12. TRANSPORT APPRAISAL

Introduction

- **Appraisal** = is a way of thinking about all the costs and benefits of different spending projects in a systematic manner so that, different projects can be compared and investment made which are going to rpovide the maximum return.
- **Transport** involves the expenditure of resources on a combination of investment in capital items (e.g. stations, tracks, roads) and/or in operations (e.g. subsidy)
- **Society** has limited resources → therefore it should seek to maximise the return from investments

Alternatives

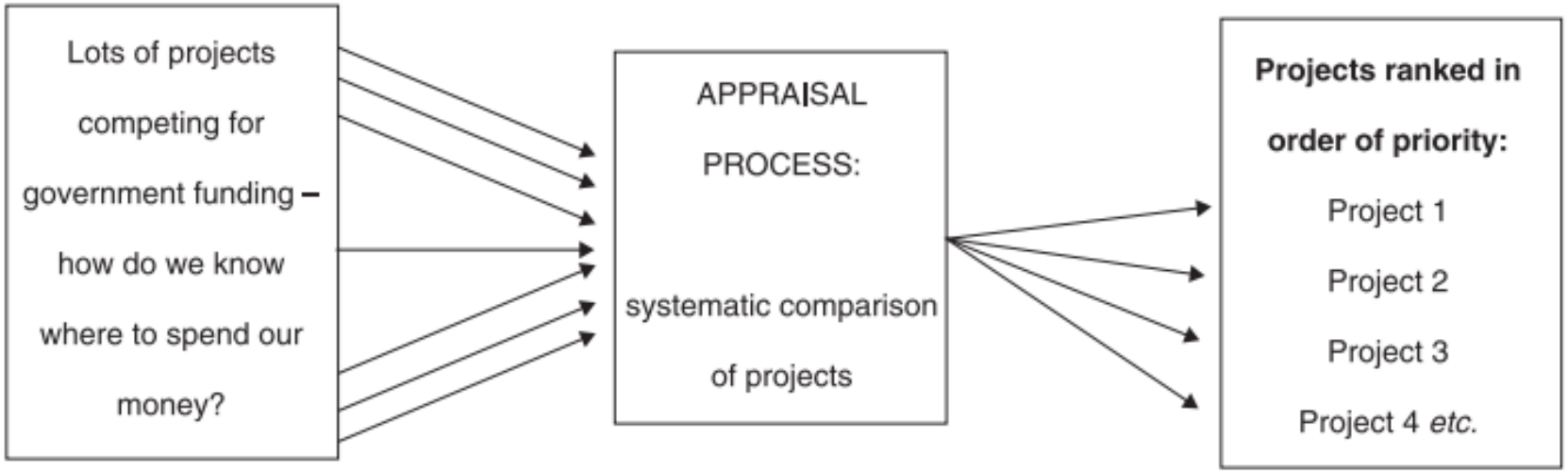
- Appraisal is a way of predicitng how much utility we as society will derive from the expenditure of resources on one thing **compared** to another, by predicting the utility that will arise from each
- For example → how much utility would we get from spending 10 bn CZK on a new **motorway** compared to a new **railway**

Appraisal and Forecasting

- It is fundamental to realise that inherent in appraisal, there is some kind of prediction or **foracsting** required
- Because we have not built the project, we are only considering whether it will be wortwhile or not → we have to try to forecast **the future** → sometimes quite far into the future
- Two main techniques can be used:

  - Looking at the performance of **similar,** existing projects
  - Using predictive **models**

The appraisal process



The role of politics

- Appraisal is **not the only basis** on which projects are selected for funding; politics often play a major role
- Politicians may have „**non-rational**“ reasons for wanting or not wanting projetcs and these may have little to do with the results of appraisal
- The appraisals are frequently done **after** the desicion to build the project had been taken – ex post justification of a political decision
- Appraisal provides the **advice**, that may be ignored by politicians. The politicians také the ultimate decisions.

Cost benefit analysis

- Cost benefit analysis (CBA) estimates and **totals up** the equivalent money value of the benefits and costs to the community of projects to establish whether they are worthwhile
- The results of CBA is a number: this shows the **ratio** of benefits to costs for the scheme.
- If it is **less than 1** (costs exceed benefits) then the rational government or organization would be expected to be unlikely to fund the scheme
- Values **above 1** indicate the overal benefit to society and higher the ratio, the higher the probabilty that it will be financed

Monetary values

- The basis of CBA is that a **monetary value** needs to be allocated to all benefits and costs associated with a given project.
- Some costs and benefits can **easily** be expressed in monetary terms (fares, costs of building roads or operating trains), some are **harder** to monetize (accidents, noise) and finally some are very **extremely diffucult** to exprsss in monetary terms (change in the quality of landscape, wider economic benefits)
- This is a funamental **diffuclty** in CBA from their beginings in late 1950s

From CBA to SCBA

- **Private** sector → CBA is straightforward → only costs and benefits that can be sold at the market
- **Public** sector → wider range of costs and benefits → what to include and what to exclude? → many factors (time and accidents savings) cannot be bought at the open market
- **Social** costs benefit analysis (SCBA) → CBA that includes factors without direct market value, but with social value

One problem

- The factors that are excluded from SCBA may be sometimes viewed as more **important** than those that are included → is it feasible to include all factors?
- The results of SCBA shows only how the scheme performs in terms of factors included in the analysis → but not necessarily how it performs in realtion to the **objectives** set fro the scheme
- Alternative appraisal methodology → **objective – based appraisal** (or multicriteria analysis)

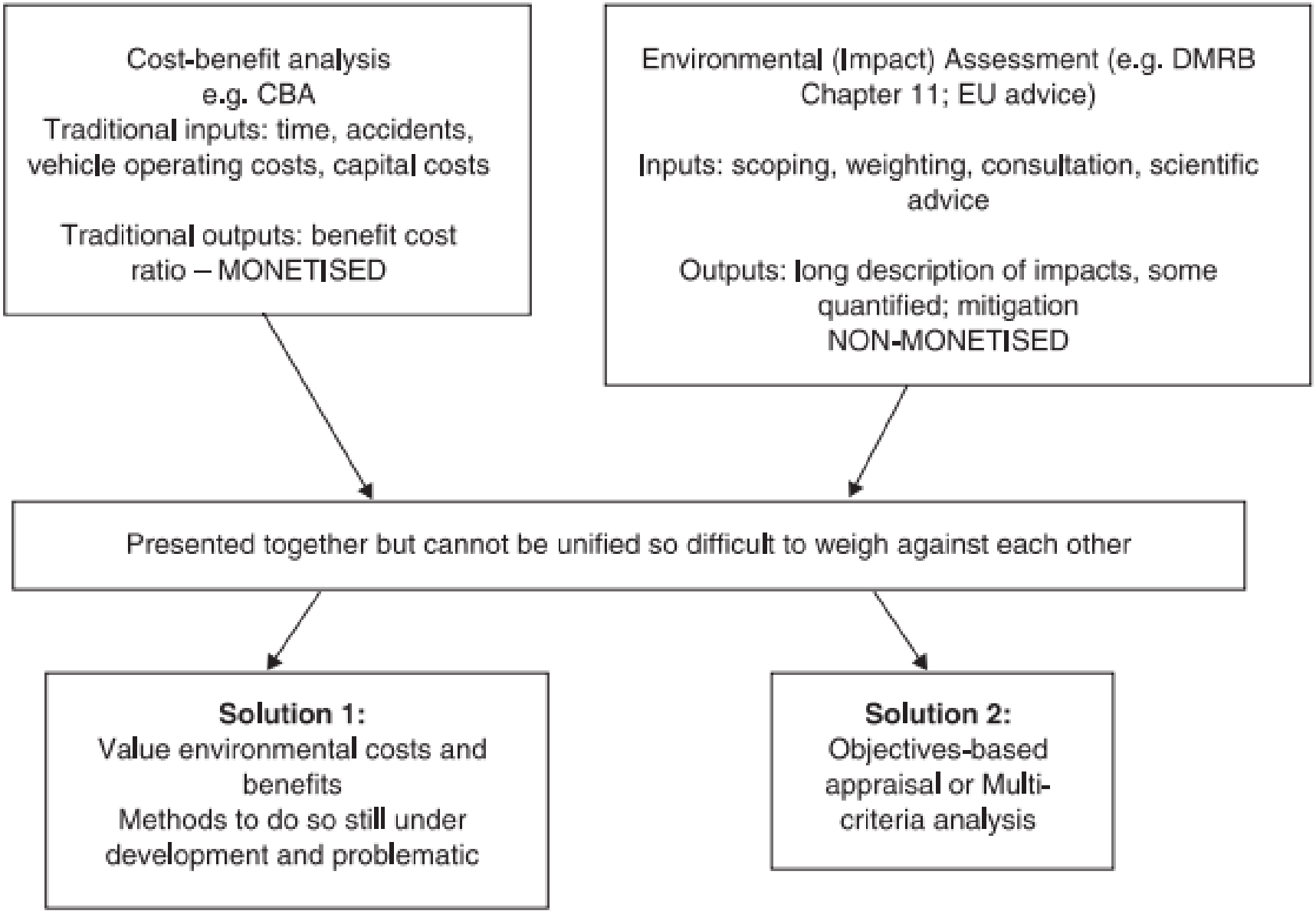


Figure 14.2 Comparison of appraisal methodologies: a summary

Objective - based appraisal

- Good objective based appraisal needs **clear objectives**
- **SMART** objectives → specific, measurable, agreed, realistic and time-dependent
- **UK governemnt** objectives → Economy, Enviroment, Safety, Integration, Accessibility and social inclusion
- There is an element of **political controversy** in objective based appraisal (choice and clarity of goals) → SCBA avoid this
- it is difficult to argue against the project that appears to be **good value for money** → it is quite easy to argue against a projects that performs well against an **objective** with wchich you do **not agree**

How does CBA work?

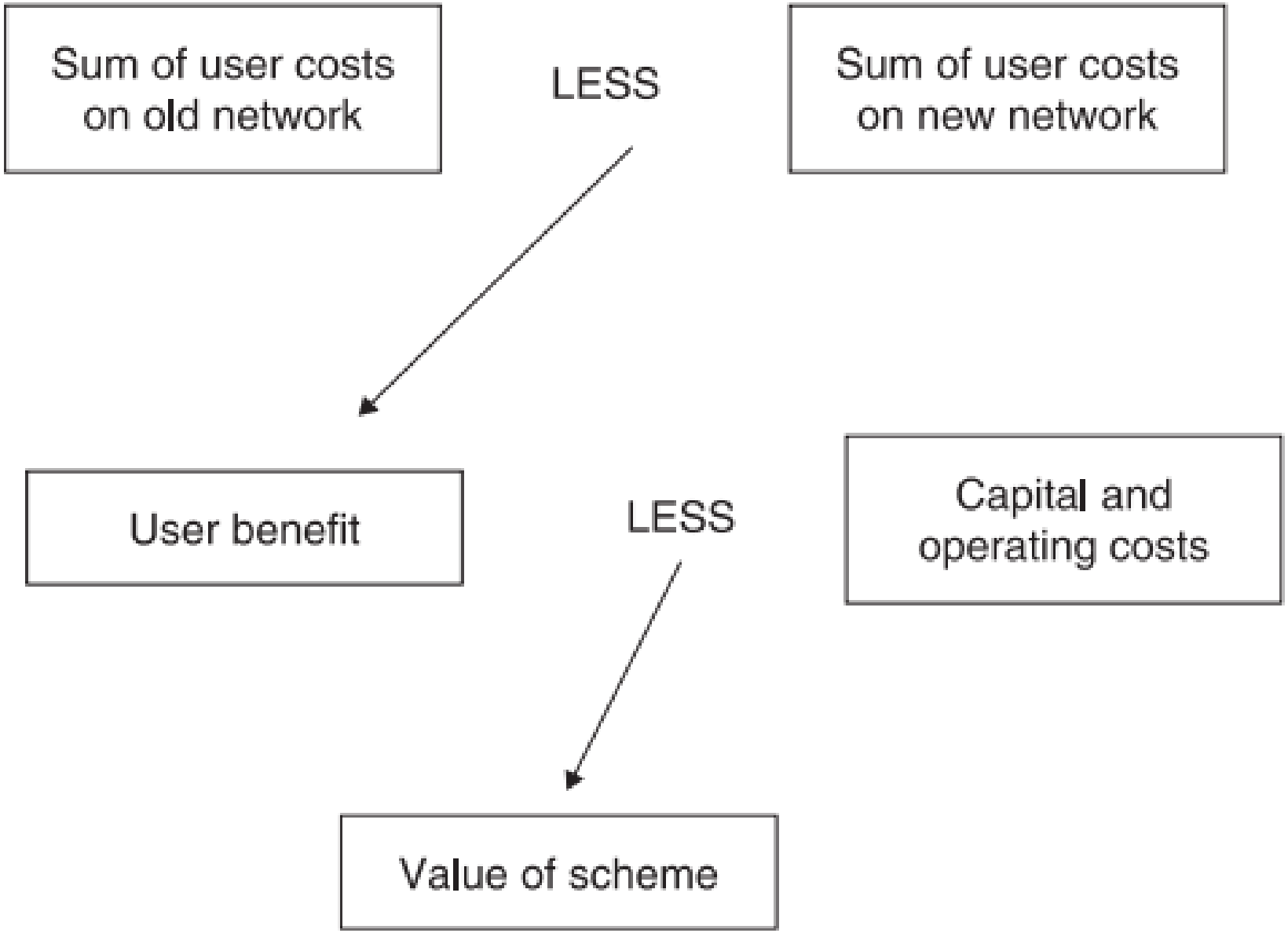
- Despite the emergence of objective based appraisal, **CBA** remains the **main** appraisal tool
- The prurpose is to **weigh up** the costs and benefits and to see whether benefits are higher, and if so, by how much.
- Example: **Tram bypass in Gothenburg** → tram network congested in city cetre → idea of tram bypass to provide faster journey times across town and to provide new journey opportunity

Steps in CBA

1) Choose one or more **alternative options** → against which to assess the tram bypass scheme. The base option (**Option B**) → to build nothing/minor improvement against (**Option A**) → building tram bypass
2) Choose **length of time** → probably several decades → over which to assess
3) Use a predcitve model to calculate the likely **ridership** during the whole evaluation period on the tram network in Options A, B. → From this, calculate the **revenue**
4) Use the same predictive model → to calculate total **journey times** on different options over the whole evaluation period

Steps in CBA (2)

5) For Option A calculate the journey **time savings** likely to result from the project
6) In a similar way, calculate journey **time savings** on the **road** network resulting from the tram bypass → if people are predicted to transfer from car and/or bus to tram
7) Calculate construction, maintenance and operating **costs** of the different options
8) Také away the benefits (revenue plus journey time savings) from the costs for Option A to find out whether benefits **exceed** costs and, if so, by how much.


Sum of user costs on old network
LESS
Sum of user costs on new network
User benefit
LESS
Capital and operating costs
Value of scheme

Key elements of SCBA (1)

- Project appraisal **period** → usually 30 – 60 years
- The **benefits** that are assessed → changes in travel time, revenues, vehicle operating costs, accident costs, (increasingly) noise and air pollution
- **Forecasting** and modelling → modelling should be traeted as indikative → induced traffic and newly created congestion
- **Present values** → costs and benefits have to be calculated in their net present values (NPV)

Key elements of SCBA (2)

- **Accident** valuation → usually based on insurance costs (policing, medical, pain and suffering, economic losses) → willigness to pay for safety improvements
- **Operating costs** → e.g. By raising average speed and reducing congestion, a new road is likely to reduce operating costs for all users
- **Revenue** → discounted flow of revenues

Value of time

- **Values of time** → normally the most significant benefit in SBCA → value of time used is abolutely **critical** to the final outcome of the evaluation
- Usually **very small** individual journey times savings multiplied by a very large number of users over a long period
- How to **estimate reliably** values of time? → estimation techniques → working and non working time → opportunity costs

Discussion

- **Valuing time savings** → proportional valuation of small and big time savings? →what we actually do with the time saved?
- **What to value**? → many costs and benefits are left out
- **Discount rate and length of time** → they are arbitrary and critical to the outcome
- **What does NPV shows us?** → they may not help us with trasnport policy objectives
- **Equity and distributional effects** → fairness and political considerations
- **Project pricing – optimism and inaccuracy** → usual escalation of costs

Exercise (1) – Discount rate

Year	Benefit (undiscounted) (£)
2003	35,000
2006	60,000
2008	100,000
2010	25,000
2014	40,000
2017	70,000

- The effect of the discounting rate and project time period
- First, discount the following stream of benefits from a project and derive a total NPB for price base year 2002. Use a discount rate of 3.5 per cent.

Exercise (2) – Value of licence

Suppose you are interested in operating a taxi and you are considering purchasing a taxi operating certificate form an existing operator. You estimate that the current operator makes annual excess profits equal to 100.000 CZK. At a 5% rate of interest, what is the maximum price you are willing to pay for this license? Would you be willing to pay this same price if the interest rate were 10%?

Exercise (3) – Investments „needs“

Critique the following statement: “We currently do not have sufficient airport capacity to meet the continuing growth in airline traffic. In order to avoid gridlock at our nations airport, we need to build additional airports”.

Exercise (4) – Value of time

Decide which values of time you should use for a person who is travelling by underground train on works' business; and for a person who is travelling to work by bus. Why do you think that values of time when travelling in working time are highest for travellers on the underground and lowest for those on the bus?

The Economics of Investment in **High Speed Rail**

based on J. Preston (2013)

Introduction

- Origin in Japan - **Shinkansen (1964)**
- Defined as new rail lines capable of operating speeds of **250 kilometres per hour** or more
- World HSR network (2013) – 22.000 km
- China, Japan, France, Spain
- Germany, UK, Italy, Korea, Taiwan, ……
- HSR **extremely costly**
- Better **understanding** of the economics of HSR **needed**

Design

- Largely **freestanding** systems (Japan, China) x systems **integrated** with conventional rail (France, Spain, Germany)
- HSR may penetrate city **centres** using conventional tracks (France) or new tracks (Japan) or may serve **edge** of city locations (China)

Aims

- **Capacity** = separating fast and slow trains
- **Speed** = rail to compete with air

- Promoting national **champions** (in supply)
- Journey time **reliability** (UK)
- Economic **development** (China)
- Political **integration**/centralization (Spain)
- **Enviroment** (UK)

Appraisal and Evaluation

- In both ex-ante **appraisal** and ex-post **evaluation** of HSR cost-benefit analysis is the dominant methodological tool
- Sometimes **distributional** impacts are important

Benefits of HSR (UK evidence)

- 30% **revenue**
- 50% users **time savings**
- 10% **reduction** of rail **overcrowding**
- 10% **wider** economic **benefits**

- Benefits from reduced rpoad congestion and enviroment improvement were relatively minor

HSR traffic (European evidence)

- 30% abstracted from **air**
- 30% abstracted from **classic rail**
- 15% from **road** (predominantly car)
- 25% **generated**

Capital costs

- **High** capital **costs** are required to achieve grade separation, curvature and gradient
- **Costs higher** when high population densities, high land values and unfavourable topography
- Costs may **vary** from below EUR 10 million per km (China) to over EUR 100 million per km (HS1 approaches to London)
- **Economies of density** important
- **Operating speed** is a key driver of capital costs

Demand

- High degree of variability in demand for HSR schemes from below **4** million passengers per annum (Madrid-Seville) to over **200** million passenger per annum (for the Tokaido and Sanyo Shinkansen)
- **Determinants**: population, spatial structures, fare levels, HSR stations location, national and sometimes regional borders
- Demand estimations: **gravity model**

Competition

- **Intermodal** competition – very intensive, low cost airlines
- Italy – HSR open access competition between Trenitalia and NTV:
  - 30% reduction in fares
  - 45% increase in services
  - 30% increase in demand
  - It is not clear whether this competition will be sustainable
- **High** access **charges** (typically 25-45% of HSR revenue) can limit open access competition

Analysis

- Paralysis by **analysis** (UK, US) – many studies, minimum service
- **Build and see** (China, Spain) – large increases in HSR network

- Step by step x big bang approach

Test for HSR investment

1. Does HSR make a **commercial** return?
2. Does HSR make a **social** return?
3. Does HSR make a social return including impacts on other transport systems and **wider** economic benefits?
4. Does HSR have social returns when **qualitative** wider benefits are taken into account?

Nash (2015): When to invest in HSR?

RÉSEAU FERRÉ DE FRANCE

L'EUROPE DE LA GRANDE VITESSE
HIGH SPEED EUROPE

2012

Vitesse autorisée supérieure ou égale à 250 km/h*
Linespeed over or equal to 250 km/h*

- Ligne en service (fin 2011) *Line in operation (as of end of 2011)*
- Ligne en travaux *Line under construction*
- Ligne en projet avancé, déclarée d'utilité publique ou équivalent *Line in advanced planning, recognised of public utility (France) or equivalent*

Vitesse autorisée comprise entre 200 et 250 km/h*
Linespeed between 200 and 250 km/h*

- Ligne en service (fin 2011) *Line in operation (as of end of 2011)*
- Ligne en cours d'amélioration *Line under upgrading works*

- Autre ligne *Other line*

* Une vitesse inférieure est possible sur de courtes sections (traversées de ville, tunnels).
** Reduced linespeeds may occur on short sections (across urban areas, tunnels).*

Sources : *RFF, Gestionnaires d'infrastructure /Rail infrastructure managers, UIC, Commission Européenne/European Commission*
Document non-contractuel/Non-binding document

0 100 200 300 km

Juillet 2012 / July 2012

HSR in France

Ex post appraisal of French high speed line construction.

		Sud Est	Atlantique	Nord
Length (km)		419	291	346
Infrastructure cost	Ex ante	1662*	2118	2666
(m euros 2003)	Ex post	1676	2630	3334
	% change	+1	+24	+25
Traffic at opening (m pass)	Ex ante	14.7	30.3	38.7
	Ex post	15.8	26.7	19.2
	% change	+7.5	−12	−50
Financial return (%)	Ex ante	15	12	12.9
	Ex post	15	7	2,9
Social return (%)	Ex ante	28	23.6	20.3
	Ex post	30	12	5

CBA of HSR in Spain

CBA of high-speed rail in Spain (billions of 2010 euros)	Madrid–Seville	Madrid–Barcelona
Costs	6.8	12.4
Benefits	4.5	7.2
Of which time savings	1.6	2.8
Generated traffic	0.8	1.1
Costs saved on other modes	1.9	2.9
External costs saved	0.2	0.4
Net present value	−2.3	−5.3

Source: de Rus (2012).

CBA of HSR in Britain

1998 Appraisal of HS1 (£m 1997 NPVs).

User benefits – international services	1800
User benefits – domestic services	1000
Road congestion	30
Environmental benefits	90
Regeneration	500
Total benefit	3420
Costs to government	1990
Net present value	1430
Benefit cost ratio (all benefits)	1.72
Benefit cost ratio (excluding regeneration benefits)	1.5

Source: National Audit Office (2001).

Note: At the current exchange rate (January, 2015) £1 equals 1.3344 euros.

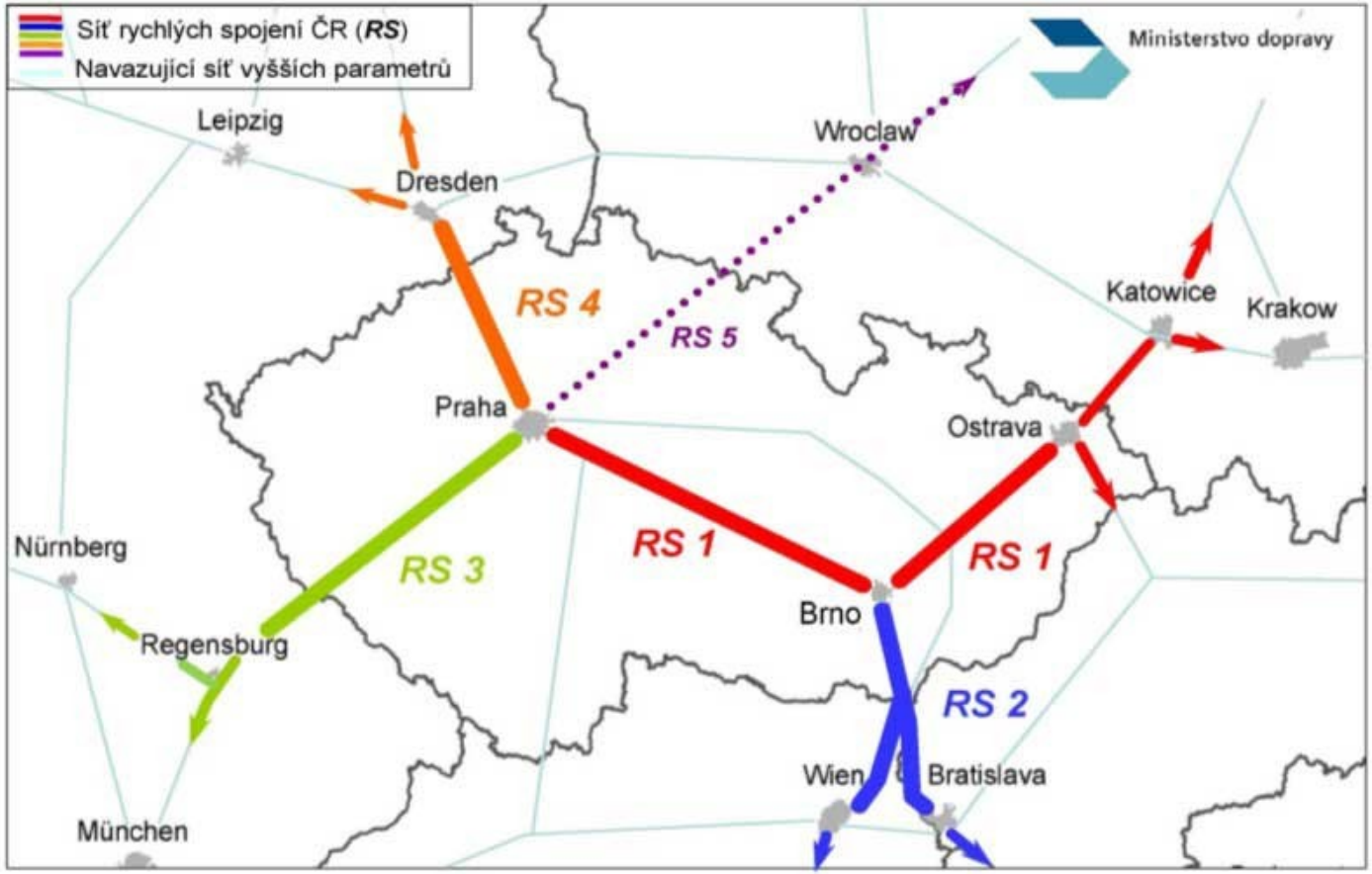
Nash (2015)

HSR costs and benefits

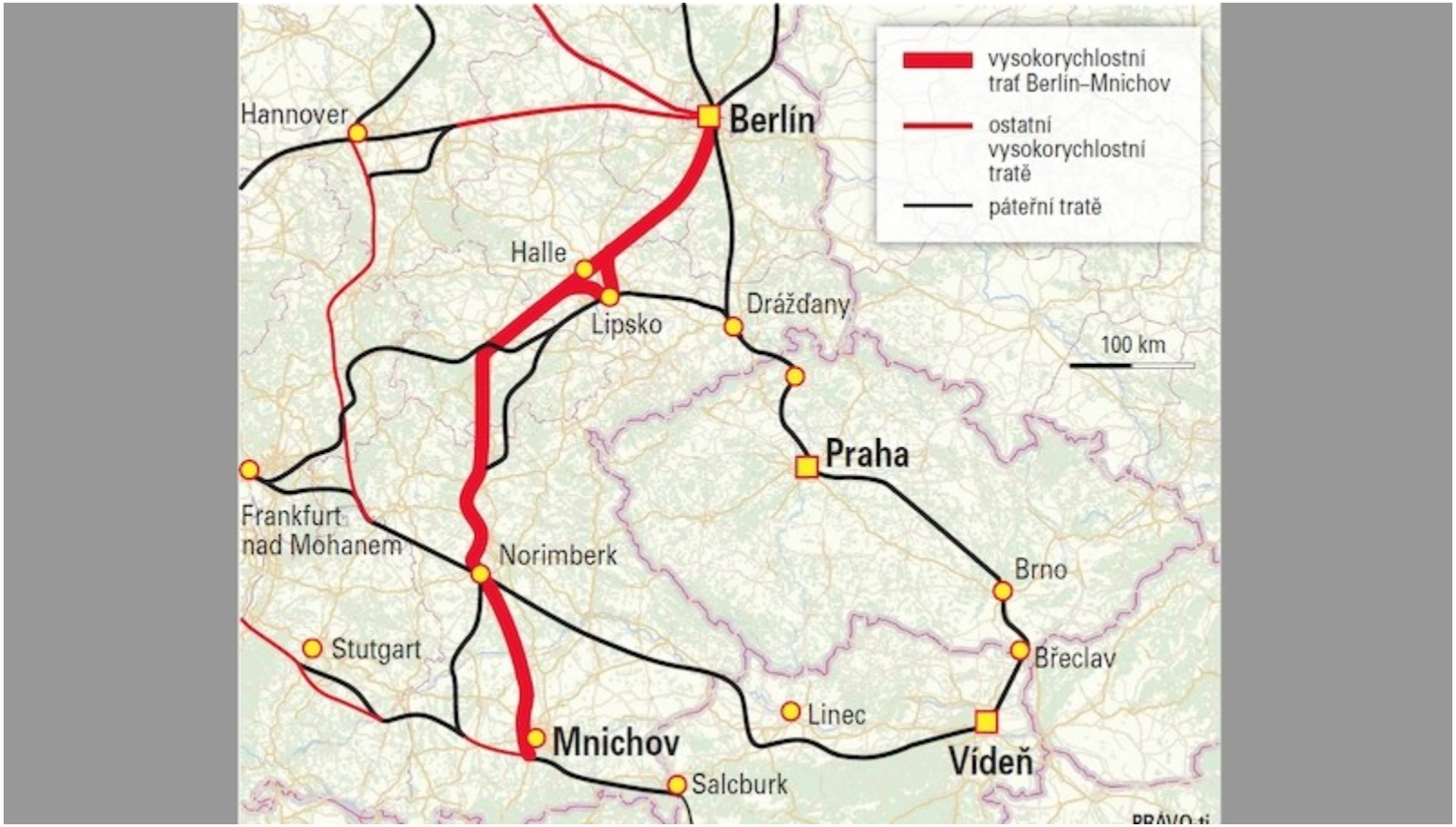
Costs	Benefits
Capital costs	Revenue
Operating costs	Time savings (beyond those recovered in higher prices)
External costs	Release of capacity on existing rail routes
Loss of tax revenue (from traffic diverted from road to rail)	Diversion from other modes – reduced congestion, accidents and environmental costs
Opportunity cost of public sector funds	Induced traffic
	Wider economic benefits

HSR in the Czech Republic

Is it a good idea to build HSR in the Czech Republic?



The „threat“ of being excluded from HSR network in Central Europe



Bent Flyvbjerg

Biased demand forecasts

- The study of **traffic forecasts** in transportation infrastructure projects. The sample used is the largest of its kind, covering 210 projects in 14 nations. The study shows that forecasters generally do a **poor job of estimating** the demand for transportation infrastructure projects.
- For **9 out of 10 rail** projects, passenger forecasts are **overestimated**; the average overestimation is 106%. For half of all **road projects**, the difference between actual and forecasted traffic is more than ±20%.
- The result is **substantial financial risks**, which are typically ignored or downplayed by planners and decision makers to the detriment of social and economic welfare.

Flyvbjerg, B., Skamris Holm, M. K., & Buhl, S. L. (2005). How (in) accurate are demand forecasts in public works projects?: The case of transportation. *Journal of the American planning association*, *71*(2), 131-146.

Cost escalation

- The study of **cost escalation** in transportation infrastructure projects. Based on a sample of 258 transportation infrastructure projects worth US$90 billion it is found that the cost estimates used to decide whether such projects should be built are **highly and systematically misleading**.
- Underestimation cannot be explained by error and is best explained by strategic misrepresentation, that is, **lying**.
- The policy implications are clear: legislators, administrators, investors, media representatives, and members of the public who value honest numbers **should not trust** cost estimates and cost-benefit analyses produced by project promoters and their analysts.

Flyvbjerg, B., Holm, M. S., & Buhl, S. (2002). Underestimating costs in public works projects: Error or lie?. *Journal of the American planning association*, *68*(3), 279-295.