

Workshop on Public administration output and productivity measurement: lessons from the international experience

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Output, outcome and quality change – measuring the production of non- market services

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Background

- Much effort spent on measuring the value of GDP at current prices
- Even more important: volumes.
- Difficult when
 - Services are complex with changing quality
 - There are no economically significant prices
- Traditionally: volume (price) of inputs = volume (price) of outputs.

Background

- New effort to develop output-based measures of health and education volumes:
 - Eurostat (2001) & EU Regulation
 - Atkinson report (2005) in the UK
 - United States: Triplett and Bosworth 2004, Abraham and Mackie 2006
 - OECD:
 - Handbook
 - Data development (see also L. Lorenzoni's presentation)

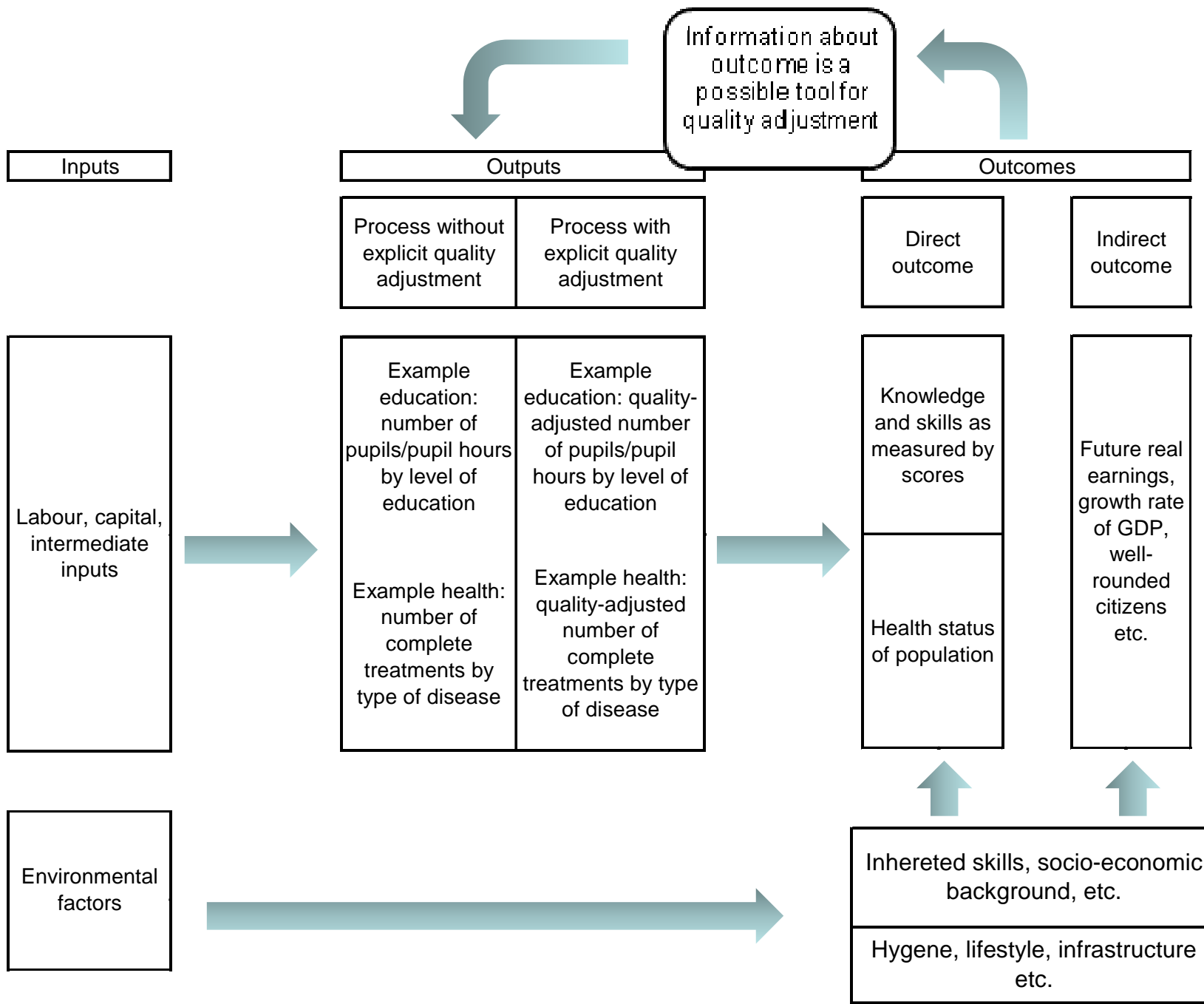


This presentation

- Terminology
- Capturing quality change
- Conclusions

Terminology

- Inputs
- Outputs
 - Processes without explicit quality adjustment
 - Processes with explicit quality adjustment
- Outcomes
 - Direct outcomes
 - Indirect outcomes
- Best explained by way of a graph



Terminology

- National accounts should strive at measuring outputs, in the form of quality-adjusted processes
- Quality adjustment may be implicit or explicit
- Outcomes (as used here) is indicative of results of the education or health system *as a whole*
- Although outcome \neq output, they are not independent



What is special about non-market production?

Prices no more economically significant

→wedge between marginal utility from consumption and marginal costs of production

→theory of producer price indices, [Fisher and Shell (1972), Archibald (1977), IMF et al. (2004)]
relies on revenue functions for producers and stipulates revenue-maximising behaviour

→theory of PPIs no more applicable

Non-market production (2)

- Measurement can be based on *unit costs*.
- *Unit costs (quasi prices)*: unobserved prices that emulate a competitive situation where prices equal average costs per product.
- Observable unit costs treated *as if they were prices*

Non-market production (3)

- Can outputs, inputs & productivity be measured?
- Yes if unit costs (quasi prices) of outputs = *costs per unit of output* (such as the costs for one treatment of a heart attack or the costs for one year of schooling)
- This is different from prices of inputs = *costs per unit of input* (such as wages per hour of a nurse or the salary of a teacher)
- If costs per unit of output rise less quickly than costs per unit of input → productivity growth
- Cost-based productivity measures are well established

Non-market production (4)

- Instead of deflating total costs by unit costs (quasi prices), one could also directly construct a volume index
- At least in concept the result would be equivalent, as long as the volume index is a volume index of *outputs*, not of *inputs*

Quality change

- Health and education services change over time
- In particular, health services undergo rapid quality change
- Health industry = large ICT investor in OECD economies
- Quality change looms prominent in price index literature:
 - Stone (1956), Griliches (1971), CPI and PPI Manuals (2004), Triplett (2006)
- Is there anything particular in the case of non-market production?



Methods to capture quality change:

- 1. Implicit quality adjustment via stratification**
2. Implicit quality adjustment via re-definition of products (human capital approach: education)
- 3. Explicit quality adjustment with non-market hedonics**
4. Explicit quality adjustment via re-definition of products as marginal contribution to outcome (e.g., QALYs, exam scores)



Capturing quality change via stratification

- Basic idea: matching products: services are stratified such that only similar services are compared
- Criterion for classification: similarity in direct outcomes, and not similarity in how services are produced
- Example: different treatments *for the same disease* (in a particular type of establishment) should be in one stratum, and not similar medical procedures for different diseases
- Implies: most detailed stratification = not necessarily best choice with cost weights and imperfect markets



Capturing quality change via stratification (2)

2 treatments, traditional and laser surgery

Same effect on outcome

Laser is cheaper

Laser surgery diffuses progressively

	Traditional surgery			Laser surgery		
	Period 0	Period 1	Period 2	Period 0	Period 1	Period 2
Unit cost	100	100	100	-	90	90
Number of interventions	50	40	5	0	10	45
Total cost	5000	4000	500	0	900	4050

Laspeyres volume index period 1 to period 2:

$$[s_T(5/40)+s_L(45/10)]-1=-7.1\%$$

where $s_T=82\%$ and $s_L=18\%$ are the period 1 cost shares



Capturing quality change via stratification (3)

- Measured output declines! → Counter-intuitive
- Problem: 2 medical procedures have been treated as 2 different services
- Note also implicit assumption:
 - consumer valuation of the two ‘products’ is captured by the relative unit costs,
 - so if laser surgery is cheaper than traditional surgery, this method implicitly quality-adjusts *downward* the quantity of laser surgery when it is combined with traditional surgery.



Capturing quality change via stratification (4)

- In a perfect market, the price of the traditional treatment would instantaneously adjust downward and/or traditional treatment would disappear
- In practice and in a non-market context, this does not happen
 - 2 treatments should be treated as the same product
 - no cost weighting, volume change = zero



Capturing quality change via stratification (5)

- A more sophisticated method would be to keep both treatments in the same stratum but explicitly adjust one of the treatments
- For example put a coefficient of 0.8 on the traditional treatment
- Such adjustments would have to rely on medical effectiveness studies
- There is some way to go before practical implementation
- For more on this, see Triplett (2001): *What's different about health? Human repair and car repair in national accounts and in national health accounts*



Capturing quality change via stratification (6)

- But note: even if we do not explicitly quality-adjust products, the decision how to group them cannot be made without *some* reference to effects on outcome
- Otherwise, no statement can be made about substitutability of services and how they should be classified
- Nearly everything that has been said about quality adjustment via stratification applies also to market production
- Only difference: price statisticians or national accountants who have to deal with it

Non-market hedonics?

- Market case:
 - identify price-determining characteristics
 - hedonic regression
 - Coefficients: market valuation of characteristics
- Can the idea be transposed to non-market case?
- Maybe.
- Consider:

$\ln u_i^t = \ln c_i^t + \ln g_i^t(\mathbf{z}_i^t) \rightarrow$ Hedonic function

u_i^t : unadjusted, observed unit cost

c_i^t : adjusted ('true') but unobserved unit costs

\mathbf{z}_i^t : vector of characteristics

Non-market hedonics?

$$\ln u_i^t = \ln c_i^t + \ln g_i^t(\mathbf{z}_i^t)$$

Non-market context:

- Regress unadjusted costs $\{u_i^t\}$ (e.g. for a cataract treatment) against observed characteristics of service \mathbf{z}_i^t (e.g. single room in hospital, patient characteristics that affect treatment)
- Result: regression identifies those changes in unit costs that are not ‘inflation’ but are due to a change in characteristics

Non-market hedonics?

- Ok, but how should the z 's be chosen?
- Market: price-determining characteristics
- Non-market: those cost-determining characteristics that are related to outcomes
 - Medical characteristics: patient structure, e.g. age of patient may require different treatment for same outcome
 - Non-medical characteristics: patient experience, catering services etc.

Non-market hedonics?

- Choice of characteristics implies some subjectivity, and expert knowledge is required but to some degree that is also true for market hedonics
- Unlike market hedonics, marginal valuation of characteristic = marginal cost, not marginal market valuation
- Choice of characteristics brings in outcomes and therefore the consumer side
- Method needs testing!

Conclusions (1)

- Output and outcome are different and should not be confused
- National accounts and productivity studies of establishments need measures of output, not of outcome
- But output and outcome are not independent
- In the presence of quality change, all existing methods require *some* implicit or explicit information or reasoning about outcome.

Conclusions (2)

- Problems of quality adjustment arise whether services are provided by market or non-market producers.
 - an observable market transaction in one period and another market transaction in the next does not imply that they are comparable
- A pragmatic approach will be called for to proceed with services measurement
 - no reason to approach every type of service with the same method for quality adjustment
 - methodologies should be robust and transparent

Conclusions (3)

- Measuring output for complex services is difficult
- But conclusion should not be that it is simply too difficult to do anything.
- Health and education account for a too large and growing part of the economy to ignore output measurement for them.
- It may take a while before consensual and internationally comparable methods are agreed upon but active research and data development is vital to achieve this objective.