

# Natural Resource Asset Accounts

Monetary Accounts

John Joisce

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# Link between physical and monetary accounts

- Asset boundary for physical and monetary largely same but to be included in monetary account asset has to have economic value
- Some physical assets have no economic value (such as unused land in remote locations)
- At same time, revaluations only found in monetary account
- Measurement of physical dimensions need to precede monetary calculation

# Link between physical and monetary accounts

- Physical volumes not merely based on “what is there” (Class A only but Classes B and C may also have extractable, economic resources but not included in asset accounting in either physical or economic measures)
- Economic, geology, and technology all have impact on extent of physical resource
- Resource is often in mind of engineer/geologist before “found”

# Link between physical and monetary accounts

- In determining whether resource is worth extracting ability to extract and cost of extraction, price of the extracted resource, ability to transport it, cost of capital, returns to capital, resource rents payable to owner of resource, among matters that need to be taken into account

# Valuation principles

- In economic theory and in practice (in SNA and elsewhere), principle of measurement is generally taken to be market price (represents a revealed preference and shows how economic decisions (to invest, to consume) are made and can be compared)
- For natural resources, usually not possible to identify them in situ
- Need for proxies to market valuation

# Alternative valuation approaches

- Residual value method
  - Discounted future stream of income after deducting all user costs of produced assets (COFC and normal returns to produced assets) and after adjustment for specific subsidies and taxes
- Appropriate method
  - Tend to underestimate substantially value of resource, especially if owned by government
- Access price method
- In principle, where freely traded, would produce similar value as PV but in practice often not freely traded, given away, or no active market

# Alternative valuation approaches

- Net price approach (more or less equivalent to Hotelling) which just takes the current natural resource rent and multiplies it by the current volume
- SEEA approach: Present value

# Present value

$$PV = \sum_{t=1}^T \frac{RR_1}{(1 + r_i)^t}$$

# Resource rent

- Resource rent = return to owner of resource for its use
- As noted, payment of rent usually low and thereby underestimates resource's value
- Most of resource rent buried in return to operator (as part of Gross operating surplus, along with return to produced capital, entrepreneurship)
- Need to separate out resource rent from other returns to capital and entrepreneurship

# Resource rent

- Based on income and operating costs of extractor
- Only extraction process: not other (downstream) activity
- In principle, should be specific to resource
- In practice, separation (e.g., of oil and gas) may not be possible

# Resource rent: Price fluctuations

- While operating costs typically change slowly, resource price often volatile
- As RR derived residually, may lead to volatile time series
- Aggregate rent payable in any given period affected by extraction rate, which may be affected by price (and demand) changes, as well as one-off events (extreme weather, mine collapse)

# Resource rent: Price fluctuations

- Need to forecast RR (as part of PV calculation)
  1. Divide total RR by Quantity extracted of individual resources (where possible)
  2. In absence of other information on future resource prices, use proxy for RR (moving averages; regressions). Over what length of time should averages/regressions be run? Must make clear assumptions used in estimation

# Calculation of “normal” rate of return to capital, entrepreneurship

- Endogenous approach =  $\text{NOS} / \text{stock of produced assets}$ : implies no return to nonproduced assets
- Exogenous: assumes rate of return on produced assets = external rate or return, as specific to industry as possible, reflecting risks associated with that activity (long-term bond rate);
- if no observable rates for industry, use general government long-term bond rate
- “Real” rate (i.e., after adjustment for expected inflation) should be used

# Calculation of “normal” rate of return to capital, entrepreneurship

- Indirectly, deriving “normal” rate of return to produced assets and entrepreneurship (such as long-term average net operating surplus for non-resource industries, or, more narrowly, for non-resource, capital intensive industries, such as manufacturing, or general return to capital where such detailed information may be lacking, such as return on long-term bonds or equity) and deducting from NOS specific subsidies plus specific taxes, leaving residual resource rent
- Where resource rent is negative, treated as zero

# Calculation of “normal” rate of return to capital, entrepreneurship

- Long time frame (20 years? Longer?)
- GOS for economy as whole economy (excluding resource industries) or capital intensive industries (excluding resource industries)
- Perpetual inventory model of fixed capital stock for economy or for capital intensive industries, excluding resource extractive industries

# Discount rate

- To calculate PV, several variables need to be obtained
- Present value represent **discounted value** of future resource rents
- Time value of money: money today worth more than money tomorrow
  - Need to provide return on future money to compensate for not spending it today
- Discount rate represents that return
- Discount rate used in asset accounting represents rate of return to nonproduced assets
- Which discount rate to choose?

# Individual or social discount rate

- Individual discount rate is rate payable by consumers or investors under own individual circumstances
- Social discount rate is rate applicable for whole economy, taking intergenerational equity considerations into account
- Social rate usually lower than individual, will give larger present value, representing a higher value for future generations
- SEEA's choice: use specific industry's cost of funds, if possible; otherwise, use general government bond rate
- Preferable to disaggregate data (industry, commodity, method of exploitation) as much as possible

# Resource rent: exploration and evaluation

- Exploration necessary for discoveries of commercially exploitable resources
- Either own account or contracted out
- All costs incurred in exploration treated as GFCF of *intellectual property* (not natural resource): capitalization of knowledge
- COFC necessary in calculation of RR
- Costs of decommissioning mines and rigs should be deducted from RR, where possible
- For service lives, use may be made of those used by extraction companies in own accounts
- For calculation of RR, necessary to deduct user costs of produced assets (including COFC) and return to those produced assets used in the extraction processes

# Resource rent: extraction rate

- In order to derive PV of resource, need to determine extraction rate over resource's life
- Where resource is renewable and exploitation sustainable, resource has infinite life
- Usually assumed extraction rate will be constant, but may not necessarily be: if information available to indicate non-K rate, should be used
- Using constant rate implies efficiency constant and stock of produced assets remains constant proportion of stock of resource

# Resource rent: resource life

- At any point, resource's life = stock/average rate of extraction for period (unless reason to believe average not typical of future rate)
- Stock may change through depletion, economic considerations, technological change, discoveries, reappraisals, catastrophic losses: all valued at average price in situ (suitably discounted, where appropriate)
- Economic stock must be consistent with physical: only Class A resource included (note: assumption of productivity of resource and ability to extract all of stock)

# Depletion (or abstraction) and other changes in opening and closing stock values

- Changes can be attributable to several factors:
  - Depletion (or abstraction for renewable resources)
  - Additions (discoveries, growth)
  - Reclassifications
  - Technological developments (making economic previously deemed uneconomic: e.g., fracking)
  - Catastrophic losses
  - Price changes (which can also make uneconomic what was previously deemed economic)
  - Exchange rate changes

# Depletion/abstraction

- Depletion
  - for non-renewable resource: reduction in value of stock attributable to extraction (as no regeneration, extraction=depletion)
  - For renewable resource: accretion (e.g., growth of trees, increase in fish stocks) mitigates abstraction. If growth = or > than abstraction, no loss of resource
- Valued at quantity extracted \* Average in situ price for period of extraction

# Accounting for depletion-adjusted saving

- As noted, rent payments usually undervalue resource's true worth: so operator often appropriates some of resource's value
- Two components of resource rent: depletion and net return to environmental asset
- In SEEA, need to record separately

# Accounting for depletion-adjusted saving

- Record total depletion in Production and Generation of Income Accounts of extractor as deduction from value added and operating surplus
  - By so doing, ensures economy-wide VA and OS fully account for depletion
  - Also, as government has no OS in extraction, excluding depletion from Production Account of General Government ensures GG output not increased by including depletion

# Accounting for depletion-adjusted saving

- Record “Depletion borne by Government” in Allocation of Primary Income Account to reflect
  1. Rent earned by government includes government’s share of depletion – it must be deducted to measure “depletion-adjusted savings of government”
  2. “depletion-adjusted savings of operator” would be understated if all depletion charges were charged to it
- In other words, rent received by government must be recorded net of depletion to reflect the loss of future earning capacity
- For many, “depletion-adjusted savings” focus of asset accounting