31E12100 Microeconomics policy

Lecture 1: Microeconomic foundations of policy analysis

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Introduction to the course: Why microeconomics for policy analysis?

Short list of recent policy issues that would require careful microeconomic analysis:

- Pricing of public services
- Innovation policy
- Pricing externalities
- Merger review
- Health and social services

Pricing externalities: How to create markets for pollution?

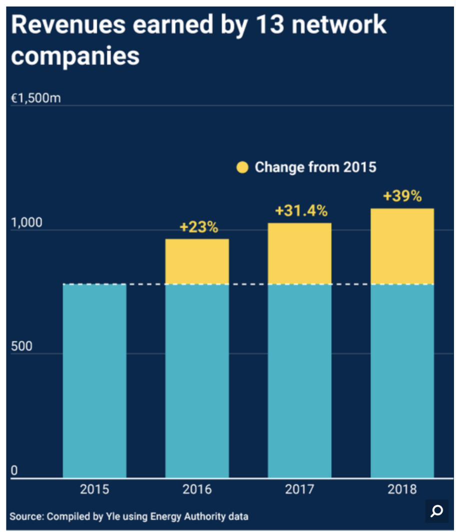
The government has ambitious targets, *(Link)*, and economists offer means for achieving them *(Link)*.

Transport emissions to zero by 2045

PRESS RELEASE 12.12.2018 15.39 fi sv en

Picture: Ministry of Transport and Communications

How to regulate natural monopolies?



The government is struggling to change the model of regulation for electricity transmission. *(Link)*

How to introduce competition here?

The government has decided to open rail passenger services to competition in stages to be completed by 2026 (Aug. 10, 2017, Ministry of Transport and Communications).

Merger review

COMPANY NEWS SEPTEMBER 29, 2020 / 4:36 PM / UPDATED A MONTH AGO

Finland's competition watchdog recommends blocking healthcare deal

By Reuters Staff 2 MIN READ

HELSINKI, Sept 29 (Reuters) - Finland's competition authority has recommended blocking Mehilainen's 362 million euros ($403 million) purchase of rival Pihlajalinna, as the deal would reduce the number of nationwide healthcare companies to just two.

Finland's Market Court will issue a ruling on the deal within three months of the recommendation from Finland's Competition and Consumer Authority (FCCA), or by Dec. 29 at the latest.

In November 2019, privately-owned Mehilainen announced a recommended cash offer for Pihlajalinna.

Should competition authority allow a merger of firms? While competition policy is not a topic of this course, the merger review is a topic that applies cost-benefit analysis. The policy maker should evaluate the impact on the market and take a stand on the distribution of gains and losses.

The plan

- Microeconomic foundations (week 1)
  - consumer theory: tools for welfare analysis.
- Market failures (weeks 2-4)
  - regulation: monopoly, asymmetric information, externalities
  - applications: Health care reform, Intellectual property (guest from Compass Lexecon), Merger review (guest from competition and consumer authority), pollution, investments in regulated activities
- Valuation (week 5)
  - estimating market impacts
  - discounting
  - applications: market impacts of policies
- Risk and uncertainty (week 6)
  - expected value analysis
  - applications: option values and investments

Group work during the course

Interaction is productive in all learning elements of the course. But note however: problems and reading assignments are to be submitted individually. These are your consumer protection: they prepare you for the exam. Copying someones' output is nonsensical. Team of 2 persons is acceptable for the course case study but the group-size has an impact on grading.

We need a tool for evaluating if consumers are better or worse off after a policy-induced change prices (minimum wages, border tax adjustments, subsidies or penalties on some consumption goods). Changes in prices and income (p, M) lead to changes in choices x:

$$(p_0, M_0) \rightarrow x_0, (p_1, M_1) \rightarrow x_1$$

But is the consumer better off? Consumer choice theory tells us how consumer responses to changes in (p, M) by choosing different vectors of quantities x. **But how to obtain a monetary (cardinal rather than ordinal) measure of the welfare change?** For this reason, we visit the consumer choice theory.

Measuring welfare changes

We consider three measures of the welfare change of the consumer:

- Compensating variation (CV)
- Equivalent variation (EV)
- Consumer surplus (CS)

CS is familiar from previous studies but CV and EV are new.

Compensating variation, CV

CV answers the following: How much the consumer should be compensated to make her as well off as before the price change? The relevance for policies:

- City of Helsinki increases the rental price of land in a neighborhood. How much would the city have to pay the residents to keep them as well off as they were before?
- Government raises the fuel tax to reflect the CO2 content of the fuel. How to compensate losers from the policy change, in particular those with low incomes? *(aside: link to a recent empirical study)*
- CV gives the answer: it measures the true change in the standard of living in the new situation

Equivalent variation, EV

EV is the maximum amount the consumer would be willing to pay to avoid a price change.
The relevance for policies:

- City of Helsinki considers increasing the rental price of land in a neighborhood. What is the maximum the residents would be willing to pay to avoid the change?
- EV gives the answer: it measures the willingness to pay to pay to maintain the status quo

CV considers welfare after the change, EV the welfare if the change had happened. EV is generally different from CV.

To derive CS, CV, and EV, we need to revisit the consumer choice theory.

Primitives: Rationality and utility functions

What is rationality? In economics, it means consistency of choices.

Some primitives:

- X denotes a set of alternatives.
- $x, y \in X$ are two distinct alternatives. For example, x could be "Porsche Cayenne with leather seats and price of 60 000 euros".
- $x \succeq y$ means that x is at least as good as y. "$\succeq$" is a preference relation, or just preference

Definition
Consumer with preference $\succeq$ is rational if the following hold:

- consumer can rank all the alternatives: for all $x, y \in X$, either $x \succeq y$ or $x \preceq y$
- consumer is consistent: for all $x, y, z \in X$, if $x \succeq y$ and $y \succeq z$, then also $x \succeq z$

The first property says that the consumers preferences are complete, that is, the consumer is not clueless when facing a choice. The second property is at the heart of rationality. More technically, it is called "transitivity".

In economics we often describe preferences using utility functions rather than $\succeq$. Utility function assigns number $u(x)$ to each $x \in X$

Definition
Function $u(x)$ represents preferences $\succeq$ if for all $x, y \in X$

$$x \succeq y \Leftrightarrow u(x) \geqslant u(y).$$

Why do we use utility functions? At least two reasons:

- just a tool for analysis: a handy way to describe the choices implied by the primitive preference $\succeq$. The choice that maximizes the utility number is the one that the consumer will choose under $\succeq$.
- can be used to introduce further properties of the preferences: tastes. How much the consumer is willing to give up of good 1 to get more of good 2 while remaining equally well off? Indifference curves!

Back to the consumer's choice:

- consumer's budget set:

$$B = \{\mathrm{x} \in X | \mathrm{p} \cdot \mathrm{x} \leq M\} = \{\mathrm{x} \in X | \sum_{i=1}^{n} p_i x_i \leq M\}$$

- Notice that B is then determined by p and M: $B(\mathrm{p}, M)$
- **Consumer's problem**: choose x to maximise utility subject to the budget constraint

$$v(\mathrm{p}, M) = \max_{\mathrm{x} \in B(\mathrm{p}, M)} u(\mathrm{x})$$

Solution $\mathrm{x}^*(\mathrm{p}, M)$ is known as **Marshallian demand**. This is the consumer choice that we observe.

- **under certain mild assumptions**: for any given p, M
    1. the problem has a **solution**
    2. the solution is **unique**
    3. can we find the solution using Lagrangian methods
- Lagrangian is

$$\mathcal{L}(\mathrm{x}, \lambda) = u(\mathrm{x}) + \lambda(M - \mathrm{p} \cdot \mathrm{x})$$

- the purpose is to find extremal points of $\mathcal{L}(\mathrm{x}, \lambda)$ with respect to (x, λ)
- if $\mathrm{x}^* = \mathrm{x}(\mathrm{p}, M) >> 0$ is a solution to the consumer's problem, then there exists a value λ^* such that the Kuhn-Tucker conditions hold

$$
\begin{aligned}
\frac{\partial}{\partial x_i}\mathcal{L}(\mathrm{x}^*, \lambda^*) &= 0,\ i = 1, ..., n \\
\frac{\partial}{\partial \lambda}\mathcal{L}(\mathrm{x}^*, \lambda^*) &\geq 0 \\
\lambda^* \frac{\partial}{\partial \lambda}\mathcal{L}(\mathrm{x}^*, \lambda^*) &= 0
\end{aligned}
$$

The optimal bundle x^* is thus such that marginal changes in x^* do not change the value of $\mathcal{L}(\mathrm{x}^*, \lambda^*)$. Then also $du = 0$ for changes in x^* that are feasible, i.e., changes in the constraint set. On the other hand, λ can be interpreted as a shadow cost of the budget constraint. In optimum we are trying to minimize the cost of the constraint. In fact, conditions for λ^* are those that we would get when minimizing $\mathcal{L}(\mathrm{x}, \lambda)$ w.r.t. λ.

Expanding

$$
\begin{aligned}
\frac{\partial}{\partial x_i} u(\mathrm{x}^*) - \lambda^* p_i &= 0, \; i = 1, ..., n \\
M - \mathrm{p} \cdot \mathrm{x}^* &\geq 0 \\
\lambda^*(M - \mathrm{p} \cdot \mathrm{x}^*) &= 0.
\end{aligned}
$$

dividing i-th condition by the j-th condition gives

$$
\frac{\frac{\partial u(\mathrm{x}^*)}{\partial x_i}}{\frac{\partial u(\mathrm{x}^*)}{\partial x_j}} = \frac{p_i}{p_j}
$$

i.e., optimal bundle is the point of tangency between relative price line and indifference curve

Consumer theory: two goods

- Consider two goods x, y with prices $p_y = 1$ and $p_x > 0$. The consumer has income $M > 0$. The optimal consumption bundle solves:

$$\max_{x,y} u(x, y) \tag{1}$$

$$p_x x + y = M \tag{2}$$

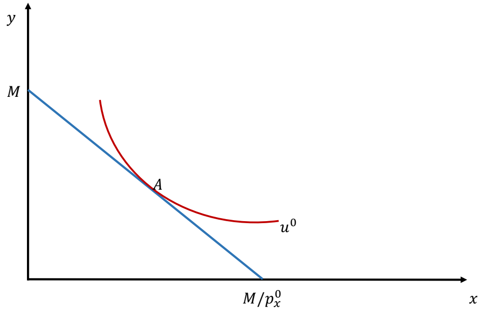
- We use this problem to find a money-metric measure of the consumer's welfare change when prices change. This will allow us to recover CV and EV.
- Utility $u(x, y)$ is an abstraction so we are not interested in utility changes as such

Check your understanding:

- suppose $u(x, y) = x^{\alpha} y^{1-\alpha}$ where $\alpha \in (0, 1)$
- derive the consumer demands for the goods as function of prices and income
- what is the price elasticity of demand for good x?

We continue with this example in the first problem set.

A familiar figure:

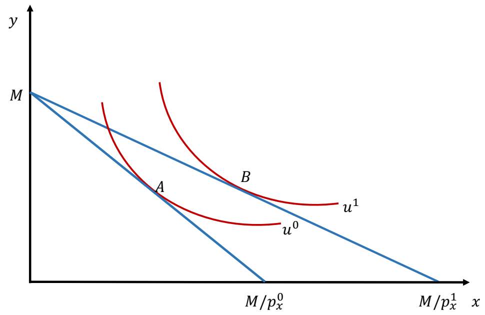


Initial situation: Prices are p_x and $p_y = 1$, and income M. Utility level is u^0 from choice A

Compensating Variation

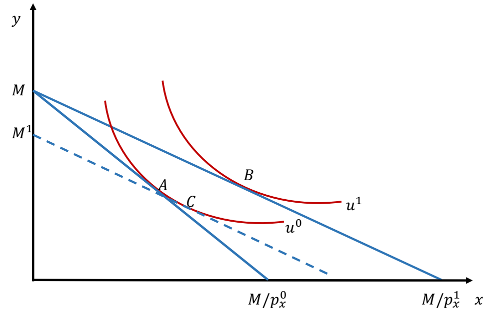
- Polices change the relative prices of goods and services. In such areas as transportation, education, health care, child care, and pollution contain explicit or implicit welfare evaluations of public policies. What are the welfare impacts?
- CV is the welfare change measured in money. In theory, measuring it can be done as follows:
    - as the vertical difference between the new budget constraint due to the price change and the parallel constraint after making the lump-sum payment that returns the individual to the original indifference curve.

Demand response from a price decrease



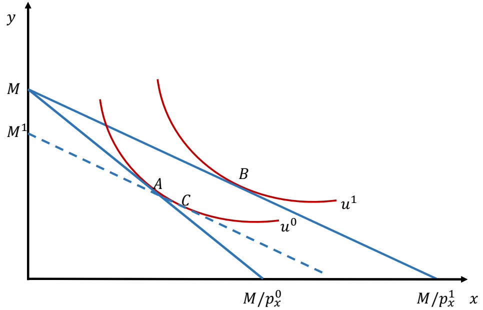
The new situation: Price p_x decreases, new choice B results.
Utility increases to u^1.

Defining compensating variation, CV



Compensating variation: we take income $M - M_1$ away to move the consumer back to the original utility u^0. New choice C results. Compensating variation is $CV = M - M_1$. Old utility at new prices.

Defining compensating variation, cont.



Compensating variation: comparing A and C shows that the consumer substitutes towards the good with lower prices. But the consumer is equally well off as before the price change. The lower income exactly removes the benefit of the lower prices. CV thus measures the value of the benefit from the lower price.

Hicksian demand

To state CV more formally, we need to consider the following version the original consumer choice problem: what is the minimum expenditure needed to reach the original utility level given the same prices. Formally, **Expenditure minimization problem**:

$$e(\mathrm{p}, \bar{u}) = \min_{\mathrm{x}} \mathrm{p} \cdot \mathrm{x} \quad \text{s.t.} \quad u(\mathrm{x}) \geq \bar{u}$$

Solution $\mathrm{h}(\mathrm{p}, \bar{u})$ is known as **Hicksian demand**. We do not observe $\mathrm{h}(\mathrm{p}, \bar{u})$ but it is formally related to the observable Marshallian demand through Slutsky equation.

Slutsky equation

We can decompose the Marshallian price responses to substitution and income effects, as in the Figures above. This is done through the Slutsky equation that gives the compensated (unobserved) price response

- $\mathrm{h}(\mathrm{p}, \bar{u}) = \mathrm{x}^*(\mathrm{p}, e(\mathrm{p}, \bar{u}))$
- differentiate wrt p_j

$$\begin{aligned}\frac{\partial h_i(\mathrm{p}, \bar{u})}{\partial p_j} &= \frac{\partial x_i(\mathrm{p}, M)}{\partial p_j} + \frac{\partial x_i(\mathrm{p}, M)}{\partial M}\frac{\partial e(\mathrm{p}, \bar{u})}{\partial p_j} \\ &= \frac{\partial x_i(\mathrm{p}, M)}{\partial p_j} + \frac{\partial x_i(\mathrm{p}, M)}{\partial M} x_j^*(\mathrm{p}, M)\end{aligned}$$

Slutsky

This is the **Slutsky equation**

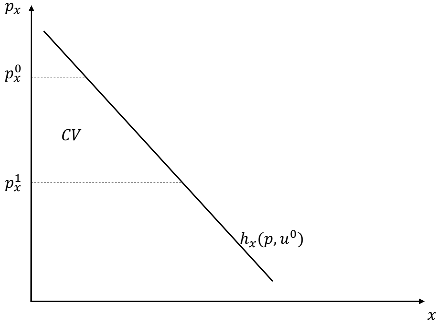
Total price effect on Marshallian demand	=	Substitution effect	+	Income effect
$\partial x_i / \partial p_j$		$\partial h_i / \partial p_j$	-	$x_j^* \partial x_i / \partial M$

Evaluating CV formally

- Let $e(p_x, u^0)$ be expenditure needed to achieve the original utility. For example, our expenditure $M^1 = e(p_x^1, u^0)$.
- Let $h(p_x, u^0)$ be the compensated demand: this identifies the move from A to C in Figures
- Then,

$$CV = e(p_x^1, u^0) - e(p_x^0, u^0) = \int_{p_x^0}^{p_x^1} h(p_x, u^0) dp$$

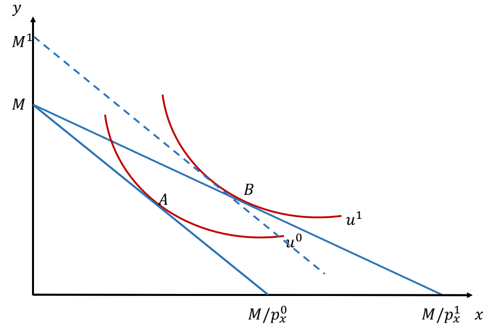
CV defined through Hicksian demand



CV is the area under the Hicksian demand.

Equivalent variation

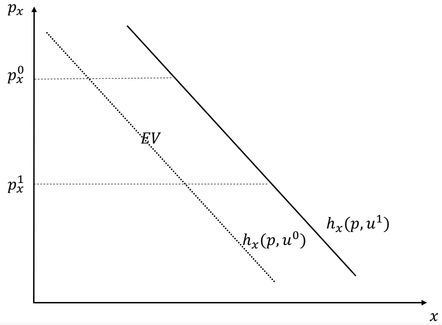
Consider again a price decrease of good x. At initial prices, EV is the amount of money needed to reach the new utility level.



EV is income $M_1 - M$ needed to move the consumer to new utility u^1. New utility, old prices.

Equivalent variation

$$EV = e(p_x^1, u^1) - e(p_x^0, u^1) = \int_{p_x^0}^{p_x^1} h(p_x, u^1) dp$$



Note that EV is defined by a Hicksian demand different from that for CV

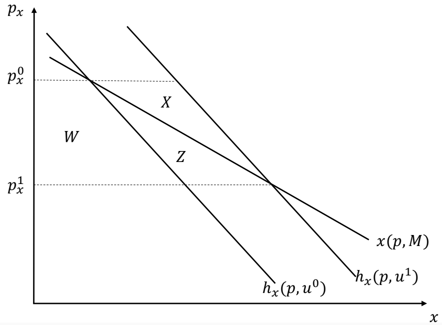
Finally: the relationship between CV, EV, and Δ CS

(We assume that goods are normal in this discussion: income and substitution effects go in the same direction)

- Hicksian demand is steeper than the observed Marshallian demand
- For a price decrease: $CV < \Delta CS < EV$
- For a price increase: $EV < \Delta CS < CV$

CS in only an approximation of the welfare impact!

The relationship between CV, EV, and Δ CS



Note: EV=W+Z+X, CV=W, $\Delta CS = W + Z$

Next lecture

- Measurement of welfare impacts
  - Deadweight loss of taxes and
  - consumer price index
- Two illustrations of policy-induced welfare impacts: houses and cars
- Two readings: in-kind transfers and excess burden of taxation
- Notion of efficiency in policy analysis: Kaldor-Hicks criterion