1. Introduction: multi-government cost–benefit analysis, shadow prices and incentives

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INTRODUCTION

Over the last two decades, the Structural Funds and the Cohesion Fund have co-financed through grants a very large number of projects in the Member States of the European Union. These include mainly railways, roads, ports and airports, water distribution and treatment, solid waste management, but also productive investments, science parks, museums and many others. Other sources of infrastructure finance include grants under the Trans-European Networks in transport and energy, and loans by the European Investment Bank (EIB), or by the European Bank for Reconstruction and Development (EBRD).

In the coming years the EU institutions, national governments, regional managing authorities, public and private companies will all face challenging infrastructure needs. In 2007–13 the EU Funds will contribute to the infrastructure plans of 27 countries, including 12 new members (mostly former transition economies). IPA funds will assist Croatia and other accession candidates. The EU seven-year budget supporting this effort will draw from a provision of over EUR 300 billion for Cohesion policy. Table 1.1 shows the Cohesion Policy Budget, eligibility, priorities and allocations.

A substantial part of the funds is going to be allocated to infrastructure projects, in regions lagging behind in the endowment of basic stock of capital compared with the rest of the EU. Moreover, there will be a leverage effect of the EU funds on public and private finance, because in many cases Brussels will contribute only part of the cost, and the rest of the capital expenditure must be matched by other sources of finance. Table 1.2 gives some figures on this important leverage effect.

This chapter focuses particularly on infrastructure that support services of general economic interest in sectors such as transport, electricity and

Table 1.1 Cohesion Policy 2007–13

Programmes and instruments	Eligibility	Priorities	Allocations
Convergence objective			81.54% (EUR 283.278 billion) <i>including the special programme for the outermost regions</i>
National and regional programmes (ERDF, ESF)	Regions with per capita GDP < 75% of EU-25 average Statistical effect: regions with per capita GDP < 75% of EU-15 and > 75% of EU-25	<ul style="list-style-type: none"> • Innovation • Environment • Accessibility • Human resources • Infrastructures • Administrative capacity 	57.37% = EUR 199.322 billion 4.02% = EUR 13.955 billion
Cohesion Fund	Member States with per capita GNI < 90% of Community average	<ul style="list-style-type: none"> • Transport networks (TEN-T) • Sustainable transport • Environment • Renewable energy 	20.02% = EUR 69.578 billion
Regional competitiveness and employment objective			15.95% (EUR 65.412 billion)
Regional programmes (ERDF) and national programmes (ESF)	The Member States propose a list of regions (NUTS1 or NUTS2) 'Phasing in' regions covered by Objective 1 between 2000 and 2006 and not covered by the employment strategy convergence objective	<ul style="list-style-type: none"> • Innovation • Environment/ risk prevention • Accessibility • European employment strategy 	12.54% = 43.556 billion 3.28% = EUR 11.409 billion

Table 1.1 (continued)

Programmes and instruments	Eligibility	Priorities	Allocations
European territorial cooperation objective			2.52% (EUR 8.723 billion)
Cross-border and transnational programmes and networks (ERDF)	Border regions and large transnational cooperation regions	<ul style="list-style-type: none"> • Innovation • Environment/ risk prevention • Accessibility • Culture, education 	100.00%
Total			347.410 billion

Source: http://ec.europa.eu/regional_policy/policy/funds/index_en.htm, accessed 18 July, 2007, and our own calculations

gas, telecommunications, environmental services, etc. However, most of the issues that I consider are relevant for social infrastructure as well, such as hospital and educational buildings, and for support to industry and R&D ventures.

The EC is in an unique position to capitalize infrastructure knowledge across countries and regions, and this learning mechanism has an intrinsic value, that would be entirely lost by full re-nationalization of planning and evaluation.¹ A consistent use of social Cost–Benefit Analysis (CBA) should be seen as the common language for this learning mechanism.

Moreover, there is an interplay between regional policy and other crucial EU integration policies, for example the creation of European-wide energy markets, of trans-boundary multimodal networks, and of standards in environmental protection. In fact Structural Funds overlap with these broader policy frameworks, because infrastructure for services of general economic interest should be a component of the wider European project.² Moreover, I think that this wide-scale experiment has importance for the rest of the world, that from EU successes and failures, can learn how to manage complex multi-lateral investment plans (Picciotto, 2006).

Before going to practical shortcuts to deal with such an ambitious planning exercise, we need to turn to a suitable analytical framework for economic evaluation in a multi-government setting.

Twenty years after their seminal contribution to CBA methods, Ian Little and James Mirrlees, looked with a critical eye at the World Bank experience:

Table 1.2 Leverage effect of structural funds on public and private expenditure under Objective 1, 1994–9 and 2000–6 (EUR)

	1994–9* National public funds per euro of SF	Private funds per euro of SF	2000–6 National public funds per euro of SF	Private funds per euro of SF
BE	0.77	1.18	1.02	1.43
DE	0.37	1.53	0.58	0.02
EL	0.52	0.28	0.50	0.48
ES	0.51	–	0.52	0.04
FR	0.54	0.23	0.88	0.33
IE	0.43	0.34	0.76	0.25
IT	1.40	–	0.89	0.45
NL	2.49	1.42	2.15	0.55
AT	1.59	3.79	0.33	1.76
PT	0.42	0.30	0.60	0.46
UK	0.53	0.24	0.85	0.43
Total EU11	0.62	0.36	0.63	0.29

Notes: * Based on actual expenditure 1994–2000

ES, IT: for 1994–9, national public funds include private funds; EU11: excluding FI, SE

Source: ‘Third report on economic and social cohesion: A new partnership for cohesion convergence competitiveness cooperation. Statistical Annex to Part 4: Impact and added value of structural policies,’ p. 180, EC, 2004.

Good project appraisal is done by people with their own incentives, within organizations that wittingly or not set these incentives. Both environments of project appraisal, the intellectual and political-organizational, are keys to the quality of selection overall. This needs to be most seriously considered by those who manage and create this environment. (Little and Mirrlees, 1994, p. 225)

Economists are often inclined to think that because analytical tools exist, they will be used in practice. This is a bit naive. Project evaluation based on CBA, even in its most simplified versions, requires research efforts, is time consuming, and in some cases may be controversial. Thus, decision-makers need to reward good analyses and to punish the sloppy ones. To do that, they should have an evaluation and planning strategy, not just a set of accounting rules. They need to use cumulative information on ex-ante and ex-post project returns to establish benchmarks and yardsticks, and to learn.

This incentive-based approach to project evaluation is feasible and useful, and social CBA, in spite of its limitation, is the best common language available to us for framing these mechanisms. This is true in infrastructure-based industries in developing and developed countries as well. Although many distortions have been addressed in the last few years, observable prices of energy, water or of transport services are far from their social opportunity costs in many countries. Some policy reforms aim in fact at 'getting price right', but first, there are often constraints to their implementation, and second, in some cases they are mistaken. For example, it is not always desirable that tariffs should be cost-reflective, when income distribution is far from being optimal. Privatization, liberalization and regulation can be good or bad. They may create private rents and increase the wedge between market prices and social opportunity costs. Hence, very often, observed prices cannot be trusted for investment decisions involving public funds. This is probably true everywhere, albeit with country or region-specific market and policy failures, and with a complex interplay of central and local governments.

The EU context poses new, interesting questions on infrastructure planning and evaluation in a multi-government setting. The European Commission and national planners should provide better designed incentives to project evaluation beyond the dissemination of basic principles, as it has done by establishing guidelines and organizing training seminars and evaluation conferences. They should agree harmonized rules on the calculation of some key shadow prices and performance indicators, and use them to steer the process. Moreover, they should use the information of ex-ante and ex-post analyses as an incentive mechanism for generating good projects evaluation and management. Only a serious dialogue among the many players in the EU planning process can offer appropriate answers to some of the open questions discussed here. To a large extent, this is an unprecedented experiment in economic and political integration that deserves attention worldwide.

The structure of the chapter is as follows. The next section proposes a broad research agenda on evaluation and planning in a multi-governmental framework. Second, standard shadow prices theory is reviewed in the context. Third, some information and incentive issues are discussed.

RESEARCH AGENDA

A tentative list of open research topics in this context are covered in this chapter.

Integrating CBA and Incentive Theory

Turning to the microeconomics of public investment, we need an analytical framework for planning and evaluation. Drèze and Stern (1987, 1990) offer a good starting point, a general theory that includes a number of earlier works as special cases. Laffont and Tirole (1993) and several other contributions in incentive theory, including Laffont (2005) offer a framework for the analysis of information and incentive structure. There are two research avenues to integrate these frameworks, discussed below.

First, one should consider a situation where CBA is decentralized in a multi-government setting, with a supra-national social planner who acts as co-financier. Second, one has to look at the information and incentive issue in this context. The shadow price definition relevant here is the social opportunity cost of a change in the world. The DS framework needs to be re-stated in a multi-country setting and under incomplete and asymmetric information. The economy to be considered includes different types of agents: individuals (consumers, workers, taxpayers), managers of private and public firms, regional governments, national governments and one supra-national planner. They have preferences and react to signals, such as prices and rations. Some of these signals are under the control of the regional government, others under the control of other levels of government, others are exogenous for all planners. Each planner may compute its set of shadow prices, based on its own preferences and constraints, and use them to evaluate projects. The interplay of planners can be modelled in different ways, including bargaining games, vector optimization, or a bottom-up lexicographic approach. The latter means that when co-funding or licensing decisions involve different planners, the projects selected are those mutually compatible, that is they simultaneously pass a CBA test. This is the 'consensus decision set' which can, however, be an empty set. Under asymmetric information in any case one government or the implementing firm may have an incentive to manipulate project evaluations to get co-financing from the supra-national planner. Moreover, evaluation is costly. Hence, there should be a mechanism to stimulate evaluation efforts and to elicit true information. One of many possible mechanisms uses cumulative information, project return benchmarks, and ex-post performance incentives. Over time, fund allocation will reward (punish) good (bad) project evaluators, planners and managers.

Learning from Project Evaluation in the Real World

To what extent the above abstract framework fits in real world project evaluation? There are two ways of looking at this issue. First, one can

consider a number of official evaluation guidelines that are relevant for infrastructure planning. For example, the CBA Guide adopted by DG Regional Policy can be compared with some national traditions of public sector project evaluation, particularly in the UK (the *Green Book*), France (*Le Plan*), and in some other EU countries. A comparison with the official CBA guidelines by the US Federal government (*Circular A-94*), some federal agencies and the World Bank may help to understand where we are in Europe looking particularly at the experience of the EIB (Carbonaro, 2006) and the EBRD (Carbajo, 2006). This comparison with what is done on the other side of the Atlantic is particularly relevant for the EU because of the quasi-federal nature of EU capital grants for infrastructure project financing (see Mairate and Angelini, 2006). Second, project appraisal guidelines are one thing, their implementation is another. Frequently observed errors and omission need to be openly discussed, including optimism bias, unrealistic schedules, inconsistent shadow pricing, and neglect of risk. The real world seems to be two steps away from theory: written guidelines need to simplify a lot, and are of varying quality and consistency with theory. In turn, practice on the ground is often far from the official guidelines. Understanding why practice and theory are so divorced in the CBA arena will help to design better incentive mechanisms.

Infrastructure Returns: Integrating Macro-econometric Modelling and CBA

There is a growing empirical literature on infrastructure and growth in Europe (Florio, 2000). This literature is often rather inconclusive because of the limitations of aggregate modelling of public investment. There is indeed some evidence that sustained infrastructure investment in Europe in the next 20 years can be an important ingredient for growth recovery. Looking at regional level data, infrastructure investment and GDP growth are correlated, but only under certain conditions. After all, having a new highway is good only if somebody is going to use it, if contractors do not earn excessive rents, if users have substantial net benefits and externalities are taken into account. In principle the micro-social rates of return as estimated in a CBA framework for this type of investment should be consistent with the equivalent returns in macro-econometric modelling. This double-check micro-macro analysis has not been yet attempted, and it would be interesting to perform some explorative work in this area to establish, if possible, broad investment priorities, see Quinet (2006) for recent debates in France.

How Many Social Discount Rates?

A standard topic in CBA, that needs further inquiry in a multi-government setting, is the social discount rate. Different theories are available, but an approach based on the social time preference, involving forecasts of the consumption growth rate and the elasticity of marginal utility of income is often deemed to be the most appropriate by economists (see Evans, 2006; Evans and Sezer, 2004; Kula, 2002, 2006). Social discount rates at a national level based on this approach should be estimated and compared with the SDRs officially adopted by the Member States (see Spackman, 2004, 2006). While in principle the SDR is a national shadow pricing parameter, in fact probably only two rates are worth using: one for the Cohesion countries, and a lower one for the remaining EU Member States (see Florio, 2006). The main rationale for this double regime is the difference in growth rates across the two groups. The alternative of two or more macro-regional SDRs should be considered along with its relationship with country-based estimates.

Shadow Wages and the Social Value of Job Creation

The social value of reducing unemployment through public investment spending in the EU is an important topic in the context of planning the Structural Funds. After considering different theoretical models, and data about labour conditions at a regional level, it seems that, unlike the social discount rate, the shadow wage rate is intrinsically region-specific, as it reflects highly idiosyncratic labour market conditions. A range of wage conversion factors can be estimated for group of regions, based on three types of unemployment: hidden unemployment in the informal sector, Keynesian unemployment, frictional unemployment (see Florio, 2006).

Estimating some Critical Shadow Prices

The shadow prices of labour and capital (including public funds) are two typical planning parameters. There are three other sets of shadow prices that need to be discussed in the EU context, looking particularly at the output of revenue generating infrastructures, such as toll motorways, railways, energy production and distribution, water, etc. These include the value of time, of life saved, environmental benefits (see De Rus, 2006; Johansson, 2006; Scapecchi, 2006; Atkinson and Mourato, 2007). While tariff policy is the responsibility of national regulators, the EC should use shadow pricing as a way to reveal the trade-offs in infrastructure

investments policies. Shadow-pricing rules should be harmonized across countries, even if key-parameters for the evaluation of intangibles and externalities should be region-specific. Transboundary effects and ethical concerns, however, may suggest adopting some European benchmark values. A range of values should be given to illustrate the variability of shadow prices across the EU, and to dismiss the simplistic view, *de facto* adopted by some national governments, that shadow prices are important only in less developed countries where actual prices are supposed to be the most distorted.

Welfare Distribution Matters in Project Analysis

There are contrasting views on this topic in CBA literature and the question arises whether one should regard EU Cohesion Policy as re-distributive in the conventional sense. My view is that while there is a solidarity element in it, the answer is negative. There is little evidence in the EU legislation that transfers from rich to poor countries and regions are a substitute for transfers from rich to poor households. Cohesion policy is best depicted as the territorial dimension of European integration. However, this is not an argument for ignoring the distribution impact of projects. If projects have adverse welfare effects on the poor they can be socially unaffordable. Moreover, tariff reforms in the new Member States, where many public services were priced below costs, are linked to EU co-financed infrastructures investments, and the Commission faces trade-offs between projects with higher tariffs and low need for EU grants and the other way round. Approaches that include social affordability in the evaluation need to be discussed and examples of regional and social welfare weights given (see for a discussion of these issues Kula, 2006; Sezer, 2006).

Better Financial Mechanisms

One weak point of standard CBA approaches is that they often overlook the relationship between financial and economic analysis. The CBA Guide suggests two different performance indicators, an internal rate of return on total costs (FRR/c), and a return on capital (FRR/k – for example private equity in public-private partnerships, or national capital before the EU grant). Existing data on ex-ante financial returns on large samples of projects need to be evaluated (see also on this Florio, 1999; Florio and Vignetti, 2005a and 2005b). This analysis is instrumental to a critical discussion of the incentive structure of the current co-financing mechanism under the Structural Funds. It is apparent that some grant mechanisms are cost reimbursement schemes, that offer inadequate efficiency incentives for project appraisal, design and

implementation. Alternative approaches can be suggested, including the integration of financial and social CBA in the granting schemes, as proposed in the concluding section of this chapter.

Returns, Risks, and Incentive Design

Finally, it seems useful to link the discussion of the financial and economic returns of an infrastructure as calculated by CBA, to a discussion of risk and incentive. First, the key concepts about the information structure of project evaluation need to be examined. Data on the expected financial and economic returns in large samples of projects approved by the EC can be used to reveal the origins of observed wide variability in returns. Ex-ante project returns are generated by a process where there is some uncertainty and asymmetric information between the European Commission, and the project proponent. This context needs to be analysed in the framework of incentive theory and development economics. Mechanisms to generate better evaluation and planning of EU co-financed infrastructures can be suggested. These revolve around the proposal that information on ex-ante and ex-post project returns be accumulated within the institutions, and be used to establish benchmarks and incentives for best performers (Florio and Vignetti, 2005b).

Having set a rather broad research agenda, the rest of the chapter covers, very selectively, some of the above-mentioned topics.

PUBLIC INVESTMENT PLANNING AND EVALUATION: THEORY

The Economic Environment

Social CBA theory, after more than a century of evolution from its French origins (Dupuit, 1848) and its first modern articulation in Cambridge, UK (Pigou, 1947), is now based on solid analytical foundations. These foundations are quite different from some popular views of CBA. The most well developed theory now available is rooted in general equilibrium foundations, it includes rationing disequilibria so common in the real world; it is welfaristic, but not necessarily individualistic; it solves the planner's problem at the same time in terms of shadow prices and of feasible policies. All of this amounts to saying that most of the twentieth-century experience with CBA, based on partial equilibrium setting, market clearing assumptions, and narrow views of government goals and constraints, is unnecessarily restrictive. There is, however, still much to do to integrate

this framework with the insights of incentive theory, the analytical framework that has changed the perspective of public economics in the last 20 years.

This section discusses the relevant social CBA ideas in the context of a multi-government setting. Drèze and Stern (1987, 1990) offer what is needed, a general theory (the DS framework) that includes a number of earlier contributions as special cases. Laffont and Tirole (1993) and subsequent work on incentive theory, including Laffont (2005), offer a frame for the analysis of information and incentive structures (the LT framework). The two strands of literature in public economics should be seen as complementary, something that is perhaps not yet fully acknowledged in traditional CBA literature.

The section restates the DS framework in a multi-country setting and under incomplete and asymmetric information. This is done in an informal way, albeit abstract.³ The shadow price definition used here is the social opportunity cost of a change of the world. The considered economy includes different types of agents: individuals (consumers, workers, taxpayers), private and public firms, regional governments, national governments and one supra-national planner. They have preferences and react to signals, such as prices and rations. Some of these signals are under the control of the regional government, others under the control of other levels of government, others are truly exogenous for all planners. Each planner computes its set of shadow prices, based on its own preferences and constraints and uses them to evaluate projects. The interplay of planners can be modelled in different ways, including games, vector optimization or a bottom-up lexicographic approach. The latter means that when co-funding or licensing decisions involve different planners, the projects selected are those mutually compatible, that is simultaneously passing a CBA test. This is the 'consensus decision set'. Under asymmetric information, however, one government or implementing body may have an incentive to manipulate project evaluations to get co-financing from the supra-national planner. Moreover, evaluation is costly. Hence, there should be a mechanism to stimulate efforts of planners, evaluators and project managers, and to elicit true information. This will be discussed in the next section (p. 22).

CBA Theory in a Multi-government Setting

To evaluate projects in the public sector, including public–private partnerships, concessions or subsidies to private firms, or other arrangements for the provision of public services, observed prices are often misleading. Observed prices are almost always the result of the interaction of imperfect

markets and government interventions. Consequently, profitability at observed prices is not sufficiently informative for planning and welfare analysis. We need more complete information on the general economic impact of the project. This leads to the definition of shadow prices.

Shadow prices are the social opportunity costs of the inputs and outputs consumed or produced by a project. They differ from observed prices because of market failures, for example monopolies, public goods, externalities, or because of distortional policy tools, such as indirect or factor taxes, rations, custom duties and quotas, public sector tariffs. This point is acknowledged by several official CBA guidelines, including the *CBA Guide*, the UK *Green Book*, or the US *Circular A-94*, but is often disregarded in practice for reasons to be discussed later.

In principle, any shadow price can be estimated as a weighted sum of the producer prices (net of indirect taxes) and of consumption prices, with the weights given by the proportion of supply and demand adjustments to meet the changes induced by the project, and in some cases corrections for distributive elements. The logic of this proposition, frequently found in CBA literature, is the following. If a project increases the demand for a production factor, for example electricity (and the supply of an output) something has to change elsewhere in the economy to allow this. The change may be given by decreased demand of the factor elsewhere in the economy because of the increased market price of electricity, or by increased supply of it, again because of the price increase, or by a combination of these two adjustments. For small changes, competitive markets, and non-distortionary taxation, market (observed) prices equal the shadow prices.

For many goods, particularly capital, land, labour, services of utilities, non-tradable goods, tradable goods under a quota regime, and so on, this assumption, however, is often unrealistic. Thus we need a theory of shadow prices.⁴

What follows is a non-technical, and highly selective, adaptation of the DS framework⁵ to a multi-government setting. The considered economy is described explicitly as an array of governments and other social actors, plus a supra-national body. Thus, there are different planners. Moreover, I stress some ideas that are particularly helpful in the context of infrastructure planning in the EU and I show some implicit information and incentive issues in this framework. The latter issues are important in a complex multi-government setting where there is one player, the European Commission (or in fact a set of EU supra-national bodies), several Member States, and lower levels of government, the regions and other local actors. Probably this setting has some relevance for other multi-lateral international aid organizations,⁶ but institutional arrangements are not developed here in detail.

The Economic Environment

The abstract economy considered by Drèze and Stern (1987) includes a number of different agents. There are six types: individuals, private and public firms, regional governments, states, and one supra-national planner. The first three types are discussed here, and the latter, that is planners, are discussed in the following subsection.

1. Individuals may be consumers, workers, taxpayers and shareholders. Workers are negative consumers of their free endowment of leisure time. Some individuals may combine these four aspects, other may be just consumers (as are children), or consumers–workers–taxpayers with no shareholding, or consumers–taxpayer–shareholders, or other combinations. Individuals earn different net incomes according to how much they work, their ability to work, and the rents they earn through their shareholdings, the tax they pay or the public transfer they receive (negative taxes). These individuals have well defined preferences, are welfare (or utility) maximizers. Some of them, however, may be rationed, meaning that at the observed prices they cannot consume what their income would allow them to do. Observed prices are determined in different ways. Some of them are market prices, with some markets competitive, others monopolistic or otherwise imperfect. The other prices are set directly by planners, that is they are fixed tariffs. Prices are non-negative by definition.
2. Private firms are profit maximizers on behalf of their shareholders. Given their technologies, prices of inputs and outputs, they determine their net supply, and earn profits gross of taxes. Their net demand to the public sector is the difference between their total demand and their demand to other private agents, that is other private firms and workers. Firms fully owned or partly owned by governments, but not under their direct control (that is not included in the production plan of the public sector), are considered private. Thus, private agents are individuals and private firms. Both have appropriate optimization programmes (respectively for welfare and profit) constrained by resources constraints and any other relevant constraint, and net demand or supply.
3. Public firms, in contrast, are production units fully controlled by governments. Given their technology, they need to efficiently produce what is requested of them by their principals, at prices set by the governments (for example by a regulator). Profits, if positive, are cashed in by the Treasury. Losses are covered by transfers. Privately-owned firms fully controlled by governments are considered public. A generic name for a variable that influences private agents' behaviour is a signal.

Signals may include, for example, producer prices, direct or indirect tax rates, shareholding rights, rations on the production or consumption of specific goods, transfers, and in fact any other variable that is needed to feed into the modelling of the behaviour of private agents. Some of these variables are endogenous, meaning that their value is determined by optimization. Others are exogenous, or parameters. All of these variables, taken together, determine an economic environment. Private agents adjust their behaviour, hence their net demands, to such economic environment.

Social Planners, Objectives and Policy Tools

Social planners have a specific social welfare function that embodies the objective of the government. These include as arguments individual direct or indirect utility, but in principle could also include other non-welfaristic variables, such as specific merit goods (for example expressing political preferences or aversion to the consumption of some merit goods). Each government is a welfare optimizer in this very broad meaning, and is budget constrained (perhaps not necessarily so strictly as to be unable to incur a deficit, but it certainly cannot select whatever deficit level it wishes, as for example under the European Monetary Union rules).

This multi-government setting is particularly interesting because it is more realistic than the earlier framework for planning in the Barone-Lange-Taylor tradition (Stiglitz, 1994), where there is just one social planner. In that traditional framework the planner has all the relevant information and powers, except the power to set *ad personam* optimal lump-sum taxation. In principle he can either implement a command economy based on full control of volumes of inputs and outputs, or decentralize the same Pareto-efficient equilibrium through a full set of shadow prices, and then let the agents react to those signals.

When we have multiple governments, it may be the case that each of them has some powers, but not all, in the same economy. Regional governments, for example, may levy some type of taxes (for example taxes on land) but not others (for example VAT). They may be in charge of the provision of some services, for example health, but not of defence, and so on. Thus the national or regional government may wish to pursue a production plan or a marginal change of it (that is a public sector project) for the public provision of certain services. To do so, it needs to disturb the economy, for example it needs to raise taxes on land use, to hire workers for urban waste management. This relationship between the public provision of services and the signals under the control of the planner is a policy function, or simply a policy in the DS framework.

A feasible policy is such that, first, the scarcity or resource constraints are met, or in other words that net private demands are equal to public production; second, the planner can select the appropriate signals within its opportunity set. The latter means that the needed change in the signals is legally or politically possible.

Regional or more local governments in some cases may have only one policy option: for example the only way to increase the provision of some transport services may be through a tariff such that the firm has a balanced budget (the Boiteux case). This is a very simple planning situation, that will be discussed below. National governments usually have a wider policy opportunity set than regional ones, but not necessarily a wider production plan. Some EC Member States have widely decentralized the provision of education, health, transport, environment and other functions to regional governments, while they have retained much greater tax powers. As a result, a system of transfers is needed to finance the public provision of services at a regional level.

The supra-national social planner is now introduced. This planner, like the Member States and regions, has its own social welfare function, a budget constraint and side constraints. Around the world there are several supra-national organizations that have a quasi-governmental status, but here I am particularly interested in the European Commission.⁷

The EC has no tax power, and no production plan of its own (except for some public goods such as legislation, information, and other intangibles). However, it has considerable regulatory powers, and its own budget (based on transfers received from Member States). As a policy tool the EC has some power to redistribute grants out of its own budget to Member States and regions, targeted at specific interventions, such as infrastructure, human capital, assistance to SMEs and R&D ventures, subsidies to agriculture, and so on.

Consequently, the EC is a social planner, albeit with a relatively limited opportunity set: it can disburse grants and regulate some production and consumption behaviour (for example it fixes trade quotas with non-EU states, establishes ceilings for some polluting activities, limits some shareholding rights through competition legislation, and so on).

The acknowledgement that the EC is an independent social planner has some consequences for planning and evaluation of public projects. This is the object of the next subsection.

Planning and Evaluating

In the context of the previous subsection, planning has three different dimensions that may arise in each government layer:

- determination of the production plan;
- policy selection; and
- calculation of shadow prices.

First, regions and member states need to establish their production plans, each for its own competences. Production plan here means the quantity of the service to be provided by firms under the control of government (publicly owned, private or public–private partnership). Examples are the amount of urban transport or refuse collection per year, or of water supply. At any point in time, such production plans exist and can be observed.

The question arises whether we need to assume that public production plans are optimal, that is whether the planner may not increase social welfare by a change in the vector of public output. The answer is that, while the planner should try to optimize its choices, it is not necessary for the other planning and evaluation activities to assume that the plan is optimal. The production plan may be sub-optimal for several reasons: for example, because the regional planner must comply with some national or EU legislation; or for other political and managerial constraints; or for lack of information.

Thus, we are interested in evaluating public production projects that represent marginal changes in the existing production plan, even if it is sub-optimal. In fact, good projects are those that change the production plan in the right direction, and no more than that is actually needed for evaluation.

The next step is policy selection. This means that because we have a function that associates a new production plan to a vector of signals under the control of the planner, there may be more than one option open to the government. It is a great advantage of the DS framework that policy optimization implies exactly the same evaluation process of the determination of shadow prices. The intuition is simple. If the planner has to finance a production plan, the planner will select the combination of taxes, rations, prices, and so on under its control that has the most favourable social impact. If some of these variables are beyond the planner's control, that is they are exogenous parameters, the study of reforms can be pursued with a similar approach (an issue I am not going to discuss further here, but that could be central in a serious regulatory impact analysis).

The third area of planning is the calculation of shadow prices. These have been defined as the social opportunity cost of a marginal increase in the provision of one good in the public production plan. Thus we have as many shadow prices as the dimension of the vector of goods provided by the public sector, and their inputs (which are negative supplies).

In the next subsection I shall briefly dwell on shadow price rules.⁸ Here I wish to remain at a very general level. By definition shadow prices are the

impact on social welfare of a change in the public provision of a good. If this change is small (in a technical sense), shadow prices are the first derivative of the social welfare function around the optimum with respect to the good considered. Equivalently, if the planner's problem is expressed in the usual Lagrange or Kuhn-Tucker constrained optimization programme, and constraints are expressed in the appropriate way, shadow prices are equal to the multipliers of such constraints.

In an ideal world, the planner determines the optimal production plan, for example how much motorway service is needed; then selects the optimal feasible policy to sustain such plan, for example taxes on fuel; then it computes the shadow price of the motorway service, which may be different from the observed toll of zero, or free access to the motorway.

It is at this stage, after planning is settled, that social cost-benefit analysis, or project evaluation comes in. A new motorway project is proposed. A policy for financing motorways should be decided. Then we need to evaluate whether that new motorway project is welfare improving, compared with the do-nothing alternative, that is to stay with the existing stock of motorways. To do so, we can either explicitly measure the net social welfare impact of the increased service (the with-without project change of the world), or equivalently use the shadow prices to compute shadow profits of the project.

We have one shadow price for the appropriate measure of the service (something like the equivalent passenger per mile per year), and some shadow prices for the inputs, such as labour and land. All the evaluator needs to do is to use these shadow prices in accounting for the project (including the consideration of any externalities) and use the simplest benefit-cost test: if the project is profitable at shadow prices, it means that it increases the social welfare by exactly that amount, and the project is approved. If the project has very limited shadow profits or incurs shadow losses (whatever its financial income forecasts), the project is rejected.

Having restated in this way a well established theory that is perhaps not always fully understood in applied CBA literature, what happens in the multi-government setting?

In the DS framework there is no all-powerful government. Each planner has limited powers, but is consistent in planning and evaluation. Suppose then that, in one region, a motorway project is proposed. Regional government has its own social welfare function and transport policy, and its own specific constraints in the implementation of a transport plan. It will then evaluate the project based on its own set of shadow prices, and this is the end of the story. Each government unit makes its own project evaluation, based on its objectives, policy opportunity set, and constraints, including those constraints arising from the decision of higher levels of government.

In the context of an earlier subsection (p. 11), however, the evaluation problem may become nested in two ways. First, one lower level of government may need the approval by another level of government, for example national, and – second – may ask for supra-national co-financing.

There are then three planning and evaluating bodies that must cooperate in some way and in principle because they face different objectives, policy mixes and constraints, they will compute different shadow prices for the same good.⁹ Is this complex environment leading to intractable problems?

This may be the case if, for example, two of the three players evaluate the project positively, each based on its own shadow prices, and the third one rejects it because his evaluation is negative. After all, income welfare weights, shadow prices of externalities, shadow wages may well differ when you move from a national to a regional perspective, and different decision-makers have different views.

In general there are different approaches to solving this class of multi-agent problems, and I shall discuss them in turn, albeit briefly and again informally.

We can look at the problem as a lexicographic one. First comes the regional evaluators: they select a number of motorway projects that pass the CBA test at regional shadow prices. Then the national governments re-evaluate those projects, with their own national shadow prices, and reject some of them. Eventually, the EC evaluators re-consider the results, use their own European shadow prices, and decide which one deserves a grant. This will be a subset of the original regional selection, and one should only hope that this is not empty.

Alternatively, one may think that we have three separate objective functions, one for each planner, and that we want to select those projects that simultaneously optimize them. There are two ways of doing that: either by a linearization of this multi-objective problem, which implies giving weight to each objective function; or by other, more general programming techniques (vector optimization). In either case a new shadow price vector emerges and it should be used instead of any of those previously mentioned.

Finally, one may think that each of the interested parties selects its preferred projects, and then bargains (in some well defined way) to find a commonly agreed solution. In this game-theoretic framework the pay-offs to each player associated with project approval are the welfare changes evaluated by their own shadow prices. The existence of one or multiple equilibria is clearly highly dependent upon the specific features of the game, and there is no general solution.

Which one of the three approaches is normatively the best avenue is generally difficult to say, because there is here no definition of social welfare

that is independent of the specific layer of government and its shadow prices. Thus I will comment on the three choices on more positive grounds.

First, the vector optimization solution is analytically attractive, but in fact it generates a fourth (!) set of shadow prices, that may obviously be different from the regional, national and European ones. Moreover, a kind of 'constitutional' agreement among the planners with (partly) conflicting objectives is needed. In fact they should either agree on the weights to be given to their social welfare functions; or they should agree to any other rule for vector optimization (there are different ways of finding compromise solutions, and in such a selection process) there will be losers and winners.

Second, the problem with the game-theoretic setting is that there is a very large number of possible game designs and solutions. No doubt some bargaining is observable between players in real world situations, but from a normative perspective, it is very difficult to say which class of games is more welfare improving in a well defined sense. Thus, my preferred option, and in fact the one closer to the real world, is the simplest: that is to think of the planning-evaluation process as nested and sequential, that is bottom-up lexicographic. In fact, if information on the shadow prices of the other two planners is known by one planner, the sequence will be purely virtual. The regional planner will select its policies and compute shadow prices, and will propose to national or supra-national planners only those projects that one knows will pass their cost-benefit tests. After all, if the EC grants are additional finance, the regional government, conditional to the national government's approval, will fully finance the projects that pass its own CBA test but not the European test, and will ask for co-funding for those that pass both tests.

While the context I have described is purely theoretical, I think it has some practical relevance, when shadow pricing rules are specified and made operational and information/issues addressed. These are the object of the next subsection.

Shadow Pricing Rules and their Use

In the DS framework the roles of planners and evaluators are conceptually quite different. Planners should carefully describe the social welfare function of the government, the signals available as control variables, the signals outside the area of control, the scarcity and additional constraints. Having set the objective function and all its constraints, they will calculate the first order conditions of the constrained optimization problem. This involves calculating the derivative of the Lagrange function to each control variable, that is the marginal social value of the control variable, and deriving the

shadow price rule by setting the marginal social value to zero. They will then ask the evaluators to use these shadow prices in appraising specific public projects, to perform the cost–benefit test on them, and then to select projects suitable for approval. In practice there will be shortcuts, that is the calculation of proxies, but it is important to understand what the proxied accounting price stands for.

In the multi-government setting I have described above, the EC, the national and regional governments, each hire their own evaluators. The information on shadow prices relevant to each planner is by assumption available to all evaluating teams. Thus, if the decision process is nested through mechanisms of co-funding and/or of authorization, the projects actually implemented under EU co-financing will only be those that pass simultaneously or in sequence, three CBA tests.

Each evaluator needs to be consistent in the use its own shadow prices. Important information and incentive problems related to these multi-government settings will be examined later. At this stage, let us suppose that information on estimated shadow prices and CBA evaluations for individual projects are available to all players. Having said this, the use of shadow prices by evaluators is quite straightforward. Evaluators are ‘price-takers’, exactly like firms in a competitive environment. They calculate shadow profits or losses and suggest a decision based on what basically is a forecasting and accounting job. They will typically be interested in a relatively small set of shadow prices, for example:

- given a numeraire, the social discount rate, that is the shadow price of such unit of account;
- the shadow wage rate, that is the social value of labour;
- the shadow prices of other major inputs;
- the shadow price of the output produced by the project;
- the shadow price of some externalities and intangible goods;¹⁰
- the shadow exchange rate and or a standard conversion factor for internationally traded goods; and
- welfare weights to account for distribution issues.

Usually, they will not be interested in shadow prices related to other policy instruments, because they focus here on evaluation of infrastructure projects. Evaluators of reforms, such as reforms of trade, taxation or environmental regulations will however focus on the shadow prices of custom duties, of indirect tax rates, of pollution quotas, and so on, but this is not our concern here.¹¹

Planners have a significant workload in our environment, because in a sense they generate new basic information. When calculating shadow prices

and disseminating them, they act as substitutes for the interaction among markets and government that generates observed prices, that is the prices relevant to financial analysis in the private sector.

They should elicit from policy-makers, or interpret from available policy data (for example past decisions), the social welfare function. This implies knowing important parameters, such as the social welfare weight of individual welfare changes; the arguments of individual welfare and their impact; the additional welfare impact of changes in any merit good in the objective function.

This is clearly a difficult task in practice, and CBA literature does not offer much guidance on how to select the appropriate SWF. The DS framework assumes the conventional Bergson-Samuelson SWF. This implies that shadow prices will assess the social impact of the project, conditional to assumptions about the preferences of the policy maker on equity, as embodied in the welfare weights. In fact, there are some useful references in the literature to distributional welfare weights estimation (but far less practical experience).

The first consequence of the above setting is that in general shadow prices of goods will include a distribution characteristic. This is different from other CBA approaches (see Harberger and Jenkins, 2002), that propose using utilitarian functions (that is giving the same social weight to any individual welfare change) and subsequently analysing the winners and losers at those 'efficiency prices'.

A second consequence of the DS framework is that general equilibrium effects enter in shadow prices rules. The marginal social value of a good will depend on its direct impact on social welfare and on the indirect impact on substitute or complementary goods.

Third, shadow prices and optimal policies depend on the planner's interpretation of which instruments are available, their constraints and exogenous variables. This point is certainly the most difficult applied analysis task, because it requires detailed information on specific market conditions. Just to give an example, the rules for the shadow wage rate (not just its value) will depend *inter alia* on the specific constraints in that specific labour market. Thus, in fact, the planner needs to have one empirical model for each market, often including the regional or local dimension. Hence, the information needed to implement the DS framework is considerable, and it comes as no surprise to find that nowhere has any attempt been made to use it in practice.

Three major departures from the DS framework can be observed in the real CBA world. First, planners take shortcuts to estimate shadow prices, that is they resort to general, simple rules, which in some case may be shown to be robust in different planning environments. This is the meaning of the

Little-Mirrlees rules, for example, and of several other project guidelines. Drèze and Stern (1987) themselves discuss such shortcuts and their relative merit sympathetically. Second, the role of planners and evaluators are often confused, that is project evaluators calculate shadow prices, because planners do not provide them with their calculations, but with rather general rules. As a result, inconsistent shadow pricing is more probable. Third, under multi-government planning and evaluation, lower level evaluators often do not use their own set of shadow prices but (directly) those of the higher level of government.

Moreover, as Little and Mirrlees (1994) discovered at the World Bank (and elsewhere, I would suspect), only a limited set of projects are seriously evaluated by CBA, for reasons that are only partly of a technical nature. To understand why there is a strong disconnection between CBA theory and practice, and to propose better evaluation designs, we need to look into the information requirements and the incentive structure of the analytical framework in depth.

INFORMATION AND INCENTIVES

Beyond the Planning Black Box

I turn now to a more realistic view of the planning and evaluation mechanism, even if the discussion is still quite general. In the standard DS framework the main information advantage as compared with the Barone-Lange-Taylor model of planning is that there is no more an all-powerful central planner, but a potentially large number of social planners. Each of them needs a fraction of the information set, and can focus on the instruments available, and takes the others as given.

While this is an interesting way to pick up the fragmented nature of many government environments, where there are indeed many departments and agencies, regional authorities, and supra-national decision-makers, the information burden is still considerable. First, governments interact in the decision process. Second, the standard framework disregards possible effects of uncertainty, information incompleteness and asymmetries, and incentive problems.

In what follows I introduce a preliminary discussion of some of these problems. The discussion is going to be informal and generic, but it can be easily translated into a number of game-theoretic models under specific hypotheses. The objective of this section is purely to illustrate a research approach, more than to suggest solutions that can be immediately transplanted in the real world. I hope, however, that future research in this direction can be

helpful in the design of more effective planning and evaluation mechanisms. Let us start with a discussion of some open questions from the previous section.

First, consider planners.¹² They have to model the economy in a fairly detailed way, including an appropriate identification of the relevant social welfare functions. In practice, there will be a lot of uncertainty surrounding the variables they observe. After all, they have to use empirical data, drawing for example marginal costs data from input-output tables and demanding forecasts from econometric estimates. Thus, the shadow prices they will compute will be statistics based on sampling and estimation errors. In many cases, they will use shortcut estimates (that is they are not solving a planning programme analytically) and hope that their results are not too far from the true, unknown shadow prices.

In the rest of the discussion I am going to use interchangeably the word 'shadow prices' for the analytical solution of the planner's optimization programme, and for their operational estimates, more appropriately defined as 'accounting prices'. These, however, are clearly two different concepts.

It is of course possible to diminish the degree of uncertainty of the estimated shadow prices through increasing the planner's research costs and efforts. How much effort and time the planner should spend in such activities clearly depends upon its reward for doing so. In the words of Little and Mirrlees (1994), there are costs and benefits of cost-benefit analysis. Until now I have not taken a strong position on the nature of the planner, particularly I have not said whether it is benevolent or whether it has a private agenda.

I prefer to consider it explicitly as benevolent, that is the planning unit is just an office of the government, without its own private agenda, and the government itself has a social welfare function that does not include the private objectives of the policy makers.¹³

Whatever the SWF, in principle the planner should spend resources in acquiring information until the marginal benefits of this activity equals the marginal costs. Suppose, for example, that the planner has estimated that the social discount rate is 5 per cent. In fact, because of uncertainties surrounding the variables involved in this calculation, it would be safer to say that there is a 90 per cent probability that the true SDR lies in a confidence interval, for example, within the 4 per cent to 6 per cent range.

CBA literature has not often considered accounting prices as stochastic variables, but of course they are conditional to the expected values of the estimated parameters, even if, for practical purposes, planners have to write unique figures in official project guidelines. Uncertainty surrounding shadow prices may typically lead to under-spending in this area of analysis by governments. In practice fixed budget for planning are allocated in

the form of constraints on available personnel. Thus, in general it is safe to assume that the planner has imperfect or costly information on the shadow prices he disseminates.

Second, consider now the evaluators. Several different organizational arrangements are possible. The planner may either ask an internal evaluation unit within its layer of government to appraise the project; or it may ask the project proponent to hire an independent evaluator.¹⁴

In fact, it is not exceptional that the initial project appraisal is provided directly by the project proponent, who has more information and also an obvious interest in complying with the expectations of the decision-makers. I assume below that the project evaluator is a professional team, with a private objective function, different from that of the planner (SWF) and the manager (profit). Again, project information search is costly. While accounting prices and other macroeconomic information are freely available at this level by assumption, albeit uncertain, the evaluator needs some micro- and macroeconomic forecasting, and should use data that are available at the firm and household levels.

Moreover, there is clearly asymmetric information between the evaluator and the private or public firm that proposes the project.¹⁵ Again the evaluator can spend money and personal effort in extracting information, but only up to a point. If the evaluator is a private consulting team, or even a public sector office where the time and effort of the personnel have a private opportunity cost, the evaluator will stop the evaluation activities when it is deemed that one more hour of work will decrease its utility. The evaluator can of course present to the decision-maker its cost-benefit results in the form of stochastic returns, for example disclosing a probability distribution of the net present value. However, the decision-maker cannot know how much effort there is behind these results, and how credible they are.

As a consequence, the decision-maker faces double uncertainty: in fact is uncertain about the credibility of the evaluation, because of both the residual uncertainty surrounding the shadow prices and the asymmetric information about the quality of the evaluation. This will often undermine the credibility of the CBA-based decision-making process, and will favour more traditional alternatives, such as purely administrative and legal appraisals, and politically-oriented decisions-making, which are no better, but are perceived as less costly and controversial.

Third, even with a benevolent decision maker, and a fully controlled planning unit, the evaluators risk being captured by the project proponent. This may happen either because of outright corruption or simply because the evaluator will find it convenient to trust the project proponent too much, and save effort. Again, because the decision-makers may suspect this is happening, they will only partly trust the evaluators. These points needs

to be discussed in some detail, because while well known to practitioners, it has never been raised in CBA literature, in contrast to its importance in regulatory economics. A full consideration goes beyond this chapter, and I start with a simple example.

The Principal-agent Framework: an Example

The illustrative model I present here draws freely from Laffont (2005), but it departs from it for some key assumptions. The supra-national planner wishes to offer a grant to promote regional development, a regional government wants to get the grant to finance an infrastructure, operating under conditions of natural monopoly, for example a motorway or a water purifying plant. To simplify the game I assume that: (a) public funds, in the form of a grant, are provided entirely by the supra-national planner (the first principal);¹⁶ (b) a regional authority has contracting/regulatory/evaluating tasks (a second principal); (c) the management is the responsibility of a beneficiary firm, either public or private (the agent). There are two principals, one agent, and asymmetric information.

The following social actors are going to be considered:

1. The supra-national planner wants to maximize social welfare, cannot be corrupted (there is no private agenda, perhaps because the planner is not elected and responds to an inter-governmental system of checks and balances), but the planner is uninformed on the true cost function of the project that depends linearly on technology and managerial effort (see below). The regional regulator can be asked to elicit ex-ante information or an 'ex-post' evaluator can be sent.¹⁷ The evaluation on behalf of the social supra-national planner is given by comparative statistics on the welfare changes of the agents, through a social welfare function with suitable welfare weights.
2. The regional regulator/evaluator is an office or team appointed by the regional government, that is responsible for passing the grant to the beneficiary, for selecting it by a contracting mechanism, on behalf of the planner, and for performing ex-ante evaluation of the proposed project; because the key cost data are private information belonging to the beneficiary firm, the regional regulator is asked to perform an ex-ante evaluation to check the project data; there are two possibilities: the ex-ante evaluator can discover whether the grant beneficiary, that is the manager, is highly efficient, or alternatively the evaluator is unable to discriminate between highly efficient and less efficient types. The probabilities of the two outcomes depend upon the efficiency and effort of the evaluator.

3. The managing body is a public or private firm under the responsibility of managers who want to maximize their utility; the latter depends on the difference between the net grant (that is the grant net of cost reimbursement) and the value of the disutility of effort needed to minimize the infrastructure total cost; the infrastructure cost, in turn, depends on technology and the manager's effort; while effort is the private information of the manager, the technology can be discovered by either ex-ante or ex-post evaluation; total costs are always verifiable ex-post.
4. The consumer gets a surplus, and, to simplify matters, the infrastructure is not tolled, the output produced is normalized to unity (hence the consumers' surplus is evaluated by a known shadow price for the service, as established by the supra-national planner).
5. The tax-payer finances the grant, plus any rent extracted by agents because of rent-seeking and corruption, and because taxation is distortional, there is a shadow price for public funds.

A well known key-aspect of this game in the LT tradition, is that the infrastructure project cost (the net present value of the investment and operating costs) depends linearly upon a technology parameter (adverse selection) and a managerial effort (moral hazard). In other words, the lesser the manager's efforts to control costs, the greater the actual project costs. Suppose that the technology variable can have only two values: 'high efficiency', and 'low efficiency' (in more general models there are frequency distributions within a range of values), with a well known probability.

Thus all the players know that there is say 0.30 probability that the beneficiary is of the high efficiency type and 0.70 probability that it is of the low efficiency type.

While the technology parameter is exogenous to the manager (perhaps because of monopoly in knowledge, or for other constraints), the resulting total infrastructure project cost is endogenous, because by working hard the manager can minimize costs. This effort has a disutility value to the manager (if the effort is measured in working hours, money disutility is a shadow wage of the manager, often greater than the observed wage, particularly in the public sector).

It is worth noting that if the infrastructure project is not a revenue generating one, that is the highway is not tolled, the manager needs to be given a full cost reimbursement, including normal profitability. The same is true if the motorway is tolled, but tolls do not cover the total cost. In such a case it is the net cost that needs to be paid out by the regulator on behalf of the planner. This total cost, however, can be high or low because of the adverse selection and moral hazard parameters. Thus the planner (and the regulator) faces a trade off. They can either pay the project cost and leave no rents

to the beneficiary, but in such a case the manager has no incentive to minimize costs, or offer the manager a socially costly rent as an incentive to minimize costs. Leaving rents to the manager is socially costly for two reasons: first because of the shadow price of public funds; second, because given a reasonably egalitarian set of welfare weights, it is harmful for the median taxpayer to transfer income to the manager.

The net welfare change for the representative consumer-taxpayer is the difference between the consumer surplus of the service, and the social cost of the infrastructure (at shadow prices), including the rents, where these costs are augmented by the shadow price of public funds. The corresponding welfare change for the manager is the difference between the incentive element in the grant and the disutility of the effort. Remember that costs are fully reimbursed through the grant. In other words, the grant is in two parts, one is just a transfer to the manager from the taxpayer to cover costs, plus the incentive element, also paid by the taxpayer.

The change of the social welfare is the weighted sum of the welfare changes of the consumer-taxpayer and the manager.

If the grant were to be decided by the supra-national planner case by case, with complete information, then the regional regulator and the ex-post evaluator play no active role. The regulator fixes the incentive exactly at the level needed to minimize costs and to extract the optimal managerial effort, and the incentive will just match the marginal disutility of effort, so that the manager has no rent (as said, normal profitability is included in the total cost). Under asymmetric information in the LT framework it is well known that the planner is compelled to leave a rent to the efficient type. In fact, the planner does not know the type of firm, and is constrained to offer a contract that allows the participation of the less efficient type, that is a high cost contract. Given the probability distribution of types, however, the manager granted the contract is, with a given probability, more efficient; can mimic the less efficient type; and earn a rent.

Laffont (2005) goes beyond this standard framework, as he assumes that government has a private agenda, and can extract a rent from the beneficiary. This additional rent extraction can be costly, because it imposes extra-costs on the manager.

One example in my context is a regional government that pushes the manager to excess employment when unemployment is high and artificial job creation is a popular policy. Moreover, the regulatory office can be corrupted and accept some kind of hidden bribes from the manager (for example the promise of future well paid post or other benefits).

Under this view, while the supra-national planner is benevolent by assumption and maximizes a standard social welfare function, the regional regulator maximizes a welfare function that includes, with an exogenous

weight, the private benefits of the decision makers. Any private agenda welfare weight greater than unity will be an indication of the degree of lack of democracy (that is of social accountability) of the regional government.

In fact, the supra-national planner needs the regional regulators and the manager to implement its development strategy, but is compelled to leave rents to them. How can the supra-national planner limit these socially costly rents?

One mechanism is 'ex-post' evaluation. With a given probability (for example, for one out of three projects) the planner can send an evaluator after the contract has been assigned. Each evaluation project has a given fixed cost and allows for reporting to the planner the observed cost structure, that is reveals with certainty the technology parameter.

A second mechanism is the contract between the planner and the regulator. The regulator, working without additional costs as an office of regional government, is responsible for ex-ante evaluation. There is a given probability that the ex-ante evaluation will discover the more efficient type of technology, or that nothing will be discovered (the evaluation fails).

Consequently, the ex-ante information on the cost for the planner is the conditional probability of the more efficient technology and of the probability of discovering it ex-ante. For example, it will be just 0.25 if the probability of the two types and of successful evaluation are respectively 0.50.

There is this sequence in the game:

1. The manager considers the project feasibility and discovers the technology that can be used, high or low, and this information is private.
2. The regional regulator is responsible for ex-ante evaluation and either discovers that the manager is highly efficient, or remains uncertain.
3. The regulator, on behalf of the planner, offers the manager a menu of two contracts: one is a full cost reimbursement for the lower technology, the other includes an incentive for a lower project cost for the higher technology; the manager accepts one of the two contracts.
4. If the manager accepts the cost-reimbursement contract, the planner can send (with a given probability) the 'ex-post' evaluator to check the technology parameter.
5. If the manager accepts the cost-reimbursement contract and the evaluation is not sent, then the contract is implemented.
6. If the manager accepts the incentive contract, the 'ex-post' evaluator is not sent, and the contract is implemented.
7. If the 'ex-post' evaluator is sent (some time after the contract is subscribed), and confirms the less efficient technology, the contract is confirmed.

8. If the 'ex-post' evaluation in the latter case discovers an efficient technology, there is a penalty.¹⁸

The planner knows, consequently, that there is only a 0.25 conditional probability of implementing an optimal grant, with no rents for the policy-makers and the manager. One has to accept that with 0.75 probability the grant is 'excessive'. Notice that under these simplistic assumptions, a key question is the cost of 'ex-post' evaluation. One may think that this cost is relatively limited, and that a systematic 'ex-post' evaluation activity can solve the problem. This is however unrealistic, because there are indirect cost due to renegotiation, project delays, and so on. Given these and some additional formal assumptions, it is possible to design the optimal incentive contract, and to compute the optimal frequency of 'ex-post' evaluation. The latter is a function of different parameters, including the shadow price of public funds, of the probability distribution of the adverse selection parameter, of the disutility of effort for the inefficient type (for details see Laffont, 2005).

Here the trade off for the planner is that either the planner allows high cost contracts, needing a great 'ex-post' evaluation effort to contain rents. The no-incentive, low-powered contracts do not create rents, neither do they minimize costs. Conversely, the incentive contracts generate rents, but minimize costs, and do not need ex-post evaluation efforts.

Under some assumptions, the lower the inspection costs, or the extent of asymmetric information, the higher will be the use of incentive contracts, and the optimal probability of ex-post evaluation. Conversely, the more inefficient and unreliable the regional regulator, the higher the shadow price of public funds, or the cost of the 'ex-post' evaluator, the better to offer a cost-reimbursement contract, hence fewer incentives and ex-post evaluation. In less developed regions this case will be more frequent.

Note that the existence of a private agenda of the regulator/ex-ante evaluator, implies a risk of collusion with the beneficiary, to hide the signal about the adverse selection parameter. To buy the loyalty of the ex-ante evaluator, the planner needs to pay compensation proportional to the information rent of the manager or – alternatively – there should be a strong and socially costly enforcement mechanism. This additional cost enters in the social welfare function and acts as a brake to the use of incentives. Inefficiency and the collusion of the regional government play the same role, decreasing the use of otherwise useful incentive contracts, and pushing the planner to offer low-powered cost-reimbursement schemes.

One conclusion of this simple illustrative example is that the optimal design of the planning–evaluation–incentive mechanism for implementing the infrastructure plan is country or region-specific, because it depends upon parameters that may vary greatly.¹⁹ The key-parameters here are the

social net project value at shadow prices, the shadow price of public funds, the shadow wage of the management team, a reliability rating of the regional regulator, an index representing the extent of asymmetric information. In a multi-government setting, such as the EU, it is unlikely that the same planning design will be optimal for less developed regions. In countries where there are unreliable regional regulators, high information asymmetries, high potential corruption, high opportunity cost of public funds, it is probably difficult to implement incentive infrastructure contracts. As a result investment costs will be high, rents will be left to the potentially efficient types, and so on.

In more developed regions, however, with a sound democratic environment that contains corruption, where regional regulatory offices are efficient in their ex-ante evaluation activity, and where there is widespread information on available technologies, incentive contracts can offer good chances of decreasing infrastructure costs.

Having said this, in a more evolutionary perspective, the planner should invest in capacity building and in democracy deepening in the less developed regions. In the LT framework there is limited scope for progress. A learning mechanism is needed, however, in order to promote something as a cooperative evolutionary game between planners, regional governments and managerial teams. Cost-benefit analysis can be seen as such language, evaluation contracts and project performance mechanisms can be helpful in this perspective.

Linking Evaluation and Co-financing Contracts

In the above setting the ex-ante evaluator has a role similar to a regulatory office for public utilities. The important difference is that usually the regulators do not disburse grants and act through other signals, such as permitted price increases in the price-cap system or in other schemes, concessions of legal monopoly or otherwise, and so on.²⁰ In the LT setting, however, the regulator pays back to the utility the public service costs or a share thereof, and offers an incentive to cover the disutility of effort. The typical regulatory problem in this context is that, while costs are verifiable ex-post by the regulator (an 'ex-post' evaluation in our setting), cost-reducing efforts are the private information of the agent (moral hazard). With more than one agent and a distribution of technologies, some more efficient than others, there is an asymmetric information problem. This leads to opportunistic behaviour by the efficient-type, who can represent itself as less efficient. Thus the regulator faces a trade-off between incentives to raise efficiency and rent appropriation by efficient types.

The ex-ante evaluator has a similar problem. She or he is responsible for suggesting that the supra-national or regional planning body offer a grant. The project proponent has a clear interest in presenting the project as financially costly net of revenues and economically beneficially net of costs. Even if the proponent and the evaluator use the shadow prices given by the planner and the market prices given by suitable forecasts, the true costs of fixed investment, personnel and other inputs, including managerial efforts, are best known by the project proponent. Should the ex-ante evaluator trust the information given by the latter, or invest its own resources in collecting information? In general this would be very costly, and again some uncertainty will surround the evaluation.

These issues are further exacerbated in a multi-government setting, where some strategic manipulation of information – even among benevolent governments – cannot be ruled out. After all, each government layer has different constituencies, and its social welfare function does not need to include the welfare of citizens of other constituencies. The current experience around the world is that these issues are very often not effectively addressed by governments and international organizations. This is compounded with other sources of mistrust in economic analysis. The calculation of shadow prices is costly, and planners tend to delegate it to project evaluators. This is clearly a capital mistake in an incentive perspective, because if ex-ante evaluators work for a regional government with a private agenda, or – even worse – for the grant beneficiary, they will be under pressure to use shadow prices that lead to high economic returns.²¹

To sum up, while standard CBA theory virtually offers a solid framework for project planning and evaluation, the information and incentive structure surrounding these activities is often such that it undermines the credibility of CBA itself. Apart from any ethical and reputational aspects, which are obviously of paramount importance for professionals in planning and evaluation, there are also economic incentives that may play a role. These are at two levels: evaluators and firms (I suppose, to simplify, that the social planner and the decision-makers coincide and are benevolent).

Evaluation can be seen as a contract between a principal, the decision-maker, and an agent, the evaluation team. Moreover, public co-funding (ex-ante) project decisions should be based on a combination of financial and economic evaluations, in order to capture the private and social impact of projects, and may have an incentive element for (ex-post) high performing projects. It is important to stress that the co-financing mechanism should be based on both dimensions of project appraisal: financial and economic. Private firms, public-private partnerships, or public firms managed by profit-maximizing managers, are not going to sell or buy at shadow prices. They are going to use observed or market prices. Thus their

incentive structure is different from the public sector. For them, financial analysis of the return for the investor is all or nearly all the project appraisal they need. Thus they are not really interested in economic analysis and in social cost and benefits, if there is no specific incentive attached. Moreover, they are ready to manipulate information provided to evaluators in order to obtain public sector co-funding, at regional, national or supra-national levels. This is not necessarily obtained by cheating, it could just be a consequence of the well known optimistic bias of any investor, including public firms.

In most cases, however, firms are not going to implement the project without a public subsidy. The most promising way to address the incentive issues described in this section is to find a way to pay back to investors a financial reward for socially deserving projects, based on ex-ante and ex-post evaluation, by eliciting true information through an appropriate revelation mechanism. Thus, the co-financing contract should be designed to offer an incentive (or an implicit punishment) according to social outcomes. The usual implicit long-term incentive for the evaluator, within or even outside the public sector is a reputation bonus for evaluation tasks perceived as successful. While this is sometimes enough to warrant good evaluation, in general this mechanism is weak when organizations, not individuals or small teams, are involved. Reputation can be indirectly related to future money rewards. One way to think in this direction is when there is a selection process of evaluators that considers information on their track record of successes and failures. A first step, recently experimented by the EC, DG Regional Policy, in another context, is to perform a systematic quality assessment of evaluation reports.²² A second step would be to create and disseminate systematic information about the comparison between ex-ante and ex-post project evaluation. After all, if an ex-ante evaluator is discovered to be systematically over-optimistic, the evaluator is less credible than a more prudent one, and in an ideal selection/compensation mechanism there should be a reward for evaluation efficiency and effort.

Using Project Return Benchmarks as Incentives

One practical approach worthy of further discussion to design incentive-based mechanisms is to use return benchmarks. There are several ways to establish benchmarks by the planner, but the most straightforward way is to systematically store information on ex-ante and ex-post project returns. Based on long memory, the planner can calculate the median value of returns from the relevant project portfolios. Projects that promise to outperform the benchmark should be given approval, co-financing and a bonus, to be disbursed only if the expectations are confirmed after 'ex-post' evaluation. The

implicit punishment for projects that do not achieve their targets is that their incentives will be lost. Here the participation constraint is that the share of the contract in the form of incentive should be not so high as to make the contract unattractive.

Let us see a simple worked example of this mechanism. The ex-ante evaluator appraises the project and, based on available information, and after risk analysis concludes that the project expects a (real) financial rate of return of 2 per cent and an economic rate of return of 5 per cent, using market prices for the former and shadow prices, given by the planner, for the latter.

Suppose the benchmark for the financial return is 4 per cent, and this is the financial discount rate, hence, the project financial net present value is negative. A grant is needed to fill the funding gap. Moreover, suppose that the benchmark for the economic rate of return is also 4 per cent.

Thus, compared with the economic benchmark, the above project deserves the grant in social cost–benefit terms. The planner then determines a co-financing grant in two parts: a funding gap part, to cover the net present value of the project cost plus a linear incentive, proportional to the ratio between the expected economic rate of return and the benchmark, which is 1.25 in our example. Consequently, a fixed share of the excess social benefit translates into a financial rent to the project proponent (or the regional government). Let us say that the fixed share is 0.5.

One way to design the incentive is to increase the financial discount rate correspondingly to establish the project funding gap. In other words, the planner offers to pay the difference between the net present value of revenues and costs, discounted at 4 per cent financial discount rate, plus promises to pay an additional bonus, equal to half the difference between using 4 per cent and 5 per cent in the calculation of the grant due:

$$NPV(4\%) + 0.5[NPV(5\%) - NPV(4\%)] = 0.5NPV(4\%) + 0.5NPV(5\%)$$

The grant is paid in two tranches. The first tranche is an ex-ante payment, based on the standard discount rate. The incentive is set aside by the planner. Some years later (the timing of the ‘ex-post’ evaluation depends upon the project construction and start up forecast) the project is re-evaluated.²³ The incentive is then disbursed to the managing authority responsible for the project only if the expectations of ‘economic’ out-performance are confirmed, or correspondingly reduced if they fall below the target. Let us see how the incentive works here. The first part of the grant is a cost reimbursement, low-powered contract. With a given probability, it offers a hidden rent to the beneficiary, who has an interest in exaggerating the project costs (or in hiding revenues). The second part of the grant, gives probably an

incentive to exaggerate social net benefits at shadow prices. The two biases, however, work at least partially in the opposite direction, because for a given set of shadow prices, provided by the planner, exaggerating costs or under-reporting expected revenues, decreases the incentive element. Moreover, because the incentive part is allocated ex-post, forecasting mistakes have an opportunity cost for the beneficiary. In the same vein, one can envisage incentives, beyond reputation, for the 'ex-ante' evaluation team,²⁴ when the project is discovered to be performing as expected.

Again, this is no more than an illustrative example. The real world situation may need many adaptations, particularly for administrative reasons. For example, project performance rating can be based on more than economic returns, and translated into a qualitative scoring scale, to consider a number of exogenous shocks in project implementation. The logic of the signalling mechanism does not change if instead of one performance indicator (that is the economic rate of return) a set of indicators is considered. Consistency, however, is needed. The project performance bonus, in principle, should be shared among the regional regulator, the managerial team, and possibly the evaluator (perhaps through a transparent reputation signal).

On the EU Co-financing Mechanisms

Building on the benchmarking approach, one can re-think the EC co-financing mechanism under the Structural Funds in a similar way. I will focus here on the cohesion fund, but a similar mechanism could be implemented for the ERDF.

First, the planner should fix a benchmark financial rate of return 'before' the grants. It is not surprising that many infrastructure projects in need of public capital are expected to have low financial returns, sometimes a negative return (otherwise there would be quite limited justification for public intervention). This is not, however, a justification for the EC to accept any 'funding gap' to be filled by the subsidy, up to the regulatory ceiling for the EU co-financing rate. The EU grant should cover the NPV of net project costs in financial terms, arising from the fact that the required rate of return for investors is positive. As said, by default, projects with negative financial returns, for example typically environmental projects, or social infrastructures, should show high economic returns (see below) to be accepted.

Second, for the calculation of the grant, in principle, one would need a standard financial discount rate in real terms. This cannot be too far from the real marginal cost of the public-sector borrowing-requirement. Under an EU common capital market, a benchmark minimum value could be the return on long-term (for example 30 years) risk-free bonds, for example, the return of EIB bonds in Euro. This was around 2 per cent in 2006. Because

of a taxation and of a still imperfect capital market a premium should be added to this benchmark. This premium can either be assessed country by country, which would be better, but more complex, or fixed by the calculation of an average premium over the specific benchmark for the Cohesion Fund countries. It should not be considered, however, as a risk premium. Elsewhere (Florio, 2006) I have proposed a 3.5 per cent real financial discount rate for the EU. Compared with the current rules, the proposal implies a decrease in the average grant per revenue generating projects (and for a given amount of the Cohesion Fund, the opportunity to invest in more projects).

Third, projects requiring assistance by the fund for public grants should not be expected to have an excessive financial return on investment, (let us say much greater than a real expected $FRR/C=5$ per cent, that is after appropriate risk analysis) otherwise one can assume that the private sector will be able to finance the project. Moreover, one would expect that the return on national equity capital, FRR/K , or 'after' the grant, to be higher than FRR/C , but not exceeding a given threshold, otherwise the project is asking an excessive grant from the EU.²⁵

Fourth, and most important, development objectives (economic growth, environmental sustainability, equal opportunities, distribution effects) are in principle measured by economic returns, not by either FRR/C or FRR/K . Because externalities and shadow prices are explicitly considered by cost-benefit analysis, in the ways suggested by the CBA Guide or in more elaborated frameworks, most projects with low or even negative FRR/C may show positive ERR to be deserving of a grant. Projects with a low ERR (based on the real GDP growth prospects in the new Member States) should be considered unappealing by the European Commission.

Fifth, the EU grant should offer a reward to regional authorities, project managers and ex-ante evaluators, proposing the most deserving projects in socio-economic terms. One simple way to do so is to stipulate that if a project expects to outperform an economic benchmark, then the ratio of the expected ERR and the benchmark (or a share of it) is used as a conversion factor for the financial rate of return. The incentive component, however, should be paid at a later stage, if confirmed by 'ex-post' evaluation.

Here the incentives to manipulate financial and economic returns, in general goes in opposite directions, because if the proponent, for example, exaggerates the demand for transport, then a lower financing gap against the incentive for the high economic return will be obtained. Thus, excess optimism in cost-benefit analysis would be partly self-correcting. However it may always be the case that a project proponent tries to manipulate CBA, especially for the estimation of non-monetary social benefits, such as, for

example, positive environmental externalities. The latter, while positively affecting the economic rate of return, are irrelevant for the calculation of the EU financing gap, in order to show high net social benefits of financially negative projects. This leads to the final suggestion.

Sixth, lack of realism in cost–benefit analysis should be sanctioned by an ex-post penalty. In a previous section I suggested offering this in the form of conditionality in the disbursement of the reward. A part of the EU grant should be set aside in the first instance. The objective of this ‘project performance reserve’ would be to reward the financial analysis (where the proponent unavoidably has some incentive to exaggerate costs) and economic analysis, (where there is the opposite incentive) with a bonus for projects with a realistic financial analysis and high re-estimated returns in terms of social costs and benefits. I suggest that some time after project assignment the EC should appoint independent evaluators to rate projects according to a clear set of performance criteria.²⁶ In other words the EU co-financing rate should have a fixed ex-ante component that depends on the ‘funding gap’ under a standard financial discount rate (but with the above-mentioned limitations) and a variable component, that depends on the ‘relative’ economic rate of return and can be disbursed as a bonus at a later date (for example after three years from the start up) if the ex-ante social net benefits expectations are going to be confirmed by this re-appraisal. Countries, regions or sector managing authorities that systematically underperform according to their own economic expectations will then be punished, because their bonuses will be reallocated to those who have matched their cost–benefit targets.²⁷

Evaluation contracts should be so designed as to offer a bonus for realism, as assessed ‘ex-post’, either in terms of reputation or perhaps of a direct monetary reward. Shadow prices values or formulas should be agreed between the EC and other planning bodies, and not delegated to evaluators. This will help all players to play the development game with common rules and to learn from their success and failures.

CONCLUDING REMARKS

This chapter is mainly methodological and unavoidably rather abstract. It should be seen as just a starting point for new research focusing on cross-fertilization between cost–benefit analysis and incentive theory. It does not offer plug-in shadow prices, or cooking recipes for contractual arrangements in the economics of infrastructure. Its objective is to offer a framework for discussion, with particular regard to the future of the EU Cohesion Policy. There are four conclusions to the above discussions.

1. Europe needs a huge investment effort for (broadly defined) infrastructure in the next decade, to support the ambition of an integrated economic space from Bulgaria to Spain, or from Finland to Cyprus. There is a limited world-wide experience of such a co-ordinated effort. In terms of the financial resources involved and of the planning mechanisms, the experiences of infrastructure funding by the US Federal Government or by the World Bank are more limited, and have a quite different orientation. The most novel aspect of the EU experiment, which has slowly and clumsily evolved over decades, is a complex multi-government planning mechanism, involving the European Commission (and other EU institutions), national governments, and regional authorities. There are two interwoven dimensions of this framework: new public policies and financial mechanisms. The EU policies, for example in transport, environment, energy, competitiveness are pushing national and regional actors towards new challenging objectives. Most of these objectives need investment to be sustained, and in turn investment needs finance. A combination of EU grants, loans from the EIB and the EBRD, and their leverage effect on private capital, is going to mobilize a huge amount of private savings, backed by the reassuring environment given by the European Monetary Union. The core of this experiment is the systematic exploitation of cross-boundary externalities, in terms of capacity building in the public administration, of the learning processes of the many actors, of economies of scale and scope in planning and financial packages. This public good dimension is rather misunderstood by proponents of re-nationalization of the EU regional policy, who suggest that the key issue is just to transfer funds to less developed Member States, and then let them plan and manage their projects as they wish. My understanding of transferring national savings to the EU budget is that this is not just a way to manage a multilateral development aid scheme, from the rich to the poor Member States. It is a way of creating an incentive mechanism in order to build integrated economic plans, to serve the long-term EU policy goals. Under this view, the design of a common European framework for investment planning and evaluation is the true added value of the Cohesion Policy, of having a Trans-European Networks policy, of having financial institutions as the EIB and the EBRD, and of several other EU mechanisms to support investment.
2. One concern in this chapter was how economists can contribute to this investment effort in a meaningful way. Other social scientists may have a lot to say about, for example, the political and legal framework needed. The failure of the European Constitutional Treaty is there to remind us that the EU project is far from being achieved in terms of

consensus, and we all are aware of some nightmarish aspects of the current inter-governmental decision-making mechanisms. Economists tend too often to oversell their recipes. They can, however, be helpful, if they are clear about the boundaries of their knowledge. On the relationship between infrastructure investment and growth, in a macro-economic perspective, we must confess that in spite of decades of academic research, the evidence is mixed. Modern growth theory, from the Solow neo-classical model, to endogenous growth models, is an extremely active research field, but its results are not robust enough to be used for actual investment planning. Growth models can offer an insight into possible economic long-term scenarios. Econometric analysis or input-output techniques can suggest some illustrative coefficient estimates. I would not, however, suggest that a planner trust the high social returns of transport investments based on the empirical elasticity in an aggregate production function as an indication of giving high priority to motorways or railways in the allocation of public funds. More research is needed about the relationship between the macro- and micro estimates of public investment returns. My tenet is that, whatever the demand side effect of public investment, in the long term it is their intrinsic social value that matters, and this is not captured by market signals in most cases. Well designed, costly motorways that nobody uses are useless. While useless private investment is wiped away by markets, this is not the case for useless infrastructure, which enter in the national capital stock and stay there for decades, at their historical cost, and are slowly depreciated. Conversely, after conventional depreciation very useful public infrastructure disappears forever from national accounts. There is thus a fundamental methodological flaw in growth accounting. By comparison, microeconomic social accounting, that is cost-benefit analysis, despite its limitations, is more reliable as a support to investment planning. Macroeconomic models should be used at a different level of economic policy-making, to build long-term scenarios, to explore short run demand shocks, to evaluate fiscal policies.

3. Cost-benefit analysis is widely taught to economists at undergraduate and graduate level, and it has a long and distinguished intellectual history. It has occasionally attracted the interest of the top of the profession, and is embodied in hundreds of papers and books. It is, however, still frequently misunderstood in its theoretical foundations, and applied in an inconsistent way on the ground. Both issues need to be addressed if CBA is to play a meaningful role in EU investment planning. It is a great merit of the EC to have explicitly asked for CBA in the Structural Funds regulations. The *CBA Guide* sponsored by DG

Regional Policy was a step forward, but it is aimed at non-specialists, and it offers a very simplified approach for desk officers and consultants. In this chapter I have tried to present in an informal way, that is without any maths, the CBA theory in the DS framework, and to adapt it to a multi-government setting. The key-message of this theory is that shadow prices are not proxies of market equilibria, but are planning signals that solve a policy-constrained social planner problem. For example, the social discount rate, does not mimic the equilibrium financial interest rate; the shadow wage is not the supply–demand equilibrium price of labour; the value of time in transport or the shadow price of carbon emissions are not given by virtual markets. There might, or there must be shortcuts and proxies, in practical estimation of shadow prices, but one has to know what the target of this empirical estimation is. When the shadow price is defined in terms of the social opportunity costs for the planner, one has to consider the dual dimension of public production and policies. There is no such thing as a shadow price of healthcare if you do not define the supporting policy, because the shadow price itself changes if public service provision is paid by tariffs, by indirect taxation or in other ways. However you do not need to think in terms of an all-powerful central planner to have a consistent theory of CBA, you can think in terms of multiple governments, each of them using its own shadow prices in a consistent way.

Having said this, there are three concluding remarks. First, do we really need shadow prices in developed market economies, are markets not giving us sufficiently ‘right’ signals? Second, if we need to use shadow prices, which amounts to saying that if we really need CBA, who is going to compute and use them? Third, what happens in a multi-government setting, when financing decisions by different social planners are linked each other? I have suggested the following answers. (a) Yes, we do need shadow prices in the UK as we do in India, because market failures are pervasive, policy interventions are widespread, and nobody can show that the value of the statistical life or of passengers’ time (or of the social value of the output of many agriculture and energy projects) is proxied by market signals in Europe, just because we have developed market economies. (b) Planners must compute a set of shadow prices, evaluators should use them for project appraisal, and the two functions should not be confused. In principle this distinction applies at each planning level, but a consensus decision-set should emerge from this process, using a bottom-up approach. (c) In a multi-government setting there are information asymmetries that need to be addressed, and we should use incentive theory, or CBA will be discredited: not because it is wrong, or too costly, but because of the bad design

of the planning and evaluation mechanism. Incentive theory has now been at the forefront of microeconomic research for 20 years. Its core message is that we have to look at the mechanisms that determine the actions or behaviour of agents. For example, we cannot just assume that a firm will maximize profits or minimize costs. We have to look into the black-box and discover that there are managers, share-holders and regulators, each with its own agenda, and they interact. Incentive theory, while having had several founding fathers, owes a lot to two French economists, Jean Tirole and the late Jean-Jacques Laffont, of the University of Toulouse. They have deeply influenced industrial and regulatory economics, and I suggest that, in the LT framework, infrastructure planning can be translated into a regulatory problem. There is a European principal acting here as a planner, a second principal and a national/regional government office, and an implementing agent, a private or public firm. The planner pays a grant for infrastructure, can use ex-ante or ex-post evaluation, the firm knows its own cost structure, and there may occasionally be cheating and even corruption. In this context planning and evaluation are games that require good strategies and design to be played well. Here CBA is the content of evaluation, it offers the right signals, but it is costly, it needs effort, and it can be manipulated. I have tried to give examples on how to think parallel incentives for regional planners, evaluators and project managers, assuming that the European social planner has no private agenda (an assumption that I am ready to defend in relative terms).

My illustrative examples are relatively simple, even if unavoidably less simplistic than the present funding mechanisms by the EC. Moreover, they may have to face opposition by those who dislike incentive-based mechanisms, either because of political or bureaucratic constraints. There may be a number of other formulas, to achieve higher efficiency in grant allocation, and several political and administrative constraints that I have not discussed here. This was not the place, however, to propose the details of financing mechanisms, but just a research perspective.

To sum-up: I propose moving away from the current low-powered incentive EU co-financing mechanism, essentially an investment cost part-reimbursement scheme, towards a more incentive-based system, where there are the following desirable features:

- Infrastructure project proponents should be given an incentive to show that, while their project has financial (net) costs they promise social (net) benefits: this incentive may take the form of a financial bonus to pay for the effort of discovering socially beneficial projects.
- The effect of an economic performance bonus partly counteracts the perverse incentive of the project proponent to show high investment

costs (and low revenues), under any cost-reimbursement grant mechanism.

- The efforts of ex-ante evaluators should be enhanced by offering them reward for evaluation effort and efficiency.
- The planner should give the evaluators, regional authorities and the project manager the relevant information about shadow prices to be used, and return benchmarks cumulative information on projects should be used to establish benchmarks and learn about factors in expected performance.
- The regional authority should be involved in sharing the incentive mechanism with the project manager.
- The incentive part of the contracts should be set aside by the planner, and confirmed, reduced or cancelled, following ex-post evaluation.
- Ex-post evaluation is the responsibility of the planner, it should lead to re-estimation of financial and economic returns at a fixed point of time after project approval, and to offer performance rating. The information on the project performance rating for each regional authority should be public. To ensure consistency in project rating, ex-post evaluation at EU level should possibly be delegated to an agency with adequate professional expertise.

Having said this, a word of caution is needed. The application of the benchmark thresholds for returns and the actual EU co-financing rate formula must not be too rigid. Under the proposed approach, financial and economic rates of return should be considered jointly and in comparison with sector/national or regional benchmarks, and ex-ante project analysis should be combined with ex-post evaluation. This mechanism is a way of playing the game, not an exact science. However, games without clear rules are often uninteresting. What matters, in practice, is the broad design and goal of the mechanism.

I am confident that moving in this direction will be of some advantage for infrastructure planning under the EU Structural Funds and the Cohesion Fund. The EIB and the EBRD, as other financial actors, have their own objectives and traditions, but a closer dialogue among the EU institutions on project evaluation methods seems useful, as in fact in several countries EU grant and loan finance will be combined. The first steps have been already taken.

Finally, I suggest that there is a more general message arising from this EU story, something that may be of interest in other contexts. Having sensible CBA rules printed in official evaluation guidelines is only part of a more complex game between social planners and executing agents. Most of the criticism of CBA among real world decision-makers arises from the less than careful design of the interplay between different actors. What is

needed is to move away from the naive view that just because there are evaluation rules they shall be implemented. We need both dimensions, in a nutshell: shadow prices and incentives. The design of planning and evaluation mechanisms is part of a learning strategy by governments and development authorities, it should take advantage of existing knowledge on project performance and failures, and should invest in offering the appropriate rewards to the various agents involved in the planning and evaluation game. Other international development actors should take notice of this aspect of the European experiment.

In a broader perspective, social CBA should be seen as a learning game among policy-makers, planners, evaluators, project managers and the public at large, more than as an abstract accounting technique. It is neither about market mimicking, nor a substitute for central planning. Social accountability of cost and benefits, and the design of evaluation and decentralized planning frameworks are parts of an open economic governance process. Democracy, in the old meaning of public discussion, and not just of voting, is to be seen as the appropriate environment for the scrutiny of social costs and benefits of investment projects.

NOTES

1. Some authors have taken a highly critical attitude about the impact of the EU funding mechanisms, and have even proposed a discontinuation of the Structural Funds. The Sapir Report (Sapir *et al.*, 2004) has proposed a wide reform, which in fact amounts to concentrating available EU resources on the new Member States, and to entirely delegating the project planning to them. While the Sapir Report offers plenty of good suggestions, I am not convinced of re-nationalization of regional policy, and I would rather advocate a stronger role for the European Commission in this area (Florio, 2005).
2. This peculiar EU policy setting contrasts sharply with some limitations of international aid to developing countries where the supra-national policy context is often weak. International lenders, such as the World Bank or the Inter-American Development Bank in Latin America, do not have the instruments to fully exploit potential externalities of a large-scale regional infrastructure strategy. In the US there was an important tradition in infrastructure planning, but it seems that social CBA is not consistently applied in the appraisal of public sector projects.
3. Real word evaluation is necessarily distant from any abstract model. It is however, important to have in mind a general framework and then look for compromises with data limitations and other constraints.
4. In some cases, international or border prices, offer useful information for the estimation of shadow prices. This is the most important message of Little and Mirrlees (1974), which however is a special case in the more general DS framework, albeit an important one.
5. Drèze and Stern (1990a, b) offer a less formal presentation of their theory. This is, however, perhaps still difficult to grasp intuitively, as showed by the fact that several subsequent CBA textbooks still rely on traditional partial equilibrium views.
6. For example the World Bank uses a cut-off (social) discount rate in project evaluation for most countries, but in principle one should compute and use both national and supra-national shadow prices, see next subsection.

7. The EC, however, is only one part of the EU architecture, that includes the European Council, the various Councils of Ministers, the European Parliament, and some EU judiciary institutions and consultative bodies, including one representing the regions.
8. I briefly discuss below the actual relevance of shadow prices for real world planners. Empirical estimates are beyond the scope of this chapter, but will be considered for future research.
9. An example is the social discount rate that does not need to be the same at EU level or for one specific Member State. The same applies to several other shadow prices.
10. Typical examples are the value of time and the value of statistical life.
11. In the US most of the CBA debate in fact is about regulatory changes, see Adler and Posner (2001).
12. In this chapter there is no explicit discussion about the relationship between planners and policy makers. I understand the planner as an office or a team in the public sector, that administers a given capital budget.
13. Others may dislike this assumption, and prefer different ones. This is, however, not a concern for us at this stage. Later I will give an example of evaluation with private agenda and corruption.
14. The EIB in recent years has regularly advised the EC on major projects. In future there will be an even closer and more structured collaboration, under the Jasper initiative (see Carbonaro, 2006; Mairate and Angelini, 2006). In the past the World Bank relied mostly on internal project analysts, now it frequently hires consultants. The European Commission considers ex-ante project evaluations to be the responsibility of the Member State, who in turn can delegate it to internal offices or again to consultants.
15. In standard CBA theory public firms are under the full control of government, and respond to shadow prices rather than to market signals. In practice, it is difficult to make this distinction.
16. In the real world, project co-financing is frequent.
17. In this chapter I use 'ex-post evaluation' as meaning an inspector who is sent after the contract is assigned to the firm. In the evaluation jargon 'ex-post' often means after completion of the project, or the start-up of its operative life. For infrastructure projects this is, however, too long a time span from the contract assignment. Thus, I prefer not to commit the planner to precise timing, I just assume that there is the probability of sending the evaluator at any convenient time after the contract assignment.
18. A key-assumption here is that the threat of the penalty is credible. The penalty can be designed in different ways.
19. This is in contrast with the current EU Structural Funds mechanism, where the grant formula is essentially the same for all eligible investment types and countries.
20. In other words, you can subsidize a highway investment either by a capital grant or by allowing for tolls that include a capital cost component, and a rent.
21. Of course, they can also manipulate assumptions about timing and quantities, for example demand forecasts.
22. For example, a score can be given by assessors to the quality of various dimensions of the evaluation report, and an overall rating can be computed.
23. Probably, for practical reasons, a fixed time span from the contract assignment is more advisable. In principle, the optimal timing, however, is variable.
24. For example, the ex-ante evaluation contract, can be offered by the regional regulator as a menu of alternatives to the pre-selected evaluation team. The evaluation team can either pick up a contract where the price for the service is proportional to the investment cost, that are supposed to be known in advance, with no performance incentive; or for a fixed price plus an incentive for ex post-performance. If the ex ante evaluator concludes that the project is not to be co-financed, he will be paid a fixed fee in any case. Obviously, if one thinks that evaluators always provide optimal effort, there is no need to apply an incentive. This is an empirical question, more than just a matter of ethical or professional standards.
25. According to the *CBA Guide*, the FRR/C is computed over total investment costs, while FRR/K is computed over national capital funding (public and private).

26. A rating agency would have useful side effects in terms of visibility and to ensure consistency. One regional government and the public at large may thus see how many ('triple A') public projects it has been able to implement.
27. Technical assistance should however help the less performing regions to investment failures.

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