Benefit Valuation: Regional Public Goods and Regional Projects

John Weiss

Some definitions

- Regional projects where total benefits for region exceed those if the investors or countries acted independently.
- RPGs are sub-set of regional projects; eg disease control, pollution abatement, forest protection
- Differing characteristics of RPGs will determine how they can be supplied most efficiently and how far MDBs should be involved in their provision.
- Classifications follow degree to which they match properties of public goods – non-rivalry in consumption and non-excludability
- and conditions under which they are produced (so-called 'aggregator technology')
- See T, Sandler ' Demand and institutions for regional public goods' in A, Estevadeordal. B, Franz and T, Nguyen (editors) *Regional Public Goods: from theory to practice*, IADB-ADB, Washington DC, 2004.

Characteristics

- By dimension of ‘publicness’ four categories.
- *Pure public goods*: where additional use does not reduce availability for others (non-rivalry) and where not possible to separate and charge individual users (non-excludability); where benefits of such goods are dispersed across region they are pure regional public goods (eg contagious disease control, CO_2 emissions reduction).
- *Impure public goods*: where partial rivalry in consumption or where possible to exclude some users through charging (eg watershed management).
- *Club goods*: where full exclusion is possible and pricing can ration use but elements of non-rivalry (eg airport network, possibly roads).
- *Joint products*: where more than one output is involved and at least one output has public good characteristics (eg biodiversity protection).

Provision categories

- *Summation*: overall level of public good supply equals sum of contributions of individual participating countries with substitutability so that extra effort by one can compensate for smaller effort by another.
- *Weighted sum*: where overall level of public good supply is weighted sum of individual country contribution with some countries more important providers than others.
- *Weakest link*: where smallest country contribution determines overall supply for the region.
- *Weaker link*: where smallest country contribution has greatest impact on supply, followed by second smallest contribution etc.
- *Best shot*: where largest contribution determines provision

Rationale for Role of MDBs

- a) where pure or impure public goods with summation technology, so that efforts of different countries are substitutable and there is free-rider problem;
- b) where for club goods poorer member countries cannot afford the full cost of supplying these goods;
- c) where weaker or weakest link technology is involved and poorer member countries lack capacity to supply to relevant standard.
- Eg provides a rationalisation for involvement with health and road projects (weaker link) and for some environmental projects (the weighted sum case).
- However full justification cannot be assessed on a-priori grounds and requires estimates of costs and benefits involved.

Economic analysis of regional projects

- Regional project is one which creates external benefits elsewhere in region so total regional benefit as measured by regional economic net present value (ENPV) exceeds national ENPVs.
- If no budget constraint in theory investment in regional projects should be up to point at which marginal project yields ENPV of zero at a discount rate, which reflects collective social time preference in region
- Where fixed budget set aside for regional projects investment in regional projects should be up to the point where budget is exhausted with projects with a positive ENPV
- Ranking of alternatives should be by ratio ENPVi/Ki, where K is capital cost and i refers to project i.

Choice of discount rate

- Concept of collective regional time preference can refer to society as whole in region or regional decision-makers
- Ramsey formula related originally to individuals has been used in this context; eg example, current ADB rate of 9% is rationalised as regional time preference rate (Guidelines for the Economic Analysis of Projects, ADB, 2017, Appendix 18).
- Regional time preference rate (RTP) is estimated from expression
- RTP = g.n + p
- 9% is derived on basis of some strong assumptions with high values for future growth (g = 5%) and elasticity of marginal utility of consumption (1.5) plus pure time preference of 1%.
- More conservative estimates of per capita consumption growth (g =3%) and a less progressive value for the elasticity (n = 1) reduce the discount rate by more than half (RTP = 4%).
- Lower estimate for time preference in line with other country estimates (eg 3% -6% in EU)
- Where budget constraint assumed 9% is reasonable default rationing rate

Partial approach

- Practical project work takes partial approach
- Once interdependence is allowed benefits of project in country A can depend on scale of activity in country B (or in a series of other countries) problem more complex; eg highway project in A benefits from similar project in B as result of cross border traffic flows
- Free rider problem as project in B may benefit from project in A even if no additional investment in B, but gains to both A and B will greater if both countries invest.
- Role of MDB to solve co-ordination problem and provide funding or technical advice to both.
- The co-ordination problem is more complex where economies of scale are important so need for formal optimisation model to determine both optimal scale and sequencing of investments.
- Regional sector master plans offer partial solution, at present most offer cost minimisation solutions rather than maximisation of net benefits because of the difficulty of attributing and valuing project level benefits

Valuing regional benefits: Power

- Regional benefits must be added to national ones
- Regional effects from power projects arise where either allow power export in region (through investment in generation or transmission) or power import (through transmission investment).
- Regional benefits arise through consumer or producer surpluses created by project
- Any difference between export tariff and economic value of power in user country creates an external gain shared between power consumers in importing country and importing power company
- Surplus capacity in the exporting country with costs below the export price will create a producer surplus

Valuing regional benefits: Transport

- Regional benefits of transport projects arise through improved regional connectivity with reductions in cost and time sometimes combined with improvements in facilities at border crossing points
- Benefit valuation largely based on savings in travel costs (principally travel time and vehicle operating cost)
- Key issue how far generated traffic and induced trade and production is created specifically by cross-border dimension
- Two approaches – derived demand using transport elasticities or estimates of induced production

Valuing regional benefits: Transport

- Elasticities – separate out national/regional traffic using different income and price elasticities
- Benefits based on travel cost savings
- Induced production – add in induced investment cost
- Agglomeration effects with distance between economic centres reduced leading to productivity change
- Developed originally for national projects in UK but can be applied to cross border trade
- UK, Department for Transport, *Wider Impacts – Transport Analysis Guidance (TAG*), 2014

Valuing regional benefits: Trade facilitation

- Regional benefits expected through lower transit time for cross border trade.
- Bulk of costs time of vehicle operators and of administrative staff involved in pre-shipment processing, unless the goods are perishable; costs are ‘tariff eqivalent’
- Estimates of import demand elasticity with respect to import tariffs can be combined with percentage reduction in estimated unit cost due to trade facilitation.
- Trade effect likely to be slight because costs saved small proportion of the value of most goods, unless they are perishable.
- Main regional effect in creating an operating environment, where perceived that transit procedures no longer obstacle to trade with neighboring countries which can encourage investment in export activities on both sides of border.
- This type of induced trade effect very difficult to capture at the project level and will not be picked up in trade elasticity estimates.

Valuing regional benefits: Education

- Regional co-operation education projects normally involve co-operation in higher education and research to spread fixed costs across countries
- Economic benefits typically based on a ‘human capital’ approach that values education on the basis of the higher productivity that additional years of education or research expenditure create
- Higher productivity approximated by incremental life-time earnings
- Approximation due to externalities
- Regional dimension requires disaggregating students between those from country of location of project and those from elsewhere in the region.

Valuing regional benefits: Health

- Best practice indicator of health impact – DALY – can be used in cost effectiveness analysis or given monetary value (relative to GDP/capita)
- For regional projects key issue is how far reduction in DALYs is improved by regional co-operation on contagious disease
- Involves two comparisons
- Full impact H = (P*D - P*D2), where P is population at risk, D is disease incidence without project and D2 is disease incidence with regional co-operation
- Regional impact H1 = (P*D1 - P*D2) D1 is disease incidence if project only on national basis, so D1> D2
- H – H1 is extra reduction in DALYs.

Valuing regional benefits: Environment

- Some effects national others regional
- Watershed management projects may improve soil conservation leading incremental agricultural production
- Off- site impacts (eroded soil from one site will have an impact on water quality, flood levels or siltation at another site) can be spread across countries affected by river-basin.
- Forestry projects preserving forests can protect bio-diversity and improve carbon sequestration.
- Removing CO_2 and protecting rare species affect countries and residents well beyond particular region.
- If carbon sequestration and CO_2 emission reduction is valued at a standard price (ADB Guidelines 2017 recommends $36/ton at 2016 prices) simple procedure allocates value of the emissions reduction between participating countries on population basis

Conclusions

- Valuation of regional benefits is essential for appraisal of projects that create regional pubic goods but difficulty varies between sectors
- Distributional issues important
- If a regional ENPV is estimated should be possible to estimate approximately how it is distributed between participating countries.
- Important to ensure adequate incentives for countries and various stakeholders to participate project.
- Any major discrepancy between country's share in costs as compared with its share in benefits can create an incentive issue and may need to be addressed by MDB, or the governments by compensatory measures
- Procedures for regional distribution analysis illustrated in ADB *Guidelines for the Economic Analysis of Projects*, 2017, Appendix 15.