

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

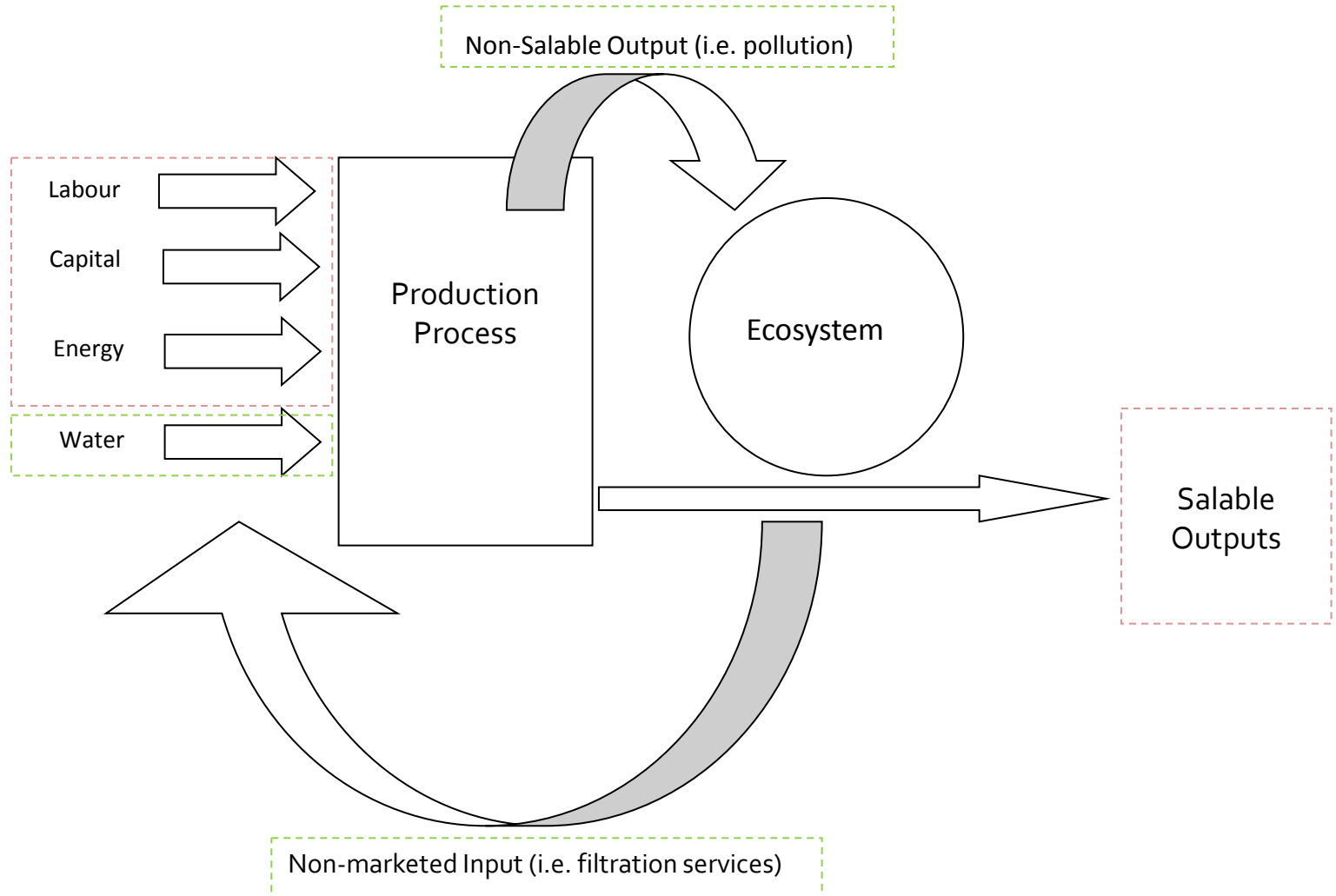
- Definition of traditional capital:
 - a stock of instruments existing at an instant in time ✓
 - a stream of services through time, flowing from this stock of wealth ✓
 - Reproducible by humankind ✗
- New, more general capital definition works better with idea of *natural* capital is

“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 = $60 - 5 / 40 + 4 = 1.25$