ECO impact assessment training workshop

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Agenda

- **Overview of impact assessment process**
- **Assessing the net economic impacts of the options**
- **Three case study examples from the UK:**
  - The economic value of licence exempt spectrum
  - Digital switchover for television
  - Digital switchover for radio
- **The three problems for tomorrow's training sessions**

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Overview of impact assessment process

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Systematic impact assessment is nothing new

- "I cannot for want of sufficient Premises, advise you what to determine, but if you please I will tell you how.
- When these difficult Cases occur, they are difficult chiefly because while we have them under Consideration all the Reasons pro and con are not present to the Mind at the same time... Hence the various Purposes or Inclinations that alternately prevail, and the Uncertainty that perplexes us.
- To get over this, my Way is, to divide half a Sheet of Paper by a Line into two Columns, writing over the one Pro, and over the other Con. Then during three or four Days Consideration I put down under the different Heads short Hints of the different Motives that at different Times occur to me for or against the Measure.
- When I have thus got them all together in one View, I endeavour to estimate their respective Weights; and where I find two, one on each side, that seem equal, I strike them both out: If I find a Reason pro equal to some two Reasons con, I strike out the three. If I judge some two Reasons con equal to some three Reasons pro, I strike out the five;
- and thus proceeding I find at length where the Balance lies."

- **Benjamin Franklin's "*Moral or Prudential Algebra*" in letter to Joseph Priestley, 19 September 1772**

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The purposes of impact assessment

- **Impact assessment is a discipline that can help define a decision problems more clearly**
  - Requires a clear articulation of the status quo and alternatives
  - Requires a clear articulation of objectives
  - Focuses attention on the net impact of change
  - Promotes analysis and engagement with stakeholders
- **Impact assessment promotes quantification**
  - Quantification can make the decision problem easier
  - Helpful, even if some things cannot be quantified, since can ask “how big would X need to be to change my decision?”
- **Process of impact assessment usually leads to more fruitful problem definition**

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ECC Report 125 - the impact assessment process

1. Identification of the issue/problem(s)
2. Describe the policy/measure and identify the objectives
3. Identify and describe the regulatory options
4. Determine the impacts on all stakeholders including relevant spectrum incumbents
5. Determine the impact on competition (if relevant)
6. Assess the impacts and choose the best option
7. Monitoring and evaluation

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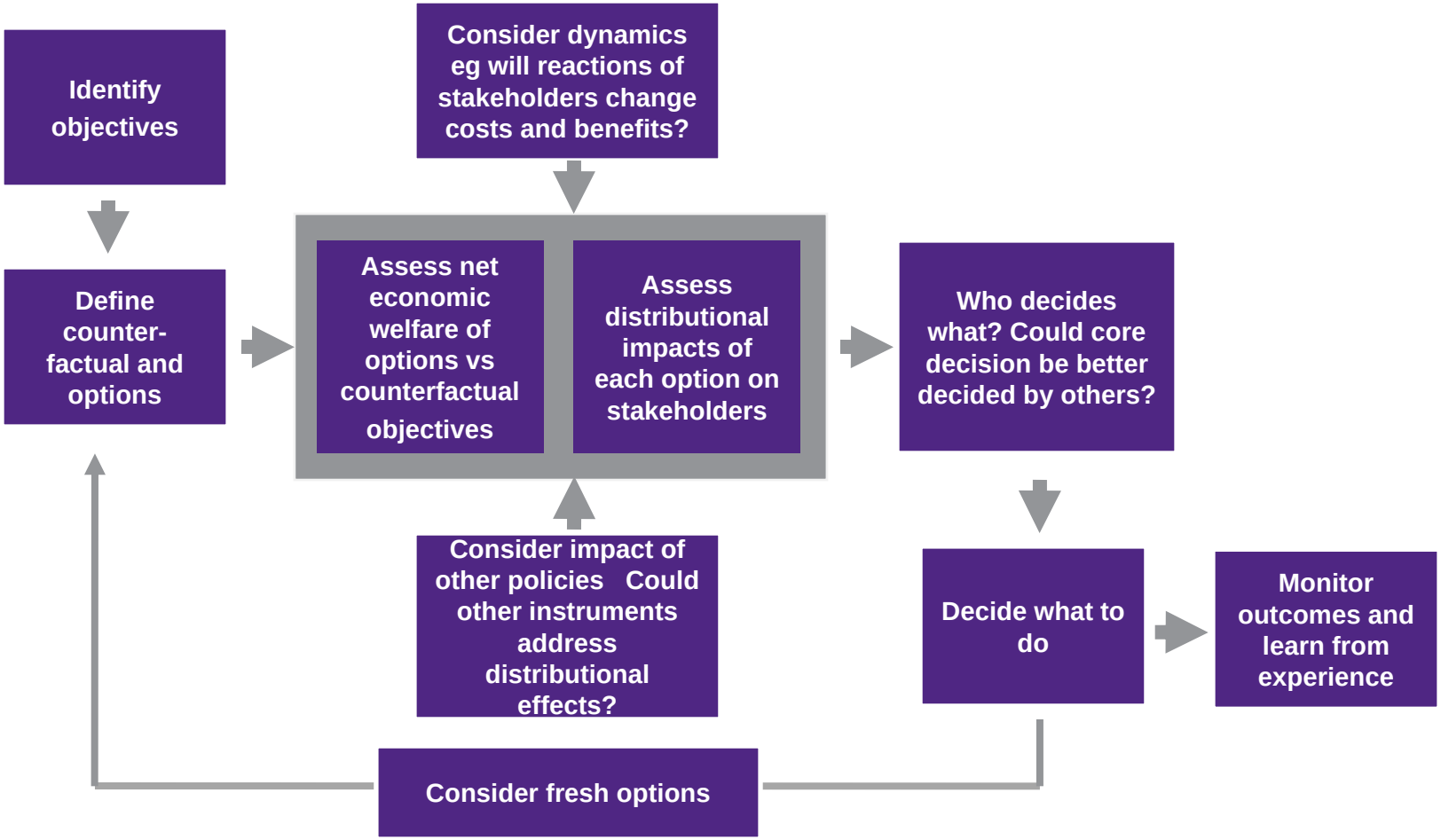
An economist's interpretation of this process



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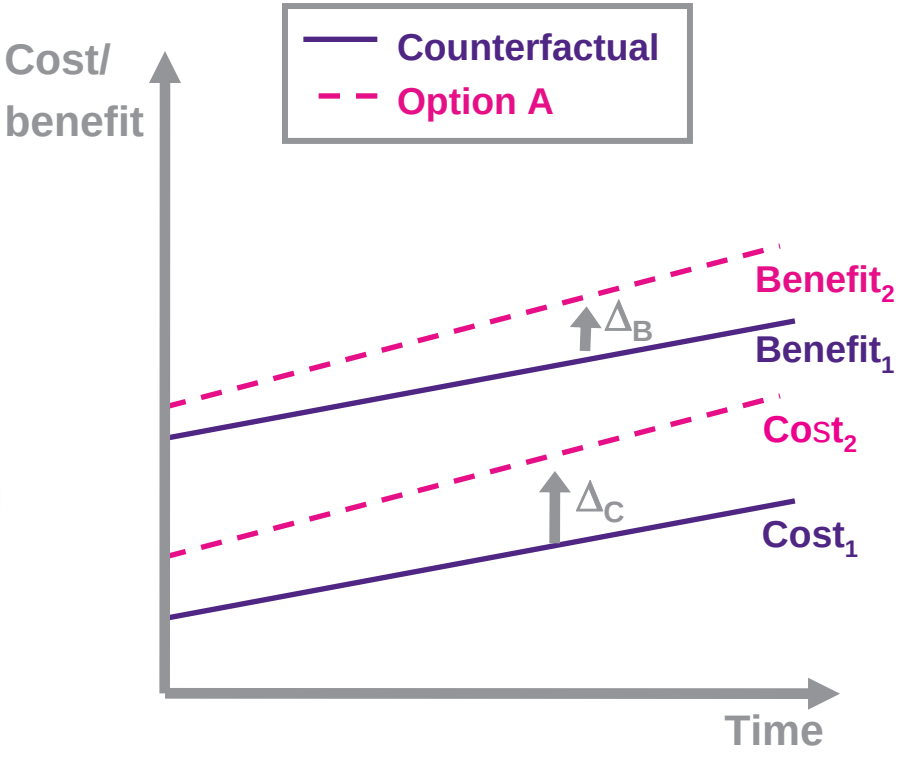
Define options and focus on incremental benefits

- **Define the counterfactual - typically the *status quo* or *do nothing* option**
- **Define options for evaluation against the counterfactual**
  - Think laterally
  - Consider the option of waiting
- **Measure incremental change in the costs and benefits of each option relative to the counterfactual**



Is Δ_B (Benefit$_2$ – Benefit$_1$) > Δ_C (Cost$_2$ – Cost$_1$)?

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Distinguishing dynamic from static impacts

- **Dynamic effects dominate over time**
  - Over time the introduction of new goods and services dominates changes in the level of costs and benefits associated with existing goods and services in terms of impacts
  - Growing affluence and leisure are driven by productivity growth
- **However impact assessment tends to focus on "static" impacts - changes in the *level* of costs and benefits**
- **Though perhaps not unreasonable to think that policies that increase net benefits worth pursuing**
- **Also a reason to consider the impact on competition separately, since there is evidence that competition drives innovation and growth**

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Distributional effects can be important

- **The economically efficient option is the one offering the biggest increase in total economic surplus**
- **But this option might not be acceptable socially and politically if some stakeholders lose out too much**
- **So we need to consider:**
  - The impact of the best option on each major group of stakeholders
  - Whether any stakeholder loses out to an unacceptable degree
  - Whether there are other policy instruments (eg direct subsidy) which can reduce such problems to acceptable levels

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The final decision - possibilities

- **Maintain the status quo**
- **Adopt one of the options evaluated**
- **Consider new options - discovered through the impact analysis**
- **Wait for new information**
- **Transfer the decision to others:**
  - If all the main costs and benefits fall on one party then is there any need to do anything?

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Assessing the net economic impact of the options

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Different approaches to impact assessment

Qualitative

Quantitative

- **Franklin's moral or prudential algebra**
- **Cost-effectiveness analysis:**
  - €100 will buy you Benefit A or Benefit B or
  - Option 1 delivers Benefit A for €X while Option 2 delivers it for €Y
- **Cost benefit analysis in which all net impacts are converted into money terms**

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The different kinds of impacts

Private	Wider economic	Wider social	Pseudo – not counted
Private costs are the resource costs valued in the market Private benefits might include: (i) Saving time or costs (ii) More of existing things (iii) New things	Non-appropriable private Externality Network effects Spill-over and virtual agglomeration Competition in sector and wider economy Resilience, adaptability and policy options Excess burden of taxation	Educated citizens Informed democracy and freedom of expression Cultural understanding Belonging to a community and inclusion Privacy Social capital, resilience and trust	Pseudo externalities Asset price changes (if already captured under private cost-benefit) Normal profits. Employment effects (other than impact on labour supply) "National competitiveness" (other than productivity impacts)

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Private costs and benefits

- **Private costs and benefits are those that market participants face**
- **If key costs and benefits are private, is impact assessment and/or regulation required?**
- **Private costs and benefits are generally valued at market prices – the price of oil, wages, land etc**
- **Some must be inferred - "opportunity cost" of leisure time**
- **Helpful to consider three categories of benefit**
  - Value of doing what people do now in less time (better roads, better broadband, more convenient services)
  - The value of doing more of what people do now (in response to time saving or lower price)
  - The value of new things/services (video rather than voice communication etc)

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Wider economic costs and benefits

- **Includes inputs which in principle have a market value – but market may not currently exist**
  - Value of spectrum which is currently not tradable in alternative uses
- **Includes economic impacts not valued in market**
  - Impact of pollutants – noise, greenhouse gases etc
  - These would have market values if there were tradable property rights
  - If there are pollution taxes or tradable permits these provide values and these will be built into market prices
- **Includes economic impacts not fully or correctly reflected in private decisions**
  - Value of agglomeration (cities) in terms of productivity spill overs
  - Competition – market participants prefer less, society more
  - Network externalities –more important for end user-to-end user services than for end user-to-Internet server services

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Wider social costs and benefits

- **May not be obvious what the direction of impact is: + or -?**
- **Society tends to adapt, aiming to minimise the bad impacts of new technology**
- **Nevertheless, potentially significant social impacts should be considered**
- **The appropriate response may involve changes to other policies rather than the policy in question**

- *"...impacts may be 'bad' (internet steals social time) or 'good' (email generates new social connections) and much time and energy has been wasted debating whether bad predominates over good, whether utopia predominates over dystopia. All of this misses the point... technology does not and has never had a simple linear predictable impact on society."* Anderson and Stoneman (2007)

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Pseudo costs and benefits

- **In general exclude second round impacts (pseudo externalities)**
- **Exclude asset price changes (land, spectrum) which reflect changes in other costs/benefits to avoid double counting**
- **Exclude normal profits - zero "economic profit"**
- **In general exclude job creation and destruction effects:**
  - Net impact from sector specific creation or loss of jobs unlikely
  - Possible net impact from change in workforce participation
  - Some technologies might change efficiency of job search – the internet, mobile phones?
- **Exclude national competitiveness (but include productivity changes)**

  "*it is simply not the case that the world's leading nations are to any important degree in economic competition with each other.*" Paul Krugman

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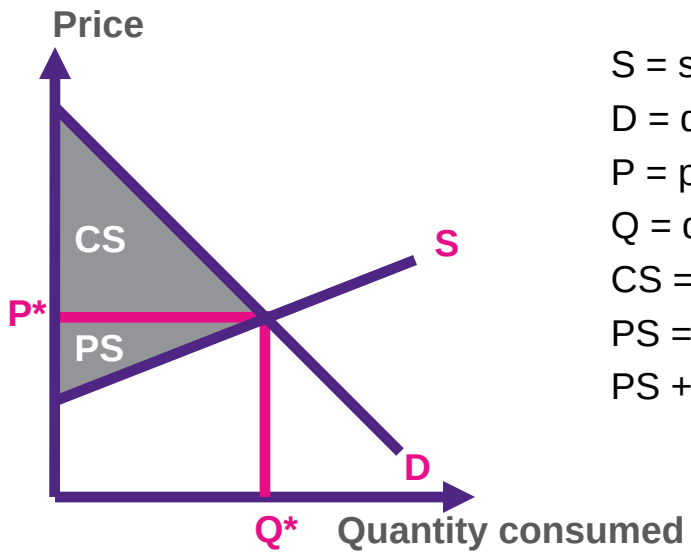
Measuring economic welfare



S = supply curve
D = demand curve
P = price
Q = quantity consumed
CS = consumer surplus = WTP less price
PS = producer surplus
PS + CS = total economic surplus or welfare

- **Dupuit, a 19th Century French engineer, defined "relative utility" as the area under the demandcurve above the price and used it as a measure of the welfare effects of public works projects – the consumer surplus**

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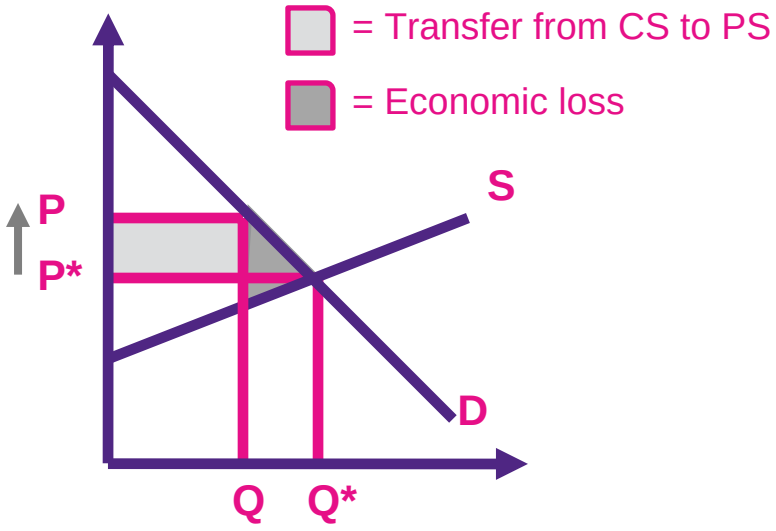
Not all stakeholder impacts are economic impacts

- Impacts which transfer costs or revenues from one stakeholder to another should not be counted
- For example the main impact of a price increase is to reduce consumer surplus and increase producer surplus...
- ...and the change in total economic surplus or welfare is often small



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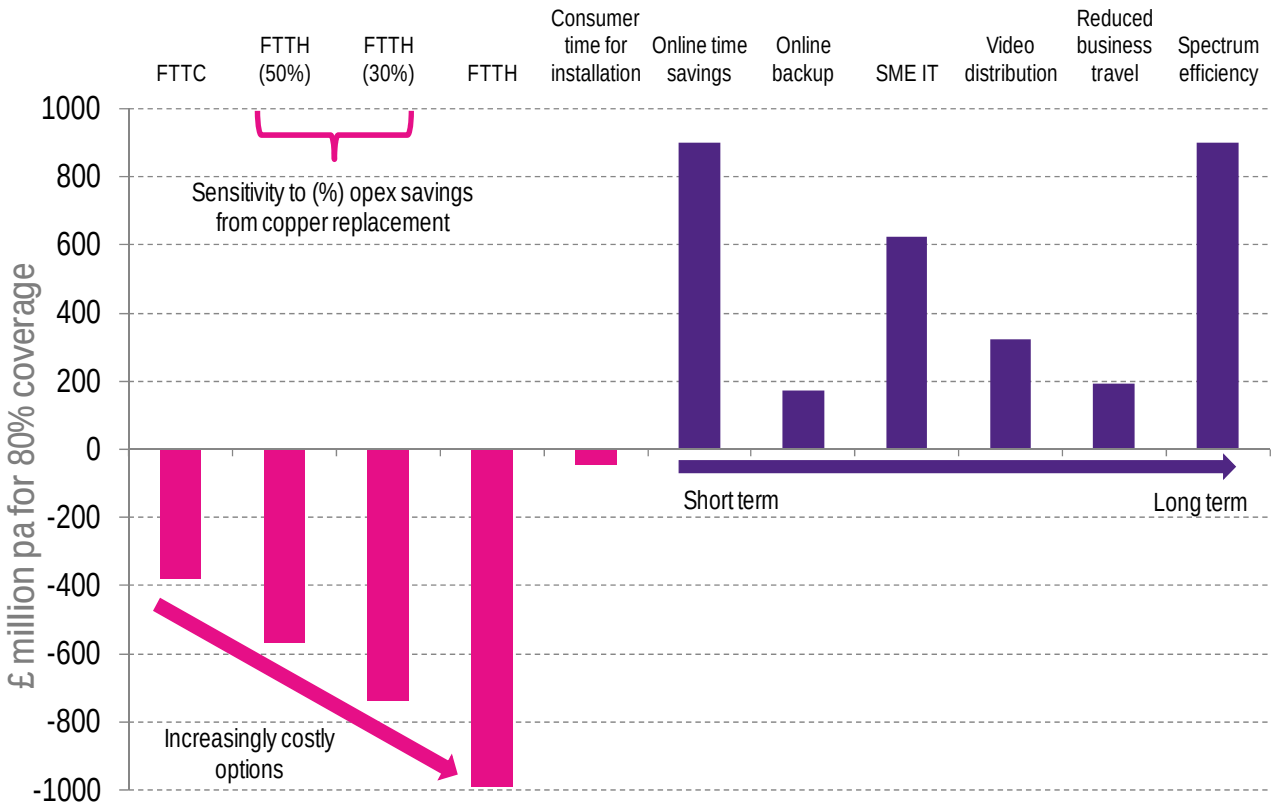
An illustration - next-generation broadband in the UK

Indicative incremental annual costs and benefits



Next-generation broadband - qualitative aspects

Scale	Private	Wider economic	Wider social
+++	Un-quantified increase in existing activity Un-quantified new things	Resilience, adaptability and policy options Spill-over and virtual agglomeration benefits	Social capital, resilience and trust
++		Competition in wider economy	Educated citizens Belonging to a community
+		Value of leased exchange land and buildings Reduced traffic congestion Network effects	Informed democracy
Neutral-unclear		Piracy Competition in telecoms Greenhouse gas emissions	Cultural understanding Privacy
-	Core network enhancement Costs of transition from copper to fibre with replacement Any change in operating costs associated with FTTC or FTTH	Traffic congestion and other disamenity during fibre build Excess burden of taxation for public funding	

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The effects of key impacts on total economic welfare

- **Assuming a competitive market what is the impact of:**
  - An X% reduction in the cost of production or end user price?
  - An X% increase in the end user's willingness to pay?
  - An X% tax on an end-user service?

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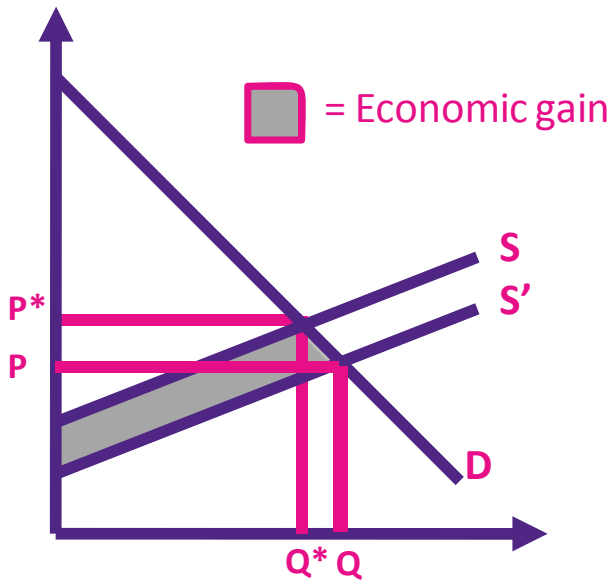
Competitive market - X% reduction in the cost of production



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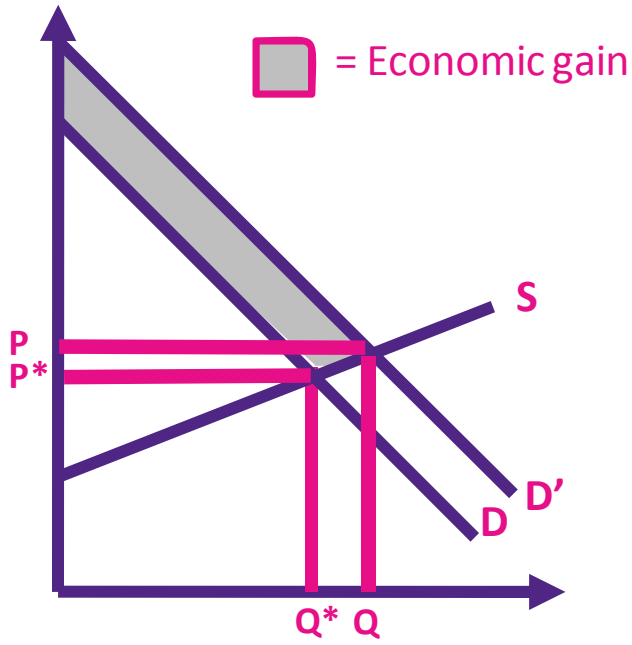
Competitive market - X% increase in the end user's willingness to pay



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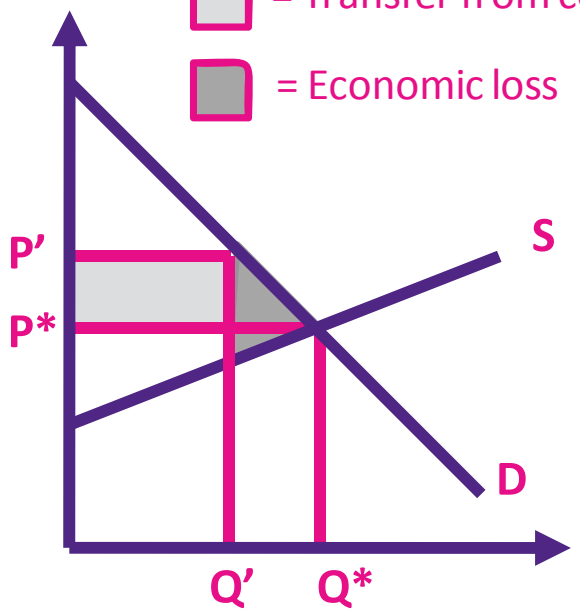
Competitive market - X% tax on an end-user service

Tax raises price from P* to P'

= Transfer from consumers to Government

= Economic loss



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Calculating the net present value (NPV) of each option - 1

- **Need to forecast costs and benefits over time - leading to a net benefit stream**
- **These forecasts may be uncertain. If so consider:**
  - High and low value assumptions to reflect the uncertainty
  - Use of Monte Carlo analysis
- **To calculate the NPV of the net benefits stream, the analyst needs to decide on:**
  - The project lifetime
  - Its termination value if any
  - The discount rate to be used

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Calculating the NPV of each option - 2

- **Discounting future net benefits - assuming zero inflation, would you prefer:**
  - £100 now or £100 in one year's time
  - £95 now or £100 in one years time?
  - £90 now or £100 in one year's time?
- **Options for dealing with termination values:**
  - Assume zero at end of project
  - Assume a positive value based on net benefit in final year continuing to infinity
- **Worked example:**

Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	
Net benefits	-100	5	10	15	15	15	15	15	
Discount factor	1	0.95	0.91	0.86	0.82	0.78	0.75	0.71	0.68
Termination value (TV)									60
Discounted net benefit	-100	5	9	13	12	12	11	11	41
NPV with TV	13								
NPV without TV	-27								

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The problems of uncertainty

- *Sensitivity analysis*: **how far do uncertain parameters in the CBA need to vary before the best option is no longer best?**
- *Asymmetry of outcomes*: **do small changes in some policy parameters lead to precipitous drops in the value of the option?**
- *Option value:* **is there value in waiting until uncertainty is reduced/resolved?**
  - Flexibility + uncertainty + irreversible element to decision (e.g. investment) introduces a value to waiting - the real option
  - Such effects can have a material impact on an efficient decision

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Case study examples from the UK

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Economic value of licence exempt spectrum

- **A study for Ofcom in 2006 to assess the economic value to to the UK of 10 selected licence exempt (LE) applications**
  - Over the next 20 years
  - Taking account of uncertainty in demand and other parameters
- **Study designed to inform Ofcom policy on balance between licensed and LE spectrum**
- **Approach**

- **For report see:**

http://www.ofcom.org.uk/research/technology/research/exempt/econassess/

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The NPV of the 10 study applications

Application	*NPV £bn*		
	Low	*Medium*	*High*
Road user charging	0.3	0.6	0.9
Short range radars	2	26	88
Blood glucose sensors	0	9	19
RFIDs in retail sector	10	35	98
Public WiFi hotspot	9	68	239
Home data networking	4	6	8
Wireless building automation	0.3	1.2	4
Fixed wireless links at 60 GHz+	0	0.6	1.7
Telemetry in utilities	8	11	13
Wireless home alarms	0.6	2.4	6.4

- **Applications defined as**
  - Use of specific technology ***for*** specific purpose ***by*** a specific set of users
- **Applications selected to span range of future LE applications**

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Value per MHz – licenses vs. LE

Licensed?	*Application*	*£m per MHz*	*Freq used (GHz)*
Yes	Mobile telephony	50	0.9 to 2
Yes	Broadcasting	27	<0.9
Yes	Fixed links	29	Various
LE	RFID in retail	620	0.8
LE	WiFi hot spots	69	2.4 and 5
LE	Short range radar	0.36	24 and 79

Value of LE applications ignores interference and congestion effects

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Key messages from LE study

- **Uncertainty in outcomes means need for range of values rather than a single value**
- **Even given this uncertainty, a big variation in the economic value of LE applications**
- **Three high-value applications identified - all requiring international harmonisation:**
  - Short range radars
  - RFIDs in the retail sector
  - Public wireless hotspots
- **Value per MHz for two of these applications higher than that of major licensed applications**
- **Current RFID allocation likely to be far too small to prevent serious congestion and major economic loss**

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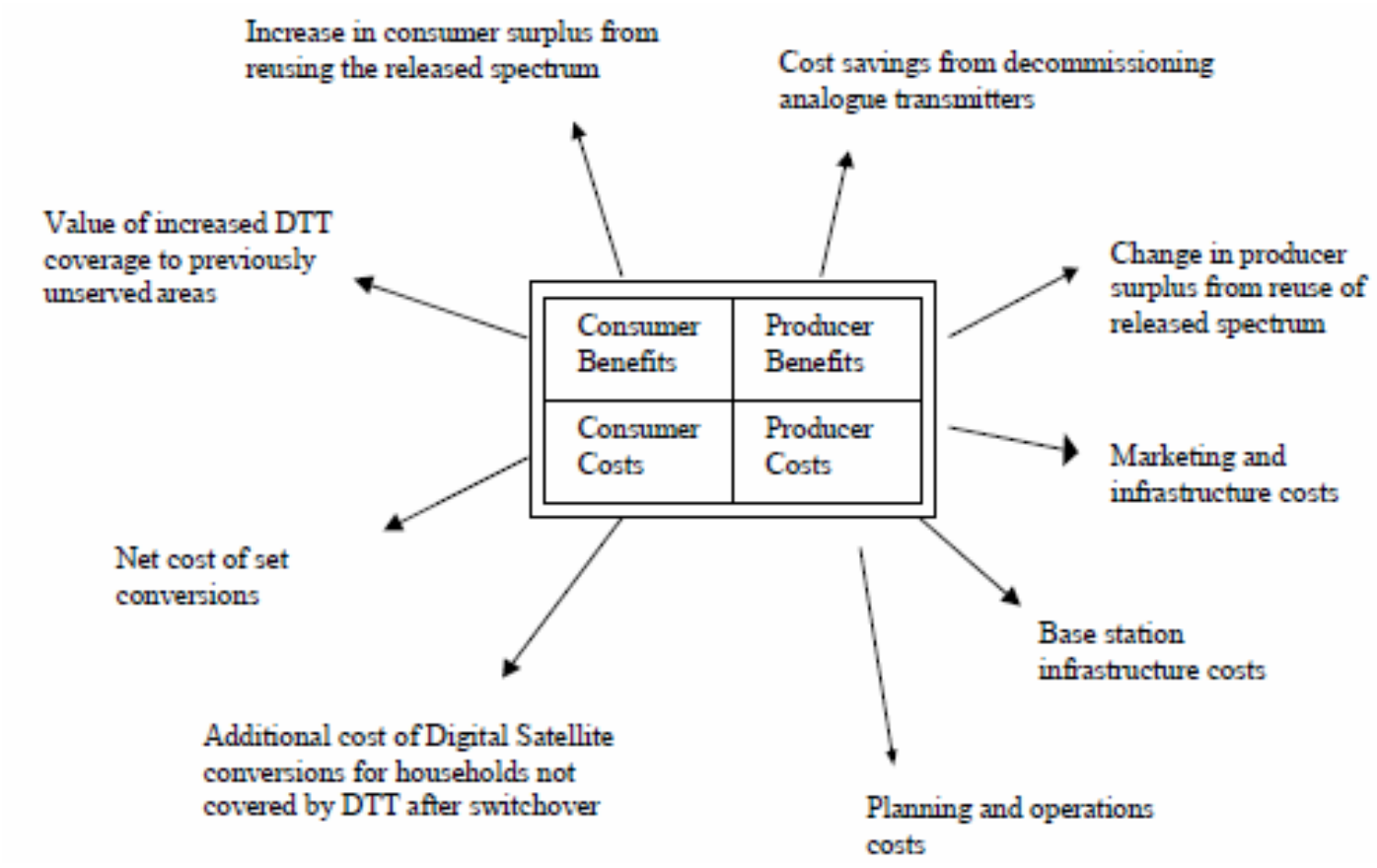
Digital switch over for TV



Digital TV quantification

Category	Net present value £ million in 2004
Benefits	
Consumer benefit in current non-DTT areas	3246
Consumer benefit from additional services in retailed spectrum	787
Consumer benefit from re-use of released spectrum	1181
Imputed consumer benefit of compulsory migration	689
Broadcaster benefits from savings on analogue transmission and energy cost	1377
Costs	
Non-voluntary consumer costs on reception equipment	2504
Additional consumer energy costs (incl. Social cost of carbon)	1651
Broadcaster investment in digital infrastructure	702
Marketing and practical support costs (excluding any targeted assistance)	174
Net benefit ((NPV)	**2249**

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Digital switch over for radio

- **Appears similar to digital TV switch over but differs in three important respects**

Parameter	Digital TV	Digital radio
Value of spectrum released by switch over	High	Low
Possibility of Internet based services in areas with WiFi at time of decision	No	Yes but what about car radios?
Number of legacy devices with analogue receivers embedded	Modest	High given car and mobile phone radios

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“Digital Britain” quantification for switchover to national digital radio

Category	Annual value £ million
Benefits	
Cost saving to national broadcasters of licence extensions	10
Cost saving to national broadcasters of co-location and increased networking	23
Benefit after dual transmission on analogue and DAB ceases	38.9
Costs	
One-off cost to Government of not auctioning national analogue licences	10
Costs to multiplex operators and broadcasters of re-structuring multiplexes	Not quantified

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Lessons from digital radio example

- **Conceptual points**
  - Relevant options, for example, analogue radio only (plus internet) are not considered
  - Possibility of leaving decision to industry (perhaps with rules regarding switch off) not evaluated
  - Combines impact of separate policy decisions (switchover and co-location of stations)
  - Considered revenue/cost flows rather than economic costs and benefits in including saving when dual transmission on analogue and DAB ceases since some of these "savings" relate to fixed common site and mast costs which may not change
- **Possible errors of inclusion/omission**
  - The costs of extending the digital radio transmission network to match existing coverage levels are not included
  - The costs to consumers of purchasing new radios for their homes and cars are not included
  - The costs in terms of possible loss of coverage to those currently receiving analogue coverage in remote areas is not included

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The three problems for tomorrow

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Case study training

- **Tomorrow morning we divide into three groups to apply impact assessment to three case study problems:**
  - Short range radars
  - Rx parameters for short range alarms
  - Mandating mobile number portability
- **The session will provide:**
  - An opportunity to discuss this afternoons lecture in more detail
  - Hands on experience in applying IA techniques
- **Tomorrow afternoon someone from each group will then present the key findings from each session**

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Short range radars

- **Determine which spectrum configuration for SRR provides the lowest implementation costs whilst providing safety benefits**
- **Currently 21.65 to 26.65 GHz is being used for SRR until 1st July 2013 cut-off**

Option	Frequency range	Main issue
1 (default)	77 to 81 GHz	Risk of not being able to fit SRR into new vehicles for a period following cut-off
2	24 to 29 GHz	Risk of interference to fixed networks
3	24.05 to 24.5 GHz and 77 to 81 GHz	Some features retained following cut-off, but risk of delay for main safety features

- **Which of the three options delivers the best outcome for Europe?**

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Mobile number portability

- **It is 2001**
- **You are the NRA in Country X:**
  - Population of 10 million
  - Not a member of the EU
- **In 1997 the Government licensed two new MNOs (C and D) to compete with the two incumbents (A and B)**
- **C and D have so far captured 15% of the mobile market between them**
- **They are now asking you to mandate MNP because they believe it will strengthen competition in the mobile market**
- **What should you do?**

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Rx parameters

- **Receiver performance (selectivity) has a direct impact on how well adjacent band services are able to share the spectrum**
- **Should regulators mandate receiver standards?**
- **Case study victim = Alarm systems SRDs**
  - In the band 868.6 – 868.7 MHz (25 kHz channels or 100 kHz channel)
  - ETSI Category 1,2, or 3 receivers
- **Case study interferers = Non-specific SRDs**
  - In the adjacent band below 868.0 – 868.6 MHz
  - In the adjacent band above 868.7 – 869.2 MHz
  - Channelisation not specified
  - Maximum power and duty cycle specified
- **How would you determine whether mandating receiver standards is a good thing in this case?**

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