Benefits and Costs in Secondary Markets

Yoshitsugu Kanemoto

BGVW Chapters 5

Outline

- Questions
- Partial equilibrium and general equilibrium demand functions
- Benefits including indirect impacts
  - Consumer surplus + Producer surplus
    Gross consumer surplus (Social benefit) − Social cost
  - Average cost, Marginal cost

Questions

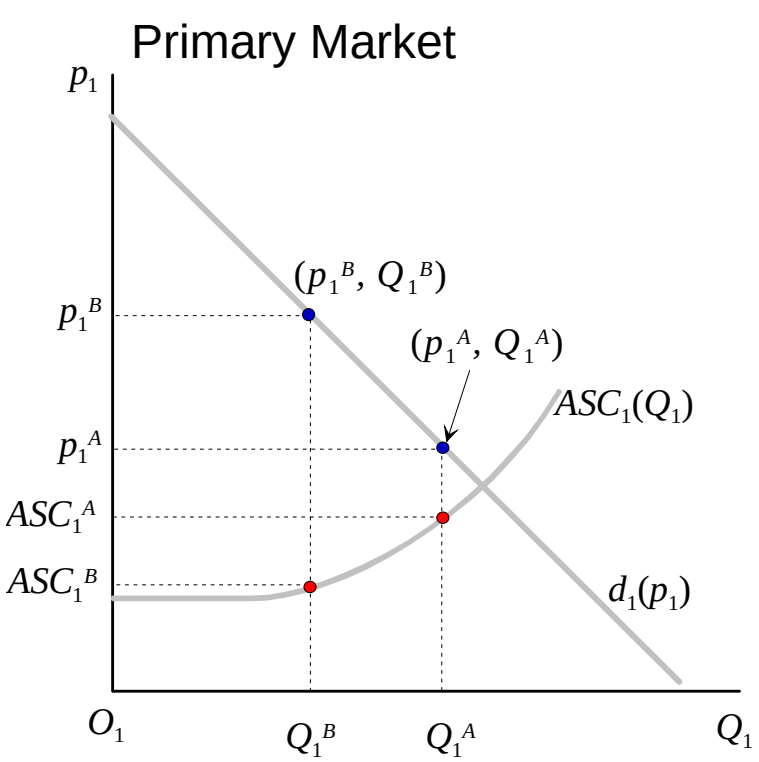
- A big transportation investment induces large impacts on regional economy, e.g., rises in land values. Should these be added to direct benefits?
- Should the benefits of increased employment be added to direct benefits?
- Should an increase in tax revenues of a local government be included in the benefits?

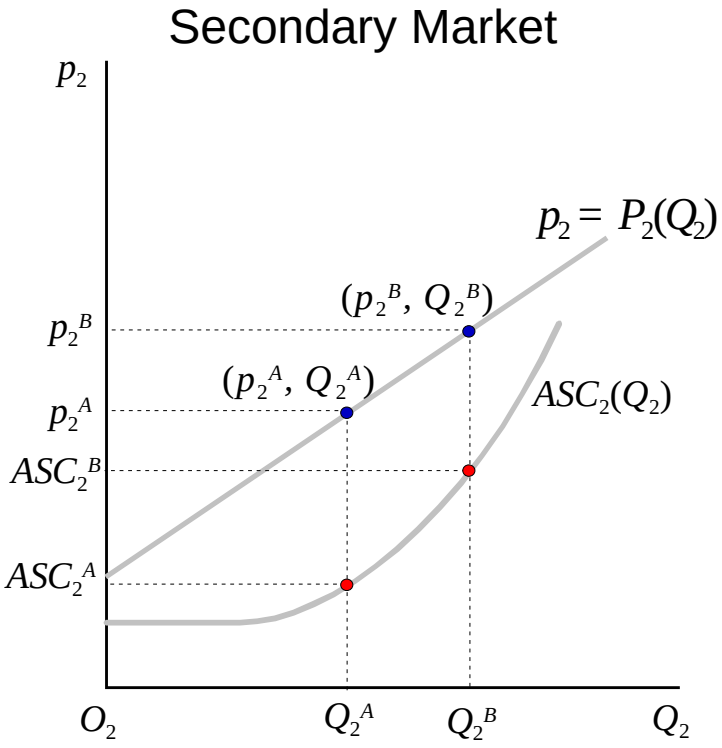
Benefits and costs in secondary markets

- Primary and secondary markets
  - Primary market: the market affected directly by a policy
  - Secondary market: the market indirectly affected
- Impacts on secondary markets
  - Reduction in highway toll: Increase traffic in the highway, decrease traffic and congestion in other roads
  - Subsidy for child care: Increase in demand for nursery, increase in working mothers
- Further changes in the primary market
  - Changes in secondary markets are fed back to the primary market.
  - Find an equilibrium after these feedbacks are settled.
- Preview of the main results
  - In a first best economy with no price distortion, benefits and costs in secondary markets cancel out each other
  - With price distortion, they do not in general cancel out each other

Benefits in primary and secondary markets: Basic steps

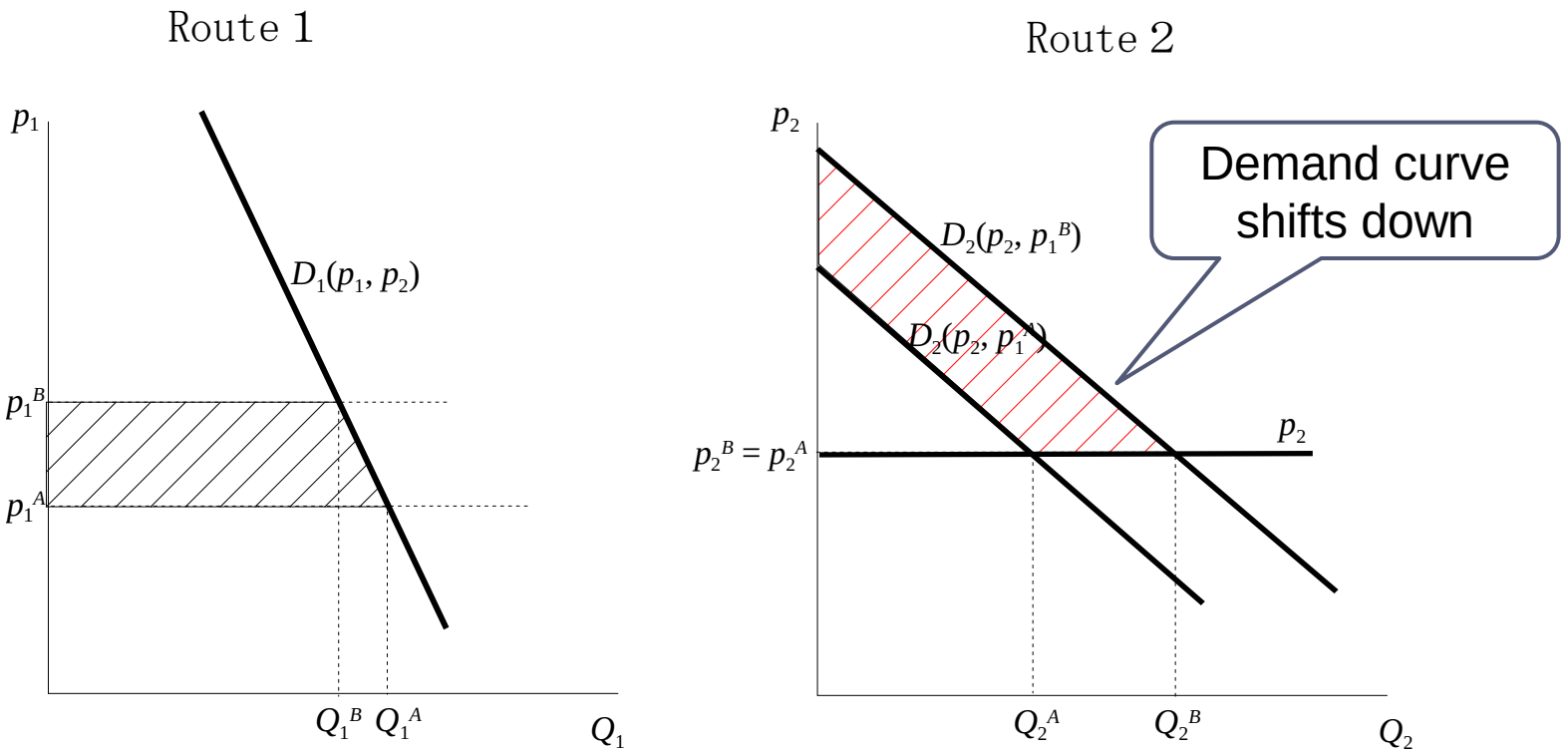
- Forecast quantities demanded, prices, and costs for Without and With cases (four points in a market).
- Estimate the net benefits in secondary markets in the same way as in the primary market.
  - Use the rule of a half if demand curves are linear.





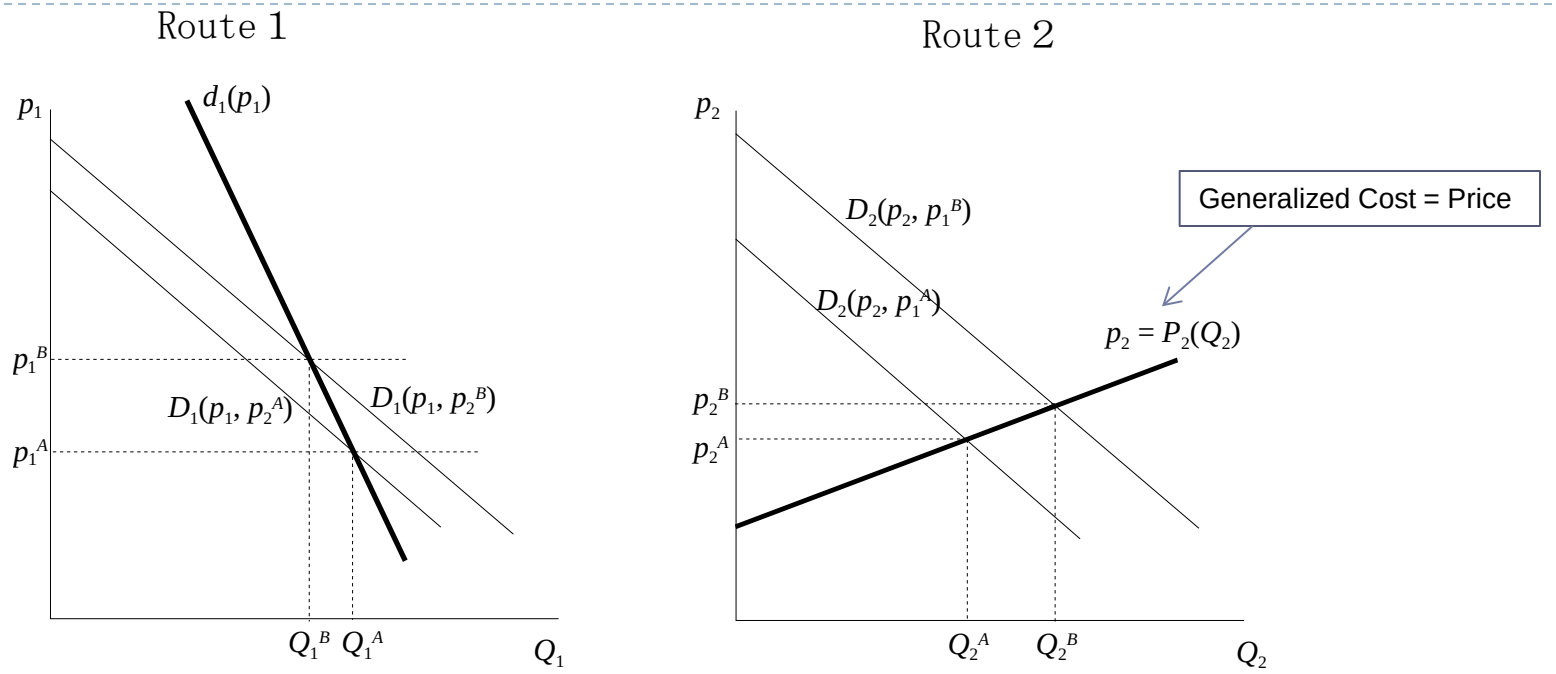
Fixed prices in the secondary market

- The hatched area in the secondary market cannot represent a decrease in CS
  - Benefits of those who continue to use Route 2 cannot change
  - No change in net benefit for those who move from Route 2 to Route 1 because they are indifferent
  - Users of Route 1 benefits from a decline in price



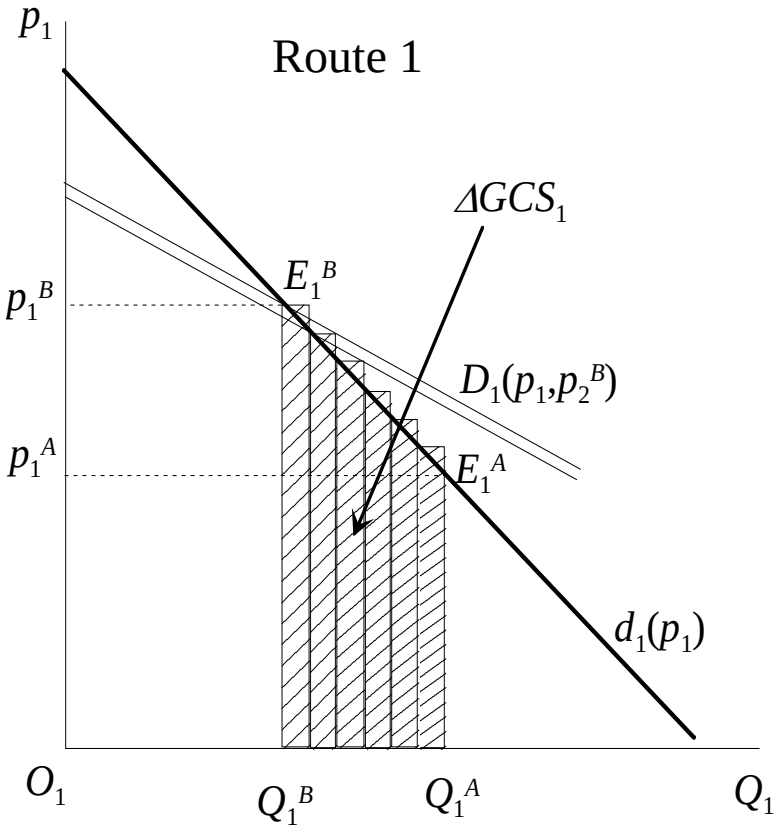
BGVW Ch.5 Fig.5-1

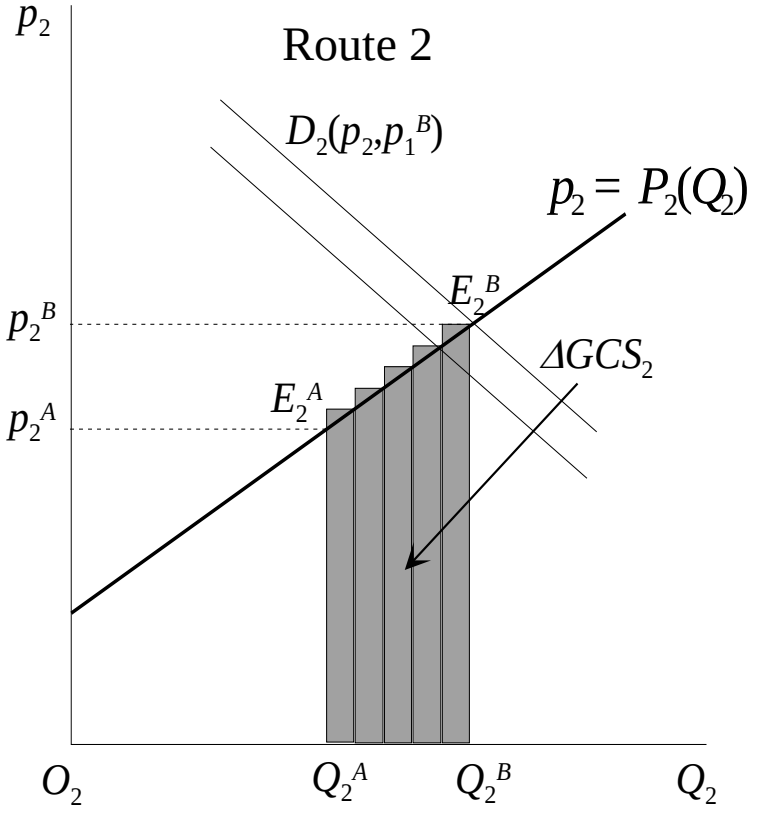
Partial equilibrium and general equilibrium demand curves



- Demand in a market depends on the price in the other market. A fall in price in route 1 makes the partial equilibrium demand curve for route 2 to shift down.
- The price (generalized cost) in the second market is determined by the supply side conditions.
  - The generalized cost in the local road is determined by technological conditions (traffic volume and road capacity).
  - If the secondary market is competitive, the supply curve yields the general equilibrium demand curve.
  - Might differ from the MSC because of externalities, taxes, etc.
- The general equilibrium demand curve is a misleading name. More appropriate is the equilibrium locus

GCS (SB) with general equilibrium demand curves

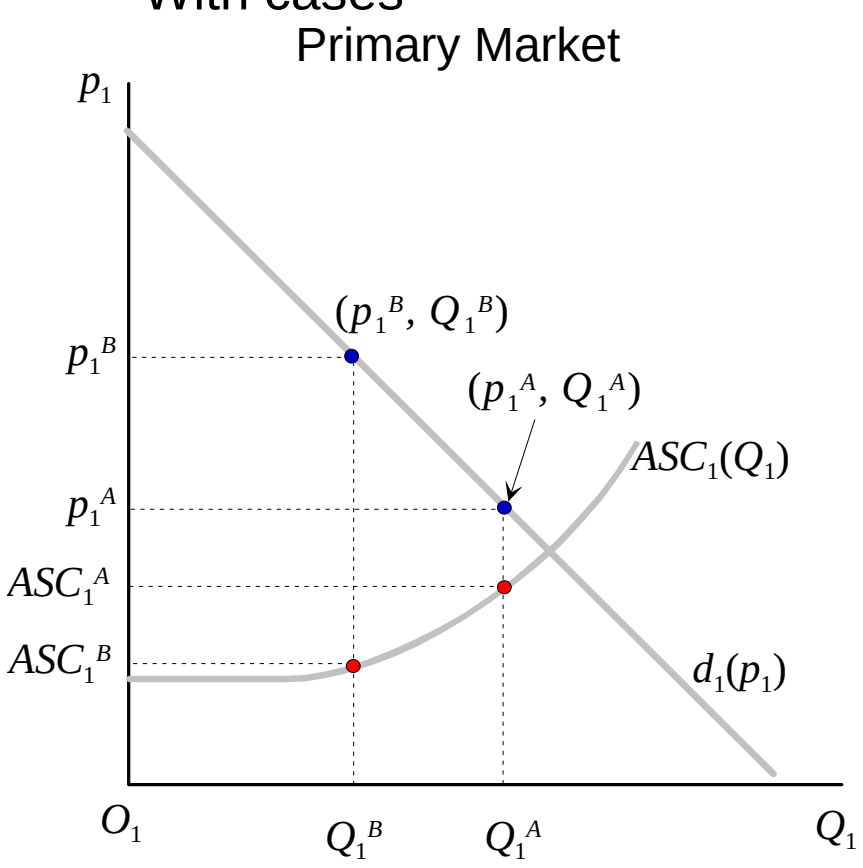


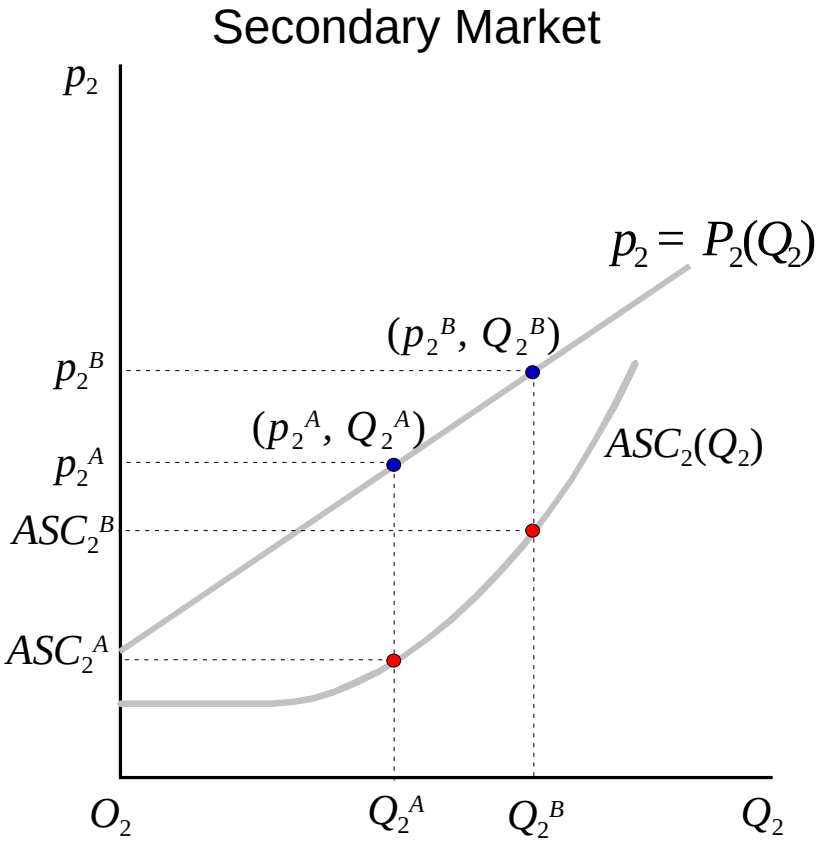


- The WTP of a person who moves yields the change in GCS.

Impacts on primary and secondary markets

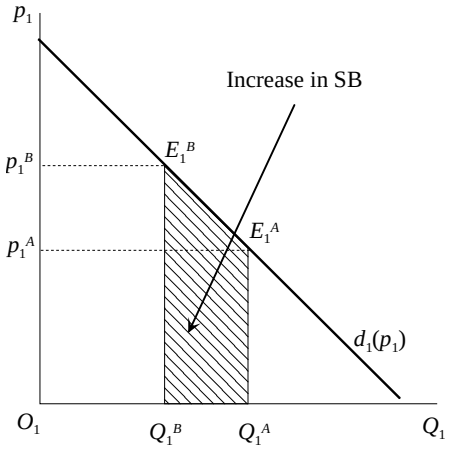
- Forecast quantities demanded, prices, and costs for Without and With cases

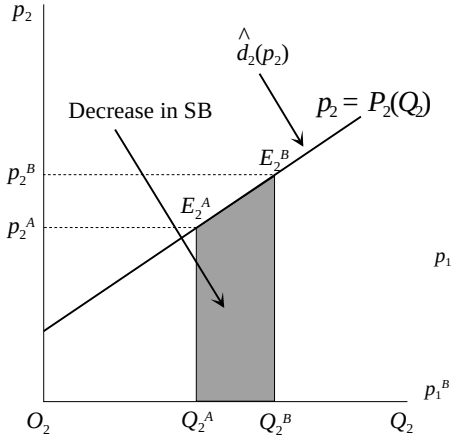




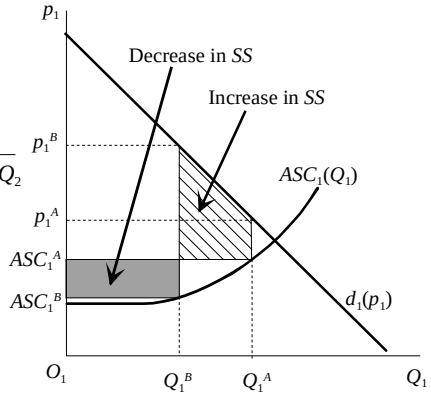
Benefits of toll reduction: Estimates with AC

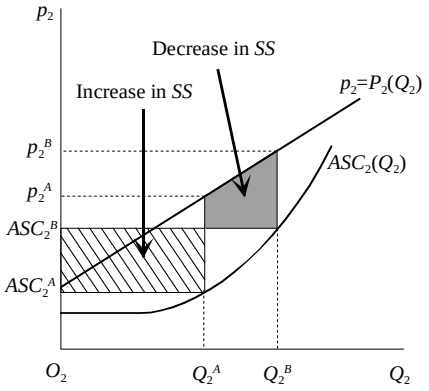
Change in SB (GCS)



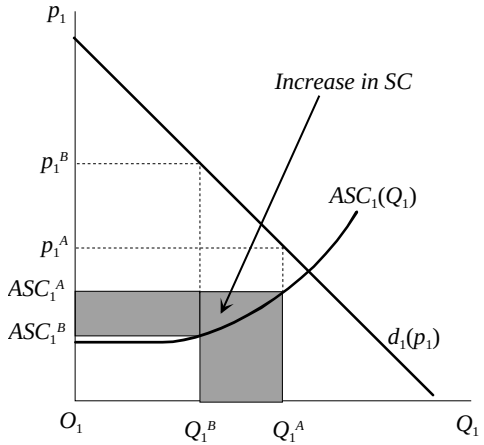


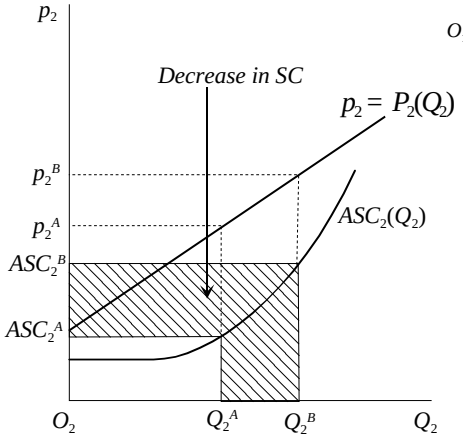
Change in SS





Change in SC



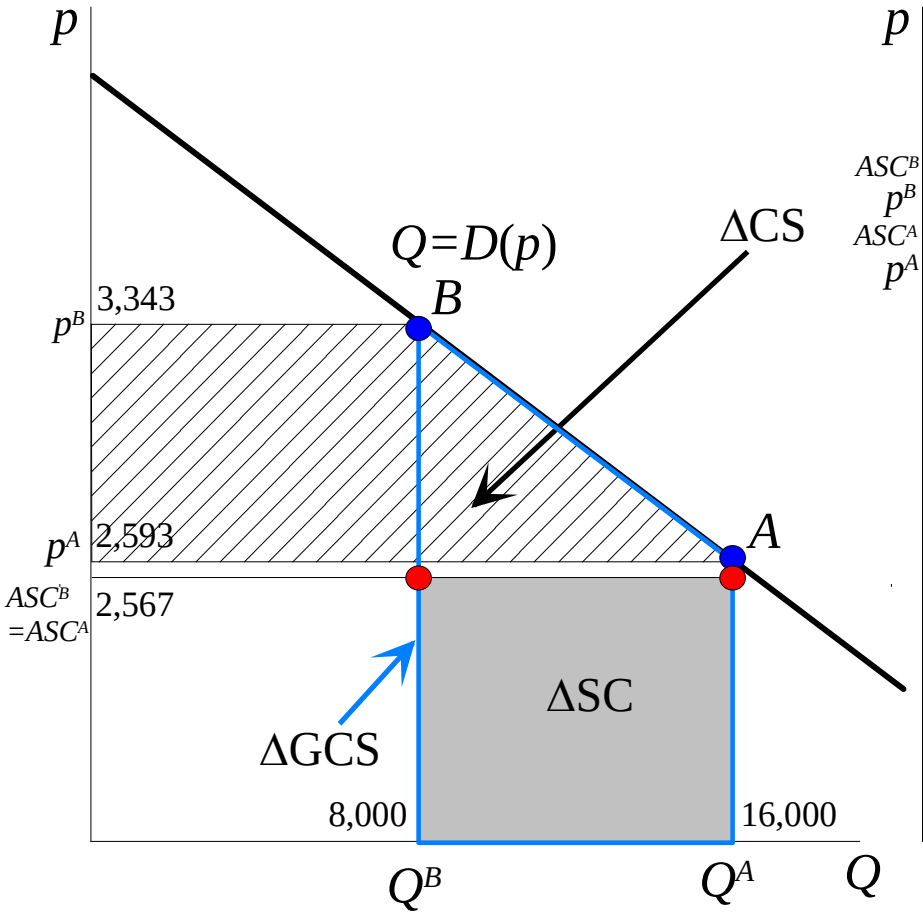


Hatched area: Positive benefits
Shaded area: Negative benefits

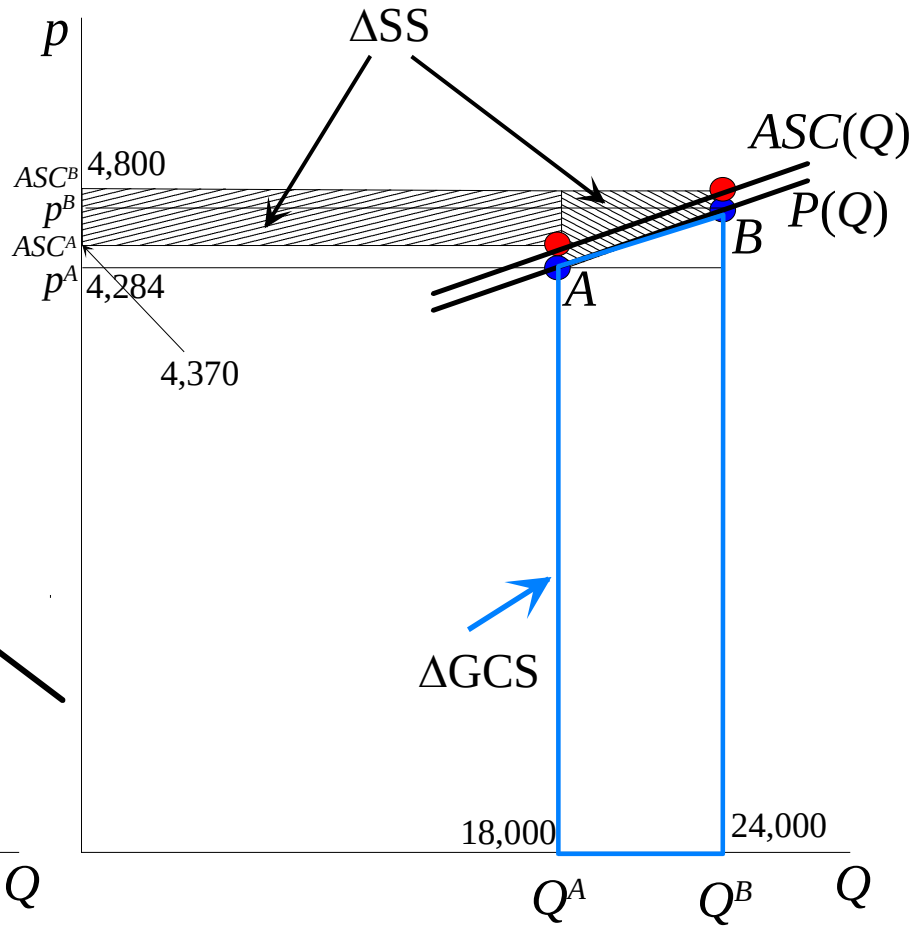
Expressway Case: Reduction in congestion on local roads

- Impacts on local roads
  - Without: Generalized cost = 4,720, Social cost = 4,800（=4,720 − 153 + 232）, Traffic = 24,000/day
  - With: Generalized cost = 4,284, Social cost = 4,370, Traffic = 18,000/day (Includes congestion reduction effects)
- Benefits in local roads (in thousand yen)
  - ΔSB（GCS）=（4,720 + 4,284）x（18 − 24）/2 = − 27,012
  - ΔSC = 4,370 x 18 − 4,800 x 24 = −36,540
  - ΔSS = ΔSB − ΔSC = 9,528
- Total benefits
  - Benefits in expressway + Benefits in local roads = 3,208 + 9,528 = 12,736

Route 1



Route 2



Benefit Assessment Formula #1

- GCS (Social Benefit) - Social Cost

$$\Delta SS = \sum_i \Delta SS_i = \sum_i \{\Delta GCS_i - \Delta SC_i\}$$

$$\Delta GCS_i = \frac{1}{2}(p_i^A + p_i^B)(Q_i^A - Q_i^B)$$

$$\Delta SC_i = SC_i^A - SC_i^B$$

$$\Delta SS_i = \frac{1}{2}(p_i^A + p_i^B)(Q_i^A - Q_i^B) - (SC_i^A - SC_i^B)$$

Benefit Assessment Formula #2

- Consumer Surplus + Producer Surplus

$$\Delta SS_i = \Delta CS_i + \Delta PS_i + \Delta T_i - \Delta EC_i$$

$$\Delta CS_i = \frac{1}{2}(p_i^B - p_i^A)(Q_i^A + Q_i^B)$$

$$\Delta PS_i = ((p_i^A - t_i^A) - AC_i^A)Q_i^A - ((p_i^B - t_i^B) - AC_i^B)Q_i^B$$

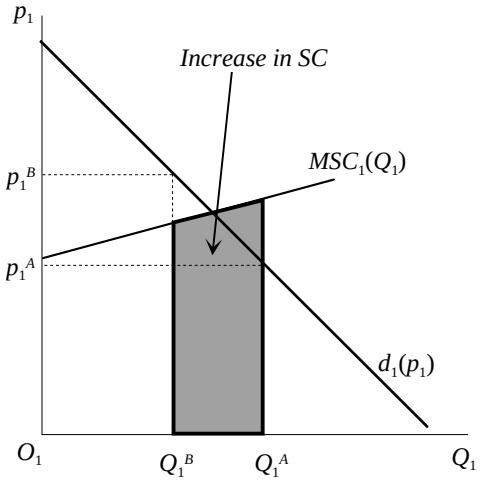
$$\Delta T_i = t_i^A Q_i^A - t_i^B Q_i^B$$

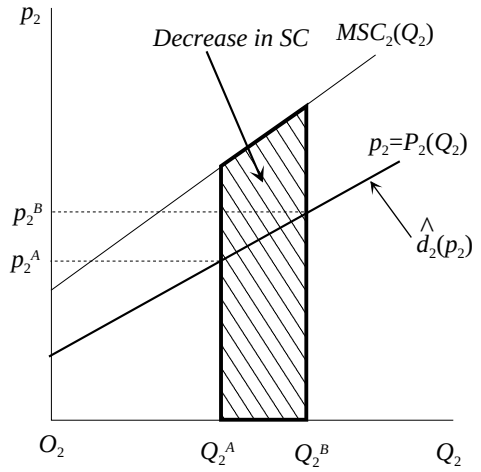
$$\Delta EC_i = (ASC_i^A - AC_i^A)Q_i^A - (ASC_i^B - AC_i^B)Q_i^B$$

$$AC: \text{Average Private Cost}$$

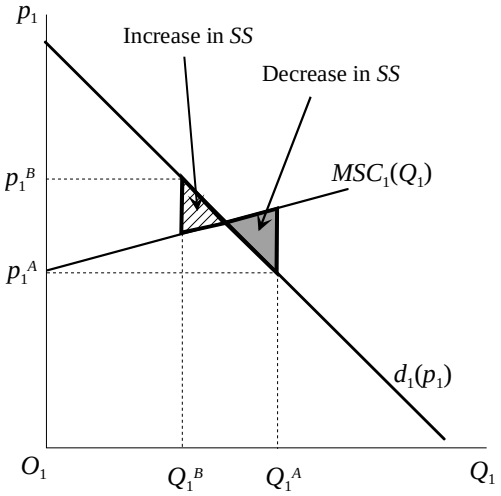
Benefit estimates with MC

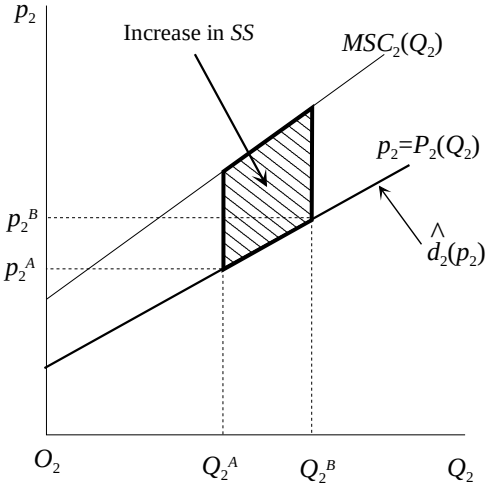
- Change in social cost





- Change in social surplus

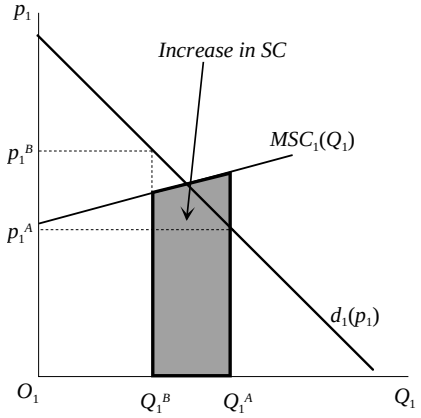


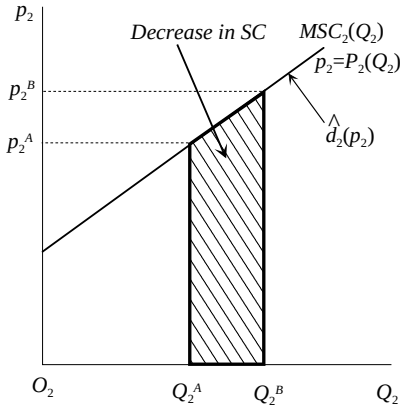


No indirect benefits in first best: Intuitive Explanation

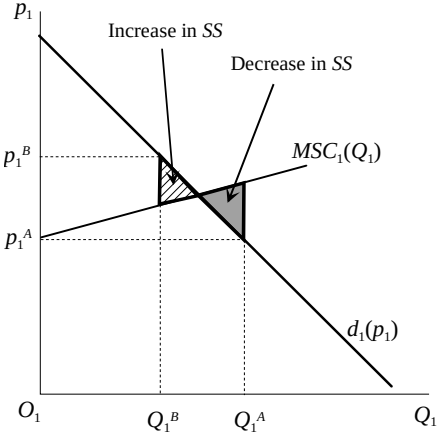
- Estimate the social cost by marginal cost curve
- First best
  - Marginal cost = Price
  - Change in GCS = Change in SC
  - Indirect effects in Market 2 cancel out each other
  - Benefits of price decrease on the demand side = Increase in costs on the supply side

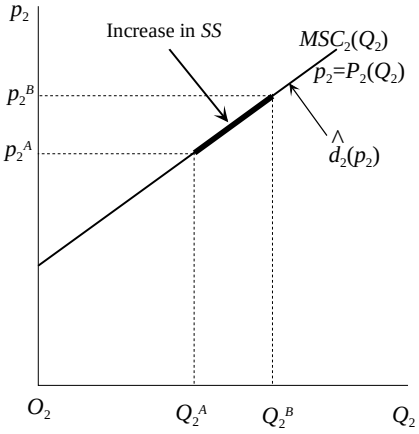
Change in Social Cost





Change in Social Surplus





Benefit Assessment Formula # 3: Marginal Costs

- Marginal Benefits and Marginal Costs

$$\Delta SS_i = \int_{Q_i^B}^{Q_i^A} \left[MSB_i(Q_i) - MSC_i(Q_i) \right] dQ_i$$

  - MSB is usually the price that demanders pay.
  - The difference between MSB and MSC includes taxed, externalities, and monopoly pricing.
  - Special case: Constant tax rate and constant marginal external cost MEC

$$\Delta SS_i = (\tau_i - MEC_i)\Delta Q_i$$

Benefit Assessment Formula: Harberger Formula

- Price distortion in other markets:

$$t_i = MSB_i - MSC_i$$

  - Taxes, Monopoly power, Externalities
- A change in market 1 (Formula #1):

$$\Delta SS_1 = \frac{1}{2}(p_1^A + p_1^B)\Delta Q_1 - \Delta SC_1$$

- Harberger formula:

Direct Benefit s

Harberger's Excess Burden

$$\Delta SS = \frac{1}{2}(p_1^A + p_1^B)\Delta Q_1 - \Delta SC_1 + \sum_{i=2}^{n} t_i \Delta Q_i$$

Secondary markets: Summary

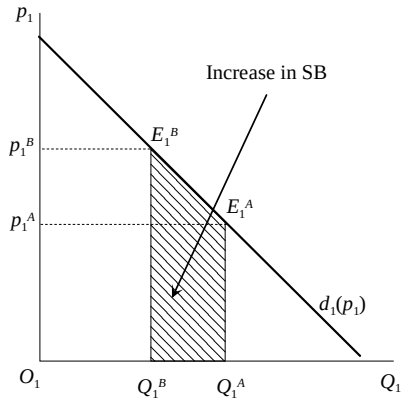
- In a first best economy, benefits and costs in secondary markets cancel out each other
  - If indirect effects increase demand in the primary market, the benefit in the primary market increases.
  - Example: Road Investment → New firms → Increased production → Increase in traffic
- In a second best economy with price distortion, benefits and costs in secondary markets do not cancel out
  - The benefits in secondary markets may be positive or negative
  - ΔSS = Price Distortion x ΔQ

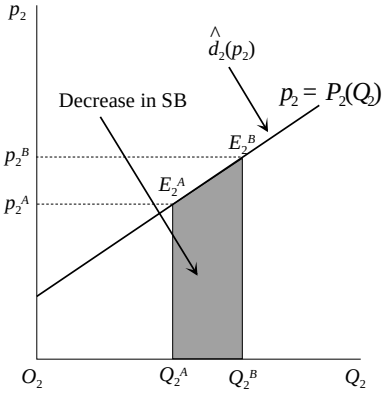
Quick Questions #3_1

- Is it true that when MC > AC, MC is upward sloping?
- Should you add to the benefits an increase in employment caused by constructing a dam? How about in an area with serious involuntary unemployment problems?
- Should you add to the benefits an increase in tax revenue generated by a road investment?

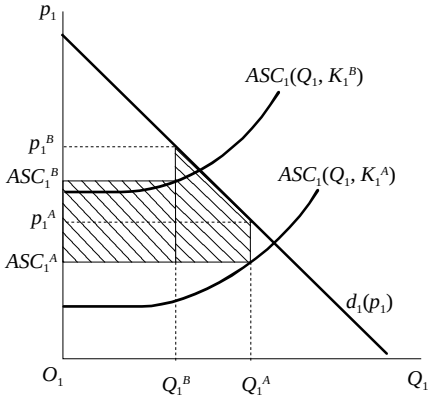
Applications: Benefits of transportation investment

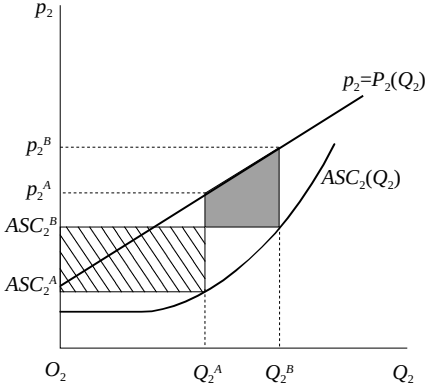
Change in SB (GCS)



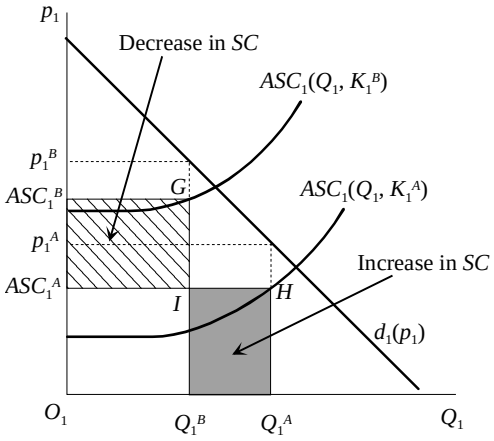


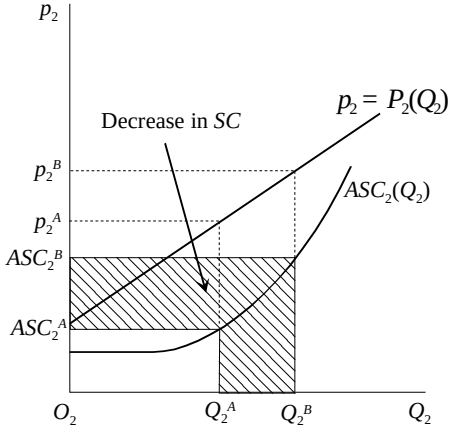
Change in SS





Change in SC





Difference from the price reduction case:
Changes in the ASC curves

Urban development project: market failures

- Market failures: Efficiency aspect
  - Agglomeration externalities
    - Commercial agglomeration, Office agglomeration, Tourism, Entertainment
  - External costs in road transportation
    - Congestion, accidents, air pollution, global warming, noise externalities
  - Scale economy in public transportation
    - Economies of density, fixed costs, discontinuation of public transit services
  - External costs related to energy consumption
    - Global warming, air pollution
  - Natural environment and agriculture in outskirts
  - Costs of public service provision
- Market failure: Equity aspect
  - Transportation for the aged and handicapped
  - Impacts on urban poor

Urban development project: Impacts and evaluation

- Impacts on
  - Commercial activities
  - New agglomerations: commercial, residential, and others
  - Convenience for consumers
  - Transportation demand and congestion
  - External costs
- Cost-Benefit Analysis
  - Primary market: activities in the developed area
  - Secondary markets: transportation, other areas, tourism
    - Net benefits or costs only when price distortions exist.
    - How to assess price distortions: price-cost margin, external costs
    - Caution: Benefits of increased agglomeration in one area might be offset by decreases in other areas

Wider Economic Benefits (UK)

- Benefits additional to conventional direct benefits (UK DfT)
  - TAG Unit 2.8 and 3.5.14 (http://www.dft.gov.uk/webtag/)
- Economic Appraisal of Crossrail 2005
  - Move to More Productive Jobs: Tax parts only
    - Increase in GDP x 30%
  - Pure Agglomeration: agglomeration benefits
    - The whole increase in output from increased employment density
    - Fail to recognize adverse impacts on agglomerations in other areas that lose population (Kanemoto 2012, 2013)
  - Increase in labour force participation: Tax parts and reductions in benefits
    - Increase in GDP x 40%
    - 21% of time savings accruing to commters
  - Impacts on imperfect competition:
    - Benefits to trips in work time x 10%

Crossrail evaluation 2005

- Crossrail Project in London (Map)
  - http://www.crossrail.co.uk/benefits/wider-economic-benefits/

Benefits and costs	Value (£m PV)
Total costs	13,902
Less net rail revenues	–6,149
Plus indirect tax reductions	1,207
Net cost to Government	**8,960**
Conventional user benefits	**16,093**
Agglomeration benefits	3,094
Imperfect competition	486
Move to more productive jobs	3,232
Labor force participation	349
Total wider economic benefits	**7,161**