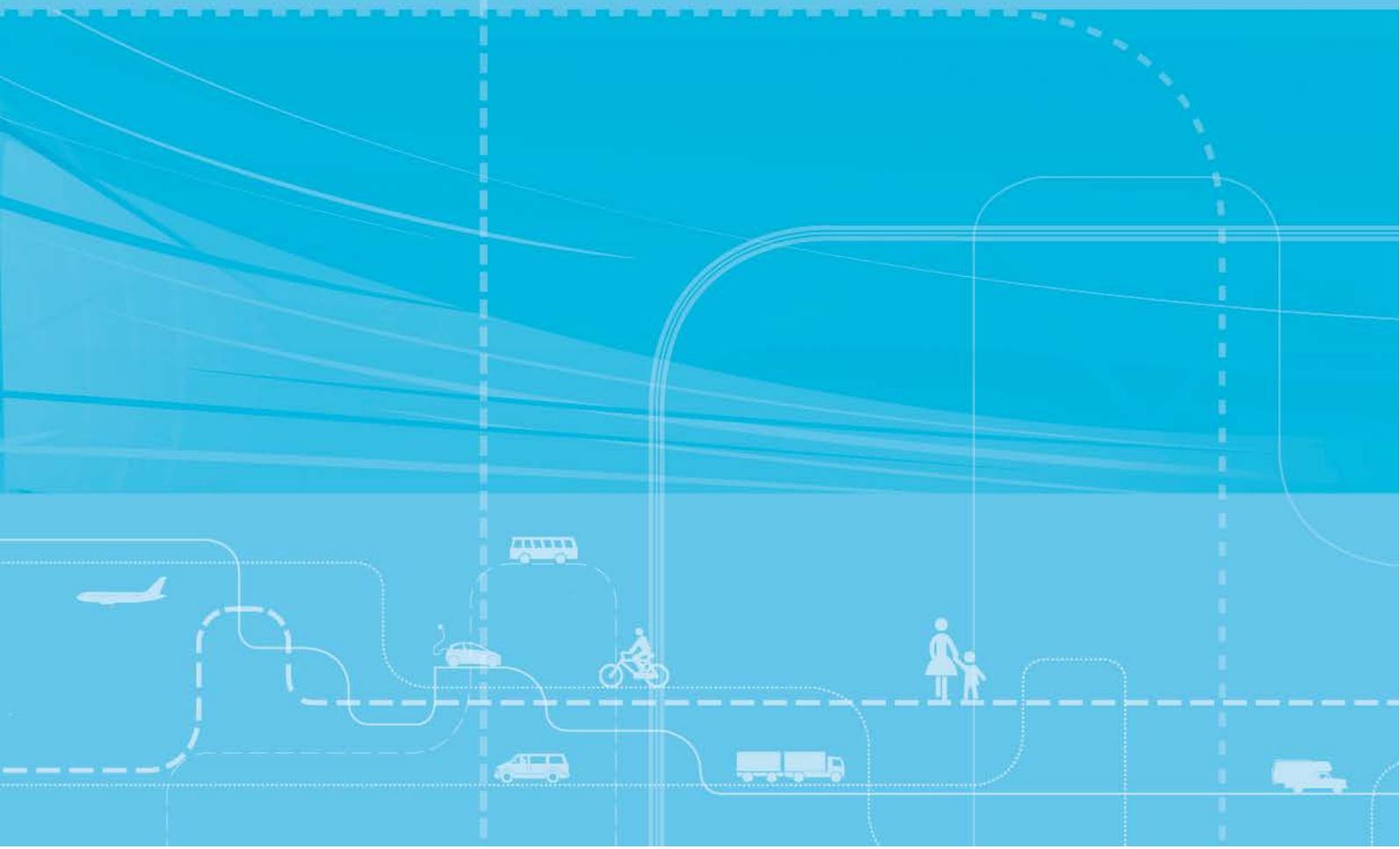


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(When) are financial policy instruments environmentally effective?



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(When) are economic policy instruments environmentally effective? Are they efficient, effective and legitimate? Are economic instruments alone sufficient to respond to the complexities of the transport system? Can behavioural economics or institutional sociology give support to the design of the economic policy instruments in order to meet the challenges of environmental concerns that we face in our time? This report summarises different Work Packages (WP) designed in the project EcoEnvi to address these questions.

Sammendrag:

(Når) er miljømessige økonomiske virkemidler effektive? Er de «efficient», effektive og legitime? Er økonomiske virkemidler alene tilstrekkelig til å svare på kompleksiteten i transportsystemet? Kan atferdsøkonomi eller institusjonell sosiologi gi støtte til utformingen av de økonomiske virkemidlene for å møte de miljømessige utfordringene vi står overfor i vår tid? Denne rapporten oppsummerer ulike arbeidspakker i prosjektet EcoEnvi, utviklet for å møte disse spørsmålene.

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Preface

(When) are economic policy instruments environmentally effective? Are they efficient, effective and legitimate? Are economic instruments alone sufficient to respond to the complexities of the transport system? Can behavioural economics or institutional sociology give support to the design of the economic policy instruments in order to meet the challenges of environmental concerns that we face in our time? This report summarises different Work Packages (WP) designed in the project EcoEnvi to address these questions.

Paradigm shift from dependence on private car to sustainable transport will take a long time and will demand continuous effort. Path dependency, both institutional and technical, to be a main challenge to the paradigm shift. A theoretical understanding of how policies at national and local levels can change the path dependency of private car system, deeply embedded in our society and the dominant car-based notion of transport policy within government and professional agencies, is of great importance for devising strategies and policies for the paradigm shift, and bypassing barriers to their implementations. This study provides an understanding of the behavioural response of an agent – an individual or an institutional – to economic instruments, and an insight to institutional barriers for making economic instruments effective and legitimate.

This research has been funded under the MILJO2015 programme - Norwegian Environmental Research Toward 2015 of the Research Council of Norway. An area of the focus of this programme is knowledge about measures and instruments for preventing or alleviating environmental damage, vital to framing effective environmental policy. The MILJO2015 programme takes a more multi- and cross-disciplinary approach than traditional environmental research.

Oslo, January 2014

Institute of Transport Economics - Norwegian Centre for Transport Research

Gunnar Lindberg
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Frode Longva
Research Director

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Summary:

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Path dependency, both institutional and technical, is a main challenge to the paradigm shift from dependence on private car to sustainable transport. An understanding of how policies at national and local levels can change the path dependency is of great importance for devising strategies and policies for the paradigm shift, and bypassing barriers to their implementations. The focus of this study is on the behavioural response of an agent – an individual or an institution – to economic instruments, and an insight to institutional barriers for making economic instruments effective and legitimate in response to the environmental concerns of our time.

(When) are economic policy instruments environmentally effective? Are they efficient, effective and legitimate? Are economic instruments alone sufficient to respond to the complexities of the transport system? Can behavioural economics or institutional sociology give support to the design of the economic policy instruments in order to meet the challenges of environmental concerns that we face? This report summarises different Work Packages (WP) designed in the project EcoEnvi to address these questions.

The Brundtland Report introduced the notion of ‘sustainable development’ into the political agenda some 27 years ago. The transport sector has become in focus due to the importance of the sector in the sustainability context, environmentally, socially and economically. The desire to move towards sustainable transport is becoming increasingly universal, with almost all jurisdictions adopting this as a policy objective. Often the reality is very different, and policy actions remain little more than statements of intent (Hickman and Banister, 2014).

Path dependency, both technical and institutional, is a main challenge to the paradigm shift. A theoretical understanding of how policies at national and local levels can change the path dependency of private car system, deeply embedded in our society and the dominant car-based notion of transport policy within government and professional agencies, is of great importance for devising strategies and policies for the paradigm shift, and bypassing barriers to their implementations. Paradigm shift from dependence on private car to sustainable transport will take a long time and will demand continuous effort.

This study provides an understanding of the behavioural response of an agent – an individual or an institution – to economic instruments, and an insight to institutional barriers for making economic instruments effective and legitimate.

The report begins with an outline of the theoretical frameworks – behavioural economics and institutional sociology – and a description of the transformation of the politico-economic mode of the governance of the Norwegian transport sector to a neo-liberal regime with its emphasis on deregulation, liberalization, and the market-based governance of the sector. The other WPs are; a meta-analysis of the economic instruments; the case study of the Stockholm congestion pricing scheme; four case studies of incentives for alternative fuel vehicles in Norway and Sweden, and; two case studies of the effects of economic incentives in the public sector. These moments of the project are summarised in Chapters 3- 7. Chapter 8 presents a discussion of the findings in the project and an attempt to respond to the challenges we had set in the project – the research questions related to the adequacy of economic policies in response to our environmental concerns. We conclude that the efficiency, effectiveness and legitimacy of the economic instruments depends on the context. The efficiency of economic instruments is not a key criterion when the objective is paradigm shift to sustainable transport, or when the objective is to support the take-off of a clean technology. We also point to institutional barriers for the efficiency and effectiveness of an economic instrument, and the design of the instrument to overcome these barriers in the case of incentive schemes in the public administration. Chapter 9 presents some recommendations on the design of economic policy instruments based on the research conducted in this study.

We also conclude that behavioural economics and institutional sociology are among the disciplines that can provide insight to the complexities of the transport system and support the design of policy instruments. “Science seeks answers through the lens of theories. If it is a hubris for natural scientist to imagine that there can be a single theory of everything, it is the height of arrogance for social scientists to do so. Different theories can illuminate reality in different ways, and these ways of illuminating reality also drive action so perhaps the episteme-phronesis distinction is also in need of revision.” (Low, 2013, pp 218).

1 Introduction

A main policy focus is to encourage pro-environmental behaviour and to influence private economic costs and benefits connected with individuals' behaviours. In this perspective, the aim of policies is to promote pro-environmental behaviour through a variety of taxes and incentives. Economic instruments can be designed in a variety of ways, and for a variety of applications.

However, economic instruments on its own has had limited success in encouraging pro-environmental behaviour changes. This is by no means suggesting that economic incentives and information campaigns are irrelevant or inappropriate as policy options for the cause, but evidence suggest that these measures are insufficient on their own to induce the behavioural change of the kind and scale required to meet the environmental challenges. The standard approach of intervention follows from the rational choice model, as defined in neoclassical economics, of human behaviour. The failures of this model to account for subjects of habit, moral norms and expectations and social embeddedness of individual behaviour are widely documented. Consumer behaviours, motivations and expectations are deeply influenced by social norms and are subject to social learning, and hence deeply entrenched in conventions and institutions. Consumer sovereignty is imprecise and fails to unravel the social and psychological influence on people's behaviour, as Galbraith (1967) suggested. The rational choice model fails to recognise how consumers are locked into specific behaviour patterns through institutional factors outside their control (Jackson, 2005).

Under a "rational" choice model, the appropriate forms of government are those that ensure adequate information to consumers for their decisions and that private costs reflect social externalities. The limitations of this model allude to the limitations of the model of governance in which the role of policy is confined mainly to providing information and internalising externalities. The "non-interventionist" rhetoric of modern governance is an ideological concept. The fact is that policy intervenes continually in people's behaviour, directly through taxes, incentives and regulatory framework, and indirectly through extensive influence over social and institutional context with in which individual's behaviours form.

In sum, the problem of promoting pro-environmental behaviour is a perpetual social issue. It is basically, warranting that behaviours that threaten the societal welfare are discouraged and that those that promote long-term societal welfare are encouraged. This can be reformulated as a problem of governance and of coordinating individual behaviours for the common good (Jackson, 2005).

1.1 Approaches, hypotheses, choice of method

The purpose of this report is to provide a theoretical understanding and present empirically findings of two contrasting perspectives on the design and effects of economic instruments in environmental policy with particular emphasis on the transport sector. *Behavioural economics* aims at analysing the deviations of behaviour

from “rationally” as defined in neoclassical economic theory, and by improving the effects of economic instruments, often in combination with other measures such as the use of information. It acknowledges the importance of justice or fairness, both as a theoretical issue on its own (Sen, 1992; 2009) and as elements in actors’ social preferences and recognises that benefits occurring in distant futures might get too little weight, what Pigou (1920) attributed to “our defective telescopic faculty”. Behavioural economics questions consumer sovereignty, as Galbraith did. The version of *critical institutional sociology* outlined here, on the other hand, claims that emphasis on economic instruments is part of a wider restructuring of the relation between state and market, unable to cope with the underlying causes of important environmental problems.

Paradigm shift from dependence on private car to sustainable transport, in particular along environment, and social dimensions, will take a long time and will demand continuous effort. Path dependency, both technical and institutional, is main challenge to the paradigm shift. A theoretical understanding of how policies at national and local levels can change the path dependency of private car system, deeply embedded in our society and the dominant car-based notion of transport policy within government and professional agencies, is of great importance for devising strategies and policies for the paradigm shift, and bypassing barriers to their implementations. This study provides an understanding of the behavioural response of an agent – an individual or an institutional – to economic instruments, and an insight to institutional barriers for making economic instruments effective and legitimate.

Empirically, the project has focuses on adequate policy strategies for reduction of environmental problems in the transport sector (i.e. local pollution, noise, climate gas emissions) and another important transport externality, i.e., congestion. A policy strategy includes a definition of a policy problem and how it is to be solved in terms of choice of policy instruments. There are numerous criteria for evaluating policy strategies. *Efficiency*, i.e., to maximise the ratio of benefits and costs of implementing the policy, and *effectiveness*, that the implementation of the policy targets the objective, are the two criteria that commonly used. *Public acceptance* and *equity* are other criteria that are often used as further criteria. Inter- and intra- generational equity are important considerations in the context of sustainable development. Vedung (2009) uses *legitimate* as a third criterion, a concept covering a continuum of definitions from acceptance to a stronger Habermas version (1987); a duty based on the recognition of normative validity claims (Habermas, 1987:271). While efficiency is an important criterion in the context of some environmental policies, various economists question its validity in the context of climate policies (see section 2.4). Efficiency, at least in the short term, is not a relevant criterion in the presence of path dependency, e.g., fossil fuel car path dependency, and for the evaluation of policies for changing course. Effectiveness and legitimacy are important criteria in these contexts (see Chapter 7).

Methodologically, the hypotheses adhering to the two theoretical perspectives are empirically tested by making use of a combination of methods. These empirical cases have in common a theoretically informed reanalyses of the vast literature on design and effects of economic instruments in the transport sector. These methods are meta-analysis, i.e. a formal, statistical synthesis of evidence from reviewed studies, and three case studies; studies of road pricing schemes; economic incentives introduced in public administration for environmental purposes, and; alternative fuels and vehicle pricing/taxes. The analyses starts with an examination of the

political and institutional settings of the transport sector in Norway, where policy strategies are developed.

Behavioural economics and critical institutional sociology varies in terms of how they conceptualise environmental policy and the use of economic instruments. In particular, they imply different hypothesis as to the long-term effects of the use of economic instruments. However, for the purpose of this study, they have in common key dimensions of analytical interest; the effects of policy instruments, in terms of efficiency, effectiveness and legitimacy; actor's behavioural model of choice; types and combinations of policy instruments, and contextual dimensions (characteristics of policy field/policy process).

1.2 The structure of the report

The analytical dimensions of behavioural economics and critical institutional sociology are the core elements in the general analytical model. Chapter 2 elaborates the behavioural economics perspective. This chapter summarises the paper "Behavioural economics: Implications for public policy for transport and environment" (Ramjerdi, 2014, forthcoming). Oddgeir Osland has produced the section on critical institutional sociology in Chapter 3.

Chapter 4 summarises the paper "Ecological modernization in the transport sector" (Osland, 2013). The paper presents an analysis of the development of Norwegian politico-administrative field of transport and in particular its relation to the environmental policy field. The paper improves the status of knowledge of this field and provides a ground for the application of the knowledge gained through the case studies to Norwegian policy-making.

Meta-analysis can be viewed as an extension of traditional narrative literature reviews, based on qualitative assessments. Meta-analysis is a comprehensive and critical review of studies dealing with a certain topic, employing a scientific approach to study retrieval and analysis. A key element of meta-analysis include a systematic and extensive search for relevant studies. Data is extracted from each study according to a standardized procedure, clear criteria for study inclusion are formulated, and an attempt is made to assess study quality and present the findings of the best studies. Procedures for study retrieval, data extraction and meta-analysis are reported in detail in order to ensure reproducibility of the review. Based on a systematic review, a meta-analysis involves a formal, statistical synthesis of evidence from the studies reviewed. Chapter 5 is on three meta-analysis studies (Elvik, 2013a; 2013b: 2014 forthcoming) on behavioural responses to economic and regulatory instruments.

Chapter 6 examines the political and institutional setting in Stockholm and Sweden when congestion pricing was introduced during a trial period and permanently afterward. It also examine the design, impacts of congestion charging in Stockholm and examines the behavioural responses in terms of mode shifts, public attitude, etc. This chapter is based on the paper "The Stockholm congestion pricing syndrome: How congestion charges went from unthinkable to uncontroversial" (Eliasson, 2014).

Chapter 7 reports of the impacts of differential fuel taxes levied on vehicles and other incentives to switch to alternative fuel vehicles in Sweden and Norway. Car traffic generates several forms of pollution, each of which has local, regional and global consequences. This complicates the selection of policies to meet

environmental targets, and causes uncertainty about the efficacy of the selected policies. The case of diesel tax well illustrates this complexity and serves to exemplify the challenges of using economic measures against specific environmental targets in Norway and E85 fuel in Sweden. This chapter also examines the introduced incentives for electric vehicles in Norway. The results presented in this chapter summarises a paper on incentives for the purchase of alternative fuel vehicles (AFV) in Norway and Sweden (Ramjerdi, 2014, forthcoming).

Chapter 8 summarises the two case studies on the design and effects of economic incentive schemes in public administration. The point of departure will be two types of theoretical analyses; principal-agent perspective reanalysing earlier evaluations, and a critical-constructivist perspective asking the question of constructed or obstructed opportunism. The first case study is on the Norwegian reward scheme for sustainable public transport. This case study summarises the study by Christiansen, et al. (2014, forthcoming) on the public sector's incentive scheme. The second case study is on a scheme for increasing energy efficiency in the public sector. This case summarises the study by Aasen et al. (2014, forthcoming).

Chapter 8 presents a summary of the research and Chapter 9 presents policy implications and suggestions for further research.

2 Behavioural economics: Implications for public policy for transport and environment

Microeconomics has been the groundwork of most economists' approach to public policy since 1950s¹. Microeconomics is based on three important principles. The first is that individuals have complete and consistent preferences and an individual behaves such that the individual's welfare is satisfied accordingly. The second is that social welfare is increasing in individual welfare, i.e., monotonicity property. The third element is the exclusivity property, i.e., that is social welfare is exclusively determined by individual welfare (see Munro, 2009). The relaxation of these principles has profound consequences for public policy.

Della Vigna (2009) states that the underpinning model of behaviour in economics are simple but powerful, defined as rationality. Individuals (*homo economicus*) make choices to maximize a utility function by processing the available information appropriately. Individuals' preferences are assumed to be time-consistent, affected only by own payoffs, and independent of the framing of the decision.

Although welfare economics has extensively contributed to public policy, a growing body of experimental and empirical research has documented substantial and often systematic deviations from its core behavioural assumptions and predictions.

In the following sections, we examine the deviations of behaviour from rational economic man and its implications for public policy with focus on environment and transport.

2.1 Behavioural economics and rational man

Behavioural economics, as a discipline, challenges the standard economic assumptions. It is grown out of the critiques of the "rational" economic man. This tradition sometimes leads to a view of behavioural economics as a collection of "biases", a collection of "anomalies", that is, violations of assumptions in standard neoclassical economics.

Behavioural models often take as a starting point a standard economic model and reinterpret the model as a description how the person thinks, feels and comes to a decision. The assumptions are scrutinized to substantiate unrealistic assumptions in the standard economic model, because humans cannot perform the difficult mental tasks represented in it. The biases are often systematic and are usually modelled by assuming that some aspect of the optimization procedure in the decision making model.

¹ What is public economics its origin and the history of its application

“Behavioural economics study the effects of social, cognitive, and emotional factors on the economic decisions of individuals and institutions and the consequences for the resource allocation. The fields are primarily concerned with the bounds of rationality of economic agents. Behavioural models typically integrate insights from psychology with microeconomic theory; in so doing, these behavioural models cover a range of concepts, methods, and fields. The study of behavioural economics includes how market decisions are made and the mechanisms that drive public choice” (Wikipedia).

2.2 Psychology and Behavioural Economics

Both neoclassical economics and psychology are founded on methodological individualism, but they have different views of the decision-making process. First, the primary focus of psychologists is to understand the nature of decision process, how these are established and modified by experience, and how they determine values. The primary focus of economists is on the mapping from information inputs to choice. Preferences can be treated for most economic applications as primitives of the analysis, and the decision process as a black box.

Second, psychological views of the decision process are dominated by ideas that behaviour is local, adaptive, learned, dependent on context, mutable, and influenced by complex interactions of perceptions, motives, attitudes, and affect.

McFadden (1999, 2001) outlines the behavioural model of choice and refers to a list of major cognitive anomalies, i.e., circumstances under which an individual exhibit surprising departure from rationality as defined in microeconomics. These are; *comprehension* (e.g. disjunction; failure to reason through or accept the logical consequences of choices, limited attention to and engagement in the cognitive task); *retrieval of factual and affective memory* (e.g. affective attenuation, selective memory, inconsistent time discounting) and; *judgement and the formation of perceptions and beliefs* (e.g. context/framing of the decision task influence perception and motivation). Additionally; *anchoring*, (i.e. judgments are influenced by quantitative cues contained in the decision task) and; *task definition and the decision and reporting processes* (e.g., awareness, suspicion, rule-driven choices rather than utilitarian calculus). Nonstandard decision making individuals resort to heuristics instead of solving the complex maximisation problems. The decisions are affected by framing of a decision problem, inattentive to less salient features of a problem.

An important feature of the standard theory is the *consumer sovereignty* property that preferences are predetermined in any choice situation, and do not depend on available alternatives: *desirability precedes availability*. Galbraith (1967) questions the validity of the assumption of consumer sovereignty earlier than most behavioural economists did.

Kahneman (2003), in his article on maps of bounded rationality, suggests how psychology interacts with the “rational” man in economic man in decision-making. Kahneman’s model distinguishes two modes of thinking and deciding, which correspond roughly to the everyday concepts of “reasoning” and “intuition”. Reasoning is the mode that the rational man in economics uses; it is done deliberately and with effort. “The operations of this system are slower, serial, effortful, and deliberately controlled; they are also relatively flexible and potentially rule-governed.” Intuitive thoughts seem to come spontaneously to mind, without conscious search or computation, and without effort. “The operations of this system are fast, automatic,

effortless, associative, and often emotionally charged; they are also governed by habit, and are therefore difficult to control or modify.” “Casual observation and systematic research indicate that most thoughts and actions are normally intuitive in this sense.” Kahneman uses the interactions of these systems to explain the deviations of decision making of an agent from the standard model in economics.

Kahneman in his article states: “Theories in behavioural economics have generally retained the basic architecture of the rational model, adding assumptions about cognitive limitations designed to account for specific anomalies. For example, the agent may be rational except for discounting hyperbolically, evaluating outcomes as changes, or a tendency to jump to conclusions”.

2.3 The deviations from the standard model

Fudenberg (2006) suggests that the major accomplishments of behavioural economics is that it has changed from a “niche topic to one that is well represented in all of the major journals”. The number of articles and books that have been published on summarizing the achievements of this topic and its relevance for public policy is overwhelming. See for example (Kahneman and Tversky, 2000; Diamond and Vartanian, 2007; Della Vigna, 2009; Camerer, 2006). While the deviations of the behaviour of an “agent” from the standard economic model forms the core of the behavioural model, the topic has been extended to cover areas such as behavioural political economy, behavioural institutional design and behavioural finance.

Della Vigna (2009), in his paper on psychology and economics, summarizes some of the main laboratory evidences on the deviation of individual behaviour from the rational economic man. While Della Vigna suggest that in markets, due to their experience, peoples’ deviations from the standard model might be limited (Levitt and List, 2007), he also suggests that there are other forces that could intensify the deviations. Firms often have incentives to emphasise the deviations of consumers for profit (DellaVigna and Malmendier, 2004). He also suggests important economic decisions, such as the choice of retirement savings or a house purchase are taken seldom, with limited scope for feedback and sorting.

In this review, we rely on Camerer et al. (2004) for summarizing the deviations of an agent from the standard model. They suggest the most acclaimed of these are (1) failures of expected utility theory; (2) the endowment effect; (3) hyperbolic discounting and (4) social preferences. We go through these deviations in the following sections.

2.3.1 Failures of the expected utility model

Kahneman and Tversky (1979) develop prospect theory to address the failures of expected utility theory. Prospect theory distinguishes between gains and losses from a situation-specific reference point. In summary Kahneman and Tversky (1979) and Tversky, Kahneman (1992) illustrate, reference dependence, loss aversion and diminishing sensitivity. In loss aversion—the value function $v(x)$ has a kink at the reference point and is steeper for losses ($x < 0$) than for gains ($x > 0$). In diminishing sensitivity—the value function v is concave over gains and convex over losses, reflecting diminishing sensitivity to outcomes further from the reference point; and probability weighting—the decision-maker transforms the probabilities with a probability-weighting function $\pi(p)$ that overweighs small probabilities and underweights large probabilities.

Barberis, Huang, and Thaler (2006) point to a fifth feature of reference-dependent preferences as “narrow framing”. According to the standard economic model, a decision-maker offered a gamble integrates the risk induced by the gamble with the other sources of uncertainty he faces. A decision-maker with narrow framing, instead, considers each risk in isolation and evaluates a lottery as if it were the only determinant of consumption.

Loss aversion is violation of consumer theory that Thaler (1980) identified and labelled the “endowment effect”: the selling price for consumption goods is much higher than the buying price, often by a factor of two or more.

Reference-dependence and loss aversion help account for several phenomena of choice. The familiar observation that out-of-pocket losses are valued much more than opportunity costs is an evidence. The distinction between “actual” losses and losses of opportunities is recognized in many ways in the law (Cohen and Knetsch, 1992) and in lay intuitions about rules of fairness in the market (Kahneman et al., 1986). Loss aversion also contributes to the well-documented status-quo bias (Samuelson and Zeckhauser, 1988).

2.3.2 Framing effects

The assumption that preferences are not affected by insignificant variations in the description of outcomes is called extensionality (Arrow, 1982) or invariance (Tversky and Kahneman, 1986). It is considered an essential aspect of rationality. Invariance is violated in framing effects, where equivalent descriptions lead to different choices by altering the relative salience of different aspects of the problem.

Framing effects are prevalent reality - they are only observed in laboratory. There has been considerable interest among behavioural economists in a particular type of framing effect, where a choice between two options A and B is affected by designating either A or B as a default option. The option designated as the default has a large advantage in such choices, even for decisions that have considerable significance. See for example Johnson et al. (1993) and Johnson and Goldstein (2003) the example of framing on the selection of insurance policy and Johnson and Goldstein (2003) on the example of framing on organ donation.

Other violations of the expected utility theory are Scope Neglect (see Desvousges et al., 1993) and Violations of Monotonicity (see Hsee, 1998; List, 2002).

2.3.3 The Endowment Effect

In standard consumer theory, demand is a function of wealth and prices but does not depend on the composition of the endowment. Thaler, in his 1980 paper, coined the term “endowment effect” to describe the experimental finding that agents value a good more if it is part of their endowment than if it is not, i.e., additions to their endowments differently from subtractions. Hence, the endowment point is treated as a reference point and agents are assumed have a kink in their valuations around the endowment point.

A finding consistent with prospect theory and inconsistent with the standard model is the so-called endowment effect, an asymmetry in willingness to pay (WTP) and willingness to accept (WTA).

2.3.4 Hyperbolic Discounting

Standard dynamic decision theory assumes that intertemporal choices do not depend on the decision date. Whether the agent chooses consumption in the initial period or sequentially has no effect on the choice if the budget constraint is the same in both periods. Strotz (1955) develops a model of decision making that relaxes this assumption. Laibson (1997) points out that this model can be used to address experimental evidence of an “immediacy effect” in behaviour: subjects have a tendency to choose earlier, smaller rewards over later, larger rewards when the earlier reward offers immediate consumption but reverse this preference when both rewards are delayed.

Della Vigna (2009) suggest that intertemporal preferences with these features capture self-control problems. When evaluating outcomes in the distant future, individuals are patient and make plans to exercise, stop smoking.

2.3.5 Other Deviations from Standard Model

Nonstandard Beliefs

Experiments suggest that consumers have systematically incorrect beliefs in at least three ways: (1) Overconfidence. Consumers overestimate their performance in tasks requiring ability, including the precision of their information; (2) Law of Small Numbers. Consumers expect small samples to exhibit large-sample statistical properties and (3) Projection Bias. Consumers project their current preferences onto future periods.

Nonstandard Decision Making

Nonstandard decision making relates to: (1) The impact of framing of a decision; (2) The underweighting (or overweighting) of information because of limited attention; (3) Suboptimal heuristics used for choices out of menu sets; (4) Social pressure—explicit pressure by others—and persuasion—excess impact of the beliefs of others; and (5) Impact of emotions.

Limited Attention

In the starkest form of the standard model, individuals make decisions using all the available information. Since Herbert A. Simon (1955), economists have attempted to relax this strong assumption and have proposed models in which individuals simplify complex decisions, for example by processing only a subset of information.

Menu Effects

The evidence in psychology suggests that individuals use (at least) five suboptimal heuristics to simplify these decisions: (1) excess diversification, (2) preference for the familiar, (3) preference for the salient, (4) choice avoidance, and (5) confusion in implementing the choices.

2.4 Social Preferences and Social Norms

Standard economic model assumes that the choices of an agent depend only on his own monetary payoff. This assumption has been challenged by a variety of experiments perhaps most famously the experiments on ultimatum bargaining (see

Guth, Schmittberger, and Schwarze, 1982). Models that have attracted a great deal of attention on the inequity aversion, or “fairness” are due to Bolton (1991), Fehr and Schmidt (1999), and Bolton and Ockenfels (2000). These models are driven by the notion that economic agents are averse to inequity in payoffs: people dislike earning less than their counterparts do but they also dislike earning more than their peers do.

Peoples’ judgments of fairness are important elements in their social preferences. Judgments of fairness are often multidimensional. Camerer and MacCrimmon (1983) point to at least six different factors that is relevant in forming such judgments: *procedural fairness*, *redistributive fairness*, *output fairness*, *pricing fairness* and finally *division fairness*.

Fershtman, Gneezy and List (2012) suggest that behaviour is importantly affected by social norms. They suggest; “if placed in an environment wherein socially acceptable actions provide one person with a greater portion of the rents, people will put forth extra effort to secure those rents, to the detriment of the other player. In this manner, when one can earn more than the other player through actions deemed customary and socially acceptable, people reveal profit maximizing preference and competitive preferences, not inequity aversion. It is important to note that the profit maximizing preferences do not exclude preferences such as status seeking”.

They state also state: “Contrary to our mythical species *Homo economicus*, in sociology there is a different dominant type of player, named *Homo sociologicus*. *Homo sociologicus* is a passive player whose behaviour is governed not entirely by free choice but by following prescribed norms of behaviour, social customs, and inertia (Elster 1989). The social norms are a prescription of behaviour for different circumstances that is common to a group of individuals and therefore are labelled as “social norms.” There is a group of individuals that share and behave according to the same social norm.”

Given the potential strength of such norms, they argue that understanding the hybrid species—a combination of *Homo economicus* and *Homo sociologicus*—is important for social science analysis and for making sense of observed behaviour.

Fershtman, Gneezy and List (2012) suggest; “individuals are not the traditional *Homo sociologicus*, in that they do not necessarily follow the social norm. The overall utility of individuals is a combination of their utility from the distribution of payoffs induced by their actions, and a social penalty whenever their actions diverge from the appropriate action dictated by the relevant social norm. People may differ in the importance they assign to social norms”.

They also state; “Social norms may be enforced by social punishment. The most familiar social punishment involves the attitudes and reactions of other society members. Every time an individual’s behaviour diverges from a norm, the action impacts the other members of the society, who then punish the deviant individual (see Akerlof 1976, 1980; Cole, et al. 1998; and Young 2006). However, social punishment can also be self-inflicted (see also Benabou and Tirole 2004). Social norms are an important part of any social identity. Adopting an identity implies accepting its social norms. The desire to maintain an identity and to view oneself as a moral person as defined by one’s identity, is an important consideration that defines the self-inflicted cost of violating a taboo”.

2.5 Incentives

Gneezy et al. (2011) state, “Economists often emphasize that “incentives matter.” The basic “law of behaviour” is that higher incentives will lead to more effort and higher performance. In recent years, the use of incentives have become more popular. Should students be provided with financial incentives for increased school attendance, for reading, or for better grades? Will financial incentives encourage higher contributions to public goods, like blood donations? Should programs to reduce smoking or to encourage exercise include a monetary incentive?”

Crowding Out in the Short Run when Incentives Are in Place

The psychology literature contains many examples of incentives that reduce effort or motivation to undertake a task during the short run when such incentives are in place.

Crowding Out after Incentives Are Removed

If incentives signal some form of “bad news,” agents who receive incentives will update their beliefs about the task, their own type, or their assessment of their principal. As a result, their motivation to perform the task without the additional incentive can be reduced permanently.

Incentives Can Break Social Norms of Trust

Pro-social behaviour often involves trust. Trust relationships are delicate, however, and explicit incentives can signal distrust.

Incentives Frame Social Interactions and Affect Social Norms

The framing of the decision situation critically influences pro-social behaviour. Moving from no incentive to a positive incentive can dramatically change the framing of the interaction and shift an individual’s decision frame from social to monetary.

Incentives Reduce Image Motivation

Image concerns are another important motivation for contributing to public goods: people volunteer, recycle, donate blood, or behave pro-socially to show others that they are “nice.” Extrinsic rewards can crowd out image motivation by diluting the signal to oneself or others of a voluntary contribution: it becomes unclear whether a person is undertaking a social activity to “do good” or to “do well.”

Incentives and Lifestyle Habits

Habits may be harmful or beneficial to the extent that they decrease or increase future utility. Marginal utility today is correlated with historical consumption; changes today may have only a small effect in the short run but increasingly large effects in the long run.

Gneezy et al. (2011) recommend that in encouraging contributions to public goods, one must be very careful when designing the incentives to prevent adverse changes in social norms, image concerns, or trust. In the emerging literature on the use of incentives for lifestyle changes, large enough incentives clearly work in the short run and even in the middle run, but in the longer run the desired change in habits can again disappear. They also point to a considerable and growing body of evidence

suggesting that the effects of incentives depend on how they are designed, the form in which they are given (especially monetary or nonmonetary), how they interact with intrinsic motivations and social motivations, and what happens after they are withdrawn. Incentives do matter, but in various and sometimes unexpected ways.

Tan and Low (2012) suggest that the combination of incentives with norms should lie at the hearth of any effort to promote sustainable development. Incentives without the supporting social norms can be deeply unpopular. Conversely, social norms without the supporting incentives may diminish or lose their hold on people over time. Behavioural economists also highlight instances where financial incentives may crowd in intrinsic motivations or reinforce social norms. What matters just as much as the policy itself is the context in which policy is implemented and how it is framed.

2.6 Market response

Della Vigna (2006) points out that “the evidence presented on behaviour raises a natural question how do markets and institutions respond to these nonstandard features? An important test for Psychology and Economics is whether it helps to understand markets and institutions, in addition to explaining individual behaviour”.

Della Vigna also raises up the question that “if consumers have nonstandard features, why should one expect firms, employers, financial operators, and politicians to not have them?” He suggests that experience is a key difference. “Unlike individual consumers, firms can specialize, hire consultants, and obtain feedback from large data sets and capital markets. Firms are also subject to competition. Compared to consumers, therefore, firms are less likely to be affected by biases (except for principle–agent problems), and we expect them to be close to profit maximization.

In addition, even when, despite the reasons above, firms still have nonstandard features, they still have incentives to respond to the nonstandard features of consumers, a point that Galbraith (1967) raises up related to consumer sovereignty. Similar arguments apply for employers, institutional investors, top managers, and politicians.

2.6.1 Behavioural Political Economy

Another setting in which we expect an asymmetry between rational and biased agents is politics. While politicians are experienced agents facing high-stake incentives and significant competition, voters make infrequent low-stake decisions—whether to vote and for whom. Therefore, we expect political settings to be well described by the interaction of rational politicians and voters with nonstandard preferences, such as imperfect memory and limited attention. Eisensee and Stromberg (2007) provides an example of politicians responding to a bias of voters, inattention.

2.6.2 Behavioural Public Finance

Behavioural public finance asks how limits on consumer and voter rationality influence taxation and public spending. Some taxes are more visible than others are, and politicians exploit these differences in searching for ways to increase tax receipts

2.6.3 Behavioural Institutional Design

Behavioural Economics has implications for how economic instruments are designed and framed, pointing to the relevance of behavioural institutional design. Societal rules and institutions can be designed to counteract the effect of consumer biases and improve the welfare of consumers, e.g. by dealing with problems of self-control/time inconsistent preferences (see Thaler and Sunstein, 2008). While firms, investors, managers, and politicians may respond to biases by exploiting them, the response to biases need not be predatory. Societal rules and institutions can be designed to counteract the effect of consumer biases and improve the welfare of consumers. Thaler and Benartzi's (2004) Save More Tomorrow plan is an example of one such institutional design for savings. A simple change in defaults, hence, can go a long way toward addressing under-saving.

2.6.4 Time inconsistency and other anomalies in policy-making

Different actors have different time preferences that often are inconsistent. Politicians might make decisions based on their immediate rewards, i.e., re-election, and postpone the costs to future while bureaucrats often reveal a longer time horizon. Bureaucrats are more concerned with professional credibility. This has implications for the division of tasks (see e.g. Alesina and Tabellini, 2004).

Della Vigna (2006) state, "The notion of an individual who is overwhelmed by his cognitive biases and complications as to be incapable of making sensible decisions is as much a caricature of a rational man. If policymakers begin with such a view of human agency, their response is likely to be far more paternalistic, choice limiting and heavy-handed than it needs to be. The libertarian paternalism advanced by Thaler and Sunstein (2003) could easily turn into hard paternalism that eliminates choices" (see also Glaeser 2006). Nevertheless, behavioural phenomena should be taken into account alongside standard phenomena in the policy design.

2.7 Response to climate change; does efficiency matters?

The World Commission on Environment and Development through its report (WCED, 1987), also called the Brundtland Report, introduced the notion of 'sustainable development' into the political agenda. Since WCED many definitions of sustainable development, often incompatible, have been offered. The differences can be linked to the differences in environmental ideologies. A central point of departure between the different views is related to substitutability between man-made capital and natural capital and the services provided by the ecological system (Hackett 2001). The spectrum of sustainability modes covers the very weak to very strong sustainability modes. A strong sustainability mode rejects that the man-made capital can perfectly substitute for the lost natural capital. In this view, some elements of the natural capital cannot be substituted by the man-made capital and some functions and services of ecosystems are essential to human survival and cannot be replaced. Other ecological assets such as landscape, space, relative peace and are quite essential to human wellbeing if not for human survival. These assets are regarded as critical natural capital and are not substitutable, if at all. Within a strong sustainability mode, policies and actions are governed by fixed standard approach, derived from absolute limits, precautionary principles, primary and secondary value of natural capital, constant natural capital, and strong version of safe minimum standard. The strong sustainability mode rejects the methodological assumptions in

cost benefit analysis. However, it does not oppose the achievement of specified goals through cost effective measures, including economic measures (Speth 2005).

In short, a major concern in “sustainable development” is the interests of future generations. Uncertainties, risk, irreversibility, path dependency is central in the course to sustainability and needs to be addressed in the policies and plans. These issues are particularly important in the context of the transport sector.

Moral responsibility, rights, and ethics are central in defining sustainability. Different notions of ethics emphasises different aspects of the consequences of decisions for others and for the future. The list is however similar, its focus is on consumption, education, health and environment (Stern, 2006). The ethical position determines the implications of the assessments of these dimensions.

Ethical considerations emphasises that all perspectives would take account of the distribution of outcomes within and across generation, together with the risks involved in different actions, now and over time. Hence crucial to policy design and choice are the aggregation over consequences

- i. within generation,
- ii. over time, and
- iii. according to risk.

Aggregation across these dimensions poses different kinds of problems and ethical questions.

Other fundamental questions relevant for social choice are (Stern, 2006):

- What do individuals value?
- What is/should be their relation to decisions and decision-making?
- What is the decision making process?
- Who are the decision makers?

2.7.1 Welfare economics approach for aggregation

The underpinning ethics of welfare economics is on the consequences of a policy for the consumption of goods and services by individuals in a community. Goods and services can be defined in a broad way to include education, health, and goods appearing at different dates and in different circumstances. Moreover, individuals value the environment are part of the analysis. Aggregating social utility across individuals to come up with a measure of social welfare has its problems. Different value judgements can lead to different rankings of possible outcomes, and deciding what values should be applied is difficult in democratic societies.

The ethical framework of standard welfare economics looks only at the consequences of actions, i.e., it has a consequentialism approach. Hence, there is no room for ethical dimensions concerning the processes. Processes are important in other notions of ethics, including those based on concepts of rights, justice and freedoms.

There are other fundamental questions related to the underpinnings of welfare economics such as:

- How preferences are formed (Consumer sovereignty)?
- How preferences change?
- Who has the moral authority to do so?

Aggregation over individuals

The overall social welfare depends on the welfare of each individual in the community. Fundamental to cost-benefit analyses (CBA) is the aggregation of individual preferences into collective ones, i.e., summation of costs and benefits over all the individuals in a society.

A main problem in CBA arises over the measurement of cost and benefits in one scale to be able to end up with numerical values for summation. Aggregating social utility across individuals to come up with a measure of social welfare has its problems. Different value judgements can lead to different rankings of possible outcomes, and deciding what values should be applied is difficult in democratic societies. How should the welfare of people with very different standards of living be assessed and aggregated in forming judgements on policy?

Aggregation over time

People do care about when the costs and benefits occur. They have time preference. Policies and plans involve costs and benefits that occur over long times. Long-term effects involves uncertainty, irreversibility and even catastrophic. Assessing impacts over a very long time emphasises the problem that future generations are not fully represented in current discussion. Hence long-term evaluation, explicitly, or implicitly is based on a “social contract” for intergenerational equity. How should future generations be represented in the views and decisions of current generations?

This is captured by the discount rate in cost benefit analysis, by the application of option theory to address risk, uncertainty and irreversibility or by Precautionary Principles or Safe Minimum Standards.

Individual time preference relates to one’s own mortality and may be the interest of direct descendants. The tyranny of discounting is that it could work against the interest of future generations. Discounting damages occurring far into the future makes the present value of such damages considerably smaller than actual damage and when extracting resources is affected by the discount rate, exhaustible resources are more likely to be used up quickly. The higher the discount rate, the less remains for the future generation. For this reason social rate of time preference should include some altruistic interest in welfare of other generations. There is in fact very little scope for avoiding a conscious ethical consideration on choosing appropriate rates of discount for cost-benefit analysis (Stiglitz 1994).

The vast attention on social discount rate in literature testifies to the importance of the subject. Many economists, since Pigou and Ramsey have been engaged in this subject. Portney and Weyant (1999), in their introduction to a collection of articles by a number of prominent economists on discounting and intergenerational equity, suggest that, “There is a sense of unease about this subject, due to the technical complexity of the issues and the ethical considerations.” All agree on a standard procedure for evaluation of projects with timeframes of forty years or less. It is beyond this horizon that the experts divert in their approach and unease sets in.

Schelling (1999), among others, even questions the validity of the standard welfare-theoretic approach for decision making with intergenerational consequences. This view coincides with the view of the supporters of the strong sustainability mode. The strong sustainability position is that sustainability constraints should be seen as expression of Precautionary Principles, similar to the notion of Safe Minimum Standards. It is a way of giving shape to the intergenerational social contract idea. The trade-off decision has to be taken within a context of uncertainty and possible

irreversibility. When harm is irreversible, and there is uncertainty associated with its magnitude and likelihood, the purchase an “option” prevents the harm at a later date. The Irreversible Harm Precautionary principle functions like option theory for environmental risk regulation. The Catastrophic Harm Precautionary Principle is applied when outcomes are catastrophic. It requires special precautions against the worst-case scenario. The principle is based on people’s potential failure to recognise the expected value of truly catastrophic losses and that political actors are likely to postpone action when the costs of precautions are immediate and when the benefits occur in the distant future. These normative arguments are demonstrated in the context of the impacts of global warming. See Sunstein (2005) for an excellent discussion on the subject.

Aggregation over risk

There is a great deal of risk and uncertainty associated with the long-term effects of an action or policy. The risks and uncertainties around the costs and benefits of environmental policies are particularly large. Hence, the analytical framework should be able to handle risk and uncertainty explicitly.

Most actions such as provisions of infrastructure and changes in land use have uncertainty associated with their social benefits and costs, and are irreversible. Their impacts on environment are also associated with uncertainty that can be irreversible, even catastrophic. Technology adoption is another example where investment decisions are made under uncertainty and irreversibility.

Some researchers have applied option theory for environmental risk regulation and evaluations (Sunstein 2005). The simple concept is that when dealing with an irreversible loss, and when uncertain about the timing and likelihood of that loss, one should be willing to pay for an option in order to maintain flexibility for the future. This implies that irreversible decisions must pass a higher obstacle in a cost benefit test.

In summary, weak sustainability views natural capital (environment) as another form of capitals. It assumes perfect substitutability between the different forms of capital. Strong sustainability view is that perfect substitution between different forms of capital is not a valid assumption. On this basis, it is possible to summarise the demands of the spectrum of the sustainability views as follow:

- *Very weak sustainability*: Conventional CBA (correction of market and intervention failures via efficiency pricing; potential Pareto criterion; consumer sovereignty; infinite substitution)
- *Weak sustainability*: Natural capital (environment) is another form of capital. It assumes perfect substitutability between the different forms of capital. Modified CBA (extended application of monetary valuation methods; actual compensation; shadow projects, etc.; systems approach; weak version of minimum safe standard)
- *Stong sustainability*: Fixed Standard Approach (precautionary principle, primary and secondary value of natural capital; constant natural capital rule; dual self-conception, social preference value; strong version of safe minimum standard)
- *Very strong sustainability*: Abandonment of CBA (or severely constrained cost-effectiveness analysis; bioethics)

The above summary suggest that the conventional cost benefit analysis is not an appropriate approach for integrating indicators that measures environmental

sustainability along with other social and economic impacts of projects, plans and policies. However, modified forms of cost benefit analysis and cost effectiveness are useful tools under all modes of sustainability.

2.8 Behavioural Economics and Environment

The standard economic approach to the problem of environmental externalities, such as climate change, is either through a carbon tax, or a cap-and-trade system, in which the government sets a quota for the total amount of externalities that can be produced and allows for the “pollution permits” to be traded.

This differs from a regulatory approach that focuses on setting a minimum mandatory standard. There are sometimes good reasons for setting “green” standards. Standards on equipment help to create a level of playing field among producers when there are high costs involved in switching to cleaner technologies. Standards overcome coordination problems and realizes network effects and economies of scale more quickly. Regulation can be more cost-effective when there are large numbers of people individually generating small negative externalities (e.g. through energy) that can be large in aggregate.

A growing body of evidence suggest that people can be motivated to behave in more environmentally friendly ways by appealing to their need for belonging and a positive self-image, their preferences for immediate gratifications, their aversion to losses and their reliance on simple rules of thumb. Ong (2012) suggests behavioural economics can play an important role in this context by pointing to

1. Image motivation: A study by Heffner et al. (2005) found that the purchase of hybrid vehicles is not motivated by fuel saving, rather than one’s own image (see also the example in the next chapter).
2. Loss aversion: Charging 10 cents for a plastic bag is more effective than rewarding them with 10 cents- Deposit refund schemes. Attention to the difference between willingness to pay and willingness to accept is important in this context. A scheme that leans on “carrots” or rebates to encourage people to switch may be more popular, but “using the stick” or appealing to people’s loss aversion may achieve a better policy outcome. Finding the balance will then be a challenge for decision makers in regulatory agencies.
3. Saliency or availability bias: People tend to weigh heavily their decisions towards more vivid and more widely known information, making any new opinion biased towards whatever information that can be easily recalled. People who see a car accident tend to drive more carefully for the next few days/weeks. Energy consumption patterns may also be shaped by whether and how we receive feedback.
4. Mental accounting: Earmarking (hypothecation) is sub-optimal according to standard economics mode while it can make an externality tax more publicly acceptable.
5. Social Norm (herd effect) See section 2.3.5
6. Framing: See section 2.3.2 and the following discussion by Norgaard.
7. Discounting: Energy efficiency is often held back by people’s tendency to discount distant benefits excessively. Myopia and high discount rates suggest that it often makes sense for government to introduce mandatory energy performance standards to remove the most inefficient appliances from the market and preclude bad choices in the first place.

Norgaard (2010), based on extensive literature review, concedes, “Barriers to effective engagement in response to climate change exist on all scales from the individual to the institutional, and these dimensions clearly interact” (pp 43). Meanwhile she outlines a number of cognitive and psychological as well as social and cultural barriers for lack of response to climate change. Related to cognitive and psychological barriers, the following are her main points. *Cognitive dissonance*: Individuals may block out or distance themselves from certain information in order to maintain coherent meaning systems. *Desire to protect individual identity*: People are motivated to avoid threats to identity. Such threats may be mitigated by selective perception and cognition, and/or redefining the situation to make it reflect a more favourable view of the self. *Role of affect*: Affect, the positive or negative evaluation of an object, idea, or mental image, strongly influence individual processing of information and decision-making. Climate change evokes negative affect. *Role of efficacy*: People stop paying attention to global climate change when they realize that there is no easy solution for it. Increased levels of information about global warming have a negative effect on concern and sense of personal responsibility. Individuals may block out or distance themselves from certain information in order to maintain a sense of self-efficacy. *Negative emotions*: Individuals may block out or distance themselves from certain information in order to maintain desirable emotional states.

Related to cognitive and psychological barriers, her main points are the following. *National Identity*: Information on high carbon footprints contradicts patriotic national pride. *Risk Society*: Complexity of modern life, knowledge specialization and overload; Modern world risks disrupt underlying sense of stability; “Disembeddeness:” Collapsing time and space, risks perceived as remote from daily life. *Cultural Cognition Norms*: Society organizes many aspects of thinking, including patterns of perception and memory; Norms of space: Focus on the local; Norms of time: Future is vague, feels distant. *Emotional Norms and Emotion Management*: Fear, Helplessness; Guilt (related to threats to identity as a good person).

She suggests *framing* of climate message to overcome most of the psychological and cognitive as well as social and cultural barriers. Examples she provides are; presenting information and designing policies that appeal to a positive sense of self, create positive associations, rather than focusing overly on information, focus on what can and should be done and convey a message that it is not too late, that action can be taken that will make a difference. Making a difference can be highlighted in both immediate economic terms (which are important, as they appear more tangible) and climate impacts. She also emphasize on the role of information, on how local events are connected to global phenomenon and to discuss future climate scenarios for specific places at specific future dates so that they can be better visualized.

2.9 Behavioural Economics and Transport

This section draws on different literature with example that suggests the implications of behavioural economics in the transport arena.

1. The power of free: The power of free suggests that once a free item is priced above zero, demand for that item could decrease significantly, more than what conventional economic theory would predict. Conversely, the power of free also implies that beyond the initial imposition of a price, further increases in price of the same magnitude can be expected to be less effective

(see Shampanier, 2007). Leong and Yii Der (2012) point to the initial impact of the area-licensing scheme in Singapore.

2. Sunk cost and variable charges: Standard economics states that sunk costs are irrelevant to current decisions - which should only be based on consideration of current costs and benefits - and should therefore not be taken into account. Arkes and Blumer (1985) randomly distributed seasonal tickets, with different price tags. Those with full price, i.e., a higher sunk cost, attended significantly more plays than those with lower ticket costs. Viewed from this perspective, designing a scheme based on pay-per-use principle is more effective. Similarly, a higher fixed cost of car ownership can be unfavourable to the policy objective of restraining car usage (Leong, and Yii Der, 2012)
3. Making charges more salient: Behavioural economists have observed that people use cognitive processes known as mental accounting to record their financial transactions and assign activities to specific account (Thaler, 1999). In particular, if payment is decoupled from consumption, i.e., put in separate mental accounts, the perceived cost of consumption is reduced and this encourage more consumption, which happens when purchases are made on credit. Conversely, the experience of “having the meter running” is generally unpleasant to most people as it is both salient and directly linked to consumption activity. Thaler noted that many car owners would be financially better off selling their cars and take taxis to the supermarket. However, this is rarely done because paying \$10 for each taxi trip seems to raise the cost of groceries in ways that paying off a monthly car loan do not.
4. Framing: Different groups of people - senior Singaporean public servants, international experts and university students in economic classes – were asked to choose between two equally costly transportation projects that would save the same number of people the same amount of travel time. The first option was a project that would shorten the distance between two points; the second would replace a failed bridge and eliminate a detour that had increased travel time. Overwhelming majorities in each of the respondent groups favoured the latter project. Importantly, a few were indifferent between the two (gain a time or reduce or eliminate a loss). Knetsch (2012)
5. Disparities between gains and loss: increase or decrease in price and the choice of measure to value change: Example of willingness to accept (WTA) vs willingness to pay (WTP) in transport, (Horowitz and McConnel, 2002).
6. The appeal of dedicated funds (earmarking): Example of setting dedicated funds in congestion or road pricing schemes to gain public and political support
7. Standard economics: compensation for harm is more efficient than mitigation actions to reduce or eliminate the harm. People’s reaction is contrary to the standard theory Loss aversion offers partial explanation for people’s preferences for mitigation (see Knetsch, 2012).
8. Herd behaviour (social norm): Axsen and Kurani (2011) report that interpersonal influences has been an important motivation for the purchase of plug-in vehicles rather than fuel efficiency.

3 Institutional sociology and the inescapability of politics

The theoretical framework outlined here is in the tradition from Weber and Bourdieu, focusing on the institutional conditions of legitimacy and power applied on the political field (see Hanf and Jansen 1998), yet complementing this tradition's (and in particular Bourdieu) inadequacy in coping with democracy and as an arena for legitimate distribution of power. Key concepts and elements in such a framework are:

Analysis of politics are, at the end of the day, about substantial matters, about their contents, their short-term impacts and their final outcomes e.g., is the transport system more efficient, what are the short term and long term environmental effects of policy interventions. Such substantial matters are often handled as policy areas, the distinct type of problems discussed by politicians or analysed by social scientists, in subject areas with different degrees of generality (traffic safety, public transport, the transport sector in general), of whom certain types of actors have influence, others not.

Politics, political decisions and outcomes of transport and environmental politics can be analysed as outcomes of the interplay between actors in different fields: the political field, the bureaucratic field and the economic field. The *political field* (Bourdieu, 1991) of transport is an arena in which political actors (not only politicians but also all actors of influence, such as lobbyists and interest groups entering the field for instrumental purposes) compete to influence political decisions. The *bureaucratic field* of transport refers to the state apparatus, the public administration. Together these fields constitute the *politico-administrative* field in which public policies are decided and are implemented and ultimately imposed on the *economic field* of transport, which refers to what is ordinarily called the transport sector. In the economic field (the transport market economy), the actors and their interests anchored here, also influence and constrain the politico-administrative field, and the availability and choice of policy strategies (Jansen, Osland and Hanf, 1998).

By *actors*, we refer to an acting units, which may be an individual or an organisation. By *organisation*, we refer to a social unit deliberately established in order to pursue certain goals (Etzioni 1964). Both individuals and organizations are of different types, they have different types of goals, norms and values that influence the strategic actions they pursue. The goals that such actors pursue are shaped by the institutional surroundings within which they act. A given political field has distinct institutional characteristics, i.e., economic structures, laws and regulations, division of responsibilities and procedural demands for the decision making. Such institutional characteristics influence the distribution of power and authority between actors, by defining 'the rules of the game', e.g., the procedures and criteria for decision-making. It also gives the actors different roles in the different *stages in the decision making process*; the agenda setting at the initial stage where a problem is recognized and defined. The next stage when possible policy alternatives are identified and the options are evaluated, the stage when political decisions are made, the implementation stage and – in some cases – the stage when the project is evaluated.

Power in this context is multidimensional (Lukes, 1974), comprising the Weberian sense of power as the ‘probability that an actor within a social relationship will be able to carry out his will despite resistance’ (Weber 1947). Yet, acknowledging that this also implies the power of non-decision making (Bachrach and Baratz 1962), not the least by the ‘mobilisation of bias’ (Schnattscheider 1960): meaning that the organisation and institutional constraints in the political process imply that some actors, issues and values are organised into politics and others are organized out. It also includes symbolic power (see e.g. Bourdieu, 1991), the power based on control over concepts and categories that produces legitimate perceptions of a problem (e.g., cost-benefit analysis, design of instruments)

The power of actors is not merely a result of the rules of the game, but also the resources (economic, cognitive, etc.) they are able to mobilise. Many involved actors in decision-making processes, in particular in the bureaucratic field, are part of or strongly associated with a profession. Professionals are a certain type of actors. A *profession* may be defined as an occupational group applying knowledge to certain problems with (successful) jurisdictional claims on certain areas (Abbott, 1988) – in our case abstract knowledge to certain areas of public policy. Professions are characterised by academic training that has resulted in a distinct, specialised body of knowledge, they have monopoly on certain positions in public and private organisations, *an esprit de corps*, and a common ethical code. Professions have a somewhat “esoteric” knowledge. The basis of their monopoly of certain knowledge is that they are trained in theories, methods and techniques that others do not easily possess. In many cases disputes over public policies are interdisciplinary disputes, stemming from different professions claiming (superior) knowledge on the same subject or problems.

Politicians have to balance their own political preferences with the need for political support, weighing the political cost and benefits of different policies. These costs and benefits are related to the acceptance and legitimacy of certain policies among citizens or segments in their constituency. Legitimacy may be based on the fact that policies are in accordance with the preferences of citizens, or – in the case of conflicting interests - that citizens whose perceived self-interests have been overruled, have been involved in and had a possibility to make their choices heard in the political process, in accordance with democratic procedures and processes (Habermas, 1996).

In other words, the rationality and logics of the political and the administrative field varies, and although the distribution of roles between politics and administration may be seen to be complementary, the gap between expert knowledge in public administration (e.g. promoting a green tax or a congestion charge) and political rationality is a key challenge in environmental policies. Policies are imposed on citizens in their roles as consumers, e.g., as car-users. The economic field of transportations comprises different types of actors; individuals (e.g., car users) and firms (e.g., a freight company), that act in accordance with different rationalities in different fields, e.g., by the rationality of self-interest or-profit-maximization combined within normative frameworks in according to laws and regulation.

A key assumption following from this perspective is that politics is not and cannot be a technocratic activity, where politicians set the overall goals and public administration choose the adequate measures. On the contrary, the introduction of a certain measure always has the potential of becoming politicized, i.e., to lead to public critique and weaken politicians’ positions and supports. This notion of the inevitability of politics, implies that the assumption that a political design of choice

architecture (contrary to, e.g., commercially motivated design) will tend to lead to moral and political debate, which may undermine or support its purpose and content.

The broader key research themes following from this perspective is major research questions in every policy area. Firstly, what are the institutional characteristics and power relation in a policy field and how these characteristics influences decision-making and choice of policies. Secondly, in this tradition, rationality has always been “a variable” contrary to the key assumptions in neo-classical economy, but similar to behavioural economics, but also focusing on how the very institutions they are embedded in, norms and values are constantly reproduced or changed.

3.1 What makes institutional sociology “critical”?

All theories are value-laden and have normative implications in terms of the key concepts they make use of and evoke. In this sense, this perspectives focus on power provides a certain view of society as characterized by asymmetric power relations and emphasize that what is at stake is power and what type of “institutional logic” (e.g. that of the market or bureaucracy) and concomitant rationality should predominate different fields. This perspective does not, however, have any clear-cut normative or political implications for the social scientists sharing the theoretical toolbox, they may have quite different political opinions, e.g., about capitalism, or be reluctant to take a stand on political issues.

On the other hand, some scholars within this tradition, e.g. Bourdieu and (at least the early) Habermas (e.g., Habermas, 1975) would advocate that social theory should be critical in the sense that it should be aware of and analyses how politics and institutional change alters the power relations in society and the relative importance of different social institutions. It is this critical theory we take as point of departure in this study. A position that emphasize that the introduction and emphasize on market mechanisms are part of a broader restructuring of social institutions, favouring certain actors and their values at the expense of others. Hence, the choice of policy instruments should also be addressed in a wider perspective, analysing not only short time efficiency and distributional effect, but also unintended effects in terms of altering institutional dynamics as well as potential for sustainable support of certain policies.

In this perspective, the use of market mechanisms may become institutional traps. Several critical theorists within this perspective argue that the restructuring of policies over the last decades implies bringing market economy back in the core institutions of the state. This restructuring leads to perverted intergovernmental relations, integrates citizens as consumers in relation to state and state policies and will lead to negative effect in terms long-term erosion of the very building blocks of policies, in this case environmental policies. In the case of environmental policies, one of the controversies about the adequacy and feasibility of policy strategies has centred around the concept of ecological modernisations, and whether increasing emphasis on economic instruments should be analysed in terms of broader restructuring of state-market relations (Jansen, Osland and Hanf (1998).

3.2 Policy instruments and their societal effects

We make an analytical distinction between three types of policy instruments, economic, regulatory and information. In general, standard evaluation of the effects of certain policy instruments focus on effectiveness, efficiency and equity/distributional effects. But given the sociological approach outlined here, more is at stake when it comes to choice and effects of policy instruments. This can be illustrated and outlined by taking Etzioni (1961) as theoretical inspiration. For Etzioni, compliance is an analytical point of departure, and compliance is crucial part of public policy; if compliance with the state's intention is not achieved, public policy makes no sense. Compliance refers both to a relation in which an actor behaves in accordance with a given measure supported by governmental power, and to the orientation of the citizen to the power (instrument) applied (Etzioni, 1961:3). So what is at stake is not only how people respond in terms of actions in accordance with the purpose of a given policy instrument, but how they respond in terms of involvement. Involvement refers to the evaluative orientation of an actor towards an object, comprising two dimensions: direction (on a continuum from positive via indifferent to negative) and intensity (from high to low). For our purpose, we distinguish between alienative (negative, high intensity), calculative (low intensity) and moral (commitment of high intensity) involvement.

Applied to the different types of instruments, they can be seen as making use of different types of power. Etzioni's analytical focus is organizational analysis, implying that it involves the use of remunerative power – based on control over material resources and over rewards through allocation cost in the production and, therefore, deciding on the level of the price of services and commodities. However, when extended the analysis of the use of economic instruments from organisations to effects a given polity and territory, e.g. a country or EU, we should acknowledge that standard environmental economics (and economists' self-understanding) would be that a purpose would be to correct market failure, by including externalities (such as pollution) in the market prices. This understanding differ from seeing it as remunerative power, although they are not necessarily inconsistent since it is a matter and governmental power to implement such measures. Anyhow, it can be assumed that in the response to economic policy instruments, public is involved in predominantly calculative manner.

When the state is applying regulatory instruments, it uses its normative power – its ability to manipulate symbolic rewards, sanction action. It is assumed that this involves citizens at a normative basis. They have to take a moral stand towards the normative argument for realizing the goals the instruments are seen to be instrumental for, and/or the legitimacy of the procedures or the government that formulated the law. When the state is applying informational instruments (which is not explicitly dealt with by Etzioni), they make use of persuasion, either by informing about cause-effects relationships and facts (involving citizens on a calculative basis) or aiming at presenting persuasive argument on questions concerning right and wrong behaviour (involving them on a predominantly moral basis).

This perspective may be an argument for, *ceteris paribus*, instruments evoking normative stands from the citizens are preferable compared to those who do not. They do, if being accepted, lead to continuous moral and political support. Hence, the invisible hands of market mechanisms may have distinct advantages in terms of efficiency, but there may be a trade-off between efficiency and moral and political support, in particular in different and contested policy areas such as climate policies and other parts of environmental policies.

4 Ecological modernization in the transport sector in Norway

This chapter takes as point of departure two main political imperatives and changes from the 1980s and onwards which has affected the transport sector 1) Climate change and climate policies, aiming at restructuring political and economic institutions in order to reduce climate gas emissions and reduce the probability of global warming, and its societal consequences. 2) Changes in economic, fiscal, competition and public sector policies in order to reduce the costs of a growing public expenditure, what was considered to be the “state failure” of Keynesian macro-economic policies and the need to adopt to dictates of international regimes for free-trade and finance in a globalized economy.

The article argues that climate policies in the transport sector must be seen as part and parcel of the Norwegian governments response to the political competition and ambitious targets for Norwegian climate policies in the late 80s. These represented a potential threat against Norway’s strategic role and position as one of the largest oil and gas producing countries in the World. This threat immediately spurred the Ministry of Finance to action, in order to ensure that cost-effectiveness became the primary criteria in climate policy and out-maneuverer The Ministry of Environment and its claim for authority in climate policies. The latter claimed that that the stabilization goal should be operationalized for each sector, i.e. that each Ministry should be responsible for achieving the goal in their sector, and make use of the necessary policy instruments within their sector to achieve this goal. And that the Ministry of Environment should be given the authority to control and follow up the sector ministries.

The predominance of the cost-effectiveness criteria as well as the character of the problem (many emission sources) implied and had as its consequence an emphasis on general instruments and taxation in climate policy. The consequences for the transport sector has been twofold. Firstly, a strong emphasis on the use of economic instruments due to cost-effectiveness, combined with regulations to improve energy efficiency and reduce greenhouse gas emissions. However, also other initiatives, such as the Reward Scheme (see Chapter 6) has been reframed as a climate initiative. Secondly that there are no sectoral goals for reducing CO₂ emissions, due to the argument that this would not be cost effective. On the other hand, the fact that the Bureau and others calculate emissions on sectors and sources implies that the question of emissions from transport sector regularly becomes a public, political issue. The notion of the sector as a statistical category spurs debates over what is to be done.

The results, in statistical terms, is that there has been a 30 percent increase in greenhouse gas emissions from the transport sector the last 20 years. This is a result of a largely demand driven policy in the transport sector, which also has been maintained through the introduction of competition policies and other types of restructuring of the transport sector, such as introduction of comprehensive planning and increased emphasis on urban transport.

It is first and foremost in aviation, competition policies has led to intended effects in terms of improved services and reduced prices, leading to increased patronage and – ultimately – to increase in greenhouse gas emissions. In public transport, on the other hand, competition and increased competition have had some positive effects on services and costs, but has had marginal effects on modal split in favour of public transport. And reduction of the emission of greenhouse gas intensity in car passenger transport, due to technical demands and use of economic instruments, has been outweighed by growth in passenger transport in the same period.

The study presented in this chapter takes as point of departure a theoretical framework and discussion, which can be seen as part of critical institutional sociology, the discussion over ecological modernization. The article shows how key actors act strategically in order to get in a dominant position in defining how the problem (climate policies) should be defined and solved, what types of instruments are legitimate and what are not. It also shows how the general approach in climate policies in the transport sector has been that of making use of economic instruments and technical regulations, with no or little emphasis on changing motivation. On the contrary, the underlying assumption is that people should respond in a calculative way; by calculating the costs of different alternatives, they should and would choose the one with the least negative climate effects.

The effects of these policies are ambiguous; seen within from the perspective of dominant actors in politics and public administration, it has been quite successful, they have stopped initiatives that might have led to measures that would both have been very costly, and distort competitiveness and efficiency in both the general economy and in transport economy.

Seen from the perspective of its opponents, on the other hand, this may be seen as a successful re-framing of climate policies, which has maintained the key role of key actors within Norwegian policy system, paying lip-service to the gravity of the climate problem, yet making sure that interventions that may threaten strong economic actors and interests were ruled out.

4.1 Implication of the study

The discussion, as formulated above, theoretically informed by a sociological perspective. What could it imply to relate key findings and assumptions to behavioural economics? For the purpose of this synthesis, we will make two points.

Firstly, it follows from the analysis that framing, as part of a policy design (e.g., the framing of climate policies in terms of cost-effectiveness and or sector-responsibility), is essentially ambiguous and contested. Framing is integral to political and administrative decision-making, it is not only a question of getting policies accepted, but implies that certain interests are given priority, and that certain policies are ruled out as inadequate.

Secondly, the political analysis made in this chapter may be rephrased in terms of key insights from behavioural economics. One example is that it may be understood in terms of hyperbolic discounting and time-inconsistency in decision-making, politicians and other important players are primarily interested in the immediacy effects, short-term political and economic pay-offs. But seen from the sociologist point of view, it also points to the significance of the knowledge base the object of the analysis (politicians and bureaucrats) uses and the type of knowledge the analyst (being e.g., sociology or behavioural economy) make use of.

5 Effects of economic policy instruments in promoting environmentally sustainable transport: A meta-analysis approach

5.1 Research questions

Are economic policy instruments effective in promoting environmentally sustainable transport? Which of the economic policy instruments that are actually used is the most effective? Do effects vary in the short and long term? These are the main research problems that are discussed in this chapter.

Before discussing these questions, the two key concepts of the study must be defined. The two key concepts are economic policy instruments and environmentally sustainable transport. Economic policy instruments include all measures that influence the generalised costs of travel. The generalised costs of travel are usually defined as the sum of travel time, often converted to a monetary value, and direct out-of-pocket costs, such as tickets for public transport or fuel costs for cars. Other items, such as subjective risk of accident, may be included if deemed relevant. Four economic policy instruments were studied

1. The price of motor fuel. Government can influence the price of motor fuel by means of taxes.
2. Congestion charging or road pricing.
3. Toll schemes, whose main purpose is often to fund road investments, but may be regarded as a very simple form of road pricing.
4. Schemes designed to reward car drivers for reducing their driving, complying with speed limits or avoid driving in the rush hours.

Compliance with speed limits was included, since vehicle emissions depend on speed and reach an overall minimum at a speed of about 70 km/h. The promotion of environmentally sustainable transport includes:

1. A reduction of the volume of travel performed by means of motor vehicles, in particular motor vehicles powered by fossil fuels.
2. A shift in the modal split of travel in favour of modes that consume less non-renewable energy and/or produce less external effects per person kilometre of travel.
3. Changes in travel behaviour, in particular road user behaviour, that reduce the external effects of transport.

External effects of transport include accidents, congestion, traffic noise and emissions of pollutants. Emissions include both greenhouse gases and toxic gases. The study of the effects of economic policy instrument for promoting

environmentally sustainable transport was based on a literature survey. Meta-analysis was used to summarise effects whenever possible.

Effects were stated in terms of elasticity values. An elasticity shows the percentage change in demand associated with a 1 percent increase in the price of a commodity:

$$\text{Elasticity} = \frac{\text{Percentage change of demand}}{1 \text{ percent increase in price}}$$

A negative elasticity means that when price increases, demand is reduced. For normal goods, elasticity values tend to be negative. Elasticity values may differ in the short term and long term. The short term usually refers to period of a year or less. The long term usually refers to a period of 1-10 years after a change in price.

5.2 The price of motor fuel

Hundreds of studies have been made to determine how the demand for motor fuel depends on its price. Two comprehensive meta-analyses were used as the basis for summarizing the effects of changing the price of motor fuel. Both these studies found that the mean short-term price elasticity for motor fuel is around -0.3 and the mean long-term elasticity around -0.8. The results of the two meta-analyses were highly consistent.

The results of the most recent of the two meta-analyses were tested for the possible presence of publication bias, a source of bias that may seriously distort the results of meta-analyses, and that neither of the meta-analyses of the effects of changes in fuel prices addressed. Publication bias denotes a tendency not to publish findings that are not statistically significant or that contradict prior expectations and are therefore regarded as difficult to interpret. One can imagine, for example, that studies showing positive elasticity values are not published and that researchers have difficulty in believing the results of such studies. A statistical techniques called trim-and-fill was used to probe for publication bias.

For short-term elasticity values, there was no strong indication of publication bias. The original mean elasticity was -0.27. When corrected for publication bias, this changed to -0.25. For long-term elasticity values, there was a stronger indication of publication bias. Mean elasticity was -0.77 without adjusting for publication bias and -0.69 when publication bias was adjusted for. Thus, testing for publication bias did not materially change the conclusions of the two meta-analyses.

5.3 Congestion charging

The study of congestion charging focused on the three most well-known and widely studies examples of it, namely congestion charging in Singapore, London and Stockholm.

For Singapore, several estimates of the demand elasticity associated with the congestion charging scheme were found. A formal synthesis of these estimates was not possible, but the general impression was that the demand elasticity for the Singapore scheme is low, probably in the range between -0.10 and -0.20.

For London, there were also many estimates of the demand elasticity. These varied quite widely, but were, on the whole, considerably more negative than those reported for Singapore. The estimates available for London suggest that the demand elasticity

with respect to the congestion charge is in the range of -0.80 to -3.20. It has been suggested that the comparatively good availability of public transport in London contributed to the high degree of elasticity, as switching to public transport was easier than in many other cities.

As far as the Stockholm congestion charging scheme is concerned, estimates of elasticity range from -0.70 to -0.86. It is not unreasonable to interpret the first estimate (-0.70) as showing short-term elasticity (it applied to the first year of the scheme) and the second (-0.86) as showing long-term elasticity (it applies to the sixth year after the scheme was introduced). The short-term elasticity is more negative than for the price of motor fuel, and the difference between the short-term and long-term elasticity smaller than for the price of motor fuel. Possible explanations for this are discussed at the end of this chapter.

5.4 Toll schemes

Toll schemes are basically not mainly intended to influence traffic. It, nevertheless, has been found that toll schemes do influence travel demand. In international studies, elasticity values around -0.10 to -0.30 have often been found. In Norway, where toll schemes contribute importantly to funding road investments, more negative elasticity values have been found.

The mean short-term elasticity for 20 Norwegian toll schemes was -0.56. The mean long-term elasticity for 5 Norwegian toll schemes was -0.82. The long-term elasticity is close to that found for the price of motor fuel and for the Stockholm congestion charging scheme. The short-term elasticity is more negative than that reported for the price of motor fuel.

5.5 Reward schemes

A limited number of trials have been made to test the effects of rewarding drivers for changing their behaviour to promote safer or more environmentally sustainable transport.

The most obvious way of promoting environmentally sustainable transport is to simply stop driving, or drive less. Four trials have been made to reward drivers for reducing their driving. In all these trials, an amount of money was offered as a reward. Then, deductions were made from the reward for every kilometre of driving. If the driver did not reduce the amount of driving, the entire reward would be spent.

The results of the four trials varied. One of them did not lead to any reduction of driving distance at all. The most successful was associated with a 9.8 percent reduction of driving distance. The elasticity associated with rewards for driving less was -0.03. Rewards are, in other words, considerably less effective in reducing driving distance than increasing the price of motor fuel (elasticity of around -0.30).

Five trials have rewarded drivers for not speeding. The effects vary substantially, but can be well described by means of a dose-response curve having the size of the reward as dose and the size of the reduction in speeding as response. In the most successful trial, speeding was reduced by nearly 80 percent. However, the reward offered to obtain this was substantial, 700 Euros per driver. The dose-response curve did not have constant elasticity. The elasticity was found to increase from -0.24 for

the steepest part of the curve (small rewards) to -0.91 for the flattest part of the curve (high rewards). Thus, the marginal effect of the reward was strongly declining.

Finally, a Dutch trial has offered rewards to drivers for avoiding rush hours driving (i.e. not driving at all or shifting the time of the trip). There was a reduction of some 50-60 percent in rush hour driving. The reward therefore had a quite large effect. Arc elasticity was estimated to -0.227 for an increase in effective reward from 15 to 30 Euros per driver and to -0.293 for an increase in effective reward from 60 to 75 Euros per driver. These elasticity values are smaller than those found for the congestion charging schemes in London and Stockholm.

5.6 Discussion of the findings

The four economic policy instruments reviewed in this chapter – the price of motor fuel, congestion charging, toll schemes and reward systems – have all been found to be effective in promoting environmentally sustainable transport. This means that the policy instruments serve to constrain overall traffic volume, reduce congestion and reduce driving at speeds associated with high emissions. However, the policy instruments differ in many respects.

Fuel prices tend to be almost uniform within a country. Taxes on fuel will therefore normally influence traffic in the whole country, whereas congestion charges and toll schemes primarily have local effects. Reward systems can be applied both locally and at a national level, but the trials made so far have all been local. The environmental problems caused by motor traffic vary substantially in time and space; there is therefore a need for policy instruments that can be targeted at local problems.

All the policy instruments reviewed in this chapter have so far been used only in a technologically quite simple form. Today an advanced system of road pricing is technologically feasible. Such a system could replace cruder policy instruments, like taxes on motor fuel or toll schemes to fund road investments. In an advanced system of road pricing, every road user would pay the marginal societal costs of road use per kilometre of travel. Each motor vehicle could be fitted with a driving computer and a geographical positioning system that could record information regarding several aspects of driver behaviour, such as speed, following distance and use of indicators. The data could, for example, be written to a memory stick; data stored on the stick could be read whenever the car was refuelled. In principle, one could price not just the use of specific roads at a specific time, but also accident rate, traffic noise, the emission of pollution and violations like speeding. The system would, however, require a continuous and detailed monitoring of driver behaviour. The anonymity and privacy permitted in the current traffic system would be gone and many drivers would probably regard this as an unacceptable invasion of privacy. Moreover, there would be high initial costs of installing the system and drivers might react unfavourably to having to pay for something they did not pay for before (congestion, the risk of accident, etc.).

Indeed, there is evidence that zero is not just another price, as standard economic theory suggests. The short-term demand elasticity of congestion charging and toll schemes tends to be higher than for the price of motor fuel. Before congestion charges and toll schemes were introduced, you did not have to pay anything, whereas motor fuel was never free. There is a stronger behavioural reaction when something that used to be free gets priced than when there is a corresponding increase in the price of a good that you always had to pay for. The elasticity values reported for

Norwegian toll schemes (short-term: -0.56; long-term: -0.82) may seem high, in view of the fact the tolls were not primarily intended to deter traffic, but to fund road investments. For some road projects, however, the tolls are considerably higher than the charges paid in the London or Stockholm congestion price systems. To the extent that alternative routes are available, toll schemes may reduce the benefits of an investment, by tempting some drivers to use the alternative routes to avoid paying the toll.

Reward systems are sometimes promoted as a more “positive” way of influencing behaviour than “negative” policy instruments such as taxes, tolls or congestion charges. So far, however, there are few examples of the use of reward systems to promote environmentally sustainable transport. The examples reviewed in this chapter all indicate that reward systems are effective. Yet, there are several problems associated with a widespread use of reward systems.

In the first place, recruiting drivers to reward systems has been difficult, in particular in the trials rewarding drivers for not speeding. Dropout rates from these trials have also been high. In the second place, the marginal effects of rewards decline rapidly; hence, fairly high rewards, like several hundred Euros per driver per year, may be needed to obtain major effects. In the third place, some trials indicate that effects decline over time; thus to maintain effects over time, it might be necessary to increase the rewards. In the fourth place, rewarding drivers for abstaining from unlawful behaviour could be viewed as ethically dubious. Drivers who are speeding most often and exceeding speed limits considerably could earn the largest rewards. Cautious drivers, who should qualify for rewards for not speeding, might view it as unfair that the worst drivers are rewarded.

6 The Stockholm congestion charges

Urban congestion pricing has been advocated by transport planners and economists for decades as a way to strike a balance between demand for accessibility and the social costs of car mobility. The big obstacle is usually public opposition. Few cities have dared to challenge this opposition, and even fewer have managed to successfully introduce congestion pricing. The Stockholm experience is an interesting exception. Congestion charges were introduced in Stockholm in 2006, first as a trial followed by a referendum, then permanently from 2007. The trial was forced through by the small Green party in exchange for its support for a national social-democratic government, in the face of public opposition and despite a promise of the social-democratic mayor in Stockholm not to introduce congestion charges. This ignited a heated debate, making public attitudes even more negative to congestion charges than before. But once the trial started in January 2006, the congestion reductions turned out to be enormous, and public opinion shifted quickly. The referendum resulted in a narrow majority in favour of keeping the charges. After the referendum, public support continued to increase, eventually reaching around 70% support (2011). No political parties want to abolish the charges anymore, and the debate has shifted from the system's existence to how it can be improved and how the revenues should be used.

In this context, the Stockholm charges can be used as a case study to investigate to what extent the standard models in neoclassical economics can explain behavioural responses and public attitudes to the charges. Moreover, we discuss the political rationality of congestion pricing, and the importance of attitude formation, framing, social norms and institutional context are important to this evolution.

Were the responses to the congestion charges consistent with the neoclassical economics assumptions? In summary, it seems that the *behavioural* responses were broadly consistent with standard economics, although with some caveats, while the changes in *public attitudes* can only partly be explained by the “rational” framework prescribed in neoclassical economic.

6.1 Behavioural responses

First, it can be concluded that the price incentive worked as expected: the charge actually did decrease traffic. Moreover, the size of the response was consistent with responses to other monetary costs: the forecast effects obtained from a standard transport model (based on cross-sectional observations of how various kinds of travel times and travel costs affect behaviour) turned out to be fairly accurate. Hence, the standard economic concept of utility maximization based on objective variables such as travel times and costs seem to work well enough to predict aggregate behavioural responses.

There was no apparent evidence that the transition from “free” to “priced” created a disproportionately large response (i.e. no visible “power of free” effect). However, since there are only two data points - with and without the charges - so the existence

of a “power of free” effect cannot be ruled out. There is one indication that there might be such an effect: despite that, the peak charge was twice as high as the off-peak charge, the off-peak traffic decrease as almost as high as the peak decrease. This might just as well be due to off-peak traffic being more elastic than peak traffic, though.

The traffic decrease has been remarkably stable ever since the introduction of the charges in 2006 (eight years ago). The effect during the first 6-8 weeks was even larger, so there was apparently some overreaction to the charges at first, perhaps because paying the charge was rather cumbersome at first. Nevertheless, since then, there has been no evidence that the effect of the charges would wane. In fact, on the contrary: traffic levels have stayed roughly constant despite substantial increases in population, income and car ownership, and lower charges in real terms due to inflation and changes in tax deductibility regulations.

The forms for paying the charge has changed several times since the charges were introduced. At first, it was intentionally cumbersome to pay the charge: it had to be paid within five days, each daily charge had to be handled as a separate payment, and unless a specific automatic debit account had been set up, the charge had to be paid in cash at certain convenience stores. The intention was to emphasize that each passage really incurred a cost, and avoid the “sunk cost” phenomenon. Since then, payment of the congestion tax has changed. At the control points, vehicles that pass them are registered. A bill is sent to the vehicle owner at the end of each month, with the charges for the preceding month's control point passages. The bill must be paid before the end of the next month. However, the tax for a passage at a control point is salient. There has been no visible effect of change in payment structure.

One observation that can be interpreted as an inconsistency with neoclassical “rationality” is that not all car drivers returned when the charges were abolished after the trial (August 2006). Traffic across the cordon during charged hours had decreased around 22%, and there was a remaining reduction of around 5% for a whole year, until the charges were reintroduced in August 2007. This may partly depend on extensive road works commencing after the trial, but it may also be a hysteresis effect. If the hysteresis depends on drivers acquiring better information about alternatives, then this can easily be incorporated in a neoclassical framework. However, if it is because of changes in preferences, then it presents a larger problem for a neoclassical interpretation: stable preferences is one of its cornerstones.

Hence, the “economic man” paradigm seems to work well enough to predict behaviour. In fact, the model could predict behaviour better than people could themselves, *ex ante* as well as *ex post*. Surveys in the fall of 2004, the fall of 2005 and the spring of 2006 asked respondents about changes in their travel patterns, in response to the charges. Respondents gave reasonably consistent answers in the three surveys. These answers can be transformed to an equivalent aggregate traffic reduction of 5-10%. This can be compared to an observed reduction of private trips around 30%. This means that around 3/4 of the reduction in car trips across the cordon seems to have gone unnoticed by the travellers themselves. In other words, people’s behavioural response is fairly predictable and consistent – but people are not good at introspection or remembering, neither *ex ante* nor *ex post*.

6.2 Attitude responses

The swing in attitudes was perhaps the most surprising development in Stockholm. The support for the charges started from a relatively high level of 43% in 2004, but dropped to 34% in 2005 immediately before the start of the trial. In April 2006, after four months of congestion charges, support had increased to 53%, similar to the referendum outcome in September 2006. A survey in December 2007 showed another leap in the support to 65%, and subsequent surveys in 2010 and 2011 have shown similar results. The explanation most commonly put forward is that benefits turned out to be much larger than expected. Indeed, several studies have shown a strong link between support for congestion charges and belief in their effectiveness. But there is actually very little support for the hypothesis due to the dramatic increase in support is caused by an increased belief in the effectiveness and benefits of the charges. In fact, beliefs about the charges' effects have remained surprisingly constant over time.

To what extent, then, can attitudes be explained by standard neoclassical variables? First, the standard economic self-interest variables are important determinants of attitudes. Else equal, individuals get more positive the less charges they pay (or expect to pay), the more time gains they get, the higher they value travel time savings, and the more satisfied they are with public transport. Individuals also become more positive if revenues are used in a way they appreciate, which can be viewed as a form of self-interest.

Attitudes to congestion charges are also linked to other preferences and attitudes, which are not usually incorporated in "economic man" frameworks, but can relatively easily be included in an extended set of consistent preferences. For example, positive attitudes to congestion charges are strongly correlated with concerns about environmental issues and with attitudes to public interventions in general (such as taxation, speed enforcement cameras, and belief in a public administration's ability to distribute a scarce resource fairly). These findings go beyond standard neoclassical explanatory models, but are not directly inconsistent with them; rather, they can be seen as extensions.

Nevertheless, there are also clear indications of "anomalies" compared to the neoclassical frameworks. First, it seems difficult to explain the substantial shift in opinion while sustaining the assumption of complete and stable preferences. While variables relating to self-interest and belief in the charges' effectiveness strongly affect attitudes at any given point in time, they do not seem to be sufficient to explain the observed attitudinal change. All groups, regardless of travel patterns, car ownership and belief in the charges' effectiveness (*ex ante* and *ex post*) show the same U-shaped change in attitudes – more negative attitudes before the introduction of the charges, and increasingly more positive attitudes after the introduction. In fact, this pattern is more pronounced for unaffected groups. While beliefs in the charges' effectiveness also increased, that change is not enough to explain the change in attitudes to the charges.

There are several possible explanations for the change in attitudes. For example, car owners who were not objectively affected by the charges may have been alienated by a perceived anti-car rhetoric; the broken election promise may have upset voters, and the democratic legitimacy after the referendum and subsequently negotiated agreement may have increased support. The phenomenon can be seen as a form of endowment effect – first a resistance against increased travel costs, then a resistance against increased travel times.

The second major “anomaly” is people’s apparent inability to predict or remember their own behaviour or attitudes. The actual change in behaviour was around four times larger than the change people anticipated before the charges, and the change they were aware of after the charges were introduced (people’s ex ante and ex post estimates of behavioural change were actually rather similar). A year after the trial period, less than half of the people who had become more positive during the trial now admitted that they had done so; apparently, they thought that they had had the same attitude all along.

The explanatory model that seem to best explain our observations seem to be the attitude formation model from social psychology. At first, few people have any particularly strong attitude towards congestion pricing; if they have, groups with strong environmental attitudes tend to cluster it to this group of attitudes, while groups with strong attitudes regarding taxation, public interventions and individual freedom and mobility tend to cluster to this group of attitudes. When the debate becomes more intensive, attitudes become stronger and more pronounced, and voters more polarized. This development is enhanced by the use of moral and emotional arguments. But once the debate calms down, attitudes become less strong, and congestion pricing may be judged more on its objective purposes and effects. As a technical-rational solution to congestion and a need to generate revenues, it may have a better chance to gain support. While the allocation efficiency and revenues do not seem to generate sufficient enthusiasm to make introducing congestion pricing worth the political risk, these arguments may be sufficient to make the charges survive once they have been introduced. This interpretation emphasizes that preferences are unstable and malleable, and that attitudes to a new issue are formed not (only) by objective evaluation, but through association to strong pre-existing attitudes in other (perhaps superficially) similar issues. Obviously, this is not compatible with the neoclassical cornerstones of complete and stable preferences.

This explanatory model also emphasizes the importance of framing. A political battle over a new issue where voters do not have strong pre-existing attitudes, such as congestion charges, will often be a battle over which existing attitude voters will associate the new issue to, using the existing attitude as a template for the new one. Hence the importance of terminology, e.g., “road toll” vs. “environmental charge”. Depending on which term is used, voters may tend to associate congestion pricing either to attitudes to “tolls” or “taxes” (negative attitudes) or to attitudes to “charges” or “environment” (positive attitudes). Other studies have shown the importance of how the question is framed. For example, a study in New York (Streetsblog, 2013) asked about support for congestion pricing using two formulations. When the proposal was phrased as “charging vehicle owners a fee to drive below 60th street in Manhattan during rush hours,” support tended to fall below 40 percent. But when the pollsters asked “Would you support congestion pricing if the money were used to prevent an increase in mass transit fares and bridge and tunnel tolls?” support increased to about 60 percent.

A third anomaly is that opinions clearly affects people’s view about objective reality. In this case, attitudes to congestion charges affect beliefs in their effectiveness – not just the other way around. Respondents with, for example, strong pro-environmental attitudes show much larger confidence in the beneficial effects of charging, even if they never drive. Conversely, the more charges drivers pay, the less they believe in the beneficial effects. The share of respondents stating that they did not know the effects of the charges were much lower *before* the charges had been introduced than afterwards – coinciding with the time when debate was the most polarized. The more

strongly held views people have about the charges, the more convinced they seem to be that they “know” the effects.

Concerns about fairness and allocation mechanisms might be called a fourth anomaly. It is clear that concerns about fairness affect people’s attitudes to congestion pricing, even if they are not directly affected by the charges through changes in travel times or costs. “Fairness” have several interpretations: “user pays” or “polluter pays” principles are two interpretations, redistributive effects another. People who state that pricing is a “fair” or “reasonable” way to allocate scarce resources are more positive to congestion pricing.

6.3 Social norms, legitimacy and political incentives

There have been suggestions that the introduction of congestion pricing established a new social norm, where driving in rush hours was less socially accepted. There is scant evidence of this, however. In fact, it is easier to interpret the introduction, polarization and subsequent lack of controversy in the opposite way – that the charges could gain broad acceptance once it was shown that it could in fact be reconciled with existing social norms: in particular, that the charges were not an attack on mobility or car use as such. This interpretation simultaneously explains why it was politically rational to first ignore congestion charges, then to advocate them in spite of public resistance from large groups, and why this resistance then died down. It also illustrates the importance of legitimacy. The story has four phases.

1. For a long time, planners and economists in Stockholm had limited success in advocating congestion pricing. Their argument was that it would increase efficiency in the transport system. But very few people have a pre-existing attitude to this concept, and even fewer have an emotional engagement in it. Instead, when faced with the question, people associated to a superficially similar issue such as mobility restrictions or taxation, where they have an existing attitude, most likely a negative one. For an issue to be politically interesting, it must generate enthusiasm among a sufficiently large group of voters. But since transport efficiency is simply not an issue that many people get enthusiastic about, the issue had virtually no political upside.
2. This changed when congestion pricing was reinterpreted as an environmental policy, which happened in Stockholm during the mid-1990’s. While allocation efficiency in the transport sector could not arouse enthusiasm or engagement among the general public, environmental concerns definitely could. This was what was needed to get congestion pricing on the political agenda – a link to an area where strong and emotional attitudes existed.
3. When the decision to carry out the congestion charging trial was made after the election in 2002, a fierce debate broke out. Consistent with what was said above about the necessity of emotions in politics, the arguments soon turned principal, moral and emotional, leaving little room for compromise. This might have been an inevitable development: if congestion pricing had not been elevated to a moral-emotional question, it had not entered the political stage in the first place. But just as inevitable, the morally supercharged arguments for congestion pricing implied (or could be perceived to imply) that all car traffic was evil and unnecessary, and should be banished. This might be one reason for the decreasing support also among car drivers that were actually unaffected: they might simply have been alienated by the anti-car rhetoric. There are also other reasons that may have caused non-affected

groups to develop more negative attitudes: the charges were claimed to have adverse equity effects, be unfair, and a waste of taxpayers' money. The most recurring argument was the lack of democratic legitimacy. The social democrats had made a very clear promise not to introduce road pricing during the election period – and here they were doing it anyway.

4. When the referendum ended in a yes to the charges, the new government decided to earmark the revenues for a motorway tunnel west of Stockholm. From an attitude point of view, this was probably important for several reasons. First, the charges now had democratic legitimacy. In addition to the referendum result, there was now a political agreement about the charges and the revenues – made by the liberal/conservative alliance no less, which meant that all political parties had now sanctioned the charges in some way. Second, the revenues were earmarked for roads. As it was really part of a multimodal package, the revenues could just as well have been earmarked for the railway investments that were also part of the package. But earmarking the revenues for roads not only spoke to motorists' self-interest. It sent a moral signal: it is OK to be a car driver. It indicated a reinterpretation or re-clustering of the congestion pricing issue from a morally charged anti-car measure to a technical-rational measure that was effective – it “worked” in the sense that it generated revenues and reduced congestion. And technical measures arouse much less emotions: people usually do not love them, but they do not hate them either. The most important function of the earmarking may hence have been to discharge some of the sentiments around the charges, moving the debate from the moral domain to the technical-rational domain. Thirdly, it calmed the fears of Stockholm politicians (from all parties) that revenues would end up in the national coffers, either directly or indirectly, by subtracting the revenues from Stockholm's “fair share” of national infrastructure grants.

As was noted in the introduction to this report, “the introduction of a certain measure always has the potential of becoming politicized”. Congestion pricing is an evident example: pricing as such may meet resistance even among people who agree in principle that road traffic should be reduced. In fact, regulation (bans on car driving in certain areas, odd/even number plate restrictions, slowing down traffic through physical measures) are often more popular than pricing measures, despite being inefficient in the standard economic model. Much of the debate before the charges were introduced centred on whether pricing was, in principle, a fair, legitimate and democratic allocation mechanism. After the charges were in place, this debate faded into the background – pricing seemed to become a reasonable accepted way to allocate road space, just as with many other scarce goods (including transport-related things as train tickets, airport slots or car ownership).

Hence, our interpretation of this process is that congestion pricing did not introduce a new social norm or a new principle. Transportation and mobility usually comes at a cost: buying and driving and parking a car is not free, nor are public transport or train tickets. All these prices are already under public control to a large extent, through taxes and subsidies. Introducing congestion charges only adds one particular instrument to affect the price of mobility – it does not change the nature of mobility or transportation.

7 Incentives for alternative fuels and vehicles

The emphasis on the promotion of alternative fuel vehicles (AFV) is in response to our unsustainable transportation systems. Industry and governments have already invested enormous resources to the promotion of alternative technologies. Electric and vehicles running on natural gas, propane, ethanol, biodiesel, and a host of hybrids have received both industry and government attention as potential substitutes to the conventional internal combustion engine (ICE) running on fossil fuel. The efforts to encourage widespread adoption of AFV have not always succeeded. Often attributes such as higher vehicle purchase and operating costs, poor vehicle performance, low re-fuelling range or inadequate government incentives have been mentioned for failures. These explanations fail to consider the entire system that is more complex and related to a well-embedded technology such as ICE. There has been little attention to the complexities of the transitional dynamic due to the diversity of stakeholders, scale and scope economies, the size and impact of AFV fleet, the essential role of infrastructure requirements (such as those related to fuel distribution, service and maintenance) and the interactions between these, in order to achieve a policy objective.

Arthur (1988) explores the dynamics of adaptation of competing technologies under increasing returns, where each technology improves as it gains share of the market. His analysis suggests that “the economy, “over time, can become locked-in by "random" historical events to a technological path that is not necessarily efficient, not possible to predict from usual knowledge of supply and demand functions, and not easy to change by standard tax or subsidy policies. Rational expectations about future agents' technology choices can exacerbate this lock-in tendency.”

The most important causes of increasing returns of adoption relevant for the analysis of ICE and AFV are:

Network externality results when one consumer's demand for a product or service depends on how many other consumers have access to the service. When a network has few subscribers, the average cost is high and the (positive) externalities small. As the number of subscribers grow the cost decline but the utility of each subscriber rises. The concept of critical mass focuses on the relationship between cost and utility. Unless the size of a network increases so that rising utility comes into balance with declining cost, the market cannot take off on its own. Government or the producer can intervene (through subsidy or regulation) to allow the size of a network reach this critical mass (Katz and Shapiro, 1985).

Supply externalities describe the relationship between the diversity of offered services and the network's size (Tirole, 1998). These are related to compatibility problem.

Learning-by-doing (Rosenberg, 1982; Atkinson and Stiglitz, 1969). This externality arises when the more a technology adopted, used and known, the more it will be improved. Since producers expect that technology to dominate, by investment they contribute to the improvement on the technology, as in any self-fulfilling expectation process. Learning-by-doing effects induce a downward change of the average cost curve.

Economies of scale: The cause of the economies of scale is mainly the existence of high fixed costs (costs of infrastructure, of R&D...) and is independent of the output volume. As the output increases, the fixed costs are shared by a larger number of units, induces a decrease of the average cost. There are other causes of increasing returns to scale such as organizational elements. The crucial result of economies of scale is that marginal cost is always lower than the average cost. Increasing returns to information come from the fact that the more a technology is used the better it is known and uncertainty reduces in favour of the dominant technology.

Technological linkages describe the development of products and sub-techniques that generate increasing returns to adoption insofar they are representative from the organization of the whole industry and from some vertical integration aspects.

Examples of these externalities are illustrated in the case of path dependency and economy's lock-in to ICT technology (Ramjerdi and Fearnley, 2014) and are important for the take-off of the AFV technologies. Exit from an inferior lock-in in an economy depends very much on sources of the self-reinforcing mechanism and on the degree to which the accumulated advantages by the inferior equilibrium are reversible or transferable to an alternative one. When learning effects and specialised fixed costs are the source of reinforcement, advantages are not usually transferable to an alternative equilibrium, and repositioning the system is then difficult. Reversing the situation may require substantial subsidy.

The creation of a self-sustaining market for AFV is very costly for society. It involves consumers, many industries, institutions and considerable investments including those related to the supporting infrastructures. The different stakeholders in these different interacting markets face decisions under uncertainty, including in their relation to governments' policies. "Irreversibility" is considerable in this process.

The role of the government in the creation of a self-sustaining market for AFV is crucial and the failure in adopting the "correct" set of policies is costly for the society. While carbon tax on fuels is cost effective and targets both the vehicle type and distance travelled, they are not enough to induce the take-off of less mature technologies (Arthur, 1988). Extra policies are necessary to promote the positive externalities we named earlier such as increased learning by doing, bring about economies of scale, network externalities, etc. In addition, incentives can reduce the risk due to uncertainties in the AFV market. Incentives transfer part of the risk of a new technology from consumers to governmental (local or national).

Examples of these policies are taxations, subsidies and regulatory measures related to fossil fuels and alternative fuel vehicles as well as policies related to the supporting infrastructures and industries. The government needs to make the "right" choice among technologies and like other stakeholders face uncertainties and risks. While a government faces uncertainty in the adoption of an "optimal" policy path, it can create uncertainty by generating an expectation of policy change or by not taking a position at the right time on a necessary regulatory framework.

Yet another equally if not even more costly solution for the society is the government's support for the take-off of an AFV technology that is not "good enough" or as bad compared to ICE. Environmental concerns are both local and global, and the AFV technologies need to respond to both demands. The adverse environmental impacts of production and use of alternative fuels, locally and globally, in a life cycle perspective could be even more than the conventional fossil fuel technologies.

In the followings, the focus will be on two examples from Sweden and two example from Norway of governments' supports for AFV technologies.

7.1 Swedish case studies

Case 1: Electric vehicle

Between 1993 and 2000, the Swedish government supported a major program focusing test introduction of electric vehicles through KFB (Swedish Board for Communication Research). The budget was large, 360 M SEK in total, of which about 60% was spent on demonstrations that is purchase and leasing of vehicles. The aim was twofold: one to support technical development through tendering of large volumes and second to test the feasibility of zero-emission vehicles in practice. The battery cars turned out less feasible than expected in a number of aspects. The initial tendering requirement of a 100 km range could not be met by any offer and in general, the battery cars did not meet technical quality of conventional cars. About 10 years after the introduction of electric vehicles, only half of initial fleet were still in use. By 2007, the size of electric car fleet was only a third of its peak during the trial, in 2001 (see Figure 1). The market share of all the AFV technologies in 2002 was less than 0.2 percent of the car fleet in Sweden.

The failure of the electric vehicle trial can be attributed to several factors. The most important among these is probably the technology of electric vehicles at the time and the lack of appropriate incentive package for the customers. Another factor could have been the lack of refuelling infrastructure, in order to overcome the “range anxiety” among the users. Different studies suggest that the concern for the limited range of electric vehicles is less among those who own electric car than among those who do not. It is possible that initially self-selectivity explain the difference. However, this group can demonstrate to others that the limited range could not be a hinder.

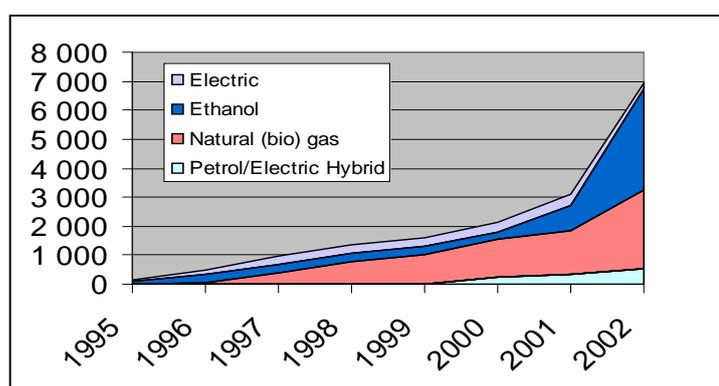


Figure 1. Market shares of AFV 1995-2002 (Source: Ramjerdi, et al. 2009)

There is a new attempt to reintroduce electric vehicles in Sweden. Electric car technology has improved considerably during the past decade. It is expected to go through further changes in future. While the newly produced electric vehicles are significantly different from those introduced in the 90s to the Swedish market, the rapid changes in technology results in risk and uncertainty for consumers. Furthermore, an electric vehicle is still far more expensive than ICE vehicle. On these ground, there is a call for incentives for the take-off of the technology. A consumer incentive was introduced in 2011 to promote vehicles with very low CO₂ emissions. The so called “super green vehicle rebate” reduces the purchase price of

vehicles with tailpipe emissions of maximum 50 g CO₂/km (i.e. only electric vehicles for now) with € 4500 for private owners and 35 percent of the premium cost of company cars and vehicles used for car pools. An extension of the present reduction by 40 % of the fringe tax value (maximum € 1800) for leased company cars is under consideration. These efforts are matched by parallel local initiatives, such as procurement of electric vehicles by organizations and companies all over Sweden.

The official Swedish policy is not to promote a specific vehicle technology; meanwhile, the government's goal is to make the vehicle fleet independent of fossil fuel by 2030.

Case 2: Ethanol fuel (E85)

Ramjerdi et al. (2009) provide a history of the “random historical event” and the take-off of flexi-fuel vehicles and Sweden. In summary, an extensive policy package led to the take-off of sales of flexible fuel vehicles and use of E85 by 2005 (see Figure 1). The policy package included regulatory measures for the provision of refuelling station for alternative fuel. Due to cost of provision of refuelling stations, stations that provided ethanol fuel (E85) became dominant. Other components were tax exemption on biofuels, CO₂ tax on fossil fuels, provision of subsidies for the purchase of alternative fuel cars and tax rebate for the purchase of alternative fuel company cars. The policy package at the national level was enhanced by local policies related to parking and exemption from congestion pricing in Stockholm. The exemption from congestion pricing contributed to a significant increase in number of “green” cars among those crossing the charging cordon – from 3% during the trial period to 14% in December 2008. This exemption of AFV from toll payment ended by 2012.

Sweden heavily subsidized the stimulation of large “flexible-fuel” passenger cars. With the spike in price of ethanol in 2008 and despite the tax exemption, it was more expensive to drive a flexible fuel car on E85 than on gasoline. The result was a car fleet with a larger CO₂ emission than if the policy package had supported smaller and more fuel-efficient ICE vehicles. The revision of many of these policies has made the policy package more technology neutral. The number of flexible-fuel cars sold in the Swedish car market decreased since its peak in 2009 (see Figure 2). The share of flexible-fuel cars in the car fleet was slightly over 5 percent in 2013.

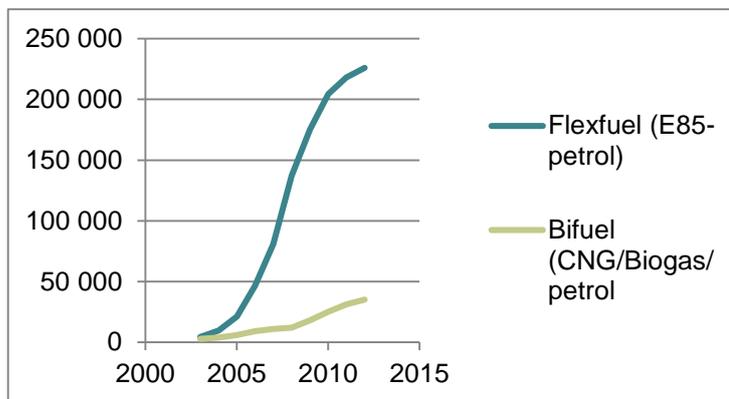


Figure 2. Market shares of flexible-fuel cars and other AFV technologies in Sweden.

The take-off of flexi-fuel vehicles and E85 by 2005 can be attributed to two important factors. One is related to the availability of the E85 at the fuelling stations. Research on the cost of limited fuel availability suggests that exponential is probably a suitable functional form and cost decreases rapidly as the fraction of refuelling

stations that offer the alternative fuel approaches 20 percent. Approximately, 2100 out of 3500 refuelling stations provided E85 in 2010 in Sweden. The second important factor is related to the increase in the price of gasoline and the price difference of gasoline and E85. The gap started to widen by 2005. Other incentives also contributed.

7.2 The Norwegian case studies

Case 1: Diesel vehicle

In Norway, the policy package for improving the fuel economy of road vehicles comprises of differential taxation on car ownership and fuels based on CO₂ emissions decreased the cost of ownership and use of diesel vehicles. An unintended consequence of this package was a large increase of the share of diesel engines in the car fleet resulting in emission of other pollutants, notably particulates and NO_x, harmful for local environments. The policy package is now modified to address this unintended consequence, and there has been a decrease in the sale of diesel cars. The share of diesel vehicles among all newly registered passenger cars has decreased from 64.3 percent in 2012 to 52.8 percent in 2013. Most new diesel cars are more fuel-efficient and have substantial reductions in emissions of local pollutants.

Obviously, in this case, the availability of refuelling infrastructure was not a hindrance for the swift increase in the purchase of diesel vehicles. Neither was the familiarity of the public with the technology. Instrumental for the increase in the diesel vehicles in the car fleet was financial incentives in the form of differential taxation of car ownership and fuels.

Norwegian Case 2: Electric vehicles

Figenbaum and Kolbenstvedt (2013) provide an excellent history of the “random historical event” at the start up to the take-off of electric vehicles in Norway (see also Sandèn, 2013). While the oil crisis of 1973 diverted attention to ethanol as alternative fuel, in Norway the crisis led to an infant electric car industry. The exemption from registration tax for electric vehicles was in place in early 90’s. There was a considerable media attention on AFV technologies, in particular electric vehicles. In a study of car ownership and alternative fuel vehicles, conducted in 1993 by TØI, 30% of living in urban areas stated that they would consider an electric vehicle as their main household vehicle, and 77% would consider it as an additional vehicle (Ramjerdi et al. 1996). At the time there were not more than 100 electric car privately owned in Norway. By 2009, with the entrance of big car manufacturing companies into the Norwegian market, electric car production in Norway came to a halt.

Institutional support for promoting low emission transport technologies originally came through organizations such as Bellona, Research Council of Norway, and Innovation Norway. Transnova, a government organisation, was established in 2009 to formally take over the task. With the support from Transnova, parallel with local initiatives, infrastructure development for refuelling electric vehicles accelerated from 2010. The support has now been extended to fast recharging stations. While no new incentives has been introduced since infrastructure development, the sales of electric vehicles have increased significantly since 2011. Throughout 2013, there were 7885 cars with zero CO₂ emissions registered, 99.6 percent more than in 2012.

Econ Pöyry calculate the total cost in relation to the CO2 emissions avoided and find a cost of 3300-4000 EUR / ton CO2 reduced. According to Sprei et al. (2013), the role of incentives has been crucial in the sales of electric vehicles (see the figure below).

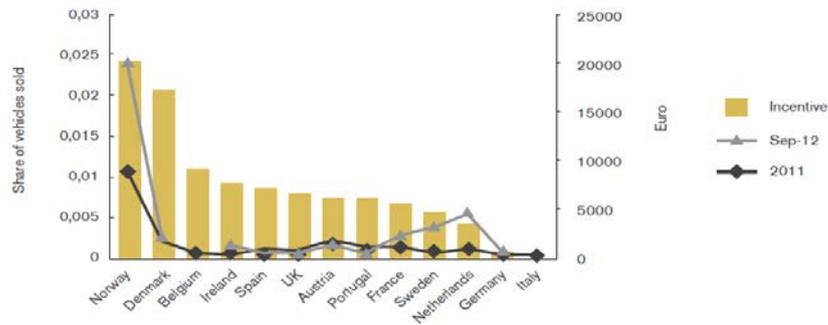


Figure 3. Lines and left axis show EVs share of new cars sold in 2011 and 2012 (for Belgium and Italy only 2011). Right axis and bars show incentive levels for each country (Source: Sprei et al. 2013).

Table 1 shows the incentives that were introduced over time that contributed to the take-off of electric vehicles in Norway.

Table 1. Phases in the development of Electric vehicles in Norway; activities, market operators, measures and incentives (Source: Figenbaum and Kolbenstvedt, 2013)

Phase	Year	Activities	Primary market operators	Measures and incentives introduced
Concept development	1970-1990	Development of Electric vehicle prototypes and propulsion systems	Bakelitfabrikken Strømmens Verksted ABB	Research funding
Test	1990-1999	Testing in test programs and car fleets, and the prelude to the commercialisation	Energy companies Think Citroën Norge Peugeot/Bertel O. Steen Kollega bil Miljøbil Grenland	Exemption from registration tax (1991) Free parking (1993, -1998) Reduced annual licence fee (1996) Road Toll exemption (1997) Reduced imposed taxable benefit on company cars (1998)
Early market	1999-2009	First attempt at commercialisation, supply of vehicles is a challenge, the technology has some teething problems	Think (part of Ford until 2003) Kollega Bil (Elbil Norge, Pure Mobility) Miljøbil Grenland	VAT (25%) exemption (2001) Experiment with bus lane access (2003), permanent 2005. Mini-buses removed from bus lanes (2009) Ferry ticket exemption (2009)
Market introduction	2009-2012	Established vehicle importer starts selling Electric vehicles in larger volumes. Supply of vehicles is no longer a limitation. Prices are decreasing. Plug in hybrid vehicles from 2012	Mitsubishi, Peugeot, Citroen, Nissan, Tesla, Renault, Mia Toyota, Opel, Volvo, Fisker	Plug-in Hybrids defined as hybrid vehicles and are thus given a 10% weight reduction before calculation of the weight tax (part of registration tax), and only the combustion engine power is subject to the engine power tax (2011). Plug-in hybrid vehicles are given permission to recharge and park at charging stations (2012).
Market expansion	2013-	More importers want to sell vehicles from 2013-2014, increased competition with more dealers will mean a continued decrease in price, but not as fast as seen in the previous phase for Electric vehicles.	As above + BMW, VW, Audi, Smart, Daimler, Ford	Plug-in hybrid vehicles have been given a greater weight reduction of 15% when calculating the registration tax (2013). In this phase, the bus lane access will be a challenge to public transport, and this will eventually be removed, first locally, then nationally. As the market increases, it will be difficult to maintain other incentives and a phasing out plan must be formulated.

7.3 Alternative fuels and vehicles: incentives and behavioural change

The review of the cases from Sweden and Norway suggests that policies for the stimulation of the market to more environmentally friendly vehicle technologies does not quite follow the standard economics policies. The existence or the provision of the necessary infrastructures such as refuelling stations are important for the take-off of AFV. Meanwhile, economic efficiency of the incentive schemes are not a consideration in the short run. “Getting prices right’ in the sense of choosing the desired (socially optimal) path or scenario and driving markets along a dynamic pattern of feasible technological change through externality taxation (or emissions permit quota) may not be an easy programme. A single price on greenhouse gas emissions or subsidy on greenhouse gas abatement might not discriminate effectively between different technologies that take into account differing roles at different

stages in the policy scenario. Arthur (1990) points out to the difficulties of such policy formulation. The failure of the take-off of electric vehicles in Sweden and its success in Norway verify this point.

Earlier we pointed to the lock-in effect in the context of ICE. Exit from lock-in arises through gradual progress and major innovations, but also through what Gaviria (2001) formulates as *change in fundamentals*, *self-fulfilling prophecies*. Under all models that describes exit from lock in, once the transition gets started, the move to a new equilibrium will happen quickly. Changes in fundamentals relate to changes in technology (or preferences) that lead to changes in behaviour. Self-fulfilling prophecies refers to changes in behaviour of people based on their expectations of changes in other people's behaviour.

Most studies suggest that different economic incentives, rather than environmental concern, are most important for switching to “environmentally” friendly vehicles (see for example Sprei et al. 2013). However, evidence also suggest that “changes in fundamentals” and “self-fulfilling prophecies” have been quite important for the take-off of electric vehicles in Norway. In behavioural economics, changes in fundamentals is referred to as the creation of social norms (or herd effect). The economic incentives have resulted in demonstration of the technology and resulted in changes in attitude towards the technology and changes in behaviour in car ownership.

It is also important to point that while economic incentives have functioned to help the take-off of a vehicle technology, such as the example of flexi-fuels vehicles in Sweden, or the widespread use of a particular technology, such as diesel fuels in Norway, with outcomes that have not been desirable. The unintended effects of subsidising some technologies can be quite significant.

8 Studies of the design and effects of economic incentive schemes in public administration

The chapter presents two case studies on the effects of incentives schemes in the public sector and analyses schemes that might fit the logics of the public sector to achieve the intended environmental effects.

Decisions in the public sector result from an interplay between political considerations and bureaucratic knowledge (Jansen et al. 1998), and therefore decisions need to be understood in a different context than those made for instance by individuals in the private sector and which are often the basis for economic analysis. A person employed in the public administration works in an organization where the division of tasks, standard practices, transmission of decisions, communication channels and training procedures are essential elements in prioritizing tasks and forming decisions (Simon, 1976). The administration must also deal with politicians who make the formal decisions on how to prioritize a municipal budget. Investments promoted by public administrators might not make it through political decision making, as politicians may consider other areas more important for getting votes. Boasson (forthcoming) specifies two types of political logics that may come into play: the logic of competition and the logic of the garbage can. Competition refers to the fact that politicians tend to be competitive in influencing policy outcomes and being elected. In addition comes the long term concern of the political parties to have legitimacy in policies. According to the theory of the garbage can logic (Cohen et al. 1972), the preferences of politicians are formed through the decision making process. Politicians do not always have a good understanding of how policy functions. Politicians are not aware of the full range of instruments available to them, nor are they able to understand all the consequences of the various decision alternatives. Thus, administrative and political practices and processes need to be studied to understand the effects of different schemes directed towards the public sector.

In two selected case studies, we have examined economic incentive schemes directed towards the public sector and analysed the effects of those. In addition, we have looked at a scheme directed towards the public sector that might overcome central barriers for action through playing along with logics in this sector. The two different studies are presented below.

8.1 A study of the Norwegian reward scheme for sustainable transport

The reward scheme is a governmental incentive agreement established in 2004. The purpose is to encourage better accessibility, safety and health in metropolitan areas, by curbing the growth in demand for motorized transport and increase the number of public transport patronage and curbing travel by private car at the local level.

Municipalities apply for an (four-year) agreement to the Ministry of Transport and may receive financial support if they have implemented or plan to implement restrictive transport measures within the agreement period. It is also a requirement that car traffic actually is reduced in the municipality. The state has the possibility to sanction municipalities if they think lower levels of authority has defected from the agreement.

The reward scheme is a response to a traditional policy dilemma. Local and regional authorities are largely responsible for measures that influence traffic developments on local level, e.g. land-use, restrictive measures and public transport. Moreover, developments in traffic has largely been increasing, which contradicts the governmental goal of reducing car traffic and increasing travels by public transport, cycling or walking. The reward scheme can be interpreted as a response to this institutional setting and the lack of goal achievement. Municipals possess the power when it comes to implementing necessary transport policies and the state possess few measures for influencing development on lower levels of authority. By providing incentives, the state aims at stimulating the use of restrictive measures and gaining control over transport policies. The state is thus applying economic instruments and its remunerative power to overcome the seemingly deadlock between national and local authorities.

What has been the effect of this scheme? The results are mainly focused on effectiveness, although efficiency and legitimacy are necessary aspects in evaluating whether the scheme has been successful (see the discussion on efficiency, effectiveness and legitimacy in the introduction). Decreased car use is the most important goal of the scheme and it has only to a limited extent been successful (Urbanet 2012). Only one out of nine municipalities have reached the goal of no growth in traffic. In the other municipalities, car traffic has in general increased. From such a perspective, the incentives has not been effective. However, use of restrictive measures are a core feature in the agreements. In the last decade, the largest Norwegian municipalities have introduced new restrictive measures through either (increased) tolls or congestion charging. This has although not been sufficient to reach national targets. It is questionable whether this trend can be only linked to the reward scheme. It is a requirement in all new infrastructure investments that local authorities contribute with “user-payment”. Therefore, use of tolls are a necessity in order to finance new investments in road or public transport. These requirements might be at least as important as the reward scheme. The reward scheme however has contributed to increased financing of infrastructure measures for public transport – which is in accordance with the agreement (Urbanet 2012).

Incentives have steadily increased throughout the past ten years been. In 2004, the total amount available for rewards were 75 million NOK and the yearly allocations has grown to 930 million in 2014. There are few empirical evidences of goal achievement despite over 800 % increase in available funding. However, the reward scheme has led to increased investments and finance in public transport, which probably would have not been the case without the scheme. In such light, the scheme has “nudged” lower levels of authority towards focusing more on public transport. This corresponds to the governmental goal.

8.1.1 Three challenges: Implications for the project

A first challenge is related to the vulnerability of the scheme to politics. Institutional sociology will be sceptical of analysing the reward scheme as apolitical and will highlight a different form of rationality compared to the logic of economic man. A

key assumption is that the reward scheme cannot be regarded as a technical institution, where the state sets goals and requirements for transport policies or requirements for transport development. The theory emphasises that the scheme is vulnerable to changing political constellations and political constellations will manifest it selves in the design of the scheme, the goals of the scheme, which actors that are allowed to apply and whether the state will sanction lack of goal achievement. In the real political world, there are political trade-offs and conflicts that cut across political levels, both in terms of transport policy priorities (for/ against congestion charging) and share similar or conflicting majority coalitions (red/ green, blue/blue, blue/green) at regional/local and central level. Further, the state will not automatically sanction municipalities that do not fulfil agreed targets or measures. This is related to a politicization of the reward scheme. The incentives have a rational design, but in reality, it is embedded in political decision. The system is therefore fragile since political interests connected to transport varies between political parties. Example: Would the Minister from the party x sanction against a municipality that does not have a desired traffic performance - and the municipality is governed by the same party x?

A second challenge is related to exogenous variables. Contract theory specify that contracts should be limited to aspects that the municipalities control. However, development in traffic are dependent on a range of exogenous factors. For instance, one main driver is economic development. Economic growth in Norway have led to substantial working immigration in Norwegian municipalities and this is a major factor explaining the growth in population. Secondly, economic growth effects freight development. It is not possible for municipalities or the Ministry to measure whether growth in traffic is due to private or business passenger transport. This is important since the reward scheme is only limited to passenger transport. The reward schemes success is therefore to some extent dependent on whether Norway experiences economic decline or growth. In a case with economic decline, the municipalities will have higher probability for rewards. In a case with economic growth, municipalities will have less probability for fulfilling the requirements in the reward scheme. This is a challenge when using goal achievement as a main factor for evaluating municipalities.

A third challenge is related to asymmetrical information and the difficulties of verifying whether the agent fulfil its responsibilities. It is especially challenging to estimate effects of future planned instruments. This is important since the reward scheme makes agreements based on estimated future developments. The governmental side has few instruments of controlling the expected consequences or verifying whether municipalities intend to implement promised measures.

In summary, the results does not suggest that rewards or incentives do not work. In general, the reward scheme has led to increased investments and finance in public transport. Nevertheless, it has been less effective in terms of restrictive measures and goal achievement. The three perspectives highlight separate problems and separate amending strategies. Institutional sociology, as analytical framework, suggests changing the reward scheme, from functioning as a steering system aimed at influencing the use of restrictive measures and traffic development at local levels, to a financing system with a limited scope of supplementing investments in alternative modes than car. Consequently removing the political and normative components of the scheme, due to its vulnerability to the differences in political values between state and local authorities and in general to different political alignments. Moreover, the political logic contradicts the logic embedded in the reward scheme. Contract theory will recommend amending the measurement of the scheme focusing on aspects that

are solely under municipal control and not including exogenous variables. Principal-agent theory will recommend amending strategies for asymmetrical information. One possibility is to change rewards towards past developments, and not future (planned) developments.

8.2 Study 2 - Energy performance contracting in the public sector: Overcoming barriers to energy savings?

This study focuses on a specific scheme for increasing energy savings in the municipal sector in Norway. The study is co-financed between two programs from the Norwegian Research Council; Energix (project ESPARR) and Miljø 2015 (this project).

Policies for energy savings are one of the main elements of the Europe 2020 flagship initiative for a resource-efficient Europe. However, experience and research show that it is difficult to realize the potential for energy savings. The topic of the paper is energy savings in the public sector and one specific method of increasing savings, namely Energy Performance Contracting (EPC). EPC consists of a set of energy efficiency measures provided by an Energy Service Company (ESCO). It guarantees that the savings produced by a project will finance its full costs. Estimates indicate that EPC is a promising way of increasing savings substantially. We explore the factors of importance for the municipal sector when choosing EPC as their method of increasing savings. The results are based on interviews in seven Norwegian municipalities.

From an economic point of view, it is difficult to understand why profitable investments and measures are not undertaken. However, when faced with energy saving decisions in the public sector, standard economic approaches for understanding barriers to energy savings are not sufficient. In this sector decisions are often a result of an interplay between political considerations and bureaucratic processes. When considering whether or not to invest in energy saving measures, politicians must consider the risk of failure. In the longer term the legitimacy of the political party can be damaged if the investments do not result in the expected energy savings. The guarantee provided as part of EPC overcomes this problem, which a competitive politician might foresee. Further, if politicians do not have a complete overview of the instruments available and the different decision alternatives, the guarantee avoids the problem of a politician regretting a decision because of a less than successful result since there are actually no risks involved. Thus, within both the political logics discussed by Boasson (op. cit) the guarantee becomes important for gaining approval for EPC.

We also find that the uptake of EPC is dependent on persons at the administrative level with technical and institutional knowledge combined with a commitment to energy saving issues. Administrative entrepreneur within the municipal organization thus play a vital role in promoting EPC. Further, the guarantee that accompanies the EPC is well suited for addressing the logic of politicians, and is crucial when the final decision is to be made.

The general lessons to be learned from the study is that schemes directed towards the public sector need to be based on the logics of those that are making the decisions and also towards the context in which these decisions are made to achieve the aimed results.

9 Discussion

The transport sector is often characterised as a socio-technical system or as an open complex system. The term socio-technical system is a conceptual reminder that technologies affect and are an effect of their broader infrastructural, organisational, regulatory, and symbolic environments. By open complex system, we mean that there are multiple interacting markets, with many types of increasing returns and many positive feedback mechanisms between these markets, with many non-linear relationships and time lags and institutional settings as well as interactions with its surrounding markets and environments. Among the characteristics of such systems are path-dependency and lock-in effects. Governing the transport system also means mediating between various conflicting interests and objectives such as economic development, environmental protection, human health and social equality. Further, it must take into consideration technical innovation, quality standards, habits, standards of living and ideological visions. (Ramjerdi and Fearnley, 2014).

An understanding of the transport sector is crucial since policies and plans are devised for implementations in this system and with the expectation to produce the intended results. Policies and plans involve costs and benefits that can occur over long periods. From an economic perspective, the complexity of the transport system has serious consequences. Most economic thinking uses simplifications and models to understand the world. These models will capture the essence of the process and help us understand it, but in doing so things are left out. This does not need to be a serious issue, but it can be when structural changes are underway or we seek radical change in direction. The alternative to this simplification is a set of very complicated dynamic models with many variables and different lags. This in turn might easily become a black box limiting, rather than helping, our understanding of the processes involved (see Key, 2011). In other words, transport systems are difficult to model precisely. This is not only linked to the internal complexity of the system, but also to external factors, such as risk and spillover effects from other markets, feedback effects *etc.*

Low and O'Connor (2013), in responding to the dilemma of sustainable mobility, pose three questions, consistent with Flyvbjerg's (2001), that requires social science response. These are:

- Where we are going?
- Is it desirable?
- What should be done?

Asheim (2007) suggest that for social choice theory to direct us on how to resolve the normative question on sustainable development, three fundamental questions should be resolved. These are:

- Justifying sustainability: From a normative perspective, why is it desirable for our generation to contribute to the implementation of sustainable development?

- Characterizing sustainability: If sustainable development is implemented, what does it look like? How do we describe the situation if we are heading for the right destination?
- Indicating sustainability: If we would like to implement sustainable development, how can we tell whether development is in fact sustainable? How to detect if we are off course?

These questions, posed by Low and O'Connor and Asheim, are fundamental questions that we need to address in finding solutions and our way to sustainable transport.

“Science seeks answers through the lens of theories. If it is a hubris for natural scientist to imagine that there can be a single theory of everything, it is the height of arrogance for social scientists to do so. Different theories can illuminate reality in different ways, and these ways of illuminating reality also drive action so perhaps the episteme-phronesis distinction is also in need of revision.” (Low, 2013, pp 218). Behavioural economics and institutional sociology are among the disciplines that can provide insight to the complexities of the transport system and support the design of policy instruments.

Behavioural economics draws mostly on psychology, but also on social psychology, to explain the deviations of behaviour from the “rationality” defined in neoclassical economics. Psychologists focus on how behaviour is affected by emotion, perception and cognition and on the role of affect in shaping cognition and often the individual is the unit of analysis. Social psychology focuses on the interaction between individuals and groups. It approaches questions from both the sociological and psychological angle.

Policies are not made in vacuum, institutions matters. The discipline of institutional sociology focus on the pull between individuals and institutions: individual behaviour rests in an institutional context and there is an interplay between the two. Sociologists have studied the relationship between the state and corporations and media discourse in structuring national policies, including climate policies, and how cognition and emotions are socially constructed. From a social problems perspective, not all imminent concerns make it to the public agenda. “Even problems which are quite serious and affect many individuals do not automatically receive space in the public eye. Rather the one criteria of whether an issue will make it to the level of a recognized “social problem” is that the condition can be solved through collective action. In this perspective, it is taken as given that if no solution is perceived to be possible, people are more likely to “resign themselves to their fate.” In other cases, the sociological emphasis on the role of culture and social structure in cognition and perception...” (Norgaard, 201, pp 16).

While the two disciplines examines the issues from different angles, they are complementary for devising environmental policies. Nevertheless, the differences on the emphasis of the two disciplines, often results on the emphasis of different policy instruments. We summarise the results from this study, with emphasis on the relevance of the two disciplines in policy design, in the following sections.

The transition to sustainable transport requires technological fixes (e.g., alternative fuels and vehicles) and behavioural changes. Meanwhile social and institutional changes are required to allow policies to bring about the necessary technological and behavioural changes. The focus of this study has been economic policy instruments.

Chapter 4 summarises the politico-economic and politico-administrative structure of the transport sector in Norway. This chapter describes the transformation of the

politico-economic mode of the governance of the of the transport sector under a neo-liberal regime with its emphasis on deregulation, liberalization and the virtue of market-based governance. An understanding of these structures are necessary to influence shifts in transport policy.

The meta-analysis results, presented in Chapter 5 suggests that economic policies works (Elvik, 2013a, 2013b, 2014). The economic policy instruments that were considered in this chapter were fuel taxes, congestion charging and cordon toll schemes. All these policy instruments have positive effects on environment, either globally or locally. The analysis in this section does not evaluate other instruments that had accompanied these economic instruments, due to lack of data. Regulatory policies, in terms of setting standards on fuel efficiency of new vehicles have been instrumental. For efficiency and legitimacy of congestion pricing and road pricing schemes, alternatives to travel by car, either by increasing the supply and improvement of alternative modes are necessary. Information technology makes it possible to carry out activities at distances. While the necessary institutions for fuel taxes are in place, the introductions of toll schemes and congestion charging required new institutions. Furthermore, with the success of Stockholm congestion charging, some important barriers to congestion pricing has been removed, at least to a large extent at a political level and it has made it more appealing for public acceptance. More and more cities are discussing congestion charging schemes. In short, social norms among politicians and public has been affected.

The reward schemes (economic instruments) considered in this chapter were the ones offered to public, for driving within the speed limit or for not using car as an alternative to a congestion-pricing scheme. These studies suggest that over time the impacts of the reward system wither away. To get the necessary response, the rewards have to increase. This effect has been discussed in behavioural economics (see section 2.3.7). Elvik questions the legitimacy of these types of reward schemes. also argues that reward system (to public) could also be viewed as unfair, since the reward is granted to those who are generating the externalities, for decreasing driving during congested periods or those who are exceeding the speed limits.

In Chapter 6, Eliasson (2014) suggests that the behavioural response to congestion charging in Stockholm has been largely consistent with neoclassical economic theory. However, the neoclassical economic theory can only partly explain the public attitude. Stockholm introduced congestion charges in January 2006, first as a trial followed by a referendum, then permanently from 2007. The small Green Party forced through the trial, in exchange for its support for a national social-democratic government. The heated debate that followed made public attitudes even more negative to congestion charges than before. However, once the trial started the massive relief from congestion shifted public opinion quickly. The referendum resulted in a narrow majority in favour of keeping the scheme. After the referendum, public support continued to increase, eventually reaching around 70% support in 2011. No political parties want to abolish the charges anymore. The debate has now shifted to how the scheme could be improved and how the revenues should be used.

An evidence of behavioural change is that after the end of the trial period there was about 5 percent reduction in traffic that crossed the cordon line. Eliasson suggest that hysteresis effect could have been an explanation. He states, "If the hysteresis depends on drivers acquiring better information about alternatives, then this can relatively easy be incorporated in a neoclassical framework. But if it is because of changes in preferences, then it presents a larger problem for a neoclassical interpretation: stable preferences is one of its cornerstones".

Eliasson suggests that the swing in attitudes defied an important assumption of standard economics, i.e., the stability of preferences. “All groups, regardless of travel patterns, car ownership and belief in the charges’ effectiveness (*ex ante* and *ex post*) show the same U-shaped change in attitudes – more negative attitudes before the introduction of the charges, and increasingly more positive attitudes after the introduction. The pattern is more pronounced for unaffected groups.” Attitudes to congestion charges are also linked to other preferences and attitudes, which are not usually incorporated in an “economic man” framework. Other issues that Eliasson addresses in his study is the “framing” of the scheme and the appeal of dedicated funds (earmarking) created public support for the congestion charging in Stockholm.

Eliasson, on the issue of “legitimacy”, suggests that the Stockholm scheme through a process gained broad acceptance. The legitimacy was achieved when it became apparent that it could reconcile with existing social norms: in particular, related to the social norm for mobility and mobility with car. This was partly achieved through the dedicated funds. This interpretation also explains why it was politically rational to advocate the congestion scheme in spite of public resistance from large groups, and why this resistance then faded away.

Chapter 7 covers the case studies of incentives for alternative fuels and vehicle (AFV). An examination of four cases, two in Sweden and two in Norway, suggests that “economic incentives” are quite curtail for the take-off of AFV technologies. As Arthur (1988) suggests, economic efficiency, in the short run does not justify these incentives. Examples of these policies are taxations, subsidies and regulatory measures related to fossil fuels and AFV as well as policies related to the supporting infrastructures and industries. The government needs to make the “right” choice among technologies and like other stakeholders face uncertainties and risks. While a government faces uncertainty in the adoption of an “optimal” policy path, it can create uncertainty by generating an expectation of policy change or by not taking a position at the right time on a necessary regulatory framework.

Most studies suggest that different economic incentives, rather than environmental concern, are most important for switching to “environmentally” friendly vehicles (see Sprei et al. 2013). However, the case studies covered in this chapter and in other studies, suggest that economic incentives are quite important for the take-off of AFV, as they have been in the case of the take-off of electric vehicles in Norway, by inducing social norms (or herd effect) and making a change in preferences regarding the technology possible.

The economic incentives have resulted in demonstration of the technology and resulted in changes in attitude and behaviour towards the technology. However, these incentives have to be accompanied by other policy instruments such as provision of necessary supporting infrastructures for the particular AFV technologies.

This chapter also point to yet another equally if not even more costly solution for the society. That is when the government’s supports the take-off of an AFV technology that is not “good enough” or as bad compared to the prevalent technology. The example of flexi-fuels vehicles in Sweden, or the widespread use of a particular technology, such as diesel fuel vehicles in Norway illustrates that the unintended effects of the promotion of technologies can be significant.

The cases study of AFV provides an important archetype for the transport sector. There is an increasing recognition that the scope of project evaluation should be extended to account for uncertainty, irreversibility, and path dependency—in

particular in response to the challenges of sustainable development. This result applies to the Norwegian reward scheme for sustainable transport.

While transport is a key to economic development, it also contributes a range of societal and environmental costs. Urban areas and regions are complex systems and provisions of transport infrastructure in such a complex environment have many rebound effects that are long lasting and reinforce the “lock-in” effect. A move to another equilibrium that is potentially more efficient in the long run than the present will require substantial effort.

As an example public transport and the private car are substitutes to a degree. Each mode is self-reinforcing in that the more it is used the more funds become available for investment and improvements that attracts even further users. Then one mode may achieve dominance at the expense of the other. Changing the situation may require substantial subsidy and capital investments. Another important setting that reinforces path dependency of the road system is caused by the extent of the development of the road network compared with rail network. This situation favours the extension of the road network compared with the rail network. The extension of the road network most often seems marginal and often the projects can be completed within relatively short time. Thus, the extension of road network almost always compares favourably with rail and even with the additional hurdles required in a real options framework. The present land use and economic activity patterns are additional factors that favour roads. Extensive subsidies to the alternative mode might in fact be desirable in the long run.

Chapter 8 presents two case studies of the design and effects of economic incentives schemes in public administration in Norway. These two case studies relates to the interplay of political processes at different levels and between politicians and bureaucrats.

Alesina and Tabellini (2004) propose that, from a perspective of economic efficiency, politicians are preferable for tasks that have the following features:

1. Differences in performance are due to effort, rather than individual talent or technical ability;
2. The preferences of the public are unstable and uncertain, so that flexibility is valuable, a case that may be especially relevant for changing and complex policy environments;
3. Time inconsistency is unlikely to be a relevant issue;
4. The nature of the policy is such that politicians cannot strategically distort policy choices in favour of short term objectives and against long term welfare;
5. The stakes for organized interest groups are small, or the legal system is poorly designed so that corruption is widespread;
6. Side payments to compensate the losers are desirable and relevant, or bundling of different aspects of policy management and a comprehensive approach is important.”

Recognition of incentives facing different actors involved in decision making is imperative for an understanding political process, including those aspects of the process that result in policies that are not in accordance with the normative principles.

The subject of time inconsistency in decision-making is particularly important in the context of environmental policies since these policies often require upfront costs that lead to environmental benefits over long periods. The framework of time

inconsistency in preferences can be applied for analysing situations involving different actors. For example, how do the public and firms respond to policy actions with their knowledge of the politicians' time-inconsistent preferences? Moreover, what are the necessary measures to assure time-consistency in the preferences of the decision maker? Among others Grossman and Helpman (1996) and Marsiliani and Renström (1999) have applied the framework of time inconsistency to show that governments are unable to commit themselves to intergenerational equity. Grossman and Helpman suggest constitutional reform while Marsiliani and Renström suggest earmarking as a solution for time-inconsistency problem that arises in the environmental taxation.

Earlier in this chapter, the path dependencies in the transport system and policies were mentioned. The theory of path dependence has been used to explain the persistence of policy, the resistance to change, over a wide range of policy domain and geographical areas. Path dependence theory relates to two related paths. The first is technical path dependence; the path set by dependence on private car ownership and the weight of supporting infrastructure that has shaped urban form (see Ramjerdi et al. 2006). The second is the institutional determination of policy. Path dependent systems display a large degree of internal coherence. "The organisational and discursive institutions that support a particular outcome are highly correlated. This is reflected in the degree of integration of policy - whether explicitly or implied - horizontally across agencies within each level of government, and vertically between levels of government. A constraint on the implementation of a new pathway is, therefore, partly dependent on the ability of vertical and horizontal integration of new policies sufficient to produce a new transport system. An indication of this ability can be illustrated by published government policy, both in document and in the process through which written policy is enacted (Sturup, et al. 2013, pp. 125)." Policy, ranging from statutory planning schemes to broad strategic vision, rationalises planning and decision-making process and contributes to the framework of norms that guide processes and practices. Horizontal and vertical integration of policy across government is a necessary but not sufficient condition for successful uptake of a new direction by all actors. It further requires sufficient organisational structures for coordination of the implementation process.

The first case study in Chapter 8 is the Norwegian reward scheme for sustainable transport. Under this scheme, a municipality can apply for an agreement to the Ministry of Transport and Communications to receive financial support if they have implemented or plan to implement restrictive transport measures within the agreement period (four-year). The agreement requires that car traffic actually is reduced. The state has the possibility to sanction the municipality for the defection from the agreement. Local and regional authorities are largely responsible for policies that influence transport developments at local level. Moreover, the national goal of reducing car traffic has not been achieved. The reward scheme can be interpreted as a response to this institutional setting and the lack of goal achievement.

Christiansen, et al. (2014) use three perspectives to analyse the effectiveness of the schemes. These perspectives highlight separate problems and separate amending strategies. The analyses of the reward scheme points to:

1. Increased length of contracts and extended possibilities in use of instruments has increased the complexity of the contract, and thus the uncertainty associated with the selection of measures, effects of instruments and monitoring these effects. This opens up for political games and opportunistic behaviour at the political- administrative level. Consideration of uncertainty

and asymmetric information implies simplification of the system: Prioritise public transport rather than reduced car use, the latter goal increases the complexity and thus increases the uncertainty. Advice: Limit uncertainty by limiting measures. This can be done in several ways, one example is to limit the scheme to specific public projects, another to just finance public transport and measurement of travel with public transport.

2. The incentives in the reward scheme is too weak to change the underlying power relations between the Road Authorities, county and municipality (resources, knowledge and skills). The current structure can be enhanced by altered responsibilities between state, county and municipality. Administrative reform is an important contribution in this respect. Within the present system, knowledge and expertise on public transport within the Road Authorities can be a natural solution.
3. The current incentive scheme has probably the greatest impact where they form the largest part. Unless the reward scheme does something with the size of the incentives and / or the underlying responsibility and power relations, the reward scheme will probably have the greatest effect in relation to medium-sized urban areas.

Hence, a weakness of reward schemes is related to the vertical and horizontal integration of policy across governments and sufficient organisational structure for the coordination of the implementation process.

The second case evaluated the energy performance contracting in the public sector. Aasen et al. (2013) suggest that the standard economics does not provide an understanding of the barriers to profitable investments and measures for energy savings in the public sector. They suggest that the answer lies in interplay between political consideration and bureaucratic processes. The design of the “Energy Performance Contracting” (EPC) has removed the risk of failure, an important concern, from politicians, by providing a guarantee for success. Hence, EPC has bypassed the time inconsistencies among politicians. EPC also spares the solicitations from the evaluation and approval of the policy instruments. In short, EPC has put bureaucrats in charge, bypassing politician, a task that according to Alesina and Tabellini (2004) should be left to the administrative level.

Yet this case provides another valuable example for the design of environmental policy instruments. An environmental policy instrument could result in short term benefits, in this case energy savings, along with meeting the long-term objectives of climate goals. Most climate policies can be framed in terms of their short-term impacts for gaining support from public and at a political level. Coupling the emissions of the Greenhouse Gases (GHG) to the emission of local pollutants is an example. Using non-motorised mode of transport, i.e., walking or cycling to fitness and being in shape is another example.

10 A summary of results and recommendations

(When) are economic policy instruments environmentally effective? Are they efficient and legitimate? Are economic instruments alone sufficient to respond to the complexities of the transport system? Can behavioural economics or institutional sociology give support to the design of the economic policy instruments in order to meet the challenges of environmental concerns that we face in our time? The following is a summary of the main results of this research.

Paradigm shift from dependence on private car to sustainable transport will not be short and will demand continuous effort. We suggest path dependency, both institutional and technical, to be a main challenge to the paradigm shift. A theoretical understanding of how policies at national and local levels can change the path dependency of private car system, deeply embedded in our society and the dominant car-based notion of transport policy within government and professional agencies, is of great value. This study only provides an understanding of the behavioural response of an agent – an individual or an institutional – to economic instruments, and an insight to institutional barriers for making economic instruments effective and legitimate. The following is a summary of the results of this study.

- Economic policy instruments are generally effective and efficient for addressing environmental objectives, however to gain legitimacy for these policies, they should be accompanied by other policy instruments; economic, regulatory and provision of information.
- Provision of information to public, through the media or other channels, boosts transparency and informed public opinion and hence important for legitimacy of economic instruments as well as supporting changes in social norms.
- Framing of the policies contribute to the public support, i.e., the legitimacy for an economic instrument. The study of the Stockholm congestion pricing schemes suggests the importance of framing of an economic policy instrument.
- Framing of policies in the media in a negative way, or miss-information, creates negative feeling among public, such as in relation to climate change.
- Education from young age about environment, climate effect and to use alternative modes, in particular walking and cycling, are important in creation of social norms positive to the paradigm shift.
- After the implementation of an economic policy instrument (and a regulatory instrument) with success in terms of efficiency and effectiveness, the public opinion can swings and the political opposition will fade away, as the example of Stockholm congestion pricing illustrates.
- Economic instruments have the potential to shifts social norms (or herd effect). In the examples AFV, use of economic instruments leads to a number of people who purchase and use these vehicles and others in the population follow. This could very well be provide a model for promoting

the use of an environmentally friendly mode such as bicycle (or electric bicycle).

- Economic policy instruments, by rewarding general public, are not always effective, efficient or legitimate, such as rewarding drivers for driving within the speed limit or rewards for not using car during congested periods.
- Economic policy instruments are necessary for the take-off of superior alternative fuel vehicles (AFV), such as electric vehicles in Norway. Their efficiency cannot and should not be evaluated in the short term.
- Economic instruments might not always lead to the take-off of a targeted technology, as was the case of electric vehicle in Sweden, suggesting that there is always a risk in their effectiveness. However, the policies generally have the public support.
- The support for an alternative technology is not without unintended effect and hence the context has to be carefully examined and the policy to be carefully designed, as the example of flexi-fuel vehicle in Sweden and diesel fuel in Norway illustrates.
- Provision of subsidies to public transport and rail or walk and cycle facilities, far beyond what the standard cost-benefit analysis suggests to be efficient, could be justified for the paradigm shift.
- Provision subsidies and economic incentives for the take-off of AFT or promotion of alternative modes (e.g. public transport, rail and slow modes) to curb car use have to be in place for long enough period. Early withdraw of support can easily reverse the situation.
- Coupling economic instruments with public concerns, such as emissions of local pollutants or health effects, could gain public and political support. Short-term benefits from climate policies, such as energy saving, is another example.
- Efficiency, effectiveness and legitimacy of the economic policy instruments in the form of incentives depends on the context and social norms. Hence, these instruments should be carefully designed and implemented to match the complexities of the location.
- Dedicated funds is important for the legitimacy of an environmental tax. The example of congestion pricing scheme in Stockholm and other similar schemes indicate that dedicated funds have been important for their public and political acceptance.
- Dedicated funds can also deal with the decision-making time-inconsistency problem that arises in environmental taxation. Is it possible to increase environmental tax on fossil fuel and connect the increase to dedicated funds for further subsidies to AFV or further improvements in environmental friendly modes of transport?
- Another important lesson from this research relates to the interplay between bureaucrats and politicians in the context of environmental incentives or policies that involve risks. The case examined in this research suggests that there are scopes in designing a policy instrument that wards politicians against taking risk by assigning the task to bureaucrats within a democratic system.
- The success of new policies, such as the Norwegian reward scheme for sustainable transport, requires vertical and horizontal institutional integration. It also requires sufficient organizational structures for coordination and implementation of the process.

Some of the further research questions that results from this study are the following:

- A study of vertical and horizontal integrations (vertical organisation between levels of government of different geographical scale and scope; horizontal organisation between departments with different professional foci at the same level) of transport organisations.
- The role and structure of supporting organisations for the integration of vertical and horizontal of transport organisations necessary for paradigm shifts.
- Governance structure addresses the relation between private sector organisations and government. What is the governance structure of the transport sector? What is the role of private sector and their responsibilities in paradigm shift in the transport sector?
- The particularities of the “neo-liberal regime of governance” under the “Nordic Economic Model” and implications for the governance of the transport sector.
- We emphasized that policies for paradigm shift should not be evaluated based on efficiency. Neither should climate policies, at least according to some eminent economists. Can and how a neo-liberal regime of governance, with its emphasis on the virtues of market based solution, address the urgent challenges we face in our time?
- Relation between politicians and bureaucrats in the transport sector and their roles in formulation of environmental policies.
- The extent to which transport policies in Norway support path dependency on private car system.
- Integration of risk, irreversibility and path dependency in evaluation of transport policies, especially those designed for paradigm shift.
- Strategies for dealing with risk and uncertainties.
- Perception of environmental quality and climate effect among public and decision makers and other stakeholders. What are the relation between information, knowledge, education and these perceptions?
- Framing of environmental policies and synergies between environmental policies and other targets such as health, fitness, etc.
- How to address efficiency, effectiveness in order to allow for the deviations from rationality in public economics.

11 References

- Aasen, M., Corneliussen K. and Westskog, H. 2014. Energy performance contracting in the public sector; overcoming barriers to energy saving? *Ecological Economics*. Under review
- Abbott, Andrew. 1988. *The System of Profession. An Essay on the Division of Expert Labor*, University of Chicago Press.
- Akerlof, George A. 1976. The Economics of Caste and of the Rat Race and Other Woeful Tales. *Quarterly Journal of Economics* 90 (4): 599–617.
- Akerlof, George A. 1980. “A Theory of Social Custom, of Which Unemployment May Be One Consequence.” *Quarterly Journal of Economics* 94 (4): 749–75.
- Alesina, A. and Tabellini, G. 2004. *Bureaucrats or Politicians?* NBER Working Papers 10241, National Bureau of Economic Research, Inc.
- Arkes, Hal and Catherine Blumer. 1985. The Psychology of Sunk Cost, *Organizational Behavior and Human Decision Process*, Vol 35, No. 1, pp. 124-140
- Arrow, Kenneth J. 1982. Risk Perception in Psychology and Economics. *Economic Inquiry*, January 1982, 20(1), pp. 1–9.
- Arthur, B. 1989. Competing Technologies, Increasing Returns, and Lock-In by Historical Events. *Economic Journal*, Vol. 99, No. 394, pp. 116-131.
- Arthur, B. 1990. Positive feedbacks in the economy, *Scientific American* 262: 92-99.
- Asheim, G.B. 2007. *Justifying, Characterizing and Indicating Sustainability*. Springer
- Atkinson, A.B. & Stiglitz, J. E. 1969. [A New View of Technological Change](#). *Economic Journal*, *Royal Economic Society*, vol. 79(315), pages 573-78
- Bachrach, P. and Baratz, M.S. 1963. Decisions and Nondecisions: An analytical Framework. *American Political Science Review*, Vol. 57
- Barberis, Nicholas, Ming Huang, and Richard H. Thaler. 2006. Individual Preferences, Monetary Gambles, and Stock Market Participation: A Case of Narrow Framing. *American Economic Review*, 96(4): 1069–90.
- Benabou, Roland, and Jean Tirole. 2004. Willpower and Personal Rules. *Journal of Political Economy* 112 (4): 848–86.
- Boasson, E (forthcoming), National Climate Policy. The Multi – Sphere Approach.
- Bolton, Gary E., and Axel Ockenfels. 2000. ERC: A Theory of Equity, Reciprocity, and Competition. *American Economic Review* 90 (1): 166–93.
- Bourdieu, Pierre. 1991. *Language and Symbolic Power*. Polity Press.
- Camerer, C., Loewenstein, G. and Rabin, M. (Ed.) 2004. *Advances in Behavioural Economics*, Russell Sage Foundation and Princeton University Press
- Camerer, C.F. 2007. Behavioral Economics, In R. Blundell, W.K. Newey and Presson T. (Ed) *Advances in Economics and Econometrics: Theory and Application*, Ninth World Congress, Volume 2, 181-214 Cambridge University Press
- Christiansen, P. Longva, F., Osland, O. 2014. Reward scheme for sustainable transport – lessons learned from Norway. To be submitted to, *Transport Policy*
- Cohen, David and Knetsch, Jack L. 1992. Judicial Choice and Disparities Between Measures of Economic Value.” *Osgoode Hall Law Review*, 30(3), pp. 737–70.
- Cohen, M.D., March J.G. and Olsen J.P. 1972. A Garbage Can Model of Organizational Choice. *Administrative Science Quarterly* 17, 1–25.
- Cole, Harold L., Mailath, George J. and Postlewaite, Andrew. 1998. Class Systems and the Enforcement of Social Norms. *Journal of Public Economics* 70 (1): 5–35.

- DellaVigna, Stefano, and Malmendier, Ulrike. 2004. Contract Design and Self-Control: Theory and Evidence. *Quarterly Journal of Economics*, 119(2): 353–402.
- DellaVigna, Stefano. 2009. Psychology and Economics: Evidence from the Field *Journal of Economic Literature*, 47:2, 315–372
- Diamond, P. and Vartianen, H. (Eds.). 2007. *Behavioural Economics and its Applications*. Princeton University Press
- Econ Pöyry. 2009. Virkemidler for introduksjon av el- og hybridbiler. Oslo, Econ Pöyry.
- Eisensee, Thomas, and David Stromberg. 2007. News Droughts, News Floods, and U.S. Disaster Relief. *Quarterly Journal of Economics*, 122(2): 693–728.
- Eliasson, J. 2014. The Stockholm congestion pricing syndrome: How congestion charges went from unthinkable to uncontroversial. Under Review *Transportation Research Part A*
- Elster, Jon. 1989. Social Norms and Economic Theory. *Journal of Economic Perspectives* 3 (4): 99–117.
- Elvik, R. 2013a. Rewarding safe and environmentally sustainable driving: a systematic review of trials. Paper submitted for presentation Transportation Research Board Annual Meeting January 2014 and publication in *Transportation Research Record*.
- Elvik, R. 2013b. Cost-benefit analysis of incentive systems one rewarding compliance with speed limits. Paper submitted for presentation Transportation Research Board Annual Meeting January 2014 and publication in *Transportation Research Record*.
- Elvik, R. 2014. A comparative analysis of the effects of economic policy instruments designed to promote environmentally sustainable transport. Under review, *Transport Policy*
- Etzioni, Amitai. 1964. *Modern Organisations*. Prentice Hall.
- Etzioni, Amite. 1961. Complex Organisations- On Power, Involvement, and their Correlates. New York. The Free Press.
- Fehr, Ernst, and Klaus M. Schmidt. 1999. A Theory of Fairness, Competition, and Cooperation. *Quarterly Journal of Economics* 114 (3): 817–68.
- Fershtman, C., Gneezy, U., & List, J. 2012. Equity Aversion: Social Norms and the Desire to be Ahead. *American Economic Journal - Microeconomics*, 4(4), 131-144
- Figenbaum E. and Kolbenstvedt, M. 2013. *Electromobility in Norway - experiences and opportunities with Electric vehicles*. TØI rapport 1281/2013. Oslo, Institute of Transport Economics.
- Flyvbjerg, B. 2001. Making Social Science Matter, *Why social inquiry fails and how it can succeed again*, Cambridge, UK: Cambridge University Press.
- Galbraith, John Kenneth. 1967. *The New Industrial State*. Princeton University Press
- Gaviria, A. 2001. History dependence in the economy: A review of literature, *Revista de Economia del Rosario*, Vol. 4, No. 1. 17-40
http://papers.ssrn.com/sol3/papers.cfm?abstract_id=928511
- Glaeser, Edward L. 2006. Paternalism and Psychology. *University of Chicago Law Review*, 73(1): 133–56.
- Gneezy, Uri, Stephan Meier, and Pedro Rey-Biel. 2011. When and Why Incentives (Don't) Work to Modify Behavior. *Journal of Economic Perspectives*, Volume 25, No. 4, 191–210
- Grossman, G.M. and Helpman E. 1996. *Intergenerational redistribution with short-lived governments*, NBER, Working Paper 5447
- Guth, Werner, Rolf Schmittberger, and Bernd Schwarze. 1982. An Experimental Analysis of Ultimatum Bargaining. *Journal of Economic Behavior and Organization*, 3(4): 367–88.
- Habermas, J. 1975. *Legitimation Crisis*. Beacon Press
- Habermas, J. 1987. *The Philosophical Discourse of Modernity: Twelve Lectures*. Cambridge, Mass.: MIT Press.
- Hackett, S.C. 2001. *Environmental and Natural resources economics: Theory, policy and the sustainable society*, 2nd ed. Available <http://www.humboldt.edu/~envecon/ancil.htm>
- Hanf & Jansen (Eds.) 1998. *Governance and Environment in Western Europe*. Addison Wesley Longman Limited. London.

- Heffner, R., K. Kurani and T. Turrentine. 2005. Effects of Vehicle Image on Gasoline Hybrid Electric Vehicles. *21st Worldwide Battery, Hybrid, and Fuel Cell Electric Vehicle Symposium and Exhibition (EVS-21)*, Monaco, April 2-6
- Horowitz, John and Kenneth McConnell. 2002. A Review of WTA/WTP Studies. *Journal of Environmental Economics and Management*, Vol.44, No.3, 426-447
- Jackson, T. 2005. *Motivating Sustainable Consumption; A review of evidence on consumer behaviour and behavioural change*. A report to the Sustainable Development Research Network, Centre for Environmental Strategy, University of Surrey.
- Jansen, A-I, O. Osland and K. Hanf. 1998. Environmental Challenges and Institutional Changes. An Overview and Interpretation of the Development of Environmental Policy in Western Europe. In Hanf & Jansen (Eds.): *Governance and Environment in Western Europe*. Addison Wesley Longman Limited. London.
- Johnson, Eric J. and Goldstein, Daniel G. 2003. *Do Defaults Save Lives?* Working paper, Center for Decision Sciences, Columbia University.
- Johnson, Eric J.; Hershey, John; Meszaros, Jacqueline and Kunreuther, Howard. 1993. Framing, Probability Distortions, and Insurance Decisions. *Journal of Risk and Uncertainty*, August 1993, 7(1), pp. 35–51
- Kahneman, Daniel and Tversky, Amos. 1979. "Prospect Theory: An Analysis of Decisions Under Risk." *Econometrica*, March 1979, 47(2), pp. 263–91.
- Kahneman, Daniel, Jack Knetsch and Richard Thaler. 1986. Fairness and the Assumptions of Economics. *Journal of Business*, Vol. 59, No. 4, pp. 285-300
- [Kahneman](#), Daniel. 2011. *Thinking, Fast and Slow*, Farrar, Straus and Giroux
- Katz M.L. and Shapiro C. 1985. Network externalities, competition and compatibility; *American Economic Review*, vol 75, n°3, pp.424-440.
- Key, J. 2011. A wise man knows one thing- the limits of his knowledge, Financial times Wednesday November 2011.
- Knetsch, Jack. 2012. Behavioural Economics, Policy Analysis and the Design of Regulatory Reform. In Low, D. (Ed.) *Behavioural Economics and Policy Design: Examples from Singapore*. World Scientific
- Laibson, David. 1997. Golden Eggs and Hyperbolic Discounting. *Quarterly Journal of Economics*, 112(2): 443-77.
- Leong, Wai yan and Lew, Yü Der. 2012. A Behavioural Perspective to Managing Traffic Congestion in Singapore in Low, D. (Ed.) *Behavioural Economics and Policy Design: Examples from Singapore*. World Scientific
- Levitt, Steven D., and John A. List. 2007. What Do Laboratory Experiments Measuring Social Preferences Reveal About the Real World? *Journal of Economic Perspectives*, 21(2): 153–74.
- List, John A. 2002. Preference Reversals of a Different Kind: The 'More Is Less' Phenomenon. *American Economic Review*, 92(5), pp. 1636–43.
- Low, N. 2013. Conclusion: dimensions of change. In Low, N. (Ed) *Transforming Urban Transport, The ethics, politics and practice of sustainable mobility*. Routledge Taylor & Francis Group, London New York.
- Low, N. and O'Connor, K. 2013. The dilemma of mobility. In Low, N. (Ed) *Transforming Urban Transport, The ethics, politics and practice of sustainable mobility*. Routledge Taylor & Francis Group, London New York.
- Lukes, Steven. 1974. *Power. A Radical View*. London, Macmillan.
- Marsiliani, L. and Renström, T.I. 1999. *Time inconsistency in environmental policy: Tax earmarking as a commitment solution*. European Association of Environmental and Resource Economists Conference, Oslo
- McFadden, D. L. 1999. Rationality for Economists? *Journal of Risk and Uncertainty* 19(1-3): 73-105
- McFadden, D. L. 2001. Economic Choices. *American Economic Review*, Vol. 91, No. 3, 351-378

- Ong, Philip. 2012. Can Psychology Save the Planet and Improve Our Environment. In Low, Donal, Ed. 2012. Behavioural Economics and Policy Design: Examples from Singapore. World Scientific
- Osland, O. 2014. Ecological modernization in the transport sector.
- Pigou, A.C. 1920. *The Economics of welfare*, 4th end, 1952, London Macmillan
- Portney P.R. and Weyant, J.P. 1999. Introduction, in *Discounting and intergenerational equity*, Portney P.R. and Weyant J.P. (eds.) Resources for the future, Washington, DC
- Ramjerdi F. 2014. Alternative fuel vehicles, the tail of two countries, Under Review. *Journal of Sustainable Transportation*
- Ramjerdi, F. 2014. Alternative fuel vehicles: A tale of two countries, under review, *Journal of Sustainable Transportation*
- Ramjerdi, F. 2014. Behavioral economics: Implications for public policy in the transport sector in response to environmental concerns. Submitted for publication to *Transport policy*
- Ramjerdi, F. Rand, L, Saetermo, I.A. and Ingebrigtsen, S. 1996. *Car ownership, car use and demand for alternative fuel vehicles*. TØI-rapport 342/1996. Oslo, Institute of Transport Economics.
- Ramjerdi, F., Brundell-Freij, K., Eidhammer, O. 2009. The dynamics of the market for alternative fuel vehicle. In Proceedings, the NECTAR Transatlantic Conference, University, 18-20 June 2009, Arlington, USA
- Ramjerdi, F., Fearnley, N. 2014. Managing risk and irreversibility of transport interventions, Special issue *Transportation Research Part A: Policy and Practice*, forthcoming
- Rosenberg, N., 1982. Inside the Black Box: Technology and Economics. Cambridge University Press, Cambridge
- Samuelson, William and Zeckhauser, Richard. 1988. Status Quo Bias in Decision Making. *Journal of Risk and Uncertainty*, March 1(1), pp. 7–59.
- Sandèn, B. (Ed.) 2013. *System Perspectives on Electromobility 2013*. Chalmers University of Technology. ISBN 978-91-980973-1-3, Göteborg.
- Schattschneider, E.E. 1960. The Semisovereign People. A Realist View of Democracy in America. The Dryden Press.
- Schelling, T.C. 1999. Intergenerational discounting. In Portney P.R. and Weyant J.P. (eds.) *Discounting and intergenerational equity*, Resources for the future, Washington, DC
- Sen, A. 1992. *Inequality Reexamined*, New York and Cambridge, MA: Russell Sage and Harvard University Press.
- Sen, A. 2009. *The Idea of Justice*, Belknap Press of Harvard University Press, Cambridge, Mass
- Shampanier, Christina, Nina Nazar and Dan Airely. 2007. Zero as a Special Price: The True Value of Free Products. *Marketing Science*, Vol. 25, No. 5, pp 742-757
- Simon, H. A. 1955. A Behavioural Model of Rational Choice, *Quarterly Journal of Economics* 69, 99-118.
- Simon, H. A. 1976. *Administrative Behavior. A study of Decision-Making Processes in Administrative Organization*. Third Edition, the Free Press, Collier Macmillan Publishers, London, UK, 1976.
- Speth, G. 2005. Creating a Sustainable Future: Are We Running Out of Time? in Robert Olson and David Rejeski, *Environmentalism and the Technologies of Tomorrow*, Washington, D.C.: Island Press.
- Sprei, F., Macharis, C. Lebea, K. and Karlström, M. 2013. Policy incentives for market introduction of electric vehicles. In Sandèn, B. (Ed.) *System Perspectives on Electromobility 2013*. Chalmers University of Technology. ISBN 978-91 980973-1-3, Göteborg.
- Stern, N. 2006. *Stern Review on the Economics of Climate Change*, http://mudancasclimaticas.cptec.inpe.br/~rmclima/pdfs/destaques/sternreview_report_complete.pdf

- Stiglitz, J.E. 1994. 'Discount rates: The rate of discount for benefit-cost analysis and the theory of the second best', in Layard, R. and S. Glaister (eds.) *Cost-Benefit Analysis*.
- Strotz, Robert H. 1955. Myopia and Inconsistency in Dynamic Utility Maximization. *Review of Economic Studies*, 23(3): 165–80.
- Sturup, S., Low, N., Rudner, J. Babb, C, Legacy, C. and Curtis, C. 2013. Institutional barriers and opportunities. In Low, N. (Ed) *Transforming Urban Transport, The ethics, politics and practice of sustainable mobility*. Routledge Taylor & Francis Group, London New York.
- Sunstein, C.R. 2005. *Irreversible and Catastrophic*, The University of Chicago, The Law School. John M. Olin Law and Economic Working Paper No. 242, Public law and Legal Theory Working Paper No. 88
- Tan, Charmaine, Low, Donald. 2012. Incentives, Norms and public Policy. In Low, Donal, (Ed.) *Behavioural Economics and Policy Design: Examples from Singapore*. World Scientific
- Thaler, R. H. 1980. Toward a Positive Theory of Consumer Choice. *Journal of Economic Behavior and Organization*, 1(1): 39–60.
- Thaler, R.H. and Sunstein G.R. 2003. Libertarian Paternalism. *American Economic Review*, Vol 93, No. 2 pp. 175-179
- Thaler, R.H. and Sunstein, G.R. 2008. *Nudges* Yale University Press New Haven & London
- Thaler, Richard H., and Shlomo Benartzi. 2004. Save More Tomorrow: Using Behavioural Economics to Increase Employee Saving. *Journal of Political Economy*, 112(1): S164–87.
- Thaler, Richard. 1999. Mental Accounting matters. *Journal of Behavioural Decision Making*, Vol. 12, No. 3 pp. 183. 206
- Tirole J. 1998. *The Theory of Industrial Organization*; M.I.T. press, Cambridge Mass.
- Tversky, Amos and Kahneman, Daniel. 1986. Rational Choice and the Framing of Decisions. *Journal of Business*, October 1986, 59(4), pp. S251–78.
- Tversky, Amos, Daniel Kahneman. 1992. [Advances in prospect theory: Cumulative representation of uncertainty](#). *Journal of Risk and Uncertainty* 5 (4): 297–323
- Vedung, E. 1998. Policy Instruments: Typologies and Theories, in Marie-Louise Bemelmans-Videc, Ray C. Rist & Evert Vedung, eds., *Carrots, Sticks, and Sermons: Policy Instruments and Their Evaluation*, 21–58, New Brunswick, New Jersey and London: Transaction Publishers.
- Vedung, E. 2009. *Utvärdering i politik och förvaltning*. 3rd ed. Lund: Studentlitteratur AB
- WCED World Commission on Environment and Development. 1987. "Our Common Future". Oxford University Press, Oxford, 1987.
- Weber, Max. 1947. *The Theory of Social and Economic Organization*. The Free Press.
- Young, H. Peyton. 2006. Social Norms. In *The New Palgrave Dictionary of Economics*, 2nd ed., edited by Steven N. Durlauf and Lawrence E. Blume. New York: Palgrave MacMillan.

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