

The Connection between Natural Capital Productivity and Intergenerational Equity

Focus on Ecosystem Services

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Introduction + Overview

Natural capital = land, natural resources
(renewable and non renewable) and
ecosystem services¹

Presentation Outline

- Research Rationale – Intergenerational Equity
- Key concepts
- Productivity and Natural Capital
- Economic Valuation + ecosystem services
(opportunities and challenges)
- Conclusions

Research Rationale – Intergenerational Equity

- Current rates of production are degrading the environment
- A degraded environment is a problem for intergenerational equity
- More specifically, degraded natural capital is a problem for potential future economic productivity

Concepts - Productivity

- Productivity measures the relationship between the inputs in a production process and the output of economic activity

$$\text{Productivity} = \text{output}/\text{input}$$

- Measure of productivity is extremely important for an economy when looking at long-term economic growth²
- Changes in productivity are related to changes in standards of living

Concepts - Productivity

- Original (and still consistently used) measure of productivity is labour (output divided by number of hours worked)³
- More recent productivity measure is multifactor (output divided by all inputs – labour, capital, energy, services etc)⁴
- While moving to compare total output against total inputs is an improvement, this still neglects natural capital (and therefore provides an inaccurate picture of the state of the economy)

Concepts – Natural Capital

- Definition of traditional capital:
 - a stock of instruments existing at an instant in time⁵
 - a stream of services through time, flowing from this stock of wealth⁶
 - Reproducible by humankind⁷

**Does this definition work for
*natural capital?***

Concepts – Natural Capital

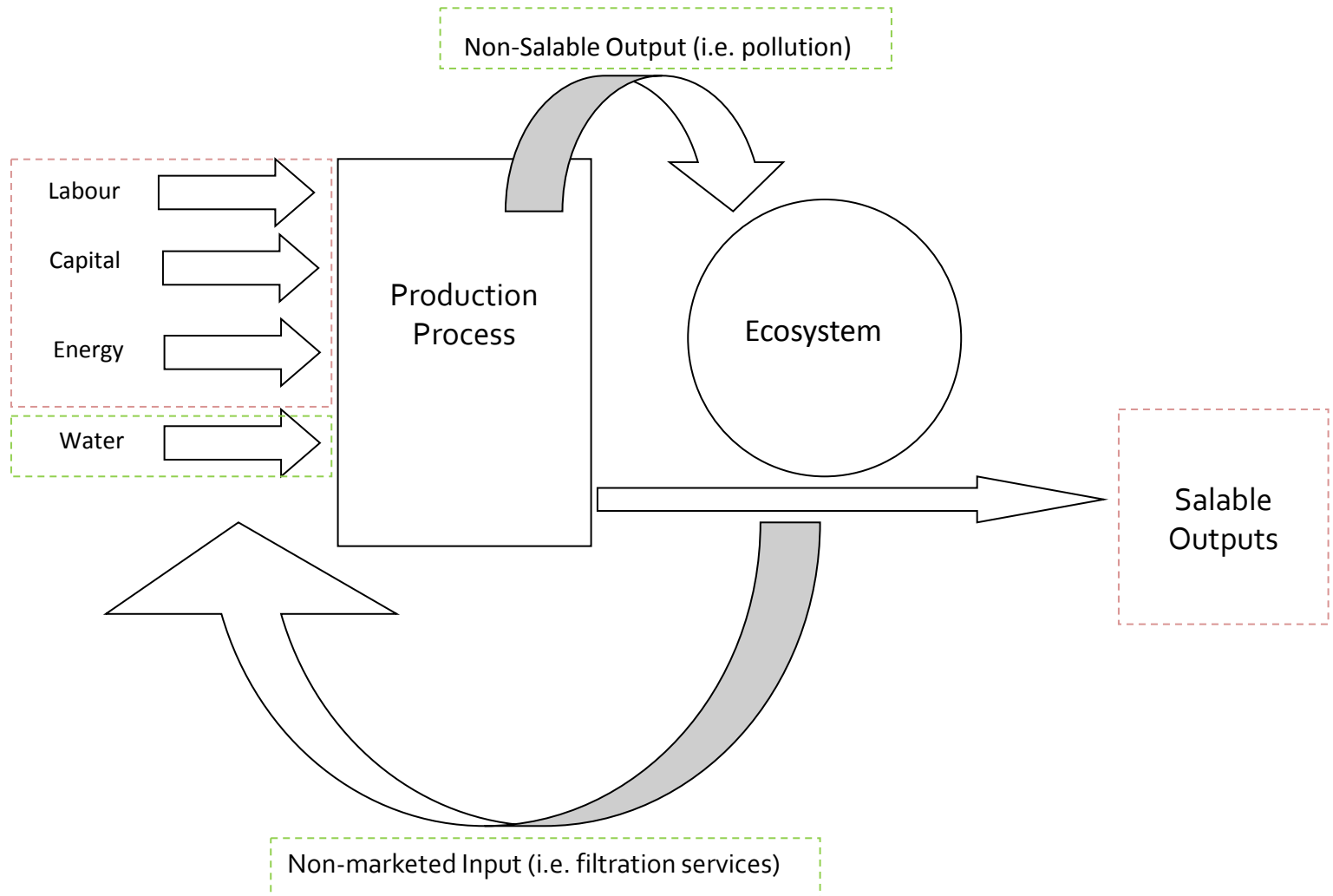
- Definition of traditional capital:
 - a stock of instruments existing at an instant in time ✓
 - a stream of services through time, flowing from this stock of wealth ✓
 - Reproducible by humankind ✗
- New, more general capital definition works better with idea of *natural* capital is

“any stock that yields a flow of valuable goods or services into the future”⁵

Concepts – Natural Capital

- As already noted, natural capital is here defined as being made up of
 - Natural resources (renewable and non renewable)
 - Ecosystem services
 - Land
- Together these make up natural capital, but it is also important to study them independently

Link between current and future natural capital use



Consequences of Current Economic Production

- Current degradation of natural capital leads to lower potential future productivity
- This likely also means a lower maximum standard of living level (at odds with goals of intergenerational equity)
- Solutions???

Possible Solutions

- Typically, environmental regulations have been the solution to environmental damage
- Lower productivity is seen as an inevitable result of these measures
 - Justifiable fear because increasing costs without increasing outputs does reduce productivity
- Result is that industry often rallies against environmental regulation

Possible Solutions

- Environmental regulation only lowers productivity under traditional – and incomplete – productivity measures
- Like GDP and others, traditional productivity does not include values of non-marketed natural capital
- If it did, environmental regulation could be seen as productivity boosters

Traditional vs. Adjusted Productivity Measure

- Traditional

$$\text{Productivity} = \frac{\text{salable outputs}}{\text{market-valued inputs}}$$

- Adjusted

$$\text{Productivity} = \frac{\text{salable outputs} - \text{non-salable outputs}}{\text{market-valued inputs} + \text{non-market valued inputs}}$$

How do we get these values?

- In order to be able to use this formula we must have values for non-salable outputs and non-marketed inputs
- Economic valuation of natural capital and ecosystem services is the key

The Economic Valuation Challenge

- The Valuation Challenge
 - Should we place monetary values on nature?
 - Different uses of natural capital that need to be valued (not just one value, but a combination)
 - Natural resources + land tend to be easier to value, ecosystem services are generally much more difficult

Economic Valuation of Ecosystem Services

Natural Capital Uses/Non Uses

| | | | |
|---------|--------------|-----------------|---|
| Use | Direct Use | Consumptive | Harvesting Resources |
| | | Non Consumptive | Recreation, Tourism |
| | Indirect Use | | Wetland Filtration Process |
| Non-Use | Existence | | Knowledge that aspect of nature exists |
| | Bequest | | Knowledge that aspect of nature will still exist for future generations |
| | Option | | Knowledge that aspect of nature will exist if you decide to visit or make use in the future |

- ← Market Values (e.g. Stumpage fee)
- ← Travel Cost Method, Hedonic Pricing Method
- ← Comparison to Cost of Substitute, Contingent Valuation
- ← Contingent Valuation, Debt-for-Nature Swaps
- ← Contingent Valuation
- ← Contingent Valuation

The process of benefits transfer can be very useful in valuation studies

Conclusions

- The implementation of a modified productivity calculation (including natural capital) should allow governments to create policy and regulation aimed at improving efficient use of natural resources and the natural productivity of ecosystem services
- These improvements will help achieve the goal of leaving the environment in a state no worse than it was received (and therefore allowing future generations to achieve the level of productivity – and standard of living – they desire)

Thank You

- Please contact me with any questions, suggestions or comments (lpento39@uottawa.ca)

References

- 1 Nancy Oleweiler, 'Natural Capital, Sustainability and Productivity: An Exploration of the Linkages' in Keith Banting, Andrew Sharpe and France St-Hilaire (eds), *The Review of Economic Performance and Social Progress* (Institute for Research on Public Policy 2002) 118
- 2 Conference Board of Canada, 'Labour Productivity Growth' (Conference Board of Canada 2009)
<http://www.conferenceboard.ca/hcp/details/economy/measuring-productivity-canada.aspx>
- 3 Tarek Harchaoui, Dmitry Kabrelyan and Rob Smith, *Accounting for Greenhouse Gases in the Standard Productivity Framework* (Statistics Canada 2002) 1.
- 4 Vivian Chen et al, 'Recent Productivity Developments in the World Economy: An Overview From the Conference Board Total Economy Database' [2010] *International Productivity Monitor* 19, 6
- 5 Irving Fisher, 'The Nature of Capital and Income' (Augustus M. Kelly, 1965)
- 6 Irving Fisher, 'The Nature of Capital and Income' (Augustus M. Kelly, 1965)
- 7 Friedrich Hinterberger, Fred Luks & Freidrich Schmidt-Bleek, 'Material Flows vs Natural Capital' – what makes an economy sustainable?' [1997] 23 *Ecological Economics* 1 at 5.

Traditional Productivity Measure

Traditional –
No Environmental Regulation

Included

Salable Outputs = + 60

Market Inputs = 30

Excluded

Non-Salable Outputs = -10

Non-Market Inputs = 10

Productivity = $60/30=2$

Traditional –
Post Environmental Regulation

Included

Salable Outputs = + 60

Market Inputs (incl. Additional cost for meeting
environmental requirement) = 40

Excluded

Non-Salable Outputs (incl. reduction in pollution as a
consequence of new environmental requirement) = -5

Non-Market Inputs (incl. increase in efficiency use of
natural capital – and therefore less cost – as a
consequence of new environmental requirement) = 6

Productivity = $60/40=1.5$

Adjusted Productivity Measure

Adjusted –
No Environmental Regulation

Included

Salable Outputs = + 60

Non-Salable Outputs = -10

Market Inputs = 30

Non-Market Inputs = 10

Productivity = $60 - 10 / 30 + 10 = 1.25$

Adjusted –
Post Environmental Regulation

Included

Salable Outputs = + 60

Non-Salable Outputs (incl. reduction in pollution as a consequence of new environmental requirement) = -5

Market Inputs (incl. Additional cost for meeting environmental requirement) = 40

Non-Market Inputs (incl. increase in efficiency use of natural capital – and therefore less cost – as a consequence of new environmental requirement) = 4

Productivity = $60 - 5 / 40 + 4 = 1.25$