Integrating considerations of equity, fairness and justice into the Israeli cost-benefit analysis

Draft final report

Dr. Karel Martens

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Environmental Simulation Laboratory, Tel Aviv University
Transport Today & Tomorrow

Content

Preface

This report presents the results of the project 'Nohal Prat and social justice' carried out on behalf of the Israeli Ministry of Transport. The aim of the project was to assess how equity considerations can be addressed in the adjusted Israeli cost-benefit analysis (Nohal Prat). The report is based on an extensive literature survey, as well as on an analysis of cost-benefit analyses used in a number of countries around the world.

The project is part of the larger effort to update the Nohal Prat, the second version of which was published in 1996. Recently, a first update was presented by the Ministry of Transport. In the second stage of the update effort further changes will be made to create a Nohal Prat that can stand the test of time for a number of years. This new Nohal Prat will address key elements relevant for the evaluation of transport projects, such as environmental externalities, inter-modal comparison, and also equity impacts.

The current project was produced under guidance of Amalya Padon of the Ministry of Transport, and Nir Sharav, consultant to the Ministry. Their valuable comments and suggestions have substantially contributed to the current report. However, I take full responsibility for any mistakes or analytical flaws that may be contained in the text.

Karel Martens

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Chapter 1   Introduction

1.1   Introduction

1.   This first chapter contains a brief overview about the main features of cost-benefit analysis. It provides the backdrop for the analyses in the later chapters on how equity considerations can be incorporated into the Nohal Prat.

2.   The chapter starts with a brief outline of the main features of standard cost-benefit analysis (Section 1.2). Then some general issues are discussed concerning the integration of equity considerations in cost-benefit analysis (Section 1.3). The discussion will make clear that the integration of equity considerations in cost-benefit analysis requires a fundamental change in the scope of standard cost-benefit analysis. Section 1.4 provides a brief overview of equity considerations addressed in cost-benefit analysis in selected countries. Finally, Section 1.5 outlines the starting points and limitations of the report. The final section provides a brief overview of the remaining chapters of the report.

1.2   Standard cost-benefit analysis

3.   Cost-benefit analysis (CBA) is a tool to identify, measure and compare the benefits and costs of an investment project or policy program.[1] It generates data on the economic *efficiency* of a project, which can be defined as the maximization of the net contribution of the project to the national income.[2]

4.   The Nohal Prat, which is the subject of this report, is the Israeli variant of standard cost-benefit analysis as applied in the field of transport. The Nohal Prat outlines how proposed transport investments should be ex ante evaluated: which costs and benefits are to be included in the assessment of the project, how each of these costs and benefits should be given a monetary value, and how the results should be presented to the decision-makers that are expected to use the results of the cost-benefit analysis in their decisions. These results, in turn, are supposed to assist decision-makers in reaching a decision about, first, whether or not to carry out a specific transport project, and, second, which alternative to implement.

5.   The Nohal Prat is largely comparable to cost-benefit analyses used throughout the world in the field of transport. Like other cost-benefit analyses, the Nohal Prat produces first of all an overview of costs and benefits generated by a transport project, and translates each

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[1] Campbell and Brown 2003: 1.
[2] See Hill 1973: 9.

of these to monetary values. Second, the Nohal Prat describes how to deal with the time horizon in evaluating the costs and benefits generated by a transport project. More specifically, the Nohal Prat outlines how to value benefits reaped and costs borne in the future through the application of a discount rate. Third, the analysis generates a set of indicators: net present value (NPV), cost-benefit ratio (C/B ratio), and internal rate of return (IRR). Each of these represents the efficiency of a proposed project or project alternative in a different way, and each of these informs decision-makers about the economic desirability of a project or project alternative. Fourth, the recently adjusted Nohal Prat is a *social* cost-benefit analysis in the sense that it encompasses costs and benefits for *all* individuals in a society and not just those for the parties directly involved in a project (the consumers and producers of a project).[3] This means that some of the costs and benefits that are external for the consumers (the users of transport infrastructure) and producers (the government) of a transport project, such as air pollution and noise, are taken into account in the Nohal Prat.

6.   The main result of the application of the Nohal Prat to a transport project consists of the set of indicators that informs decision-makers about the economic efficiency of various project alternatives. It is important to note that these indicators are primarily suitable for ranking or comparing project alternatives designed to obtain the same ends. They are not appropriate for comparing projects that have different goals. For instance, cost-benefit analysis can be used to rank various alternatives that aim to reduce congestion on a major artery, but it cannot be used to compare these alternatives with a project that aims to improve the mobility for the handicapped. The latter project has fundamentally different goals than the former and it would be wrong to reduce the projects to monetary terms and decide for or against one of them on the basis of the criterion of economic efficiency. It would be like going out to a department store to buy a radio in order to be able to listen to the news, and to purchase a bicycle because it scores better in the cost-benefit analysis! The criterion of economic efficiency is, in other words, only relevant when choosing projects with comparable ends. It cannot be used to determine the absolute desirability of a project.[4]

7.   Obviously, the term 'comparable ends' can be interpreted in various ways. It may be clear that it is irrelevant to compare a road project against a new school in terms of economic efficiency. It is also evident that the choice between a project that aims to increase road safety and one that aims to reduce travel times into the city center should not be guided by the result of a cost-benefit analysis. But it is less obvious whether projects that aim to reduce congestion in the Haifa area can be compared with projects that aim to achieve the same goal in the Tel Aviv metropolitan area. From the perspective of the country as a whole, congestion can be perceived first and foremost as a cost to the national economy, implying that the projects are largely interchangeable. But from an individual perspective the projects have fundamentally different impacts, simply because they affect different population groups. This latter argument suggests that cost-benefit analysis should only be used as a tool to compare projects that have largely the same goals, also in terms of target groups and/or affected population groups. Thus,

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[3] Cf. Brent 1996: 5.
[4] Hill 1973: 14-15.

comparability is a necessary condition for the use of cost-benefit analysis as a decision-support tool to choose between alternative projects.[5]

1.3   Standard cost-benefit analysis and equity

8.   Standard cost-benefit analysis is a tool to assess the economic efficiency of a project. The basic features of the CBA methodology are geared towards this goal. Against this background, it may come as no surprise that some of these features pose a challenge for integrating equity considerations within the cost-benefit analysis framework. Some of these features will be discussed below. They serve as a basis for the in-depth exploration in the remaining chapters of the report about the ways in which equity concerns could be addressed within cost-benefit analysis.

9.   First, the integration of equity considerations has consequences for the use of cost-benefit analysis as a decision-making tool. Standard cost-benefit analysis generates information about only one decision-making criterion – economic efficiency – which makes it relatively easy to compare and rank project alternatives. In case cost-benefit analysis also provides indicators about the equity impacts of project alternatives, decision-makers are provided with two types of information that have to be weighed against each other. This could lead to a lack of clarity, consistency and accountability in a crucial part of the decision-taking process, in which project alternatives are compared with each other and preferences formed.[6] Against this background, one of the main questions is whether to integrate the information on both issues into one (set of) indicator(s), or whether to present decision-makers with separate information about each of them. Note that the integration of equity considerations into cost-benefit analysis thus poses more of a challenge than the integration of e.g. environmental impacts. In the latter case, new types of costs and benefits are simply added to the CBA calculations, but efficiency remains the sole criterion for the evaluation of project alternatives. In the former case, cost-benefit analysis can no longer suffice with producing only efficiency indicators, but will have to generate information about two overarching decision-making criteria (efficiency and equity).

10.   Second, standard cost-benefit analysis takes a *lump-sum approach* towards costs and benefits. This means that cost-benefit analysis generates aggregative data about the total costs and benefits of a project, without providing information about how these benefits and costs are distributed over people – which people benefit from a transport project and which people pay for its costs. These aggregative data are sufficient for providing information about the economic efficiency of a project, but do not deliver any insights about the equity impacts of a project or project alternative. This is because equity is all about the *distribution* of costs and benefits over population groups. Where from an efficiency perspective it makes no difference who benefits from a new transport project, from a perspective of equity the who-question is what it is all about. The integration of equity concerns in cost-benefit analysis thus requires that the traditional lump-sum

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[5] Hill 1973: 15.
[6] See Sayers, Jessop *et al.* 2003: 95.

methodology characteristic for cost-benefit analysis is replaced by a methodology that explicitly takes into account the way costs and benefits are distributed over population groups. Once again, this makes clear how great a challenge the equity issue poses for standard cost-benefit analysis. Where the inclusion of (negative) externalities only adds a cost or a benefit to the balance sheet generated by standard cost-benefit analysis, the integration of equity considerations in cost-benefit analysis requires a shift in the way costs and benefits are dealt with (from lump-sum to distribution) and a change in the CBA methodology.[7]

11. A third key characteristic of standard cost-benefit analysis is that market prices or market-based prices are used in the calculation of the monetary values of costs and benefits. This applies to both goods that are sold on the market, such as construction costs, as to goods that are not directly traded in the market place, such as travel time savings or air pollution. In the latter case, so-called shadow prices are calculated through a variety of methods, including willingness-to-pay and contingent valuation measures.[8] The use of market-based values often implies that the value ascribed to a good depends on the person that receives the good. For instance, higher income groups will ascribe a higher value to travel time savings than lower income groups, in part because of the higher opportunity cost of the former. Likewise, higher income groups may be expected to have a higher willing-to-pay for reductions in air pollution or noise, at least in part because their higher ability-to-pay. The consequence of using market-based values is that project alternatives that generate primarily benefits for higher income groups will perform better in cost-benefit analysis, than alternatives which primarily benefit the poor, *ceteris paribus*. This built-in distributional impact of cost-benefit analysis has to be taken into account explicitly when addressing equity considerations in cost-benefit analysis.

12. A fourth issue concerns the importance of travel time savings in cost-benefit analysis for transport projects. Travel time savings typically account for the vast majority of benefits generated by a transport investment and most transport projects score positive in cost-benefit analysis precisely because they reduce travel times. This is important from an equity perspective, as different population groups have distinctly different travel patterns. Especially stronger population groups – by income or car ownership levels – are highly mobile, in both number and length of trips. Because of this, a transport project that serves strong population groups is more likely to score positive in a cost-benefit analysis, than an identical project that primarily serves weaker population groups. The impact of the differences in travel patterns between population groups on the results of cost-benefit analysis are thus largely comparable with the impact of the use of market-based values for travel times. Like in latter case, the distributional impacts of differing travel patterns on the outcomes of cost-benefit analysis need to be accounted for when developing a methodology to include equity concerns in cost-benefit analysis.

13. These four points suggest that the integration of equity considerations in cost-benefit analysis requires a fundamental change in the scope of standard cost-benefit analysis. The integration of these concerns will only be possible if an explicit *equity analysis* is added

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[7] On the inclusion of externalities in cost-benefit analysis, see e.g. Shiftan, de Jong *et al.* 2002.
[8] See e.g. Dodgson and Gonzalez Savignat 1998.

to the standard cost-benefit analysis. The key element of this equity analysis consists of an assessment of the way in which costs and benefits generated by a transport investment are distributed over population groups. The equity analysis will also have to take into account the direct impacts of the use of market-based values on the distribution of benefits over income groups, as well as be sensitive to the possible distributive impacts related to the importance of travel time savings and the differences in travel patterns between population groups. Furthermore, the integration of equity considerations in cost-benefit analysis requires an explicit decision with regard to the results generated by the adjusted cost-benefit analysis. Standard cost-benefit analysis generates only results with regard to the efficiency of projects and project alternatives. An equity analysis will add results with regard to the equity implications of a project. The question here is whether efficiency and equity should be presented in one, integrated, (set of) indicator(s), or whether it is preferable to generate two (sets of) indicator(s), one for each criterion. The current report aims to provide practical answers to these issues, answers that can be implemented within the Israeli circumstances.

1.4   Equity considerations in cost-benefit analysis in selected countries

14.   Equity considerations have never taken center stage in the practical application of cost-benefit analysis in the field of transport. A review of CBA practices in a number of countries (France, Germany, Japan, and the UK) shows that relatively little time and effort has been devoted to develop a deeper understanding of the types of equity concerns that can be distinguished and the various ways to deal with them within the CBA framework.[9] Yet, the CBA guidelines of the selected countries do address the equity consequences of using market-based values. These consequences were recognized in a relatively early stage and since then so-called equity values have been suggested as a solution.[10] The application of equity values implies that identical monetary values are used for all population groups. In this way, differences in monetary values between population groups as a result of variation in ability-to-pay are avoided.[11]

15.   The equity values solution has been adopted by most developed countries around the world for at least some of the benefits and costs addressed in cost-benefit analysis. For instance, Japan, France, and the UK use equity values in the calculation of the monetary value related to travel time savings.[12] While they generally do distinguish between work and non-work trips, these countries do not use separate monetary values for different income groups. In the UK, equity values are furthermore used in the calculation of the net benefits derived from reductions in road death, accident risks, and air pollution.[13] Likewise, Japan applies equity values in the calculation of the costs related to road fatalities, seriously injured, and lightly injured persons, resulting from a transport project. More examples could be provided from around the world.

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[9] See, among others, the special number of *Transport Policy*, Volume 7, Issue 1 (2000).

[10] See e.g. Mackie, Fowkes *et al.* 2003: 3.

[11] See for a more elaborate explanation Chapter 5, Section 5.2.1.

[12] Morisugi 2000; Quinet 2000; Vickerman 2000.

[13] Vickerman 2000.

16.   The use of equity values is virtually the only way in which equity considerations are addressed in current CBA practice around the world. Germany is an exception to the rule. Here, regional disparities in the scope and quality of the transport network are explicitly dealt with in the CBA methodology.[14] Following the goal to narrow the existing regional infrastructure gap, travel time savings are valued higher in regions lagging behind than in regions with a well-developed (road) infrastructure. Since the income levels tend to be lower in the weaker regions, the German CBA guidelines thus suggest exactly the opposite of standard cost-benefit analysis. Where standard practice suggests ascribing higher monetary values to travel time savings generated in stronger regions, given the overall higher income levels and higher levels of willingness-to-pay in those regions, the German guidelines prescribe higher monetary values to be used in the weaker regions. In other words, the German guidelines go one step further than equity values. Rather than ascribing identical monetary values to all population groups, so-called 'inverse social values' are used.[15]

17.   Germany applies, in addition to the inverse monetary values, yet another methodology to guarantee that transport projects in weaker regions score relatively well in cost-benefit analysis. This methodology encompasses the use of a regional weighting factor, as well as the addition of an extra benefit to the CBA calculations. The weighing factor is linked to the level of unemployment in a region, while the extra benefit concerns the benefits from 'improved spatial situation'. The latter is calculated using a number of the benefits also taken into account in the regular CBA calculations. The methodology thus results in a double counting of some of the benefits for the weaker regions, which obviously positively influences the CBA results for transport projects implemented in disadvantaged regions.

18.   The German guidelines contain the most developed methodology to include some equity considerations – in this case concerns about regional distribution of transport projects – into the CBA framework. However, apart from the German example and the near general use of equity values in industrialized countries, equity considerations are hardly addressed within CBA practice. Despite a long-standing academic discussion on the inclusion of so-called distributional weights in cost-benefit analysis, none of the countries reviewed actually prescribes the use of these weights in their guidelines. As discussed later on in the report, this may come as no surprise, given the highly political nature of distributional weights.[16]

1.5   Starting points and limitations of the report

19.   Before engaging in an in-depth exploration of the possible ways to address equity considerations within the framework of the adjusted Nohal Prat, it is important to clarify the starting points and limitations of the report.

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[14] Rothengatter 2000.
[15] See for a more elaborate explanation Chapter 5, Section 5.2.1.
[16] See for a more elaborate explanation Chapter 5, Section 5.2.2.

20.   First, the report will follow the current Nohal Prat, including the recent changes and improvements in the methodology. This implies that the list of costs and benefits included in the Nohal Prat is taken as a given. This is important, as the inclusion of additional benefits and costs can change the results of cost-benefit analysis in a systematic way. For instance, the inclusion of additional negative environmental externalities, like the emission of greenhouse gases, works in the advantage of low-energy transport solutions, such as free bus lanes. The addition of environmental costs thus increases the chances that public transport solutions are selected rather than road projects, which in turn increases the chances that car-less households and population groups will benefit from transport investments. This starting point also implies that the German methodology of adding an extra benefit to account for, and ultimately reduce, regional disparities will not be addressed. This methodology is beyond the scope of the current report, foremost because it would imply a substantial change in the way transport project are assessed. Furthermore, the inclusion of additional benefits is a rather blunt instrument for addressing equity concerns at a variety of levels. E.g., the inclusion of extra benefits to account for regional disparities may address regional gaps, but it does little to promote the selection of project alternatives that distribute benefits equitably *within* a region. Given these complications, the report will take the adjusted Nohal Prat as given and only discuss methodologies that do not imply changes in the basic features of the adjusted Nohal Prat.

21.   A second limitation concerns the distribution of benefits and costs over different generations. This is obviously an equity issue. For instance, is it fair that the current generation mainly invests in a project, while the future generation reaps the benefits? Or, more philosophical, is it fair that a reduced accident risk today is valued higher in cost-benefit analysis than a comparable decrease in the future?[17] These and other issues related to inter-generational distribution are closely related to the debate about the social discount rate – the rate with which benefits reaped, and costs borne, in the future, are to be recalculated to a certain fixed date in the present. Based on an agreed-upon social discount rate, the net present value (NPV) of a project alternative can be calculated.[18] To address the distribution of benefits and costs over different generation would thus imply an in-depth exploration of the social discount rate. However, the discount rate has already been addressed in a separate project carried out within the framework of the adjustment of the Nohal Prat. While no explicit attention has been paid there to the equity implications of using a certain discount rate, it is not prudent to re-open the discussion about the discount rate within the current study. Against this background, the issue of inter-generation distribution will not be addressed in this report.

22.   The third limitation concerns the distinction between *intra-project* and *inter-project* comparison. Intra-project comparison relates to the appraisal of alternative plans that seek to solve – by and large – the same transport problem. Typical examples include alternatives that primarily differ in technical terms, or alternative solutions to solve congestion on a specific corridor, such as the widening of a road versus the addition of a

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[17] See e.g. Holland no date.
[18] For a discussion on inter-generational distribution and the importance of the discount rate, see e.g. Brent 1996, Chapter 11; Campbell and Brown 2003, Chapter 10.

free bus lane. Inter-project comparison concerns the evaluation of projects that differ substantially in terms of the problem they aim to solve. It may include a comparison of projects as distinct as a new interchange of two major highways, a new pedestrian bridge in an urban area, or the upgrading of an existing railway station. Standard cost-benefit analysis can be used as a decision-support tool in both instances. In the case of intra-project comparison, cost-benefit analysis will result in the identification of the best alternative, whereas in the case of inter-project comparison it will result in a prioritization of projects (see Figure 1.1).

Figure 1.1 Intra-project comparison versus inter-project comparison. Cost-benefit analysis can be applied as a decision-support tool at both levels of decision-making.

Intra-project comparison resulting in selection of best alternative

**Inter-project comparison** resulting in prioritization of projects
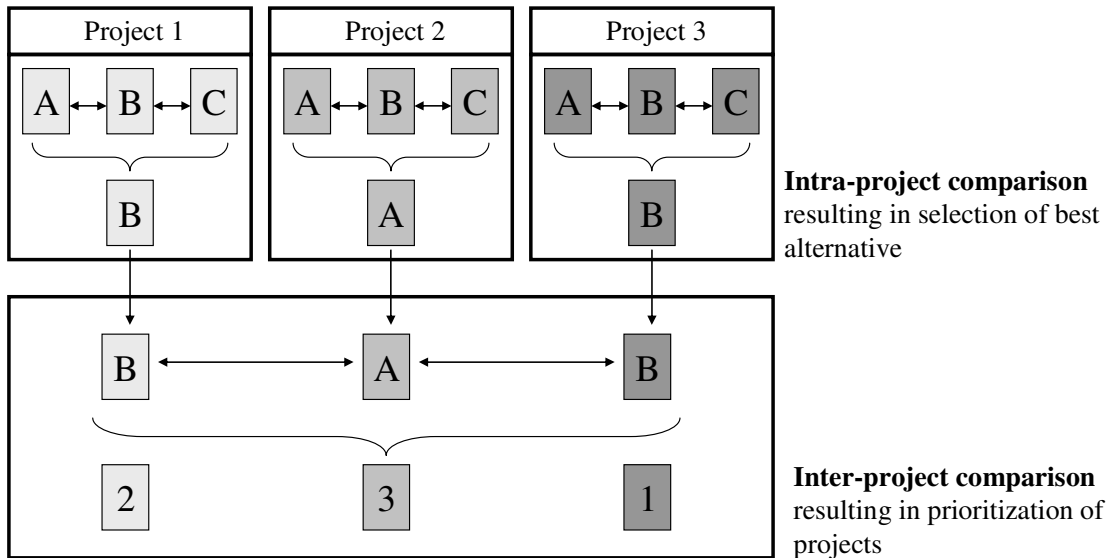
23.   The difference between intra-project and inter-project comparison is closely related to the applicability of cost-benefit analysis. As discussed in Section 1.2 above, cost-benefit analysis is primarily suitable for ranking or comparing project alternatives designed to obtain the same ends. This prerequisite of comparability is unproblematic for intra-project comparison, as it concerns the appraisal of alternatives that aim to solve the same transport problem and thus aim to reach – by and large – the same ends. This analysis holds for the comparison of alternatives in terms of efficiency, as well as in terms of equity. The situation is different for inter-project comparisons. Here, projects of different type, scale and location are compared with one another. Whether these projects are designed to 'obtain the same ends' depends on the way the ends of transport projects are defined.[19] From an equity perspective, projects are designed to obtain the same ends if they intend to serve – by and large – the same population. In other words, from an equity

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[19] From an efficiency perspective, this problem can be solved by defining the goal of transport projects very broadly as 'the improvement of the transport network in Israel'. This broad definition enables the direct comparison of all types of projects – ranging from a pedestrian bridge to a main highway interchange – as each of these projects will improve Israel's transport network in some way. Standard cost-benefit analysis can subsequently be used as a tool to determine in which project it would be most efficient to invest.

perspective, the question is whether projects are comparable in terms of the population they intend to serve. The larger the overlap in the population group served by two transport projects, the easier it is to compare these projects in terms of equity. The smaller the overlap, the more problematic such a comparison becomes (Figure 1.2). This is because lack of overlap requires a shift in the focus of the equity analysis. In such a case it is not sufficient to analyze how costs and benefits are distributed over the population served by a specific project, but it becomes necessary to analyze how cost and benefits are distributed over the total population potentially affected by *both* projects. Only by creating a common 'benchmark' – a common denominator in terms of population – can such projects be compared in terms of their equity impacts in a meaningful way. The methodology developed in this report to address equity concerns within the CBA framework is primarily suitable for intra-project comparison. Its application for inter-project comparison will primarily depend on the extent to which various projects can be compared in terms of the potentially affected population.

Figure 1.2 Level of overlap between projects and project alternatives and its consequences for the direct comparability of equity impacts of projects/alternatives.
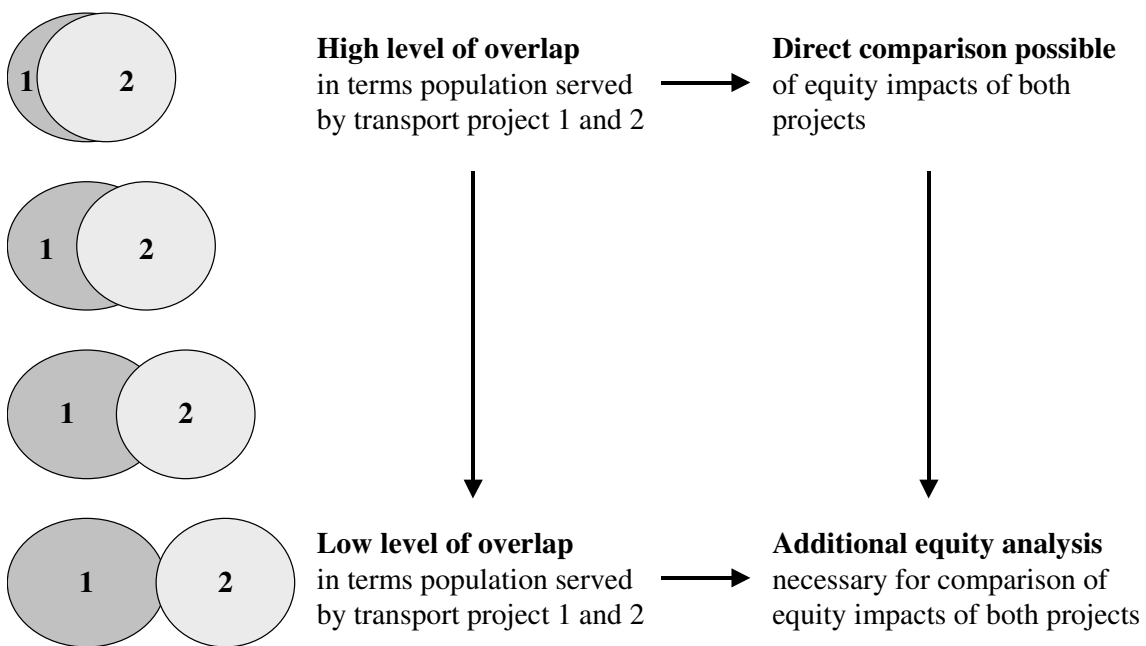
24.   Finally, it is important to note that it is beyond the scope of the report to determine which equity considerations will have to be addressed within the framework of the Nohal Prat. This is an issue that deserves a wider discussion, as different decision-makers may be interested in different equity impacts resulting from a transport project. For instance, decision-makers at the national level might be interested primarily in the distribution of net benefits over income groups, while local level officials may be more worried about the increase in air pollution for vulnerable population groups. Each of these equity concerns is legitimate and could be addressed within the Nohal Prat framework. The goal of the report is not to determine which of the equity concerns should be included in the ex

ante assessment of transport projects, but to provide a clear framework on how various equity considerations could be addressed within the existing framework of the Nohal Prat. By doing so, the report will provide the parameters necessary for an informed discussion and decision-making about the issue within the broader settings of the Nohal Prat steering committee and the higher echelons of decision-making.

1.6   Overview of the report

25.   The report starts with a discussion about equity (Chapter 2). This results in the definition of three question that need to be answered before engaging in an equity analysis within the framework of cost-benefit analysis:
–   Which goods and/or bads should be addressed in the equity analysis?
–   How should the recipients of goods/bads be divided into groups?
–   Which distributive principle should be used as the yardstick to assess the distribution of a specific good?

26.   The first two of these questions will be addressed in Chapter 3, while the third question will be answered in Chapter 4. Taken together, these chapters will result in a so-called matrix of equity considerations, which provides an organized overview of the equity concerns mentioned (implicitly) in the literature and in practice. Chapter 5 encompasses a discussion of possible methodologies to address the nine distinct equity concerns identified in the matrix. The report ends with a brief summary and specification of the choices that will have to be made, before a practical method can be developed to address equity concerns within the framework of Nohal Prat (Chapter 6).

Chapter 2   What is equity?

2.1   Introduction

27.   Equity – also referred to as justice or fairness – is about the morally proper *distribution* of goods and bads over members of society.[20] From the perspective of equity, human society is perceived first and foremost as a distributive community in which people produce things that are shared, divided and exchanged in specific ways.[21] The way these 'things' – commonly defined as benefits and burdens or goods and bads – are and should be distributed is the subject of study. Thus, social justice scholars view fields like health, education or employment as areas in which a specific good or set of benefits and burdens is distributed over men and women, children and adults, rich and poor, white and black, and so on.

28.   Transport projects can also be viewed as a government intervention through which specific goods and bads are distributed. For instance, the construction of a new road may reduce vehicle operation costs for some, while increasing levels of air pollution for others. Likewise, the creation of a public transport lane may generate travel time savings for a specific segment of society, while another segment may bear most of the resulting increase in accident risks. Each transport project will generate a variety of benefits and costs and each of them will be distributed in a specific way over the population. Where standard cost-benefit analysis is a tool to assess the sum of these costs and benefits, equity analysis is a tool to study their distribution over members of society.

29.   The distributive approach to equity draws the attention to three key elements: (1) the *goods and bads* or benefits and burdens that are distributed through a government intervention; (2) the *members of society* between whom goods and bads or distributed; and (3) the *distributive principles* that determine what is a fair distribution of the goods and bads under discussion. The study of social justice requires that explicit attention is paid to each of these elements and that they are linked to each other in a coherent way. Only after an explicit and well-motivated decision is made about which goods/bads to include in the analysis, which population groups to distinguish, and which distributive principle to use as a yardstick to judge the distribution of the selected goods/bads, a proper equity analysis can be carried out.

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[20] See e.g. Boucher and Kelly 1998: 1; Miller 1999: 1.
[21] Walzer 1983: 3.

30.   In Sections 2.2 to 2.4 each of the three elements will be discussed and linked to the application of cost-benefit analysis to transport investments. The last section of the chapter contains a brief summary of the main points of the chapter.

2.2   Goods and bads or benefits and burdens

31.   The first key element that requires attention in a social justice analysis concerns the goods and bads or benefits and costs that are distributed in society. The terms goods and bads are generally used in a liberal way. They do not only refer to objects, but also to services, opportunities, and even less tangible things like power and prestige. Money is probably the good that has received most attention in the literature, but opportunities (to e.g. education or jobs) have also been addressed in an extensive body of literature. In addition to (positive) goods, the distribution of bads or burdens has been addressed in more recent years. Especially the rise of the environmental justice literature has directed the attention to the distribution of bads like air pollution, noise, and waste disposal sites.[22]

32.   As discussed above, a transport investment can be viewed as a government intervention through which various costs and bads are being allocated over the population. More specifically, each of the benefits addressed in cost-benefit analysis can be considered as a good that is being distributed through a transport investment. Depending on scope of cost-benefit analysis, the list of benefits may include travel time savings, reductions in vehicle operation costs, and reductions in road fatalities and accident risk. Likewise, each of the costs addressed in cost-benefit analysis can be viewed as a bad distributed through a transport project. This encompasses construction and maintenance costs, air pollution, noise, increases in accident risks, etc. In addition to these particular goods and bads, the net benefits (or net costs) generated by a transport project can also be viewed as a good distributed by a transport project.

33.   Given the wide variety in goods and bads generated by a transport project, a decision will have to be made which goods and/or bads will be the subject of analysis. The analysis of the distribution of travel time savings may result in totally different conclusions about the fairness of a proposed transport project, than the analysis of the distribution of air pollution generated by that same project. This is so, because it is highly likely that the various benefits and costs generated by a transport project will be distributed in different ways over members of society. This brings us to the first key question that needs to be answered before engaging in an equity analysis: which goods and/or bads should be subjected to the analysis? In Chapter 3, we distinguish three possible answers to this question in relation to the application of cost-benefit analysis to transport investments.

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[22] See e.g. Forkenbrock and Schweitzer 1999; Feitelson 2002.

2.3   Members of society

34.   The second key element that requires attention in a social justice analysis concerns the members of society over which goods and bads are distributed. Two issues need to be addressed here.

35.   First, which individuals belong to the members of society? Or, in terms of cost-benefit analysis, which individuals belong to the so-called referent group?[23] The delineation of the referent group is as important for standard cost-benefit analysis as it is for equity analysis. In case of standard cost-benefit analysis, the calculation of net benefits includes only benefits reaped by, and costs borne by, the referent group. In case of equity analysis, the examination is limited to the way costs and benefits are distributed over the members of the referent groups. In both cases, any goods or bads received by people that do not belong to the referent group are not taken into consideration. In both cost-benefit analysis and equity analysis, the referent group often consists of all the residents of a country. However, in case of transport projects, the referent groups will often be limited to the areas directly influenced by the project. The question in that case is how to delineate that area.

36.   The second issue is how to divide the members of society, or referent group, into meaningful groups. Such a division is a necessary prerequisite for implementing an equity study. The most basic distinction is that between intra-generational and inter-generational distribution of goods. The first focuses on the way in which goods/bads are distributed over various groups of people of the same generation, while the second focuses on the way goods/bads are distributed between generations.

37.   The vast majority of the justice literature studies the distribution of goods within a generation. These analyses require a further distinction of members of society in population groups. In line with the focus on the distribution of money or income, much of the literature distinguishes groups by income level. But other distinctions are also common, such as by ethnicity, gender, or various socio-economic characteristics. Two considerations should play a key role in the distinction of population groups. First, the division of recipients into groups should be linked to the good/bad that is subject of analysis. In case the distribution of money is studied, a distinction of the population by income levels is obvious. But if the analysis focuses on the distribution of fatality risks caused by traffic accidents, a distinction by age may be more appropriate, given the differences in accident rates between children and elderly on the one hand, and the remainder of the population on the other. Second, the distinction of recipients in groups should be linked to the equity considerations that motivate a justice analysis in the first place. Thus, if one is concerned about air pollution experienced by population groups living close to major traffic arteries, the recipients of air pollution should be divided according to area of residence, and not by income level or socio-economic status. Likewise, if one is concerned about the inequalities between women and men in terms of travel times, the population should be divided by gender and not by income, age or any

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[23] Campbell and Brown 2003: 6-7.

other parameter. Another common concern relates to the way in which people that do not benefit directly from a proposed transport are affected by the costs it generates. In such a case, the population should be divided into users and non-users of the transport facility.[24]

38. The attention for the distribution of goods/bads between generations has risen in recent years, in part in relation to the emergence of the concept of sustainable development. Sustainable development is commonly defined as a development that "meets the needs of the present without compromising the ability of future generations to meet their own needs".[25] The concept raises the question how the available, especially non-renewable, resources are distributed over generations. In addition, the lifespan of transport investments calls for explicit attention to issues of inter-generational distribution. For instance, a road project may generate substantial travel time savings directly after the opening, but may generate high levels of air pollution in a later stage of the project. In such a case, benefits and burdens are not evenly distributed over time, and an explicit attention for the inter-temporal distribution of goods/bads may be called for.

39. Following the argumentation above, the second key question that has to be answered before engaging in an equity analysis is how the recipients of goods/bads should be divided into groups? As discussed above, the answer will depend at least in part on the answer to the first question (Which goods/bads should be subjected to equity analysis?). We will provide a preliminary answer to the second question in Chapter 3. For now, it suffices to say that the report will not deal with the inter-generational distribution of benefits/costs. The focus will be solely on the distribution of goods/bads within a generation.

2.4   Distributive principles

40. The third issue that has to be addressed before engaging in an equity analysis concerns the distributive principle that will be used as a yardstick to judge whether a specific distribution of goods/bads is just or not. It is this distributive principle that defines the morally proper way to distribute goods and bads. The default option tends to be 'simple equality', which describes a distribution in which each recipient or groups of recipients receives the same amount of a certain good.[26, 27]

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[24] See e.g. Campbell and Brown 2003: 6-10; Farrell and Saleh 2005.

[25] Brundtland 1987. Another definition is provided by the Organization for Economic Co-operation and Development (OECD). The Environmental Directorate of this organization defines environmentally sustainable transportation as, "transportation that does not endanger public health or ecosystems and that meets needs for access consistent with (a) use of renewable resources that are below their rates of regeneration, and (b) use of non-renewable resources below the rates of development of renewable substitutes." (see http://www.vtpi.org/tdm/tdm67.htm).

[26] The term 'simple equality' is taken from Walzer 1983. I use it here to distinguishing it more clearly from the term equity.

[27] See Smith 1994. The challenge for scholars of social justice, according to Smith, is to provide convincing arguments why to deviate from the criterion of simple equality.

41.   But an equal distribution of goods will not always be considered just or fair. The social justice literature actually abounds with examples in which simple equality would, at least by most people, be regarded to be at odds with principles of justice. For instance, many people would consider it unfair to tax the poor in the same way as the rich. For these people, a fair distribution of the 'bad' or 'burden' of taxation does not coincide with simple equality. That this opinion is shared by many is reflected in the fact that most countries apply a certain level of progressive taxation. In many countries, too, the provision of health services depends on need rather than simple equality. Thus the ill receive the largest share of health services, while the healthy contribute more to the system than they receive in terms of medical care. Likewise, in many countries grants for university studies are not distributed evenly among students, but are dependent on the performance of the students at high school (merit) as well as on the financial capabilities of the students' family (need).

42.   These examples point at the variety of distributive principle that could be used as a yardstick to assess the distribution of a specific good/bad. The social justice literature distinguishes a number of criteria that could, under certain circumstances, be defended as a just criterion. In addition to simple equality, need (as used in the field of health care), and equalization (underlying progressive taxation), this includes criteria such as merit (the distribution of goods to persons that deserve it in some sense), entitlement, or distribution by democratic rule.[28]

43.   Many more examples could be provided in which justice will not be not equated with simple equality. What the examples point at is the need to explicitly determine which distributive principle to use as the yardstick to assess the distribution of a specific good. Without an explicit and well-motivated decision which yardstick to use, any equity analysis becomes basically pointless. It would be meaningless, for instance, to assess whether each member of a community receives the same level of health care, if that same community agrees that health services should be provided according to need. An analysis of the distribution of health care would obviously show large gaps between various groups, but would this point to injustices in that community? Likewise, it would be pointless to analyze whether all university students receive the same study grant, if a society agrees that the height of the grants should depend on students' intellectual capabilities and parents' financial capabilities.

44.   These examples stress the link between the good/bad that is subject of analysis and the distributive principle that is used as a yardstick to assess distributive justice. In other words, if one is interested in the distribution of a certain good, certain distributive principles might be suitable as a yardstick, while others may not. This is surely true within a given society with its dominant opinions about the morally proper way to distribute various goods. An excellent example of the link between good and yardstick is the distribution of health care according to need, which has strong foundations in most (but not all) Western countries.

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[28] For an extensive discussion on distribution according to merit, see Sadurski 1985. For a defense of distribution according to entitlement, see Nozick 1974.

45.   For our purposes, the main point is that any equity analysis requires both an explicit yardstick and a clear motivation concerning the reasons to use this yardstick. This may seem obvious, but both issues are hardly addressed in all the instances in which the cost-benefit analysis literature touches upon issues of distributive justice. The result is an emphasis on the methodologies to address equity concerns in CBA calculations, without an in-depth discussion of the underlying equity considerations to apply these methodologies.

46.   In sum, the third question that needs to be answered before engaging in an equity analysis is which distributive principle to use as the yardstick to assess the distribution of a specific good. The possible answers to this question will be provided in Chapter 4.

2.5   Summary

47.   This chapter discussed the concept of equity and its elements. Equity – often also referred to as justice or fairness – has been defined as the morally proper distributions of goods and bads over members of society. Based on this definition, we have distinguished three key questions that have to be answered before engaging in an equity analysis:

   −   Which goods and/or bads should be subjected to the analysis?
   −   How should the recipients of goods/bads be divided into groups?
   −   Which distributive principle should be used as the yardstick to assess
       the distribution of a specific good?

48.   The remainder of the report aims to answer these questions in relation to the application of cost-benefit analysis in the assessment of transport project.

Chapter 3   Possible goods and bads

3.1   Introduction

49.   Chapter 2 defined three questions that need to be answered before engaging in an equity assessment. This chapter provides an answer to the first two questions. As may be recalled, the first question is which goods/bads should be subjected to analysis? Even when applied to cost-benefit analysis, the answer to this question is less obvious than it may seem at first sight. Cost-benefit analysis includes a number of benefits and costs, such as travel time savings, air pollution, or maintenance costs. Should the equity analysis focus on each of these goods and bads? Or should the analysis be limited to the distribution of the net benefits generated by a transport project? Or something else? This chapter provides three possible answers to this question. Each of the answers is based on a specific view on cost-benefit analysis and transport projects.

50.   The second question that requires an answer before starting an equity analysis relates to the recipients of goods or bads. The question here is how these recipients should be divided into population groups? As discussed in Chapter 2, the answer to this question is closely related to the first question discussed above. Because of this, both questions will be answered in an integrated way in this chapter.

51.   The chapter consists of five sections. Following this introduction, three subsequent sections will provide three different answers to the question which goods/bads should be subjected to an equity analysis. The answer provided in Section 3.2 follows the standard reasoning behind cost-benefit analysis and contains that the most important good distributed through an investment project is money or, in CBA terms, net benefits. The subsequent section discusses the view that the aim of transport projects is not to distribute money, but rather in-kind benefits (Section 3.3). Section 3.4, in turn, follows the lines of the distributive justice literature as well as the incommensurability discussion, resulting in the opinion that the distribution of each of the costs and benefits generated by a transport project deserves explicit attention from an equity perspective.[29] Note that each of these three sections also addresses the second question, i.e. the division of recipients into population groups. The final section of the chapter provides an overview of the three answers.

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[29] See e.g. Frank 2001: 77-78.

3.2 Net benefits

52. The first view on the dominant good addressed in cost-benefit analysis upholds that the distribution of the net benefits generated by a transport project should be at the core of the equity analysis. The argument follows the lines of standard cost-benefit analysis and its emphasis on total costs and benefits generated by a project. This emphasis is based on two assumptions underlying standard cost-benefit analysis: (1) each of the goods or bads generated by a project can be translated into monetary terms and can thus be related to as a benefit or a cost; and (2) these benefits and costs are substitutes of one another in monetary terms.[30] Following these assumptions, standard cost-benefit analysis does not focus on the individual goods and bads generated by a (transport) project. The assessment of the size of the individual benefits and costs is merely seen as a necessary step in the calculation of total net benefits. From the standard CBA perspective it is not important whether a project generates positive net benefits due to substantial travel time savings or because of large reductions in road fatalities. The size of the monetary values is what counts.

53. If these two assumptions are accepted, it follows not only that money is the most important good, but that it is the *only* good that is being distributed through a transport project. It is the 'single currency' in which all costs and benefits can be expressed. It follows that it is the distribution of the total monetary value of a project – the net benefits – over population groups that is of interest.

54. An additional argument to focus on net benefits in cost-benefit analysis, relates to the use of transport investments as an alternative for taxation. Taxation is generally applied as a tool to transfer income from rich to poor population groups. However, taxation has its drawbacks as it involves administrative or transaction costs. Because of this, various authors have argued that it may be more efficient to use (transport) investment projects as an instrument to redistribute income from the rich to the poor. In case an investment project generates more benefits for poor than for rich population groups, redistribution is an 'automatic' result of project implementation. This makes redistribution through investment projects cheaper and more efficient than transfer through taxation, and therefore the preferred option.[31] Note that this argumentation is based on an implicit decision with regard to the distributive principle that should guide the equity analysis. In this case, the principle is equalization of differences in income levels between population groups. As will be discussed in Chapter 4, equalization is only one of possible equity principles that can be used in equity analysis.

55. The focus on net benefits as the dominant good has direct implications for the division of the affected population into groups. With the focus on money, the obvious division is one by income, i.e. a division in income groups. For example, the recipients of the benefits and costs generated by a transport project can be divided into income deciles, with each group containing 10% of the total population. Likewise, income quintiles or quartiles could be used, depending on the available data and the income gaps within society. It is

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[30] See e.g. Sen 2001.
[31] See e.g. Brent 1996: 241-242; Ray 1984.

important to avoid a division into income groups that levels out the actual differences between population groups. For instance, the use of income quartiles may be problematic in a society with a small population group that is substantially poorer than the second-poorest income decile.

3.3   Potential mobility

56.   The second view with regard to the dominant good distributed through transport projects starts from the *goals* of these projects. The goal of an investment project is first and foremost to improve a specific area of life. It does so by providing specific goods to people. In case of transport projects, the prime goal of new investments is *to improve the ability of people to travel from one place to another*. The projects achieve this goal by providing new transport infrastructure (e.g. a road, railway line, bus lane, station). Put in general terms, an investment project is first of all a tool to assist people *in-kind*, that is, a tool to provide people with specific goods, services or infrastructure, rather than a tool to generate cash income or net benefits.[32]

57.   The distinction between net benefits and in-kind assistance is especially relevant in case a good provided by an investment project cannot be acquired in any other way (e.g. through the market). In case of transport projects this is mostly the case: virtually all infrastructure facilities (roads, bus lanes, railway lines, stations, bicycle paths) are collectively provided and cannot be purchased through the market place or in any other way. Moreover, no alternative 'products' are available that could replace the services provided through transport infrastructure. Transport infrastructure is a public good whose provision depends on state intervention or, more generally, collective action. If this is the case, the key question from an equity perspective is how the goods that are *only or primarily* provided through a transport project are distributed over various population groups. The distribution of these *core* benefits should be subject to analysis rather than the distribution of total net benefits. Linked to the goal of a transport project, these core benefits encompass all benefits that improve the ability of people to travel from one place to another, in other words, the benefits that improve the 'potential mobility' of people. [33]

58.   The identification of potential mobility as the dominant good distributed through transport projects implies a focus on all those benefits included in CBA calculations that improve the ability of people to travel from one place to another. Three of the benefits included into the Nohal Prat can be considered to belong to this group of core benefits. Two of them are obvious: travel time savings and vehicle operation costs. Both of them make it easier to travel, either in terms of time or in terms of money. Population groups that receive large shares of these benefits will experience an improvement in potential mobility, while those groups that do not receive any of these benefits will not see any improvement. In addition to these benefits, reductions in road accidents can also be considered to belong to the category of core benefits, as a reduction in travel risks

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[32] See Brent 1996: 243.
[33] See Sager 2005.

improves people's ability to travel through space, at least in a statistical sense, but possibly also in a real sense.[34]

59. The focus on the benefits that improve the ability to travel has implications for the way in which the population affected by a transport project is to be divided into groups. A division along income lines is hardly relevant, as income levels do not necessarily correspond with levels of potential mobility. The challenge is to distinguish groups by exactly this criterion: their potential mobility or their ability to move through space. This is not a simple task. It may be clear that actual mobility of people is a poor indicator of potential mobility. Actual travel patterns are to a large extent a reflection of behavioral patterns, which differ widely between people and population groups. For instance, elderly people tend to travel substantially less than people that participate in the workforce, or people that combine work and household tasks. However, this does not necessarily mean that their potential mobility is lower.

60. In a theoretical sense, potential mobility is a result of system characteristics (available infrastructure, timetables, etc.) and personal characteristics (location of residence, vehicle availability, etc.). Within the context of cost-benefit analysis it is practically infeasible to distinguish population groups using a complex indicator that includes these factors. The distinction of population groups will have to be based on data collected within the framework of Nohal Prat or data readily available from existing sources (such as the Central Bureau of Statistics). Given these practical limitations, car availability could be used as the key indicator of travel ability or potential mobility. In the current circumstances of a highly developed road network, car availability is an important determinant of potential mobility. People that have continuous access to a car will generally have no problems to travel through space, as the car is always at their disposal, as is the network of roads and parking spaces. The potential mobility provided for by the car may be reduced by congestion, lack of parking spaces or congestion pricing, but in many cases will remain superior to the potential mobility provided by the public transport system. While the latter may be better for specific connections and at specific times (e.g. long-distance or peak-hour trips), the first is currently superior for the vast amount of trips. Thus, car-owners may be expected to have substantially higher levels of potential mobility than car-less groups. Given this situation, car availability could be used as a practical indicator for potential mobility and as a criterion to distinguish population groups.

61. Note that there is a strong relationship between income levels and motorization rates, with higher income groups characterized by substantially higher levels of car ownership than lower income groups.[35] While this suggests that income groups could be used as a 'proxy' of car ownership groups, this is not the case. Within each income group, a substantial number of people does not have (continuous) access to a private car. E.g., in

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[34] In some countries, the CBA framework includes a number of other benefits that can be considered part of the core good distributed by a transport project. This includes e.g. journey time reliability as used in the UK (Vickerman 2000), or reduction in vehicle standing costs (Rothengatter 2000). These benefits are ignored in the report, as they are not part of the Israeli CBA framework.

[35] See Martens forthcoming.

2003, 10% of the households in the richest income decile did not own a private car. In contrast, about 20% of the households in the poorest income decile did own a car in the same year.[36] An analysis of the distribution of mobility-enhancing benefits by income groups would thus fail to provide insight into the way a transport project reduces gaps between groups with low and high levels of potential mobility.

62.   The distinction of population groups by car ownership can also be applied in the case of vehicle operation costs. However, since this benefit is only relevant for car-users, all reductions in vehicle operating costs generated by a specific transport project will be primarily accrued by car-owners and not by the car-less. In other words, from a distributive perspective it is hardly relevant to analyze the way vehicle operating costs are distributed over car-owning and car-less population groups. A further specification into sub-groups is necessary. Since vehicle operation costs are a relevant part of potential mobility, especially for lower income groups, there are good reasons to further divide the car-owning versus car-less households into subgroups by income. Depending on the division in income groups by decile or quintile, ten or twenty sub-groups can then be distinguished. The distinction may also be used for reductions in accident risks.

3.4   Individual goods and bads

63.   The third view on the dominant good upholds that the distribution of each of the costs and benefits generated by a transport investment deserves explicit attention in an equity analysis. The starting point of the argument is that the benefits and costs generated by a transport project are not simply interchangeable. It does make a difference if a population group experiences a raise in taxes or increased levels of pollution as a result of a new transport project. While both of them can perhaps be translated to monetary terms, this translation is inherently problematic from an ethical point of view. Increased air pollution can simply not be equated with an increased contribution to construction costs through taxation.[37] The impacts on human life are fundamentally different and therefore require different treatment. A common conclusion following this argument is that cost-benefit analysis is problematic as such.[38] It can, however, also be uphold that cost-benefit analysis is still relevant as a tool to determine the efficiency of projects and project alternatives, but that it needs to be supplemented with a complete overview of the way in which the various costs and benefits are distributed over population groups. In this way, each of the goods/bads can be given its due.

64.   Following the argumentation above, it also follows that the focus in an equity analysis should not be on the monetary values of each benefit or cost, but rather on the absolute values of each item. In case of air pollution, for instance, the question is to what extent a project increases or reduces the level of polluting substances in the air, such as NOx or particles. Similarly, in case of noise, an increase or decrease in dB(A) is what counts. It may be clear that the focus on these absolute values shapes the possible format of an

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[36] See Martens forthcoming.
[37] See e.g. Kelman 2002.
[38] See e.g. Kelman 2002.

equity analysis. Not only should each good and bad be addressed separately, but separate measures and indicators will also have to be used. Furthermore, each good and bad may also require a different method to assess how it is distributed over population groups. It is, for instance, not clear from the outset how to calculate the distribution of increases and decreases in noise levels.

65. The focus on individual costs and benefits has implications for the division of the population into groups. The difference in character between the costs/benefits suggests that various divisions may be called for. For instance, in case of air pollution a distinction according to sensitivity to air pollution may be most relevant. In practice, this may imply a division in age groups, given the high sensitivity to air pollution among especially young children and older population groups. The same distinction could be used for accident risks, although a distinction by transport mode may also be relevant here, given the differences between car passengers, pedestrians, and cyclists in terms of their vulnerability and accident risk per passenger kilometer. Following the argumentation in the previous section, the analysis of travel time savings should distinguish between two groups: car owners and car-less people. In addition, a division according to income groups is reasonable when analyzing vehicle operation costs, as well as the tax consequences of construction and maintenance costs.

3.5 Summary

66. This chapter provides an answer to the first and second questions that need to be answered before engaging in an equity analysis:
   − Which goods and/or bads should be subjected to the analysis?
   − How should the recipients of goods/bads be divided into groups?

67. The chapter distinguishes three different answers to the first question, each reflecting a specific equity concern with regard to the implementation of a transport project. Each of the answers also has implications for the answer to the second question.

68. The first answer to the first question states that cost-benefit analysis is first and foremost about the distribution of net benefits over population groups. Following this focus, the level of income is the most obvious criterion to divide the population into groups.

69. The second answer upholds that the main aim of transport projects is to improve potential mobility: people's ability to travel from one place to another. Following this goal, the equity analysis should focus on the way a proposed transport project distributes potential mobility over population groups. Translated to the costs and benefits included in the Nohal Prat, the distribution of travel time savings, vehicle operation costs, and, to a lesser extent, reductions in accident risks should be at the center of the analysis. The division of the population into groups follows this line of reasoning and would be based on existing levels of potential mobility and income levels.

70. The third answer upholds that it is neither possible to summarize all costs and benefits into one measure (net benefits) nor that it is recommendable to focus on only a selection of the goods and bads distributed through a transport project. Following this third approach, the distribution of each of the benefits and costs needs to be addressed separately. Furthermore, the distribution should be measured in units that are relevant for the item in question (e.g. in case of noise, in terms an increase in dB(A) levels rather than monetary values ascribed to this increase). Accordingly, each good may also require a matching distinction of the population into groups (e.g. by vulnerability to respiratory diseases in case of air pollution).

Chapter 4   Possible distributive principles

4.1   Introduction

71.   Chapter 2 distinguished three questions to be addressed before engaging in an equity assessment. The previous chapter provided an answer to the first two questions. In this chapter, we will focus on the third question: *Which distributive principle should be used as the yardstick to assess the distribution of goods/bads through a transport project?* The underlying question here is: *Which distribution of the selected good do we – as decision-makers or the wider public – consider to be just?* Based on an answer to this latter question, it is possible to identify the distributive principle to be used as a yardstick to assess the distribution of goods/bads through a transport project.

72.   In the subsequent sections we will distinguish three answers to the latter question, each of which will be discussed in a separate section. In the final section we will link the answers to the three different goods distinguished in the previous chapter. By doing so, we will generate a matrix that provides an overview of possible equity considerations with regard to transport investments.

73.   The three distributive principles discussed in the chapter are all variations on the criterion of equality. Equality is by many defined as the 'default' option to distribute goods and bads in a just way.[39] That is to say, an equal division of goods or bads is considered as fair or just, unless convincing arguments can be provided for an alternative distribution. Lacking such arguments, equality remains as the only just distributive principle. The first principle discussed below follows this logic most closely. The second and third principles do provide arguments for a deviation of pure equality, but each provides an alternative that reflects the ideal of equality.

74.   The reason to limit the discussion to principles of equality is that other criteria put forward as principles of social justice seem hardly appropriate. This is true for criteria like need, merit, or free exchange, which have often been defended as 'the beginning and end of distributive justice'.[40] The principle of need, for instance, seems hardly compatible with the basic methodology underlying cost-benefit analysis. While it could be argued that goods generated by transport investments, such as travel time savings, reductions in accident risks, or reductions in air pollution, should be distributed according to need, the assessment of the level of need among various population groups would imply a fundamentally different type of analysis than the one pursued in cost-benefit analysis. The criteria of merit and free exchange, in turn, seem hardly relevant in case of the

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[39] See e.g. Smith 1994.
[40] Walzer 1983: 21; see also Sen 1973: 77.

distribution of goods and bads generated by a transport project. Merit, the distribution of goods to persons that deserve it in some sense, may perhaps be defended as a criterion for the distribution of travel time savings, but it can hardly serve as a distributive principle for bads like air pollution, accident risks, or noise. Free exchange, in turn, is not relevant at all, as the goods and bads generated by a transport project are distributed outside the marketplace – the distributive principle of free exchange can simply play no role in their distribution.

75.   Comparable arguments could be put forward against other distributive principles, such as distribution by democratic rule or entitlement. Following these arguments, variations on the criterion of equality remain as the most appropriate principles for the distribution of goods and bads generated by a transport investment. In the sections following this introduction, these variations on equality are presented.

4.2 Equality

76.   Equality is the first distributive principle that can be applied as a yardstick to assess the equity impacts of a transport project. The principle of equality refers to a distribution in which each person or population group receives the same share of a certain good or bad. The distribution is not in any way related to the characteristics of the person or the group – whether the group is already rich or poor, whether the group is vulnerable to a specific bad, or whether the group has special needs. For this reason, the principle of equality is sometimes also referred to as 'pure equality' or 'simple equality'.[41]

77.   The principle of equality can be applied to all three types of goods discussed in the previous chapter. The application to the distribution of net benefits is straightforward. The question here is whether the net benefits generated by a transport project are distributed in an equal way over the various population groups, and, if not, to what extent the actual distribution deviates from a perfectly equal distribution. In case of mobility-related benefits or other goods and bads generated by a transport project, the application of the equality criterion is less clear-cut. Here, the question raised by Sen 'Equality of what?' needs to be answered, as the equality criterion could be applied to the actual goods/bads distributed through a transport project, or to the monetary values ascribed to these goods/bads.[42] The arguments presented in the previous chapter point to the first approach. As discussed there, the focus on mobility-enhancing benefits derives from the acknowledgment that transport projects are virtually the only way to improve the mobility and/or accessibility of people. The goods themselves – travel time savings and reductions in vehicle operation costs – are thus of importance, and not the monetary values ascribed to these goods. A similar argument applies to the case in which the equity concern relates to the distribution of individual goods/bads generated by a transport project.

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[41] Walzer 1983: 14.
[42] Sen 1992.

78.   The argument provided in the next section against equality is that transport projects generate localized goods and bads, automatically resulting in an inequality in distribution. But this argument does not necessarily hold. Because even if goods and bads are distributed unequally over space, this does not necessarily imply that they are distributed unequally over population groups. This is because population groups themselves are distributed unevenly over space. Poor population groups are not necessarily clustered in one part of a metropolitan area, children are certainly not concentrated in one neighborhood, and pedestrians can be found in every neighborhood. Thus, although the impacts of a transport project may be concentrated in space, their distribution over population groups may well reveal a totally different pattern. In fact, it may well be that transport projects can be designed that distribute goods and bads in an equal way over relevant population groups. The criterion of equality may thus well be applied in the assessment of the equity impacts of a transport project.

4.3   Avoidance of disproportionate distributions

79.   The second distributive principle to assess the equity impacts of transport alternatives is the avoidance of disproportionate distributions. The principle starts from the fact that transport projects are located in space. The consequence of this simple fact is that the goods and bads generated by a transport project will always be unequally distributed over space.[43] For instance, neighborhoods that are located close to a new road will suffer more from the air pollution produced by vehicles using the road, than areas at a larger distance from the road. Likewise, residents living close to a new train station will benefit more from the reduction in travel time generated by a new railway line, than those living farther away. In other words, space itself creates an unequal distribution of goods and bads in case a project is located in space. Since this applies to all transport investments – but possibly less to transport policies like fuel taxes or public transport subsidies – it is virtually impossible to achieve the ideal of an equal distribution of costs and benefits generated by a transport project.

80.   This is a strong argument against a straightforward application of the criterion of equality to transport projects. It raises the question whether the goal of equality should not be abandoned altogether. At the same time, given the moral strength of the criterion of equality, it may be expected that both decision-makers and the wider public will remain committed to some level of equality. Given this commitment and the virtual impossibility to achieve perfect equality, differences in benefits reaped by, or costs borne by, population groups may be considered acceptable, as long as these differences are not disproportional. In other words, the distributive principle used as a yardstick to assess transport projects is the avoidance of disproportionate distributions.

81.   Note that a distribution can be disproportionate in many ways. It may imply that high income groups receive a disproportionate share of the total net benefits generated by a transport project. However, it may also mean exactly the opposite, i.e. that low income groups reap most of the net benefits of a transport project. Likewise, if one is concerned

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[43] See e.g. Portugali 1980.

about the distribution of individual costs and benefits, a disproportionate distribution may imply that a large share of air pollution caused by a new road is borne by young children or by adults. As these examples show, the criterion 'avoidance of disproportionate distributions' does not distinguish between various population groups. A disproportionate distribution is always considered problematic, whether it is in the advantage of weak or strong population groups.

82. There are a number of reasons that may motivate the application of the criterion 'avoidance of disproportionate distributions' as the yardstick to assess transport projects. The most important reason is that decision-makers may consider inequalities in society unproblematic, as long as they do not exceed a certain level. The second is that decision-makers do not consider transport projects as a tool to correct existing inequalities in society. This second motivation follows the traditional argument for not using distributive weights in cost-benefit analysis. [44] The argument is that policy objectives and policy tools should be linked in a proper way. If there are two goals, improvement of the transport system and redistribution of income, two policy tools should be used. The transport project is the tool to achieve the first and cost-benefit analysis the tool to make sure that the most efficient, cost-effective, transport project is selected. The tax-transfer system, in turn, is the tool to achieve the latter goal of income redistribution. The distributive principle 'avoidance of disproportionate distributions' follows this reasoning to the extent that it does not consider a transport project as a tool for income redistribution. It does, however, provide a yardstick to avoid the systematic selection of transport projects that disproportionately benefit one population group over others.

83. The practical challenge of the criterion of 'avoidance of disproportionate distributions' (ADD principle) is obviously to determine what constitutes a disproportionate distribution. The basic solution to this challenge is the definition of a certain bandwidth beyond which a distribution is considered as disproportionate. For instance, in case five population groups are distinguished, an equal distribution would imply that each of the population groups receive 20% of the benefits generated by a transport project. The bandwidth for disproportionate distribution could now be set at plus or minus 10%, implying that as long as no population group receives more than 30%, or no less than 10%, of the total benefits, the project will be considered as acceptable from an equity perspective. Obviously, more advanced applications of a bandwidth could be developed.

84. Finally note that the difference between the ADD principle and the criterion of equality lies in the way project alternatives will be rated from an equity perspective. In case the principle of equality is used, project alternatives will be rated based on the extent to which they deviate from the ideal of equality. Each project alternative will thus receive a unique rating, unless their deviation from perfect equality is exactly the same. In case the ADD principle is applied, many project alternatives may receive the same rating, as long as they fall within the defined bandwidth of an appropriate distribution. This implies that efficiency considerations will play a larger role in project selection.

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[44] See Brent 1996: 241.

4.4   Equalization

85.   The third distributive principle that can be used as a yardstick to assess the equity impacts of a transport project is equalization. Equalization refers to a reduction in the existing gaps between population groups. The criterion is a variation of the principle of equality. In the case of 'simple' equality, the comparison between groups concerns only the goods and bads generated by a transport project. Project alternatives that distribute these goods and benefits in an equal way are preferred over alternatives that generate more benefits or costs for certain population groups than others. In the case of equalization, the way the goods and bads generated by a transport project are distributed is compared to the existing distribution of that good. Project alternatives that narrow the gaps in an existing distribution are preferred over alternatives that consolidate or widen these gaps. The distributive criterion of equalization is thus also a criterion of equality, but with a different 'benchmark'.[45] The goal as defined by the criterion of equalization is a society in which the good under question is distributed in an equal way. The project is perceived as one of the tools to achieve this goal.

86.   Note that the principle of equalization is the underlying motivation for the use of distributive weights in cost-benefit analysis. The goal of applying weights in cost-benefit analysis is to increase the probability that project alternatives will be selected that result in a redistribution of income from richer to poorer population groups. Like in the case of equalization, the goal of the application of distributional weights is thus a reduction in the existing income gaps in society. In other words, the system of distributional weights is one of the methods to incorporate the goal of equalization in cost-benefit analysis. We will discuss this method and its possible application to the three types of goods distributed through transport projects in Chapter 5.

87.   Like the principle of equality and the ADD criterion, the principle of equalization can be applied to all goods and bads distinguished in Chapter 3. For each good and bad, an explicit 'benchmark' will have to be defined that indicates the current distribution of that good/bad over population groups. For some goods this may be a relatively straight-forward task, but for others it will be more difficult. The net benefits generated by a transport project certainly belong to the first group. In this case the distribution of income over population groups can serve as the benchmark. The benchmark for goods like accident risks or travel time savings is less clear. In case of the first, existing accident risks by population group could be used as a benchmark. But since a transport project will reduce, or increase, accident risks in a certain location, the use of average, country-wide, accident risk data may be less meaningful. It could be argued that a more appropriate benchmark would comprise of the accident risks for the specific corridor under consideration. A comparable argument holds for travel time savings. Here, too, average travel times for population groups seem hardly relevant. Rather, the different

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[45] This follows the logic of Sen, who claims that all theories of social justice aim to achieve equality in one way or another. The key question according to him is: Equality of what? In other words, the discussion between philosophers of social justice concerns the way in which people should be equal. There is near-universal agreement about equality as the just criterion for distribution of goods. This, then, also explains the use of equality as the 'default' option. See Sen 1992.

travel times for the trips that will be affected by the transport project should serve as the benchmark.

88.   The difference between net benefits and other goods produced by a transport project, is that the first good can be used in many ways, whereas the 'consumption' of the latter type of goods is dependent on time and place. Net benefits translate to money and money can be used to purchase a wide variety of goods, can be used now and in the future, in this locality and that. Money can be added to an existing stock of money, simply resulting in the growth of the stock. This is less so for accidents risks or travel time savings. The reduction of accident risks on a major artery into the city does not reduce the accident risks for residents of an outlying town who virtually never use that artery. Likewise, a reduction in travel time on the link between one suburb and the city does not reduce travel time between another suburb and the city. A transport project that reduces travel times during rush hours does not necessarily generate time savings for population groups that do not travel in rush hours. These examples point out that the application of the criterion of equalization in cost-benefit analysis is by no means a straightforward matter. It requires a thorough analysis and discussion in order to determine which benchmark to use and how to divide the population under consideration into groups.

4.5   A matrix of equity considerations

89.   Based on the discussions in this and the previous chapter, we can now define a matrix of equity considerations (see Table 4.1). The matrix links the three types of goods distinguished in Chapter 3 with the three types of distributive principles discussed in this chapter, thus creating nine different equity considerations. The matrix presents these nine equity considerations and specifies the goal of addressing the relevant equity concern in cost-benefit analysis.

90.   In the matrix, the goal of addressing equity concerns in cost-benefit analysis is explicitly defined as increasing the *probability* that project alternatives are selected that have the sought-for distributive impacts. The integration of equity consideration in the CBA methodology does not aim to guarantee that the most fair project alternative scores best in the cost-benefit analysis and is selected as a result. This is because an adjusted cost-benefit analysis will generate information with regard to two overarching policy goals: efficiency and equity. Equity thus needs to be balanced against efficiency in the process of selecting the most preferable project alternative.

91.   We feel that matrix provides an adequate overview of the equity considerations often mentioned in the literature, albeit perhaps implicitly. They also by-and-large cover the equity concerns that may be raised in actual practice, although there is limited research about the equity concerns of decision-makers or the wider public with regard to transport investments.[46] The challenge for decision-makers is to come to an agreement about which

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[46] Perhaps with the exception of the literature on road pricing, which tends to be much more explicit about the various equity considerations. See e.g. Proost no date; Jones no date; Richardson and Bae 1999; Jones 1999; Raux and Souche 2004.

equity consideration is most important. The standard CBA methodology should then be adjusted to account for this equity concern. The next chapter discusses a number of methods to address the nine equity concerns distinguished in the matrix.

Table 4.1 A matrix of equity considerations.

Goods and bads		Distributive principles		
		Avoidance of disproportionate distributions	**Equality**	**Equalization**
Net benefits	**Concern**	Cost-benefit analysis will result in the selection of project alternatives that distribute a disproportionately large share of total net benefits to one or more population groups	Cost-benefit analysis will result in the selection of alternatives that distribute net benefits in an unequal way	Cost-benefit analysis will result in the selection of project alternatives that maintain or increase the existing income gaps in society
	Goal	To increase the probability that project alternatives will be selected that do not distribute total net benefits in a disproportionate way	To increase the probability that project alternatives will be selected that distribute net benefits in an equal way	To increase the probability that project alternatives will be selected that narrow the income gaps in society
Mobility-enhancing benefits	**Concern**	Cost-benefit analysis will result in the selection of project alternatives that a distribute disproportionately large share of mobility-related benefits to one or more population groups	Cost-benefit analysis will result in the selection of alternatives that distribute mobility-related benefits in an unequal way	Cost-benefit analysis will result in the selection of project alternatives that maintain or increase the existing gaps in potential mobility between population groups
	Goal	To increase the probability that project alternatives will be selected that do not distributive mobility-related benefits in a disproportionate way	To increase the probability that project alternatives will be selected that distribute mobility-related benefits in an equal way	To increase the probability that project alternatives are selected that reduce the gaps in potential mobility between population groups
Individual goods and bads	**Concern**	Cost-benefit analysis will result in the selection of project alternatives that distribute disproportionately large shares of goods and bads to one or more population groups	Cost-benefit analysis will result in the selection of alternatives that distribute goods/bads in an unequal way	Cost-benefit analysis will result in the selection of project alternatives that maintain or increase the existing gaps between population groups with regard to individual goods and bads
	Goal	To increase the probability that project alternatives will be selected that do not distribute individual goods and bads in a disproportionate way	To increase the probability that project alternatives will be selected that distribute goods and bads in an equal way	To increase the probability that project alternatives are selected that reduce the gaps between population groups in terms of individual goods and bads

Chapter 5   Possible methodologies to incorporate equity considerations into the Nohal Prat

5.1   Introduction

92.   This chapter provides an overview of the methodologies that can be applied to address equity considerations in the Nohal Prat. The chapter first discusses these methodologies – each of which implies an adjustment in the standard cost-benefit analysis approach – separate from the underlying equity concerns. In the final section, the methodologies will be linked to the matrix of equity considerations presented in the previous chapter.

93.   The chapter distinguishes three basic approaches for addressing equity concerns in cost-benefit analysis. The first approach changes the way in which benefits and costs of a specific project alternative are calculated. Adjustments of this type result in changes in the key outcomes of cost-benefit analysis: C/B ratio, NPV and/or IRR. The second approach does not imply a change in the standard CBA methodology, but adds one or more equity indicators to the standard efficiency indicators generated by cost-benefit analysis. The third approach integrates efficiency and equity indicators into one (set of) indicator(s). Table 5.1 provides an overview of the three approaches. As the table shows, each of the first two approaches encompasses two practical methodologies for integrating equity considerations into cost-benefit analysis, which will be discussed in detail in the subsequent sections of this chapter. The third approach will only briefly be touched upon, given its drawbacks and shortcomings.

94.   The goal of all presented methods is to increase the *probability* that a project alternative with the *most favorable* equity impacts will perform well in the cost-benefit analysis. As discussed before, the proposed methodologies do not aim to guarantee that the most fair project alternative scores best in the calculations. This is because an adjusted cost-benefit analysis should take into account two overarching goals: efficiency and equity. But by assuring that a project alternative characterized by a fair distribution of goods, scores better in the adjusted than in the standard cost-benefit analysis, the probability is increased that in a substantial share of proposed transport projects the most fair alternative will be selected.

Table 5.1 Overview of approaches and methodologies to address equity concerns in cost-benefit analysis.

Approaches	Methodologies	Results
Adjustment in CBA calculation methodology	– Social values – Distributional weights	Adjusted scores of B/C ratio, NPV and IRR
Addition of equity indicator(s)	– Equity coefficient – Equity Impact Sheet	– 'Normal' score of B/C ratio, NPV and IRR – Additional equity indicator(s)
Integration of efficiency and equity indicators	– Various weighting methods	One (or more) indicator(s) replacing efficiency (B/C ratio, NPV and IRR) **and** equity indicators

5.2 First approach: adjustments in CBA calculation methodology

95. The first approach for addressing equity concerns in cost-benefit analysis changes the way in which the key CBA indicators are calculated, resulting in one (set of) indicator(s) that reflect both efficiency and equity. The cost-benefit analysis literature distinguishes between two possible adjustments: social valuation of benefits and costs; and weighting of benefits and costs.[47] As we will discuss below, the methods are only suited to address the principle of equalization. The other two equity concerns – avoidance of disproportionate distributions and basic equality – cannot be dealt with through the proposed adjustments in the CBA methodology. We have not been able to identify or define comparable methodologies that belong to this first approach and address these equity concerns.

5.2.1 Social values

96. The first adjustment in the CBA methodology relates to the way in which the monetary value of costs and benefits are calculated. Standard CBA methodology is based on the use of market prices or market-based prices, such as prices based on willingness-to-pay analyses or opportunity cost method.[48] The use of market-based prices generally implies that one unit of a specific benefit accrued by higher income groups will have a higher monetary value than the same unit for lower income groups. The same is true for costs borne by higher income groups. For instance, higher income groups are highly likely to be willing (and able) to pay more for a minute of travel time savings, than lower income groups. Likewise, they will generally be willing (and able) to pay more than lower income groups in order to avoid costs like an increase in air pollution in their neighborhood. The application in cost-benefit analysis of monetary values based on

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[47] See e.g. Brent 1996 and Campbell and Brown 2003.
[48] See e.g. Campbell and Brown 2003: 267-283; Dodgson and Gonzalez Savignat 1998.

willingness-to-pay or other market-based methods will thus result in the use of different monetary values for different income groups, with higher monetary values ascribed to benefits accrued and costs borne by higher income groups. The latter is especially true in case of normal goods (as opposed to inferior goods) and in cases in which preferences of higher and lower income groups are largely comparable. This may be expected to be the case for key costs and benefits generated by a transport project, such as travel time savings, fatality risk, and air pollution.

97.   The implication of using market-based values is that project alternatives that generate benefits for, or reduce costs for, higher income groups will perform better in the CBA calculations than alternatives that primarily affect weaker population groups, ceteris paribus. This, in turn, will increase the probability that the alternative that generates most benefits for higher income groups will be preferred over other alternatives. The use of the standard CBA methodology thus has direct consequences for the way in which goods and bads related to transport investments are distributed.

98.   This implication of using market-based values was recognized relatively early in the development and application of cost-benefit analysis to transport investments.[49] The use of so-called social values as opposed to market or market-based values is one possibility of dealing with this systematic bias in standard CBA methodology. The concept of social values is based on the acknowledgement that the use of market-based values does not always reflect the value society or decision-makers may ascribe to a benefit accrued by a certain population group. For instance, a decision-maker may ascribe a high value to the reduction in fatality risk for children or elderly given the existing high risk levels among these groups. If so, the decision-maker may decide to value risk reduction for these groups higher than that for other groups or higher than the monetary value derived from a market-based methodology. Another example is the monetary value of a reduction in air pollution levels. While low income groups are highly likely to have a lower willingness-to-pay for a reduction in air pollution due to, at least in part, their lower ability-to-pay[50], a decision-maker may want to ascribe a higher value to air pollution reductions for these groups, for instance because they already suffer high levels of air pollution.

99.   These examples suggest that there may be various reasons to use social values rather than market-based values in the calculation of the total costs and benefits generated by a transport project. More specifically, two applications of social values can be distinguished.

100.   In the first application identical monetary values are used for all population groups. This is generally referred to as equity values. Within the field of transport, equity values have been used in cost-benefit analysis for a variety of costs and benefits, most notably travel time savings, value of life, and air pollution.[51] Like in other countries, the Nohal Prat also prescribes the use of equity values for travel time savings, value of life, and benefits due to a reduction in accidents.

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[49] See e.g. Mackie, Fowkes *et al.* 2003: 3.
[50] See Brent 1996: 240.
[51] See Chapter 1, Section 1.3.

101.   The second application encompasses the use of what can be called 'inverse monetary values'. In this case, decision-makers make explicit a ranking of preferred population groups for each type of benefit and cost. For instance, in case of accident risks the ranking may be children-elderly-others, reflecting the priority that decision-makers attach to the reduction in road fatalities and accidents among, first, children and, second, the elderly. This then translates into the monetary values ascribed to a life in each of these three groups, with the highest value of life ascribed to children and the lowest to the group 'others'. Likewise, in case of air pollution reduction, the ranking may be based on income groups, with the highest monetary values ascribed to the lowest income groups and the lowest values to the highest income groups. The method is called 'inverse monetary values' because it will often imply that groups characterized by high monetary values if a market-based approach is used, will have a low monetary value when using social values, and vice versa.

102.   Both applications of the concept of social values have advantages and disadvantages. The use of equity values will be less controversial than the inverse monetary value approach, as it may be easier to agree that e.g. the value of life should be the same for all population groups, than to agree that the value of the life of a member of a specific population group is higher than that of another population group. The advantage of inverse monetary values is that policy considerations can be explicitly addressed in the CBA methodology. For instance, if decision-makers want to reduce the differences in accident risks between children/elderly and other adults, the use of inverse monetary values may be a very strong tool, as project alternatives that reduce the accident risks for these population groups will score better in the cost-benefit analysis, ceteris paribus.

103.   Note that the application of equity and inverse values only makes sense if decision-makers want to use a transport project to equalize the existing difference in society. The application of social values merely raises the monetary value of the benefits reaped by weaker population groups, which implies that the change in the score of a transport alternative – in terms of NPV, B/C ratio and/or IRR – depends on the amount of benefits the alternative generates for these population groups. The more benefits a project produces for weak groups, the more the score of the project will improve in comparison with the score generated by standard cost-benefit analysis. The application of social values thus increases the probability that a project will be selected that delivers a high share of benefits for weaker population groups. This, in turn, raises the chance that a project will be selected that equalizes the existing differences in society. Note that it is by no means a guarantee. In case all projects widen the existing gaps in society, the application of social values can neither correct nor highlight this.

104.   Note furthermore that social values do not increase the probability that projects will be selected that distribute benefits in an equal way. An example can confirm this. In case equity values would be applied to calculate the monetary value for all costs and benefits generated by a project alternative, and the investment costs of each alternative would be the same, the alternative with the highest level of total benefits (in physical entities) would score best. There is obviously no guarantee that this is the alternative in which

benefits are distributed in an equal way. A comparable argumentation holds for the use of inverse values.

5.2.2   Weighting of benefits and costs

105.   The second method to include equity considerations in the CBA methodology is the use of so-called distributional weights in the calculation of net benefits of a transport project. Like social values, this methodology is only suited to address the principle of equalization. The use of weighting has been discussed extensively in the literature.[52] Here, we follow Campbell et al. (2003) in order to explain the methodology underlying distributional weights.[53]

106.   Suppose a government has to select one transport project from a set of three alternatives. Table 5.2 describes the three alternatives in terms of total net benefits and the way in which they are distributed over the two relevant population groups (rich and poor). Following the logic underlying cost-benefit analysis, Project B can be rejected on economic efficiency grounds – its total net benefits are lower than those of both A and B *and* the distribution of benefits over rich and poor is less egalitarian than that of either Project A or C. So the question remains whether to choose A or C. Since both projects have the same total net benefits, the focus can be on the way in which the benefits are distributed over the income groups. Given the goal of equalizing existing income gaps, Project C will be preferred. Aggregate net benefits are the same, but the distribution of benefits is more favorable towards the poor than in the case of Project B.

Table 5.2 Comparison of projects with different distributions of net benefits.

	Referent Group Net Benefits ($ NPV)		
Project	Rich	Poor	Total
A	60	40	100
B	50	30	80
C	20	80	100

107.   The situation becomes more complex if efficiency and equity do not go together. Table 5.3 provides an example. The table presents two projects. Project D scores best in terms of total net benefits, but leads to an income redistribution in the non-preferred direction (regressive). Project E does lead to income distribution in the preferred direction (from rich to poor), but generates less total net benefits than Project D. Which project is to be preferred? Project D would be preferred on purely economic efficiency grounds, whereas Project E might be preferred on purely distributional grounds. In case there is a commitment to both the objectives of economic efficiency and income distribution, a conflict arises.

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[52] See e.g. Schofield 1987; Brent 1996; Campbell and Brown 2003.
[53] Campbell and Brown 2003.

Table 5.3 Comparison of projects with different aggregate benefits and distributions.

	Referent Group Net Benefits ($ NPV)		
Project	**Rich**	**Poor**	**Total**
D	60	40	100
E	40	50	90

108.   The system of distributional weights has been developed to solve the conflict in a mathematical way. The distributional weights basically state which 'value' is attached to each dollar of net benefit received by the poor and which 'value' is attached to the same net benefit accrued by the rich. Since the underlying equity goal is to distribute income from the rich to the poor – in other words: equalization of existing gaps in income – the value ascribed to the poor will be higher than the value ascribed to the rich. For instance, each additional dollar received by the poor could be valued three times as much as an additional dollar received by the rich. The weight for the rich is thus 1.0 and the weight for the poor is 3.0. Using these distributional weights, the weighted benefits of a project can be calculated. Table 5.4 shows the results. Based on the results of the calculation, Project E is favored, as the total value of its net benefits, adjusted according to the distributional weights, exceeds that of Project D.

Table 5.4 Application of distributional weights to project net benefits.

	Referent Group Net Benefits ($NPV)			Weighted (Social) Benefits ($)		
Project	**Rich**	**Poor**	**Total**	**Rich**	**Poor**	**Total**
D	60	40	100	(60x1.0)+(40x3.0) = 180		
E	40	50	90	(40x1.0)+(50x3.0) = 190		

109.   The explanation above links the distributional weights to the net benefits generated by project alternatives. This is not the only possible application of distributional weights. The methodology can also be used at the level of individual costs and benefits.[54] In that case, weights are used to recalculate the net benefits that result from e.g. travel time savings or reductions in air pollution produced by a transport project. The advantage of this method is that different distributional weights can be ascribed to different goods or bads.

110.   Table 5.5 provides an example of the application of distributional weights to individual goods and bads. The table presents three benefits generated by a transport project and the way in which they are distributed over two population groups (rich and poor). For each benefit, distributional weights are ascribed to the benefits reaped by the poor and those by the rich. In the table, the travel time savings received by the poor are valued twice as high

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[54] See Feldstein 1972, quoted in Brent 1996: 245-246.

as those accrued by the rich. In case of vehicle operation costs, the weight for the poor is even three times as high as the weight for the rich. In both cases, the higher weights ascribed to the poor may be motivated by the existing gaps in potential mobility between rich and poor. The relatively high importance of costs in the decisions of the poor to travel, in turn, motivate the even higher weights ascribed to vehicle operation costs reaped by the poor. Note finally, that the methodology also enables the use of 'equity weights', in case the benefits reaped by each group are considered equally important. In the table, this concerns the reduction in road fatalities. The application of distributional weights at the level of individual costs and benefits rather than at the level of net benefits thus makes it possible to relate explicitly to various policy considerations.

111.   The application of distributional weights to individual goods is basically identical to the use of social values in cost-benefit analysis. The difference lies primarily in the need for justification. In the case of social values, the discussion centers on the monetary value to ascribe to each of the population groups. This mixes a basically political issue – the value attached to benefits for each population group – with a rather technical issue – how to calculate the monetary value of a specific benefit. In case of weighting, the technical issue remains within the realm of economics, and the discussion can concentrate on the political considerations.[55, 56]

Table 5.5 Application of distributional weights to individual costs and benefits.

Benefit	Income group	Project output	Value per unit in NIS	Total benefits in NIS	Weights	Adjusted benefits
Travel time savings	Poor	7,000 hours per year	25	175,000	2	350,000
	Rich	18,000 hours per year	60	1,080,000	1	1,080,000
Reduction in vehicle operation costs	Poor	5,000 NIS per year	--	5,000	3	15,000
	Rich	12,000 NIS per year	--	12,000	1	12,000
Reduction in fatalities	Poor	4 lives per year	50,000	200,000	1	200,000
	Rich	1 live per year	100,000	100,000	1	100,000

112.   Note that, like in the case of social values, the goal of the application of distributional weights is not to make sure that alternatives benefiting lower income groups *always* score better in cost-benefit analysis. As the first example above shows, the application of the weights merely makes sure that investment projects resulting in an income redistribution in the preferred direction – from higher income groups to lower income groups – score

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[55] See Galvez and Jara-Diaz 1998 for a comparable discussion on social values. They develop a methodology that isolates what is a political decision (the social weight of individual welfare) from what is a technical issue (the measure of subjective valuations of e.g. travel time savings).

[56] Note KM: The application of distributional weights has as a result that the share of the benefits that are weighted in the total net benefits will increase, at the expense of the benefits that are not weighted.

relatively better in the cost-benefit analysis than projects that do not result in any income redistribution or in a redistribution in the opposite direction. The weights thus increase the probability that in a substantial share of proposed transport projects an alternative will be selected that benefits lower income groups.

113.   Finally, it is important to note that the key problem with using distributional weights lies in establishing the height of the weights. While various methods have been developed to establish the weights, it remains a highly controversial and political issue.[57] This is often used as an argument against the use of weights – if there is no proper way to establish the weights, the use of weights implies the inclusion of an arbitrary element into the CBA systematic.[58] The counter-argument is that distributional weights are always used, either implicitly or explicitly. In case 'no' weighting is applied, implicitly equal weights are ascribed to the net benefits accruing to different population groups.[59] While this latter line of reasoning provides a strong argument in favor of weighting, it has not led to a widespread application of distributional weights in cost-benefit analyses as applied in the field of transport.[60] This, without doubt, is a consequence of the fact that the setting of distributional weights is a political rather than a professional issue, given the lack of an agreed-upon methodology.

5.3   Second approach: adding equity indicators

114.   The second approach to address equity considerations in cost-benefit analysis is by adding equity indicators to the standard efficiency indicators generated by cost-benefit analysis (B/C ratio, NPV, IRR). This approach is fundamentally different from the one discussed above, as it does not require a change in the standard CBA methodology and it does not impact the score of project alternatives on each of the efficiency indicators. The equity indicators also do not come instead of these indicators, but add a new output to the CBA systematic, employing the data used for, and generated by, the CBA calculations. This approach of adding equity indicators widens the scope of cost-benefit analysis as a decision-support tool.[61] Also, by providing two sets of indicators, the weighting of efficiency versus equity would be left to decision-makers and could become an explicit part of the discussions between the various bodies involved in selecting the preferred project alternative. This, too, is fundamentally different from the first approach, in which the equity implications of project alternatives are integrated into the CBA calculations, thereby 'hiding' these implications from decision-makers.

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[57] One method is the establishment of implicit distributional weights used in previous projects and apply them to the project under consideration (see e.g. Campbell and Brown 2003: 253-254; Brent 1996: 249-252). Galvez discusses another method, in which distributional weights are related to the existing tax system in a country (Galvez and Jara-Diaz 1998; Jara-Diaz 2000: 313). Finally, the United Nations has developed a method in which distributional weights can be made explicit and discussed in relation to the net benefits generated by various project alternatives (see Campbell and Brown 2003: 252-253).
[58] E.g.Campbell and Brown 2003.
[59] See e.g. Brent 1996: 239; Campbell and Brown 2003: 245.
[60] See the special issue on cost-benefit analysis of *Transport Policy*, Volume 7, Issue 1 (2000).
[61] See Campbell and Brown 2003: 268 for a brief discussion of cost-benefit analysis as a decision-support tool.

115.   Two basic methods can be distinguished to add equity indicators to standard CBA methodology: (1) equity coefficient; and (2) equity impact sheet. Both methods are discussed below.

5.3.1   Equity coefficient

116.   The Webster dictionary defines a coefficient as 'a factor that measures some property'.[62] Analogous, an equity coefficient can be defined as a factor that measures the extent to which a project alternative has equity properties. In other words, the score of a project alternative on an equity coefficient indicates the extent to which a specific good or bad is distributed in an equitable way over population groups. As discussed in the previous chapter, an equitable distribution can be defined in different ways: as the avoidance of disproportionate distributions, as equality, or as equalization. Since each of these equity principles uses a different benchmark to judge whether a specific distribution is just or not, each of these principles also requires a different equity coefficient. In this section, we will focus on a coefficient to measure equality in distribution. Comparable measures as the one presented here could be developed to assess the extent to which a project alternative stands up to the ADD principle or the principle or equalization.

117.   Probably the most widely used equity coefficient to measure the level of equality is the so-called Gini coefficient.[63] It is usually used to measure income inequality, but can be used to measure any form of uneven distribution, including the distribution of the various costs and benefits calculated in cost-benefit analysis. The Gini coefficient is calculated using the so-called Lorenz curve, as depicted in Figure 5.1.[64] The Lorenz curve shows the cumulative percentage of the population and the cumulative percentage of a certain good (such as income, travel time savings, or net benefits). If there is perfect equality among all households, the Lorenz curve would be a straight line or diagonal, indicating that $x\%$ of the population receives $x\%$ of a specific good for all values of x between 0 and 100. The deviation of the Lorenz curve from this diagonal indicates the degree of inequality. The greater the extent of the deviation, as shown by the shaded area in Figure 5.1, the greater the degree of inequality.

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[62] The Webster dictionary defines an indicator as 'thing that indicates a state or a level'.

[63] The coefficient is named after the Italian statistician Corrado Gini, who developed the measure in the 19th century.

[64] See e.g. Campbell and Brown 2003: 240-242. A simple explanation of the Lorenz curve and the calculation of the Gini coefficient can also be found at http://en.wikipedia.org/wiki/Gini_coefficient#Calculation.

Figure 5.1 The relationship between Gini coefficient, line of perfect equality and the Lorenz curve.[65]
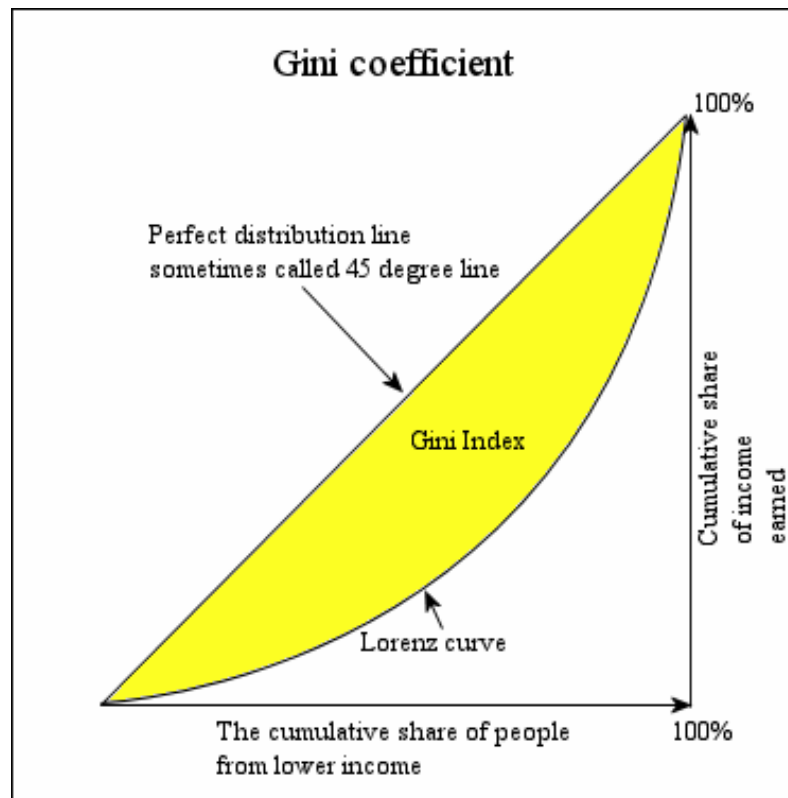

118.   The Gini coefficient expresses the degree of inequality in a numerical way. Traditionally, the Gini coefficient is calculated in the following way. If the area between the line of perfect equality and Lorenz curve is A, and the area underneath the Lorenz curve is B, then the Gini coefficient is A/(A+B). This ratio is expressed as a percentage or as the numerical equivalent of that percentage. This numerical equivalent is always a number between 0 and 1, where 0 corresponds with perfect equality (in which case a good is evenly distributed over all population groups) and 1 corresponds with perfect inequality (in which case one population group owns all goods under consideration). This way of calculation is appropriate for the traditional application of the Gini coefficient, the measurement of income inequality within and in-between countries. For this application, the population is divided into income groups, starting with the poorest income group on the left side of the *x* axis in Figure 5.1. The cumulative income is placed on the *y* axis. In such a case, the Lorenz curve will virtually always lie below the line of perfect equality (unless income is indeed distributed in a perfectly equal way between population groups) and the formula mentioned above can be applied without problems.

119.   But the Lorenz curve does not necessarily lie *below* the line of perfect equality. If the methodology is applied to other goods (or bads) than income, the curve might as well lie

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[65] Source: www.wikipedia.com.

above this line of perfect equality. For instance, the net benefits generated by a transport project could well be distributed in a *progressive* way over population groups, with poorer income groups receiving *more* net benefits than richer population groups. In such a case, the Lorenz curve lies *above* the line of perfect equality (see Figure 5.2). In order to make adequate use of the Gini coefficient, it is necessary to redefine the way in which the coefficient is calculated.[66] Let C be the area below the line of perfect equality and let B be the area below the Lorenz curve. Then the Gini coefficient can be expressed as -(C-B)/C. Using this formula, the range of the Gini coefficient runs from -1 to +1, with -1 to 0 reflecting various degrees of regressive distributions, 0 reflecting perfect equality, and 0 to +1 reflecting various degrees of progressive equality.

Figure 5.2 Example of a progressive distribution of a benefit, with the Lorenz curve positioned above the line of perfect equality.
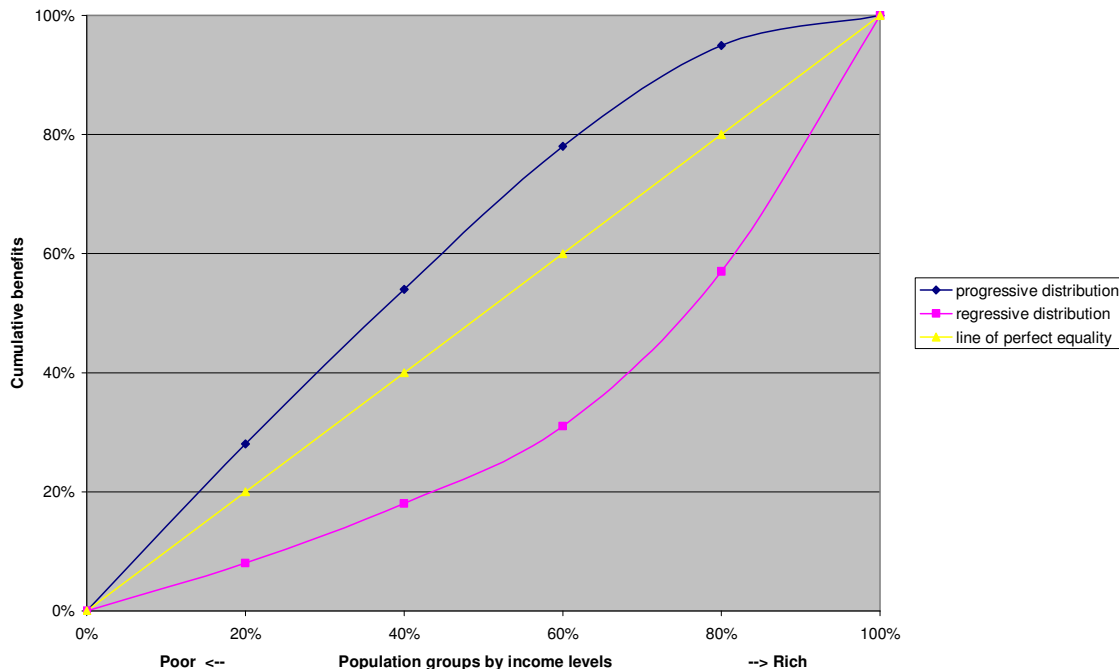
120.   The Gini coefficient is a convenient measure to compare alternatives with each other. Because of this it can be easily combined with the standard CBA methodology. Two types of applications can be distinguished. In the first, the Gini coefficient is applied to assess the distribution of the total net benefits over population groups distinguished by level of income. Such an approach would be closest to the common application of the Gini coefficient, the distribution of income over population groups. Note that the proposed addition of the Gini coefficient implies that the CBA methodology will generate

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[66] This is primarily important for sake of clarity. In the standard application of the Gini coefficient the scale runs from 0 to 2, with 0 reflecting perfect equality, 0-1 reflecting various degrees of regressive distributions, and 1-2 reflecting various degrees of progressive distributions. This obviously calls for confusion.

for each project alternative the known set of efficiency indicators (B/C ratio, NPV and IRR) and one additional equity indicator (the Gini coefficient).

121.   The second possibility is to apply the Gini-coefficient separately to the various costs and benefits included in cost-benefit analysis. The underlying thought is that even if net benefits are distributed fairly over various population groups, it does not imply that each of the costs and benefits is distributed in a just way. By separately calculating the way in which benefits like travel time savings, reductions in air pollution, or reductions in road fatalities are distributed over income groups, a more complete picture of the equity implications of each project alternative can be produced. In this case, the result of the CBA methodology is a set of efficiency indicators and a set of equity indicators (Gini coefficient per benefit and cost).

122.   Note that in order to apply the Gini coefficient certain requirements have to be fulfilled. Like in the case of distributional weights, the application of the Gini coefficient demands that all benefits and costs are expressed in quantitative terms and can be linked to population groups. Following the standard application of the Gini coefficient, it is most obvious to define costs and benefits in monetary terms and to distinguish population groups by level of income, although this is not absolutely necessary. Furthermore, the application of the Gini coefficient requires a 'normal' progressive or regressive distribution of benefits or costs over population groups. If this is not the case, the Gini coefficient may be close to 0 while the actual distribution of benefits is far from equal, for instance in case the vast majority of benefits of a transport investment is reaped by middle income groups at the expense of both low and high income groups (see Figure 5.3).[67] These requirements obviously limit the possible application of the Gini coefficient.

123.   Finally, it needs to be stressed that the Gini-coefficient is only suitable in case equality is considered to be the morally proper way to distribute benefits and/or costs over members of society. The coefficient is not suited to shed light on the extent to which a specific transport project conforms to the criteria of avoidance of disproportionate distributions or equalization. For both latter cases, separate equity indicators will have to be developed. This, however, is beyond the scope of the current report.

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[67] This would require yet another way of calculating the Gini coefficient, whereby the areas between the Lorenz curve and the line of perfect equality are added to one another, so as to avoid that the Gini coefficient will be close to 0 in case of high levels of inequality. See Sen 1973, Chapter 2.

Figure 5.3 An 'abnormal' or skewed distribution of net benefits over population groups results in a Gini coefficient close to 0 despite the substantial deviations from the line of perfect equality.
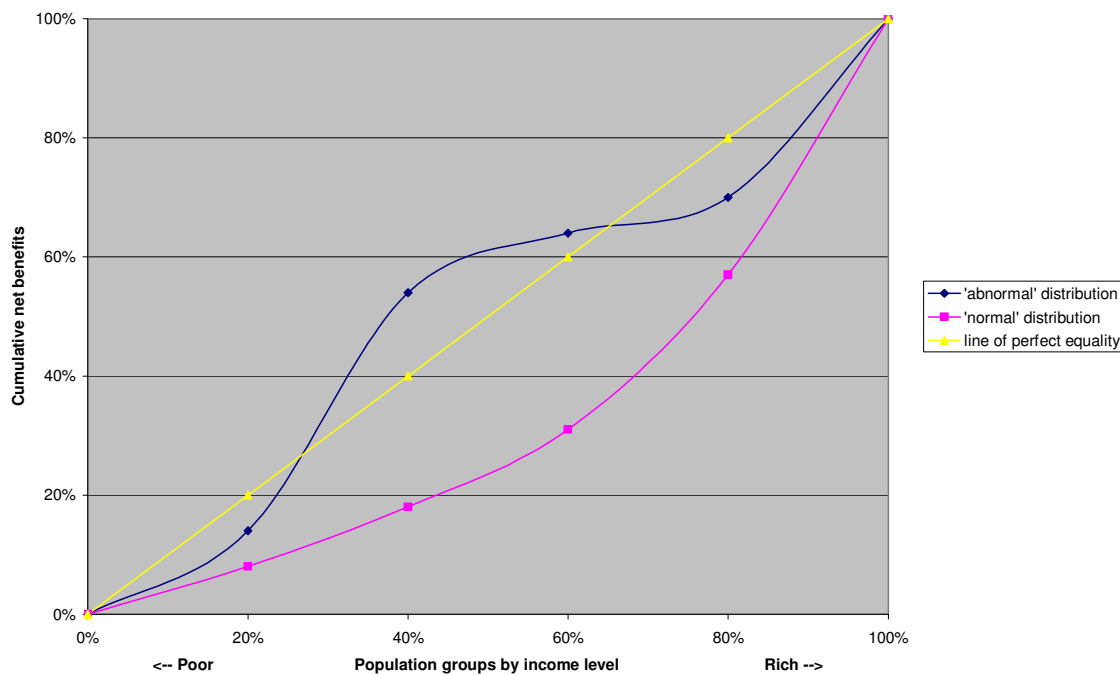
5.3.2   Equity impact sheet

124.   The equity impact sheet is the second method that addresses equity considerations in cost-benefit analysis by adding a set of indicators to the traditional CBA output. Whereas the equity coefficient follows a large body of literature, the equity impact sheet is not an existing method to address equity concerns. However, the method is relatively straightforward and largely comparable to existing methods such as the planning balance sheet and methods used in the field of Multi-Criteria Analysis.[68] It is also similar to the relatively recent approach to transport project appraisal in the UK, which includes a so-called Appraisal Summary Table.[69] Like these approaches, the equity impact sheet (EIS) provides an overview of the various costs and benefits generated by different project alternatives. The main difference with other appraisal sheets or tables, with the exception of the planning balance sheet, is that the EIS provides an overview of the distribution of costs and benefits over relevant population groups.

125.   The EIS has a number of basic characteristics. First, it does not require the translation of costs and benefits into monetary terms. Each of the benefits and costs can be specified in units relevant to the project impact under consideration. Thus, improvements in road safety can be expressed in terms of the reduction in the number road fatalities as a result

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[68] This approach was developed in the 1960s by Nathaniel Lichfield. See e.g. Lichfield 1960.

[69] See Vickerman 2000 for a brief discussion of the UK appraisal methodology.

of a project. Or travel time savings can be expressed in the number of minutes or hours saved due to a specific project alternative.

126.   Second, the EIS does not require a uniform distinction in population groups for all costs and benefits. Rather, the classification of population groups can be matched with the characteristics of the cost or benefit under consideration. Thus, when assessing the reduction in road fatalities, the categorization of population groups can be based on differences in vulnerability, e.g. by using a classification by age. Likewise, when analyzing the distribution of increases in air pollution as a result of a project, the population could be distinguished by current levels of air pollution. This would make it possible to show whether a project has a strongly negative impacts for population groups already suffering from high levels of pollution. Obviously, the EIS also enables a uniform classification of population groups, e.g. by levels of income.

127.   A third basic feature of the EIS is that it does not call for the inclusion of all costs and benefits. The EIS could only cover those benefits, whose distribution is considered of importance in the selection of a preferred alternative. Thus, road safety could be included in the EIS, whereas the distribution of reductions in noise levels is left out. Alternatively, the EIS could only encompass data on the distribution of net benefits over income groups, thereby providing an alternative for the use of distributional weights or equity coefficients (like the Gini coefficient). The decision on what to include may depend on the type of project that is under consideration, as well as on political considerations. An example of the first may be the scale of the project, whereby large scale projects may call for a more comprehensive EIS given the possible distributional impacts of such projects. An example of the second may be political priorities, such as an emphasis on road safety or on a reduction in air pollution.

128.   Following these basic characteristics, the EIS can take various sizes and shapes. Table 5.6 provides an example of what an EIS could look like. In this case, two project alternatives are compared. The EIS includes three benefits and presents the way in which these are distributed over three population groups distinguished by income level. The table shows that in case of Alternative A, middle and high income groups reap a relatively large part of travel time savings and reductions in vehicle operation costs (VOC), while the low income group collects a relatively large share of the reduction in road fatalities. In comparison, Alternative B distributes a substantial higher share of travel time savings and reductions in VOC to the low income group, but substantially less to the high income group.

Table 5.6 Example of an equity impact sheet (EIS) comparing the distribution of three benefits over three income groups, for two project alternatives.

	Total	Alternative A			Alternative B		
		Income group			Income group		
		Low	Middle	High	Low	Middle	High
Share in population	470,000 affected people	32%	50%	18%	32%	50%	18%
Travel time savings	35,000 hours per year	14%	63%	23%	23%	71%	6%
Reductions in VOC	27,000 NIS per year	11%	67%	22%	17%	74%	9%
Reduction in road fatalities	22 lives per year	55%	32%	14%	48%	32%	20%

129. The range of data included in the EIS and the way they are presented will depend on a number of factors, including the political weight attached to the various costs and benefits addressed in cost-benefit analysis, the type of project, and the underlying equity considerations. In case of Table 5.6, the implicit equity concern is for an equal distribution of benefits over various population groups. For this reason, the share of each group in the total population is presented in percentage points, as is the share of benefits each group receives. In this way, it is relatively easy to assess whether benefits are distributed in an equal way or not. In case other equity considerations motivate the application of an EIS, other ways of presentation may be preferred. For instance, if decision-makers want to use transport investments to reduce the gaps between population groups with regard to e.g. travel times or road fatalities, the EIS will have to present data that link the distribution of benefits and costs of the project to the current distribution of the relevant goods.

130. Finally, it should be noted that substantial thought has to be given to the decision which figures to present in the EIS. Especially the presentation of information on the distribution of net benefits may be problematic, given the existing Nohal Prat framework. This is because the recently adjusted Nohal Prat prescribes the use of equity values for, among others, travel time savings. These equity values are lower than the willingness-to-pay values of stronger population groups, and higher than the willingness-to-pay values of weaker population groups. The presentation of net benefits data taken *directly* from the CBA calculations will thus exaggerate the net benefits for the poor, while understating the 'real' monetary benefits reaped by the rich. This in turn, may result in a positive evaluation of a project alternative from the perspective of justice, while in actual fact the alternative results in a highly skewed distribution of benefits over various population groups. Note that this line of reasoning also holds for some applications of the equity indicator.

5.4   Third approach: integrating efficiency and equity into one indicator

131.   The third approach to address equity considerations in cost-benefit analysis encompasses the integration of efficiency and equity indicators into one comprehensive indicator. The approach provides primarily and alternative for the second approach. The drawback of this approach is that it generates two sets of indicators, without providing decision-makers or decision-takers with clear guidance on the relative importance of each of the indicators. This could lead to a lack of clarity, consistency and accountability in a crucial part of the decision-taking process, in which project alternatives are compared with each other and preferences formed.[70] The third approach solves this problem by introducing a methodology to link efficiency and equity indicators into one comprehensive indicator.

132.   The approach requires, first of all, a separate calculation of efficiency and equity indicators, where the score on the efficiency indicators can be calculated using the standard CBA methodology. As for the equity indicators, one of the methodologies belonging to the second approach will have to be used. The second step of the approach encompasses the integration of both (sets of) indicator(s) into one comprehensive indicator. The shape of this second step will depend on the choice of indicators in the first step, and vice versa. The literature on Multi Criteria Analysis provides various methods to integrate the scores on a set of criteria.[71] Specific methods have also been developed for application in the evaluation of transport options.[72]

133.   The development of the third approach is beyond the scope of the report, for a number of reasons. First, the integration of efficiency and equity indicators is not a straightforward matter, but requires the development of a methodology that is suitable for the application in the field of transport. Second, in order to generate a score on the overarching indicator(s), weights will have to be ascribed to the equity and efficiency indicators in order to generate an overarching indicator. Like in the case of distributional weights, the setting of these weights is a political rather than a professional matter. The combination of a complex methodology and a heavy political element may actually create an indicator that obscures more than it reveals about transport investments. Against this background, it was decided not to develop the third approach further within the scope of this report.

5.5   Advantages and drawbacks of the approaches

134.   Each of the approaches for integrating equity considerations in cost-benefit analysis has advantages and drawback. The discussion below focuses on the first and second approach, as well as on the methodologies that belong to each of the approaches.

135.   The advantage of the first approach is that it remains close to the current practices. The approach generates only one (set of) efficiency indicators, and as such does not require

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[70] See Sayers, Jessop *et al.* 2003: 95.
[71] See e.g. Stewart 1992; Dodgson, Spackman *et al.* 2000; Sayers, Jessop *et al.* 2003.
[72] See e.g. Sayers, Jessop *et al.* 2003.

changes in the way projects alternatives and projects are evaluated against one another. The numbers change, but the decision-making processes can remain the same. Because only (a set of) efficiency indicators are generated, relatively easy comparison between alternatives, as well as between projects, remains possible. This is a clear advantage of this first method over the second approach (see below). The drawback of the first approach is that the equity impacts of project alternatives and projects remain hidden from decision-makers and the wider public alike, and as a result do neither enter the political discussions nor the wider discourse about transport projects and their impacts.

136. These (dis)advantages obviously also apply to the two methodologies belonging to the first approach. In addition, each of the methodologies has its own pros and cons. The advantage of the social values methodology is that it makes it possible to directly translate specific political or policy concerns into the CBA methodology. The drawback is that it will be politically difficult to agree on other social values than equity values, which severely limits the advantage of the methodology. The same weakness applies to distributional weights, which have hardly been applied in practice precisely because of the political problems in setting the heights of the weights. The advantage of the distributional weights is the simplicity of the methodology – it leaves the basic CBA methodology intact and only adds one step to the calculation of the key indicators. These drawbacks of the methodologies also reflect back on the approach itself. Given the political character of the setting of inverse social values and distributional weights, the actual strength of the approach is substantially diminished.

137. The (dis)advantages of the second approach are to some extent a mirror image of those of the first. The prime advantage of the second approach is that the equity impacts of transport alternatives and projects are made explicit, to both decision-makers and the wider public. This allows for an explicit discussion of the equity aspects of transport investments, as well as explicit weighting of equity versus efficiency. The separate presentation of equity and economic impacts in two (sets of) indicator(s) also has its drawbacks. Most notably, it does not give any guidance to decision-makers on how to relate to each of the indicators. This could lead to a lack of clarity, consistency and accountability in a crucial part of the decision-taking process.[73] In addition, it could marginalize the importance of the equity impacts in the actual decision-making process, since it will be difficult to evaluate projects of different size and scope using a double set of indicators. For instance, how to compare a project with a B/C ratio of 2.3 and a Gini coefficient of 0.4, with a project that has B/C ratio of 2.7 and a Gini coefficient of 0.2?[74] It is exactly this problem that has led to the development of integrated indicators in the field of Multi-Criteria Analysis, as proposed in the third approach.

138. The (dis)advantages of the methodologies belonging to the second approach have been briefly discussed above. The main advantage of using an equity coefficient is its clarity.

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[73] Sayers, Jessop *et al.* 2003: 95.

[74] The figures are based on the adjusted Gini coefficient discussed on Section 5.3.1, with -1 to 0 reflecting various degrees of regressive distributions, 0 reflecting perfect equality, and 0 to +1 reflecting various degrees of progressive equality. The 0.4 score of the first alternative is thus better than the 0.2 score, assuming that decision-makers want to equalize the differences in income.

The Gini-coefficient, as well as possible alternatives, indicates the 'equity level' of a project alternative in one simple number that is easy to interpret. Obviously, the simplicity will be somewhat diminished if a coefficient is calculated separately for each benefit or cost. The weakness of the Gini coefficient is the fact that it requires a 'normal' distribution of benefits (or costs) over population groups. This problem may also exist for other equity coefficients. The equity impact sheet is more flexible in this respect, but is less easy to interpret because it provides a wide variety of information to decision-makers.

139. Table 5.7 provides an overview of the (dis)advantages of the various approaches and methodologies. These obviously need to play a role in the selection of the preferred methodology, but a selection is not possible without linking the methodologies to the equity concerns that are on the agenda of decision-makers, involved parties, and the wider public.

Table 5.7 Comparison of approaches and methodologies to address equity considerations in cost-benefit analysis.

	First approach	**Second approach**
Advantages	- Close to current practice - Easy comparison of alternatives and projects	- Explicit presentation of equity impacts - Less sensitive to political decisions on methodology
Disadvantages	- Equity impacts hidden	- Lack of clarity about the importance of equity indicator(s) in decision-making - Risk of marginalization of equity considerations - Difficult to compare alternatives and projects

	Social values	**Distributional weights**
Advantages	- Sensitive to policy and political preferences	- Simple methodology
Disadvantages	- Politically difficult to agree upon values	- Politically difficult to agree upon weights

	Gini coefficient	**Equity Impact Sheet**
Advantages	- Easy to interpret	- Complete overview of equity impacts
Disadvantages	- Application in case of 'normal' distribution of benefits/costs	- Difficult to interpret

5.6   Summary

140.   This chapter has provided an overview of the methodologies that can be used to address equity concerns within the framework of the Nohal Prat. Two main approaches have been distinguished: (1) approaches methodologies that change the way in which the key CBA indicators are calculated; and (2) approaches that add a (set of) equity indicator(s) to the existing set of efficiency indicators generated by standard cost-benefit analysis. Each of these approaches encompasses two practical methodologies to integrate equity considerations into the Nohal Prat.

141.   The methodologies that belong to the first approach are:
   −   *Social values* ascribe other than market-based values to benefits or costs generated by a transport project depending on the group that reaps the benefits or bears the costs (e.g. higher values for travel time savings by lower income groups).
   −   *Distributional weights* ascribe weights to benefits or costs generated by a transport project depending on the group that receives the benefit or cost (traditional discussed in the literature only in relation to the net benefits of a transport project).

142.   The methodologies that belong to the second approach are:
   −   *Equity indicator(s)* translates the way in which benefits/costs are distributed over population groups into one (set of) indicators (e.g. an adjusted version of the Gini coefficient).
   −   *Equity impact sheet* presents the way in which benefits/costs are distributed over population groups in a (comprehensive) table (e.g. presentation of the percentage each population group receives of a certain set of benefits).

143.   The four methodologies can now be confronted with the matrix of equity considerations presented in the previous chapter. This results in an overview of the way in which the various equity concerns could be addressed within the Nohal Prat framework. Table 5.8 provides the results. The table highlights a number of conclusions.

144.   First, the table shows that the methodologies that imply a change in the CBA calculations are only relevant if one wants to use transport projects to *equalize* existing gaps in society. These methodologies – social values and distributional weights – cannot be used if one is concerned about an equal distribution of goods, or about the avoidance of disproportionate distributions.

145.   Second, both social values and distributional weights can be used for all goods distributed through a transport project. Thus, while the discussion on weighting tends to focus on net benefits, its application is not necessarily limited to these overall benefits. This observation suggests that, from a methodological perspective, weighting is to be

preferred over social values, given the drawbacks of the latter.[75] However, politically, social values may be preferred, as it will be easier to generate (political) support for the use of equity values for e.g. travel time savings, than to ascribe higher weights to the travel time savings reaped by the poor and lower weights to those received by the rich.

146.   The table shows, in the third place, that the methodologies belonging to second approach can be applied for all nine equity considerations distinguished in this report. This does not imply that the equity indicator or equity impact sheet will take the same shape in each case, but it does imply that the same basic methodology could be applied in all cases. This may be of benefit if decision-makers want to address various equity considerations at the same time.

Table 5.8   Overview of the methodologies that can be used to address the nine equity considerations distinguished in the report.

Goods and bads	Methodologies	Distributive principles		
		Avoidance of disproportionate distributions	Equality	Equalization
Net benefits	First approach	--	--	Weighting (Social values)
	Second approach	Equity impact sheet Equity indicator	Equity coefficient (e.g. adjusted Gini) Equity impact sheet	Equity coefficient Equity impact sheet
Mobility-enhancing benefits	First approach	--	--	Social values (Weighting)
	Second approach	Equity impact sheet Equity indicator	Equity coefficient (e.g. adjusted Gini) Equity impact sheet	Equity coefficient Equity impact sheet
Individual goods and bads	First approach	--	--	Social values (Weighting)
	Second approach	Equity impact sheet Equity indicator	Equity impact sheet Equity indicator	Equity impact sheet Equity indicator

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[75] Social values mix the technical issue of assessing the monetary value of a benefit, with the political issue of ascribing a value to the benefit accruing to each population group. See also Section 6.2.2 and Galvez and Jara-Diaz 1998.

Chapter 6   Summary and concluding remarks

6.1   Introduction

147. This chapter brings together the findings presented in the previous chapters. It will start with a very brief discussion of standard cost-benefit analysis and the implications of addressing equity issues within its framework (Section 6.2). Then, a systematic review will be provided of nine different equity concerns that may motivate the adjustment of standard cost-benefit analysis, or, more specifically, the Nohal Prat (Section 6.3). Section 6.4 presents an overview of the methodologies than can be used to address the nine equity considerations within the framework of the Nohal Prat. The subsequent section provides an overview of the advantages and disadvantages of the various methodologies, which need to be taken into account in the decision-making process on how to deal with equity issues in the Nohal Prat. The final section of the chapter turns to the application of the equity analysis in actual practice (Section 6.6).

6.2   Equity and standard cost-benefit analysis

148. Every new transport project – whether it concerns a new a bridge, the widening of an existing road, or the creation of a free bus lane – generates various costs and benefits. These include, for instance, reductions or increases in travel times, in vehicle operation costs, in air pollution, or in accident risks.

149. Standard cost-benefit analysis is a tool to assess whether the monetary value that can be attached to the benefits generated by a proposed transport project exceeds the monetary value that can be attached to the costs related to that project. This assessment results in a judgment of the economic *efficiency* of a transport project, which can be defined as the maximization of the net contribution of the project to the national income. The more the benefits exceed the costs, the more worthwhile a project is from an economic efficiency perspective. Cost-benefit analysis traditionally generates three indicators on the economic efficiency of a project: cost-benefit ratio (C/B ratio), net present value (NPV, and internal rate of return (IRR). This information generated by standard cost-benefit analysis - or its Israeli variety: the Nohal Prat – thus assists decision-makers to select the most *efficient* project from a set of possible alternatives.

150. The issue of *equity* directs the attention to the question on how the costs and benefits generated by a proposed transport project are *distributed* over various population groups. The question from an equity perspective is whether this distribution is fair, just or

equitable. The Nohal Prat or other cost-benefit analyses used around the world are not suited to provide information on the distribution of costs and benefits. The wish to address equity issues within the CBA or Nohal Prat framework thus requires an adjustment of the existing tool in such a way that it will not only generate information on the economic efficiency of a transport project, but also on the equity of that project. In other words, the ambition to address equity considerations implies that cost-benefit analysis will have to develop from a tool that assists decision-makers to rate projects from one perspective (efficiency), into a tool that can help decision-makers to rank projects from two – sometimes opposed – perspectives (efficiency and equity). The issue of equity has thus much farther-reaching consequences for cost-benefit analysis than, for instance, the integration of additional costs, such as environmental externalities, in the CBA calculations.

6.3   A matrix of equity considerations

151.   Equity – often also referred to as justice or fairness – can be defined as the morally proper distributions of goods and bads over members of society. This definition draws the attention to the three key elements of equity:
   (1) the *goods and bads* or benefits and burdens that are distributed through a government intervention;
   (2) the *members of society* over whom the goods and bads are being distributed; and
   (3) the *distributive principles* that determine what kind of distribution of the goods and bads under discussion is considered to be fair.

152.   The assessment of the equity impacts of a proposed transport project requires that explicit attention is paid to each of these elements and that they are linked to each other in a coherent way. It has to be clear:
   (1) *In which goods we are interested?* E.g. are we concerned about the distribution of the extra air pollution resulting from a transport project? Or are we more interested in the distribution of the net benefits generated by that project?
   (2) *In which population groups are we interested?* Are we concerned that children will suffer from increased levels of air pollution? Or are we more worried that the citizens of certain areas will not profit from transport projects? Or, alternatively, do we care first and foremost about the impacts of a transport project on low income groups?
   (3) *Which distribution do we consider to be fair?* Do we aspire for an equal distribution, a distribution in which each citizen receives exactly the same amount of benefits and costs? Or do we consider it fair that a transport project reduces existing gaps in society, e.g. in income levels? Or do we use yet another yardstick to judge whether a specific distribution is fair or not?

153.   The answer to each of these questions is obviously not only a matter of sound analysis. It requires just as much a (society-wide) debate that invokes values. Against this

background, the report only aims to frame the discussion by providing possible answers to each of the questions. These answers can then feed the decision-making process about which equity issues to address within the Nohal Prat framework and which methodologies to use to address them.

6.3.1   Goods and population groups

154.   The report has identified three possible answers to the first question *'In which goods are we interested?'* Each answer to this question, in turn, also includes a suggestion on how to divide the population into groups and thus to answer the second question posed above.

155.   The first answer to the first question states that cost-benefit analysis is first and foremost about the distribution of *net benefits* over population groups. The argument follows the lines of standard cost-benefit analysis and its emphasis on total costs and benefits generated by a project. From the standard CBA perspective it is not important whether a project generates positive net benefits because of substantial travel time savings, reductions in air pollution, reductions in road fatalities, or low construction costs. The size of the monetary values of costs and benefits, and ultimately of the net benefits, is what counts. Following this focus on monetary values, the answer to the second question is also obvious: we are primarily interested in population groups divided by level of income. The first approach thus suggests that the key equity question to be asked when deciding about transport projects is: *How are net benefits distributed over income groups?*

156.   The second answer upholds that the main aim of transport projects is to improve *potential mobility*: people's ability to travel from one place to another. Following this goal, the equity analysis should focus on the way a proposed transport project distributes potential mobility over population groups. Translated to the costs and benefits included in the Nohal Prat, the distribution of travel time savings, vehicle operation costs, and, to a lesser extent, reductions in accident risks should be at the center of the analysis. The division of the population into groups follows this line of reasoning and would be based on existing levels of potential mobility and income levels. Practically, this means a distinction of the population by level of car ownership, with special attention to groups that do not own a car. The second approach can then be summarized in the following equity question: *How are mobility-enhancing benefits distributed over population groups as defined by car ownership and income?*

157.   The third answer upholds that it is neither desirable to summarize all costs and benefits into one measure (net benefits) nor to focus on only a selection of the goods and bads distributed through a transport project (mobility-enhancing benefits). Summation is not desirable, because benefits and costs generated by a transport project are not simply interchangeable from an ethical point of view. For instance, increased air pollution cannot be simply equated with an increased contribution to construction costs through taxation. Selection is not desirable, because this would disregard the importance not-included costs and benefits can have for specific population groups. For instance, increased air pollution

may be considered to be off the utmost importance among residents of areas that already suffer from high levels of air pollution. Following this argumentation, the distribution of *each of the benefits and costs* needs to be addressed separately. Furthermore, the distribution should be measured in units that are relevant for the item in question (e.g. in case of noise, in terms an increase in dB(A) levels) and not in terms of the monetary values. Accordingly, each good may also require a matching distinction of the population into groups (e.g. by vulnerability to respiratory diseases in case of air pollution). From the third perspective, the key equity question to be answered is then: *How is each of the benefits and costs generated by a transport project distributed over population groups?*

6.3.2   Possible distributive principles

158.   The third question to be answered before the equity of a transport project can be assessed is: *Which distribution do we consider to be fair?* Based on an answer to this question, it is possible to identify the *distributive principle* to be used as a yardstick to assess the distribution of costs and benefits generated by a transport project. The report presents three possible distributive principles, each of which is a variation on the criterion of equality.

159.   *Simple equality* is the first distributive principle that can be applied as a yardstick to assess the equity impacts of a transport project. The principle refers to a distribution in which each person or population group receives the same share of a certain good or bad. The reason for explicitly including equality as a potential criterion is simple: many scholars of social justice have identified equality as the 'default' option to distribute goods and bads in a just way. That is to say, an equal division of goods or bads is considered as fair or just, unless convincing arguments can be provided for an alternative distribution. Lacking such arguments, equality remains as the only just distributive principle.

160.   The second distributive principle to assess the equity impacts of transport alternatives is the *avoidance of disproportionate distributions*. The principle starts from the fact that transport projects are located in space. The consequence of this simple fact is that the goods and bads generated by a transport project will always be unequally distributed over space. Against this background, it is virtually impossible to achieve the ideal of an equal distribution of costs and benefits generated by a transport project. At the same time, given the moral strength of the criterion of equality, it may be expected that both decision-makers and the wider public will remain committed to some level of equality. Given this commitment and the virtual impossibility to achieve perfect equality, differences in benefits reaped by, or costs borne by, population groups may be considered acceptable, as long as these differences are not disproportional. In other words, the distributive principle used as a yardstick to assess transport projects is the avoidance of disproportionate distributions. Note that this criterion implies that a disproportionate distribution is always considered problematic, whether it is in the advantage of weak or strong population groups.

161. The third distributive principle that can be used as a yardstick to assess the equity impacts of a transport project is *equalization*. Equalization refers to a reduction in the existing gaps between population groups. The criterion is a variation of the principle of equality. In the case of 'simple' equality, the comparison between groups concerns only the goods and bads generated by a transport project. Project alternatives that distribute these goods and benefits in an equal way are preferred over alternatives that generate more benefits or costs for certain population groups than others. In the case of equalization, the way the goods and bads generated by a transport project are distributed is compared to the existing distribution of that good. Project alternatives that narrow the gaps in an existing distribution are preferred over alternatives that consolidate or widen these gaps. The distributive criterion of equalization is thus also a criterion of equality, but with a different 'benchmark'. The goal as defined by the criterion of equalization is a society in which the good under question is distributed in an equal way. The project is perceived as one of the tools to achieve this goal.

162. The implications of each of the criteria for the analysis of the distribution of costs and benefits generated by a transport project, can be summarized as follows:
   – *Simple equality*: an equal distribution of the costs and benefits generated by a transport projects over population groups (e.g. an equal distribution of net benefits over income groups). Transport projects score better in the equity analysis the more they distribute the goods in which we are interested in an equal way.
   – *Avoidance of disproportionate distributions*: the distribution of costs and benefits generated by a transport project in such a way that no population group receives a disproportionately large share of either (e.g. no population group reaps a disproportionately large share of the travel time savings generated by a transport project). Transport projects score better in the equity analysis, the less they result in a distribution that benefits or hurts one or more population groups in a disproportionate way.
   – *Equalization*: the contribution of a transport project in reducing existing inequalities in society (e.g. in terms of income or levels of air pollution). Transport projects score better in the analysis the more they succeed in narrowing the existing distributional gaps in society.

6.3.3 The matrix

163. Based on the analysis presented above, it is now possible to define a matrix of equity considerations (see Table 6.1). The matrix links the three types of goods with the three types of distributive principles, thus creating nine different equity considerations. The matrix presents these nine equity considerations and specifies the goal of addressing the relevant equity concern in cost-benefit analysis.

164. In the matrix, the goal of addressing equity concerns in cost-benefit analysis is explicitly defined as increasing the *probability* that project alternatives are selected that have the sought-for distributive impacts. The integration of equity consideration in the CBA

methodology does not aim to guarantee that the most fair project alternative scores best in the cost-benefit analysis and is selected as a result. This is because an adjusted cost-benefit analysis will generate information with regard to two overarching policy goals: efficiency and equity. Equity thus needs to be balanced against efficiency in the process of selecting the most preferable project alternative.

Table 6.1 A matrix of equity considerations.

Goods and bads		Distributive principles		
		Avoidance of disproportionate distributions	**Equality**	**Equalization**
Net benefits	**Concern**	Cost-benefit analysis will result in the selection of project alternatives that distribute a disproportionately large share of total net benefits to one or more population groups	Cost-benefit analysis will result in the selection of alternatives that distribute net benefits in an unequal way	Cost-benefit analysis will result in the selection of project alternatives that maintain or increase the existing income gaps in society
	Goal	To increase the probability that project alternatives will be selected that do not distribute total net benefits in a disproportionate way	To increase the probability that project alternatives will be selected that distribute net benefits in an equal way	To increase the probability that project alternatives will be selected that narrow the income gaps in society
Mobility-enhancing benefits	**Concern**	Cost-benefit analysis will result in the selection of project alternatives that a distribute disproportionately large share of mobility-related benefits to one or more population groups	Cost-benefit analysis will result in the selection of alternatives that distribute mobility-related benefits in an unequal way	Cost-benefit analysis will result in the selection of project alternatives that maintain or increase the existing gaps in potential mobility between population groups
	Goal	To increase the probability that project alternatives will be selected that do not distributive mobility-related benefits in a disproportionate way	To increase the probability that project alternatives will be selected that distribute mobility-related benefits in an equal way	To increase the probability that project alternatives are selected that reduce the gaps in potential mobility between population groups
Individual goods and bads	**Concern**	Cost-benefit analysis will result in the selection of project alternatives that distribute disproportionately large shares of goods and bads to one or more population groups	Cost-benefit analysis will result in the selection of alternatives that distribute goods/bads in an unequal way	Cost-benefit analysis will result in the selection of project alternatives that maintain or increase the existing gaps between population groups with regard to individual goods and bads
	Goal	To increase the probability that project alternatives will be selected that do not distribute individual goods and bads in a disproportionate way	To increase the probability that project alternatives will be selected that distribute goods and bads in an equal way	To increase the probability that project alternatives are selected that reduce the gaps between population groups in terms of individual goods and bads

6.4   Methodologies to address equity concerns in cost-benefit analysis

165.   As discussed at the beginning of this concluding chapter, the nine equity concerns distinguished in this report cannot be addressed through the existing Nohal Prat or standard cost-benefit analysis. The CBA methodology needs to be adjusted or complemented before the methodology will be able to produce information on the equity impacts of a transport project. In the report, two main approaches have been distinguished to widen the scope of standard cost-benefit analysis to include equity issues: (1) approaches that change the way in which the key CBA indicators are calculated; and (2) approaches that add a (set of) equity indicator(s) to the existing set of efficiency indicators generated by standard cost-benefit analysis. Each of these approaches encompasses two practical methodologies to integrate equity considerations into the Nohal Prat.

166.   The methodologies that belong to the first approach are:
   − *Social values*: Ascribing other than market-based values to benefits or costs generated by a transport project depending on the group that reaps the benefits or bears the costs (e.g. higher values for travel time savings by lower income groups).
   − *Distributional weights*: Ascribing weights to benefits or costs generated by a transport project depending on the group that receives the benefit or cost (traditional discussed in the literature only in relation to the net benefits of a transport project).

167.   The methodologies that belong to the second approach are:
   − *Equity indicator(s)*: Translating the way in which benefits/costs are distributed over population groups into one (set of) indicators (e.g. an adjusted version of the Gini coefficient).
   − *Equity impact sheet*: Presenting the way in which benefits/costs are distributed over population groups in a (comprehensive) table (e.g. presentation of the percentage each population group receives of a certain set of benefits).

168.   The four methodologies can now be confronted with the matrix of equity considerations presented before. This results in an overview of the way in which the various equity concerns could be addressed within the Nohal Prat framework. Table 6.2 provides the results. The most important conclusion that can be drawn from the table is that the methodologies that imply a change in the CBA calculations are only relevant if one wants to use transport projects to *equalize* existing gaps in society. These methodologies – social values and distributional weights – cannot be used if one is concerned about an equal distribution of goods, or about the avoidance of disproportionate distributions. In contrast, both the equity indicator and the equity impact sheet can be used for all purposes.

Table 6.2 Overview of the methodologies that can be used to address the nine equity concerns distinguished in the report.

Goods and bads	Methodologies	Distributive principles		
		Avoidance of disproportionate distributions	**Equality**	**Equalization**
Net benefits	**First approach**	--	--	Weighting (Social values)
	Second approach	Equity impact sheet Equity indicator	Equity coefficient (e.g. adjusted Gini) Equity impact sheet	Equity coefficient Equity impact sheet
Mobility-enhancing benefits	**First approach**	--	--	Social values (Weighting)
	Second approach	Equity impact sheet Equity indicator	Equity coefficient (e.g. adjusted Gini) Equity impact sheet	Equity coefficient Equity impact sheet
Individual goods and bads	**First approach**	--	--	Social values (Weighting)
	Second approach	Equity impact sheet Equity indicator	Equity impact sheet Equity indicator	Equity impact sheet Equity indicator

6.5 (Dis)advantages of methodologies to address equity concerns

169. Each of the approaches for integrating equity considerations in cost-benefit analysis has advantages and drawback.

170. The advantage of the first approach is that it remains close to the current practices. The approach generates only one (set of) efficiency indicators, and as such does not require changes in the way projects alternatives and projects are evaluated against one another. The numbers change, but the decision-making processes can remain the same. Because only (a set of) efficiency indicators are generated, relatively easy comparison between alternatives, as well as between projects, remains possible. This is a clear advantage of this first method over the second approach (see below). The drawback of the first approach is that the equity impacts of project alternatives and projects remain hidden from decision-makers and the wider public alike, and as a result do neither enter the political discussions nor the wider discourse about transport projects and their impacts. Furthermore, given the political character of the setting of (inverse) social values or distributional weights, the actual strength of the approach is substantially diminished.

171.   The (dis)advantages of the second approach are to some extent a mirror image of those of the first. The prime advantage of the second approach is that the equity impacts of transport alternatives and projects are made explicit, to both decision-makers and the wider public. This will: (1) encourage the development of project alternatives with the sought-for equity impacts; (2) facilitate an explicit discussion about the equity aspects of transport investments; and (3) enable an explicit weighting of equity versus efficiency. The separate presentation of equity and economic impacts in two (sets of) indicator(s) also has its drawbacks. Most notably, it does not give any guidance to decision-makers on how to relate to each of the indicators. This could lead to a lack of clarity, consistency and accountability in a crucial part of the decision-taking process.[76] In addition, it could marginalize the importance of the equity impacts in the actual decision-making process, since it will be difficult to evaluate projects of different size and scope using a double set of indicators.

172.   Given the political character of equity concerns and the lack of an agreed-upon method to integrate equity impacts into cost-benefit analysis, the methodologies belonging to the second approach are preferred above those belonging to the first approach. This especially holds during the first period in which the new methodology will be applied in actual practice. Only explicit attention for equity impacts in this stage will make sure that an agreed-upon method will develop over time.

6.6   Concluding remarks on the application of equity analysis

173.   This report presents the results of the project 'Nohal Prat and social justice' carried out on behalf of the Israeli Ministry of Transport. The aim of the project was to assess how equity considerations can be addressed in the recently adjusted version of the Israeli cost-benefit analysis (Nohal Prat). At the end of the report it is valuable to provide an outline of the argument developed in the report.

174.   The report starts from the existing, recently adjusted, Nohal Prat. Like standard cost-benefit analysis, the Nohal Prat is a tool to assess the efficiency of transport projects. The application of cost-benefit analysis to a transport project provides decision-makers with detailed information on the efficiency of various project alternatives, and enables them to select the most efficient alternative – that is, the alternative that contributes most to the national economy.

175.   The evaluation of alternatives in terms of efficiency alone may result in the selection of alternatives that have unwanted equity impacts. For instance, it may result in the selection of alternatives that increase existing income gaps in society. The concerns about this and other equity impacts is the underlying rational behind the search for methodologies to assess the equity impacts of transport projects within the CBA framework, and has also motivated the writing of this report.

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[76] Sayers, Jessop *et al.* 2003: 95.

176.   The report has first of all provided more detail about the exact equity concerns that may motivate the wish to address equity impacts within the CBA framework. This has resulted in the identification of nine different equity concerns (see Table 6.1), each of which is legitimate in its own right. Furthermore, four different methodologies have been identified and developed that could address each of these equity concerns (see Table 6.2). Subsequent decision-making by the relevant bodies (most notably, the Nohal Prat steering committee and the Ministry of Transport) will have to result in decisions with regard to: (1) the equity concern(s) that will be addressed in actual practice; and (2) the methodology that will be applied to address that equity concern(s).

177.   Decisions about both subjects are of key importance, for two reasons. First, different equity concerns may demand different adjustments in the existing Nohal Prat, which may be at odds with one another. A decision is thus necessary to guarantee a coherent way to integrate equity concerns into the Nohal Prat. Second, if all equity concerns are addressed in the CBA framework, decision-makers may be overwhelmed with information on the various equity impacts of project alternatives. This may result in an 'inflation' of the information on equity impacts, with little weight ascribed to equity in the actual comparison and selection of project alternatives.

178.   The integration of equity considerations into the CBA framework can serve two purposes, irrespective of the choices regarding equity concerns or methodologies. First, it can provide decision-makers with information on the equity impacts of project alternatives and can thus assist them in selecting the alternative with the most favorable equity impacts. Second, it can assists professionals in the definition of project alternatives that may have score well in terms of their equity impacts. Both of them are of the utmost importance if one is concerned about equity in transport.

179.   The first purpose relates to cost-benefit analysis as a decision-support tool. By explicitly generating, in the course of cost-benefit analysis, information on the equity impacts of project alternatives, decision-makers will be able to weigh this information against the information on the efficiency of the alternatives. They can then adjust their decisions accordingly if they are of the opinion that this is justified. The integration of equity consideration into the Nohal Prat will thus increase the *probability* that the comparison of project alternatives will result in the selection of the alternative with the most favorable equity impacts. Without an explicit equity analysis, the selection of a project with favorable equity impacts is merely a result of chance.

180.   It is important to note that the increase in probability that a project alternative will be selected with the *most favorable* equity impacts, is by no means a guarantee that the decision-making process will result in the selection of an alternative with the *sought-for* equity impacts. This is true, even if decision-makers attach highest importance to the equity impacts of a transport project. This is because all alternatives taken into consideration may have adverse equity impacts. For instance, in considering a specific transport project, the comparison may be limited to three alternatives that all result in the widening of income gaps in society. If decision-makers are concerned about existing income gaps and want to use transport projects as a tool to reduce these gaps, information

about the equity consequences of each alternative will hardly help them in selecting an alternative that has the sought-for equity impacts – simply because such an alternative is not available.

181.   This observation points to the second purpose of integrating equity impacts into cost-benefit analysis. The explicit attention for equity impacts of transport projects may provide the impetus to develop and design project alternatives that are likely to have the sought-for equity impacts. Thus, the awareness that income gaps will be assessed in the course of cost-benefit analysis, may encourage professionals to develop alternatives that score well on this criterion. Or, if decision-makers are concerned about the growing gaps in potential mobility, this may stimulate professionals to design transport projects that will benefit all relevant population groups. This, then, also suggests that it would be best to present data on efficiency and equity of project alternatives in separate indicators.

182.   The integration of equity impacts into cost-benefit analysis is thus of importance for two reasons: (1) to increase the probability that project alternatives with the *sought-for* equity impacts are developed during the course of a project; and (2) to increase the probability that the comparison of project alternatives will result in the selection of the alternative with the *most favorable* equity impacts. Taken together, the integration of equity impacts into cost-benefit analysis may result in the selection and execution of transport projects that have the *sought-for* equity impacts.

References

Boucher, D. and P. Kelly (1998) Introduction. In: D. Boucher and P. Kelly, *Social justice: from Hume to Walzer*. London/New York, Routledge**:** 1-16

Brent, R.J. (1996) *Applied cost-benefit analysis*. Cheltenham, Edward Elgar Publishing

Brundtland, G., Ed. (1987) *Our common future: The World Commission on Environment and Development*. Oxford, Oxford University Press

Campbell, H.F. and R.P.C. Brown (2003) *Benefit-cost analysis: financial and economic appraisal using spreadsheets*. Cambridge, UK, Cambridge University Press

Dodgson, J. and M. Gonzalez Savignat (1998) Efficiency in public resource allocation: the social appraisal of projects. *International Journal of Transport Economics*, 25/2: 221-242

Dodgson, J., M. Spackman, et al. (2000) Multi-criteria Analysis: A manual. London, Department of the Environment, Transport and the Regions

Farrell, S. and W. Saleh (2005) Road-user charging and the modelling of revenue allocation. *Transport Policy*, 12/5: 431-442

Feitelson, E. (2002) Introducing environmental equity dimensions into the sustainable transport discourse: issues and pitfalls. *Transportation Research Part D: Transport and Environment*, 7/2: 99-118

Feldstein, M.S. (1972) Distributional equity and the optimal structure of public prices. *American Economic Review*, 62: 32-36

Forkenbrock, D.J. and L.A. Schweitzer (1999) Environmental justice in transportation planning. *Journal of the American Planning Association*, 65/1: 96-111

Frank, R.H. (2001) Why is cost-benefit analysis so controversial? In: M.D. Adler and E.A. Posner, *Cost-benefit analysis: legal, economic and philosophical perspectives*. Chicago/London, The University of Chicago Press**:** 77-94

Galvez, T. and S.R. Jara-Diaz (1998) On the social valuation of travel time savings. *International Journal of Transport Economics*, 25: 205-219

Hill, M. (1973) *Planning for multiple objectives: an approach to the evaluation of transportation plans*. Philadelphia (Pennsylvania), Regional Science Research Institute

Holland, A. (no date) *The assumptions of cost-benefit analysis: a philosopher's view*. http://www.lancs.ac.uk/users/philosophy/awaymave/onlineresources/assumption%20of%20cost-benefit%20analysis%20_a%20holland_.pdf. Last accessed 31 May 2006

Jara-Diaz, S.R. (2000) Allocation and valuation of travel time savings. In: D.A. Hensher and K.J. Button, *Handbook of Transport Modelling*. Oxford, Pergamon

Jones, P. (1999) Urban road pricing: public acceptability and barriers to implementation. In: K.J. Button and E.T. Verhoef, *Road pricing, traffic congestion and the environment*. Cheltenham, Edward Elgar Publishing

Jones, P. (no date) *Addressing equity concerns in relation to road user charging*. http://www.transport-pricing.net/jonel.doc. Last accessed 10 September 2003

Kelman, S. (2002) Cost-benefit analysis: an ethical critique. In: T. Donaldson, P.H. Werhane and M. Cording, *Ethical issues in business: a philosophical approach*. Upper Saddle River, NJ, USA, Prentice Hall**:** 559-564

Lichfield, N. (1960) Cost-benefit analysis in city planning. *Journal of the American Institute of Planners*, 26/4: 273-279

Mackie, P.J., A.S. Fowkes, et al. (2003) Value of travel time savings in the UK: Summary Report. Leeds, Institute for Transport Studies, University of Leeds/John Bates Services

Martens, K. (forthcoming) Car ownership levels by income deciles. Jerusalem, Jerusalem Institute for Israel Studies

Miller, D. (1999) *Principles of social justice*. Cambridge/London, Harvard University Press

Morisugi, H. (2000) Evaluation methodologies of transportation projects in Japan. *Transport Policy*, 7/1: 35-40

Nozick, R. (1974) *Anarchy, state, and utopia*. New York

Portugali, J. (1980) Distribution, allocation, social structure and spatial form: elements of planning theory. *Progress in Planning*, 14/3: 227-310

Proost, S. (no date) *Achieving equity through urban transport pricing?* http://www.transport-pricing.net/proost.doc. Last accessed 10 September 2003

Quinet, E. (2000) Evaluation methodologies of transportation projects in France. *Transport Policy*, 7/1: 27-34

Raux, C. and S. Souche (2004) The acceptability of urban road pricing: A theoretical analysis applied to experience in Lyon. *Journal of Transport Economics and Policy*, 38/2: 191-216

Ray, A. (1984) *Cost-benefit analysis*. Baltimore, John Hopkins

Richardson, H.W. and C.C. Bae (1999) The equity impacts of road congestion pricing. In: K.J. Button and E.T. Verhoef, *Road pricing, traffic congestion and the environment*. Cheltenham, Edward Elgar Publishing

Rothengatter, W. (2000) Evaluation of infrastructure investments in Germany. *Transport Policy*, 7/1: 17-25

Sadurski, W. (1985) *Giving desert its due: social justice and legal theory*. Dordrecht, D. Reidel Publishing Company

Sager, T. (2005) Footloose and Forecast-free: Hypermobility and the Planning of Society. *European Journal of Spatial Development*, September 2005/17: 1-23

Sayers, T.M., A.T. Jessop, et al. (2003) Multi-criteria evaluation of transport options-- flexible, transparent and user-friendly? *Transport Policy*, 10/2: 95-105

Schofield, J.A. (1987) *Cost-benefit analysis in urban and regional planning*. London, Allen & Unwin

Sen, A.K. (1973) *On economic inequality*. Oxford, Clarendon Press

Sen, A.K. (1992) *Inequality reexamined*. Oxford, Oxford University Press

Sen, A.K. (2001) The discipline of cost-benefit analysis. In: M.D. Adler and E.A. Posner, *Cost-benefit analysis: legal, economic and philosophical perspectives*. Chicago/London, The University of Chicago Press**:** 95-116

Shiftan, Y., G. de Jong, et al. (2002) *Externalities' evaluation in transport projects*. http://www.stellaproject.org/focusgroup4/helsinki/papers/shiftan.doc. Last accessed 13 July 2004

Smith, D.M. (1994) *Geography and social justice*. Cambridge, Blackwell

Stewart, T.J. (1992) A critical survey on the status of multiple criteria decision making theory and practice. *Omega*, 20/5-6: 569-586

Vickerman, R. (2000) Evaluation methodologies for transport projects in the United Kingdom. *Transport Policy*, 7/1: 7-16

Walzer, M. (1983) *Spheres of justice: a defense of pluralism and equality*, Basic Books