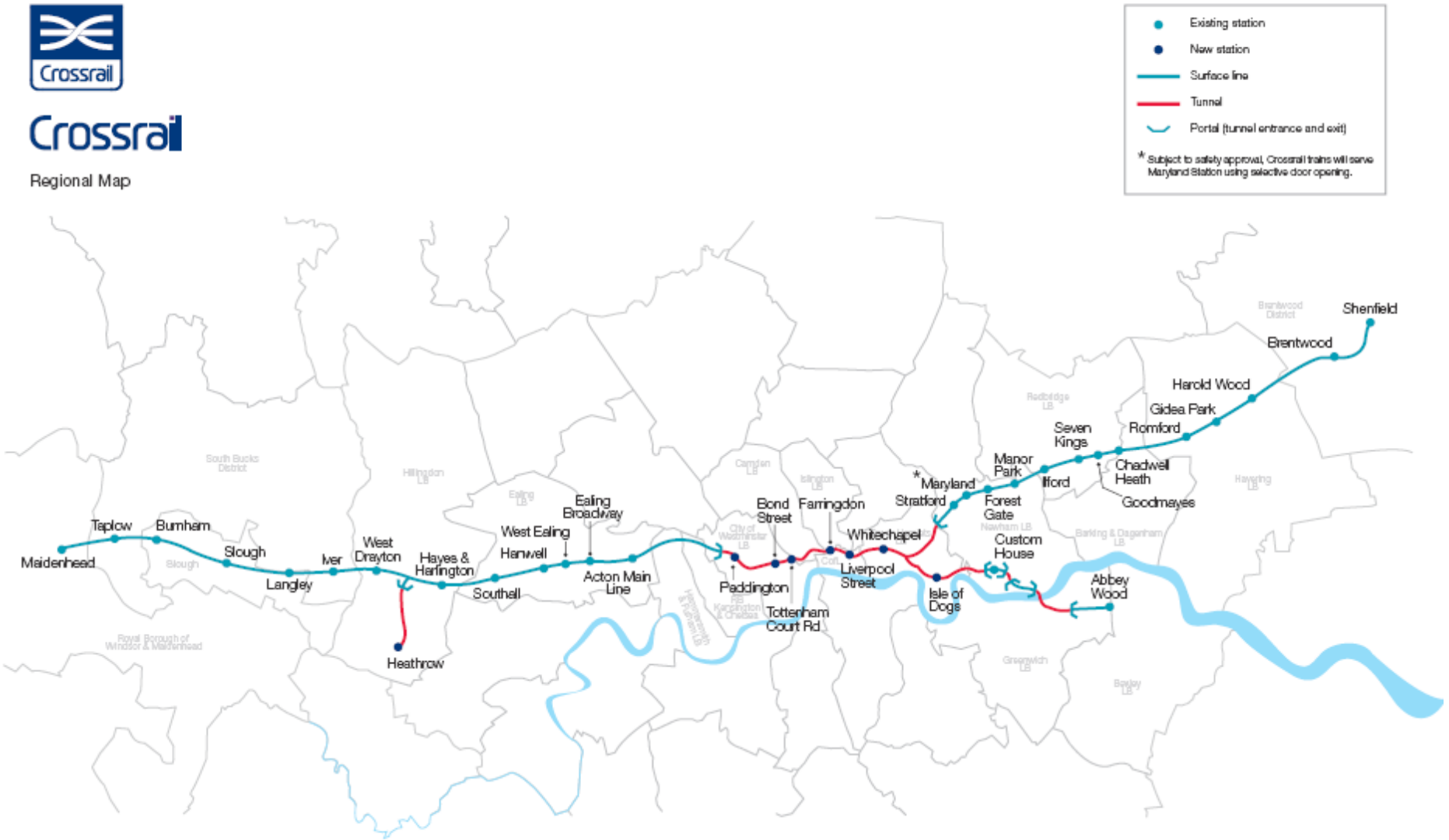
- Additional consideration given to impacts on Regeneration Areas (RAs).
- Impact measured as the change in the number of RA residents in employment (plus the change in the number of jobs in the RA).
- Concerned with impacts only within the RA and the surrounding region; not necessary to demonstrate whether any new jobs generated by a transport scheme would otherwise have gone somewhere else in the country.
- Use patterns of accessibility to indicate feasible ranges for any increases in employment.
- Need to decide if there are identifiable regeneration impacts, and recognise that they may not always be positive, for example , by exposing an RA to increased competition, the scheme might lead to a reduction in employment.

Two case studies

- Crossrail
  - Urban rail project in London
  - Cost GBP16bn
  - Direct user benefits insufficient
  - But could have significant agglomeration benefits?
- HS2
  - High-speed rail line London-Birmingham (with possible extensions northwards)
  - Cost GBP20bn (£35bn for full Y-network)
  - Direct user benefits estimated sufficient
  - But wider benefits add (although relatively smaller than urban situation)
  - Have all the impacts been captured?

Crossrail

Regional Map



August 2006

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Welfare and GDP impacts of Crossrail

Benefits	Welfare (£mn)	GDP (£mn)
Business time savings	4,487	4,847
Commuting time savings	4,152	
Leisure Time savings	3,833	
Total transport user benefits	**12,832**	
Increase in labour force participation		872
People working longer		0
Move to more productive jobs		10,772
Agglomeration benefits	3,094	3,094
Increased competition	0	0
Imperfect competition	485	485
Exchequer consequences of increased GDP	3,580	
Addition to conventional appraisal	**7,159**	
Total (excluding financing, social and environmental costs and benefits)	**19,991**	**20,069**

Source: Department for Transport (2005)

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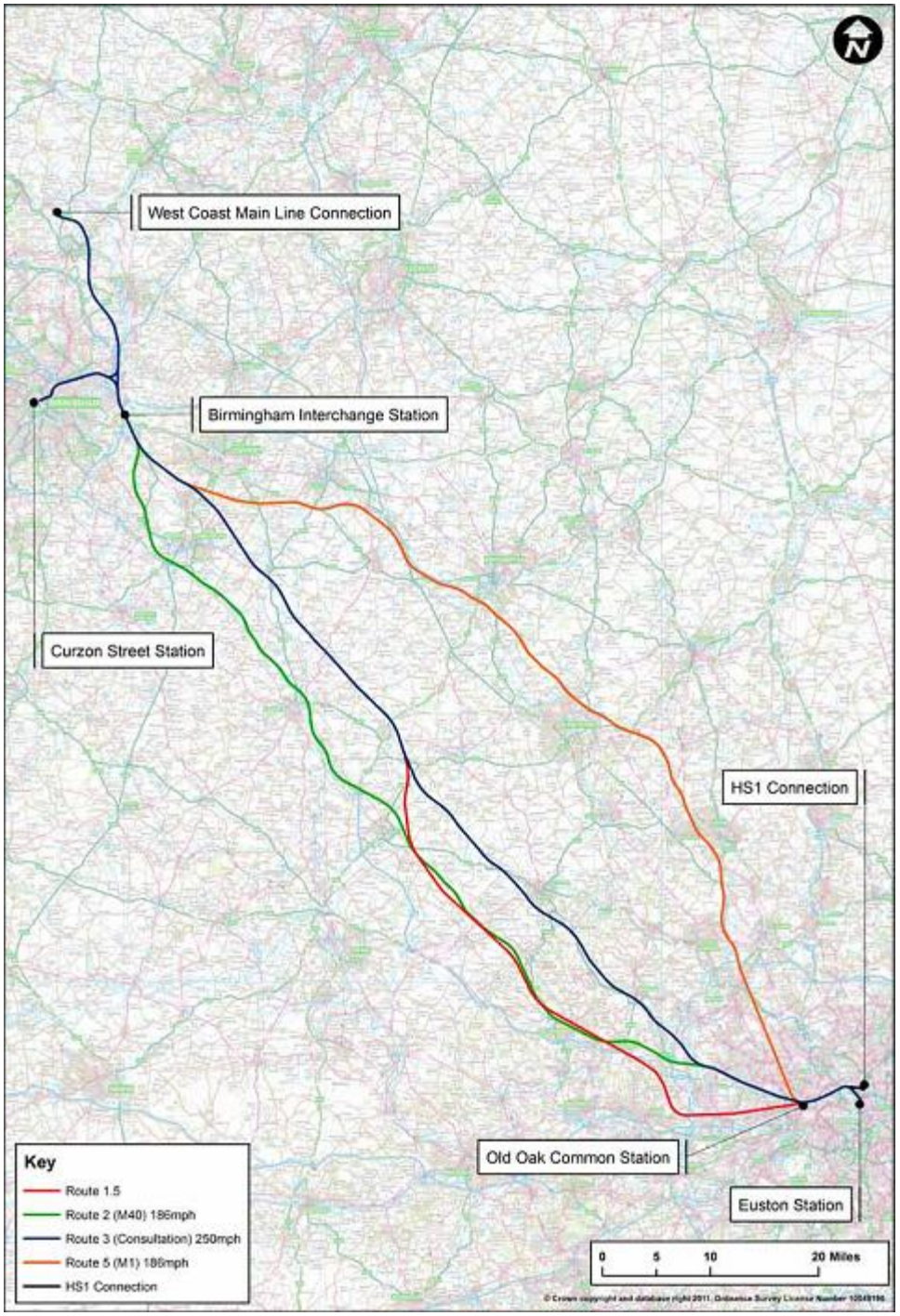

HS2 Proposed Route, January 2012

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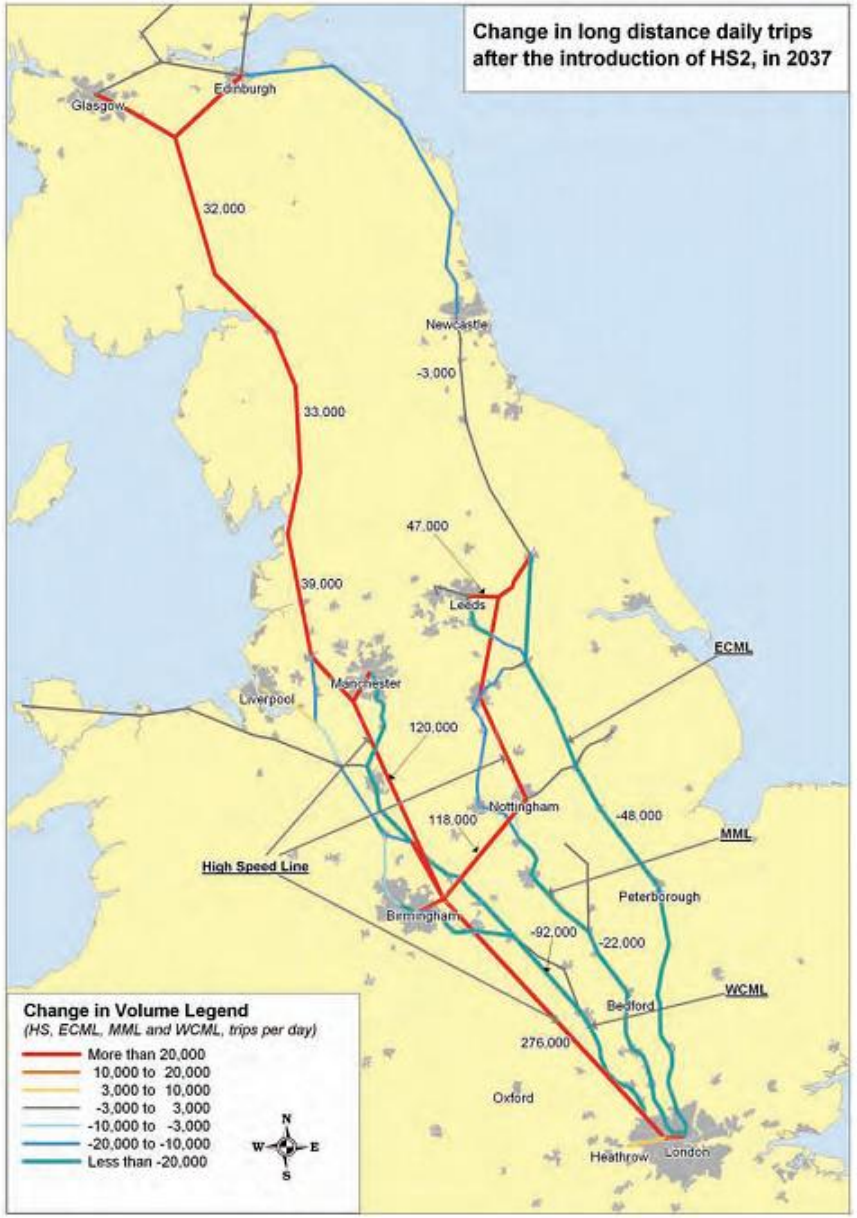
HS2 as part of a HSR Network

Figure 1 – **Change in long distance daily trips after introduction of the Y network, in 2037**



Disclaimer: This is a schematic reference for HS2. It does not represent the geographical location of potential HS2 lines.

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Table 1 – **Summary of the update to quantified benefits and costs of HS2 (£ billions 2011 PV/prices) and the resulting Benefit Cost Ratio (BCR)**

	London – West Midlands		Y Network	
	Economic Case February 2011	Update January 2012	Economic Case February 2011	Update January 2012
Capital cost	£20.2bn	£18.8bn	£34.6bn	£36.4bn
Operating costs	£7.0bn	£8.6bn	£15.8bn (£12.3bn – £19.3bn)	£21.7bn
Increase in rail revenue	£15.5bn	£13.9bn	£31.0bn	£31.8bn – £34.0bn
Economic benefits (excluding WEIs)	£18.9bn	£19.0bn	£42.7bn (£41.2bn – £44.2bn)	£41.4bn – £46.9bn
Wider Economic Impacts (WEIs)	£4.7bn	£4.1bn	£7.4bn (£4.7bn – £10.2bn)	£5.7bn – £12.3bn
BCR (including WEIs)	**2**	**1.7**	**2.6 (2.0–3.4)**	**1.8–2.5**

Source: HS2 Ltd
N.B. The numbers in brackets represent a range around the central numbers presented above them.

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Table 15 – **Quantified costs and benefits (£ billions) of HS2 London to West Midlands (2011 PV/prices) and resulting BCR**

1	Transport User Benefits	Business	£12.3bn
		Other	£7.8bn
2	Other quantifiable benefits		£0.6bn
3	Loss to Government of Indirect Taxes		-£1.6bn
4	**Net Transport Benefits (PVB) = (1) + (2) + (3)**		**£19.0bn**
5	Wider Economic Impacts (WEIs)		£4.1bn
6	**Net Benefits including WEIs = (4) + (5)**		**£23.1bn**
7	Capital Costs		£18.8bn
8	Operating Costs		£8.6bn
9	**Total Costs = (7) + (8)**		**£27.4bn**
10	Revenues		£13.9bn
11	**Net Costs to Government (PVC) = (9) – (10)**		**£13.5bn**
12	BCR without WEIs (ratio) = (4)/(11)		1.4
13	**BCR with WEIs (ratio) = (6)/(11)**		**1.7**

Source: HS2 Ltd

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Table 9 – **HS2 Y Network quantified costs and benefits (£ billions) of HS2 (2011 PV/prices) and resulting BCR**

1	Transport User Benefits	Business	£28.8bn – £32.3bn
		Other	£15.3bn – £17.4bn
2	Other quantifiable benefits		£1.0bn – £1.1bn
3	Loss to Government of Indirect Taxes		-£3.6bn – -£3.9bn
4	**Net Transport Benefits (PVB) = (1) + (2) + (3)**		**£41.4bn – £46.9bn**
5	Wider Economic Impacts (WEIs)		£5.7bn – £12.3bn
6	**Net Benefits including WEIs = (4) + (5)**		**£47.2bn – £59.3bn**
7	Capital Costs		£36.4bn
8	Operating Costs		£21.7bn
9	**Total Costs = (7) + (8)**		**£58.1bn**
10	Revenues		£31.8bn – £34.0bn
11	**Net Costs to Government (PVC) = (9) – (10)**		**£26.3bn – £24.1bn**
12	BCR without WEIs (ratio) = (4)/(11)		1.6 – 1.9
13	**BCR with WEIs (ratio) = (6)/(11)**		**1.8 – 2.5**

Source: HS2 Ltd

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Table 4 – **Breakdown of benefits for lower bound estimate of the Y Network (£ millions 2011 PV/Prices)**

Benefit	Business	Other	Total
Journey Time Saving	18,700	5,800	24,500
Improved Reliability	4,100	1,100	5,200
Reduced Crowding	1,800	4,900	6,700
Other Rail User Impacts	2,900	2,600	5,500
Other Impacts	1,200	900	2,100
Total Benefits	28,800	15,300	44,100

Source: HS2 Ltd

Implications for appraisal

- From theoretical model to method of appraisal for individual projects.
  - Towards a more theoretically correct CBA recognising externalities and imperfect competition.
  - Appropriate models and the scale of projects: what is the relevant study area for impact?
  - Link estimates and network effects
- Data requirements
  - Need evidence at more detailed level then typical in most transport models
  - How does behaviour change with major projects?
- Scale factors
  - Agglomeration clear for major urban projects
  - But distance decay pronounced
  - Can inter-urban projects have agglomeration effects?
  - Are they always uni-directional?

Implications for policy

- Simple rules are dangerous
  - Investment in transport can damage your health
  - Failure to invest in transport can damage it too
- Appraisal rules need to be comprehensive but transparent
  - Decisions have to be robust
  - But clearly understood by all stakeholders
- Levels of decision making
  - Spillovers
  - Policy refraction in multi-level governments
  - Jurisdictional competition and over- or under-investment

Concluding remarks

- Full circle on wider benefits
  - From “transport is critical”
  - To “beware double counting”
  - To “wider benefits are the key”
- But beware all simple rules in transport appraisal
- There remains much on the research agenda
  - Imperfect competition and the productivity gains from transport
  - Micro-behavioural evidence
  - Link versus network effects
  - Spillovers and jurisdictional competition
  - More ex post studies, does transport investment really make the difference claimed?