

Chapter 19: Charging for change: the effectiveness of economic instruments to change environmentally-relevant behaviours

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In: Gatersleben, B., & Murtagh, N. (Eds) (2023). Handbook on pro-environmental behaviour change. Edward Elgar Publishing

<a> Abstract

Economic instruments, such as taxes, charges and rewards, are policy interventions that try to change environmentally-relevant behaviours through financial incentives. This chapter reviews the effectiveness of economic instruments in comparison to behavioural interventions informed by psychological theory and insights. It further reviews the evidence of positive or negative motivation crowding effects that may either strengthen or weaken the effectiveness of economic incentives, and whether combining economic and behavioural measures could produce more profound behavioural change. The chapter concludes that economic instruments show better results than many other behavioural interventions. It also concludes that the evidence on psychological processes affecting the effectiveness of economic instruments is rather thin, and that there is limited evidence of synergetic effects. Overall, the chapter shows that well-designed economic instruments can be highly effective, but that more research is needed to test theoretical ideas and assumptions about how they work and to identify optimal policy mixes.

<a> 1. Introduction

Meeting ambitious targets to keep climate change within a 1.5 °C temperature increase above pre-industrial levels requires substantial changes to the way we use and produce energy (IPCC, 2018). There is broad agreement that these changes have to be accelerated by public policy interventions in order to succeed at mitigating climate change in time (Roberts et al., 2018). This needs to involve interventions that establish behaviour change across a range of activities to reduce carbon emissions in a meaningful way (Nielsen et al., 2020), as technological changes alone are unlikely to be sufficient (IPCC, 2018).

An established body of research has provided important insights into factors underlying pro-environmental behaviours as well interventions that may help promote these behaviours. A long-standing focus on a limited number of socio-cognitive models, such as the Theory of Planned Behaviour (TPB) and the Value-Belief-Norm (VBN) model (Ajzen, 1991; Kaiser et al., 2005; Stern, 2000), has provided a literature that covers a relatively small number of theoretical psychological constructs to inform behaviour change interventions (Whitmarsh et al., 2021). While a range of policies and measures can be used to promote environmental sustainability through behaviour change, psychological research has predominantly focused on downstream interventions (Verplanken & Wood, 2006) that influence individual decision-making for example through information provision (see Gatersleben, Murrell & Guesen, Chapter 3, this book). Less attention is given to more upstream interventions that change the context in which decisions are being made (also see Schultz & Mertens, Chapter 24, this book). This is surprising, given that upstream interventions have the potential to change behaviour at the population rather than the individual level and thus can have large effects overall in terms of environmental quality.

Economic instruments are one particular type of intervention that can be applied upstream (e.g. a carbon tax) but also downstream (e.g. a plastic bag charge). Economic instruments are fiscal or legislative policies that are designed to change the relative prices of products and services with the intention to change behaviour. They can be used to either promote pro-environmental behaviours or to discourage environmentally damaging behaviours (collectively referred to as environmentally-relevant behaviours). This chapter reviews the evidence whether economic instruments, such as taxes, charges and rewards, are effective in changing environmentally-relevant behaviours, notably in comparison with other behavioural interventions. We make a distinction between behavioural interventions and economic instruments. While both are intended and used to change behaviour, in this chapter we specifically refer to behavioural interventions as those that have been informed by psychological insights and theory, and economic instruments as those that make use of monetary or financial incentives and disincentives. While economic instruments are usually seen as the preserve of (behavioural) economists, as they are thought to influence behaviour through the provision of price signals, they may also have psychological effects that may either strengthen or weaken their effectiveness. The chapter reviews the evidence of positive and negative motivation crowding, whereby financial incentives may either reinforce ('crowd in') or undermine ('crowd out') people's intrinsic motivation to act in the desired way. The chapter further discusses whether combining economic and behavioural measures may produce better outcomes than they would have individually. The chapter finishes with a discussion of the practical implications for behaviour change policy.

<a> 2. Behaviour Change Interventions

 2.1 Types of Interventions

Behaviour change can be encouraged through a range of different policies and instruments, with different typologies available to categorise these interventions. Verplanken and Wood (2006) distinguish between 'downstream' and 'upstream' interventions as those that influence individual decision making that results in undesirable behaviours versus those that change the conditions

that produce the undesirable behaviours so that they can be prevented altogether. Other intervention frameworks make a similar distinction between informational and structural strategies to change behaviour, whereby informational strategies are aimed at changing individuals' attitudes, beliefs and norms, and structural strategies aimed at changing the circumstances that contribute to behavioural decisions (Steg & Vlek, 2009).

More detailed frameworks often provide a taxonomy of different types of instruments that are available to policymakers. For example, Kolstad et al. (2014) list (1) information programmes that provide information about the costs and benefits of alternative options, (2) regulatory approaches involving rules that need to be upheld, such as performance standards, (3) provision of public goods and services that reduce greenhouse gas emissions (for example providing infrastructure, public transport or services that use less energy), and (4) economic incentives that alter the conditions for behaviour, by providing price signals to discourage the emission of greenhouse gases or encourage emission reductions. Here, information programmes can be considered typical downstream interventions, while regulatory approaches, government provision of goods and services, and economic incentives are all examples of more upstream interventions that change the availability and/or trade-offs of different behavioural options. The behaviour change wheel (BCW) is a comprehensive framework to categorise and design behaviour change interventions. In contrast to other frameworks and taxonomies, the BCW explicitly links different policy categories (communication/marketing, guidelines, fiscal measures, regulations/legislation, service provision and environmental/social planning) to different components of behaviour change via intervention functions, i.e. the mechanisms through which interventions change behaviour. The different policy categories of the BCW can again be classified according to the upstream-downstream distinction and tend to influence different parts of the behaviour system (Michie et al., 2011).

The upstream-downstream distinction should not be seen as a dichotomy, but more as a spectrum along which behaviour change interventions can be positioned. Interventions may consist of both upstream and downstream features. It is also possible for contextual factors to influence behaviours indirectly via people's motivations and capabilities. For example, investments in cycling infrastructure not only provides a person with the opportunity to cycle safely, it may also impact on their attitudes and perceived capability to engage in this form of active travel (Aldred et al., 2019; Chapman et al., 2014). Furthermore, (environmentally-relevant) behaviour can be considered part of a complex system of multiple interdependent factors and feedback loops that support and sustain that behaviour (Lucas et al., 2008). This suggests that behaviour change is more likely to occur if an intervention combines multiple instruments and/or addresses multiple aspects of behaviour simultaneously. This is discussed in more detail in Section 4.

 2.2 Behavioural interventions

Psychologists have traditionally focused on more downstream interventions, mostly with the intention to influence determinants of behaviour, based on available theoretical psychological models such as the TPB or VBN. These are in the literature often referred to as behavioural interventions (Nisa et al., 2019). In addition to antecedent strategies that aim to influence one or

more determinants of environmentally significant behaviours (e.g. knowledge, attitudes, subjective norms), consequence approaches can be used to change behaviour by providing information about how someone is doing (i.e. feedback) or a consequence (e.g. a reward) after the behaviour has taken place (Abrahamse et al., 2005).

While there is evidence that theoretically-derived messaging may help in specific circumstances, informational approaches tend to be less effective than other types of interventions. Information campaigns are able to raise awareness and concern but do not necessarily produce behaviour change, in particular where they only provide generic information about the environment in order to address an information deficit (Abrahamse & Matthies, 2012). A recent meta-analysis concluded that, overall, information-based interventions have a limited impact on climate change mitigation when only considering studies with the strongest research designs (Nisa et al., 2019). There is also limited evidence that effects last beyond the interventions themselves (ibid). The relatively small effects of information-based interventions are confirmed by another meta-analysis focusing specifically on energy conservation (Nemati & Penn, 2020).

Research on the effectiveness of different types of appeals suggests that those focusing on moral or environmental concerns are more effective than those that appeal to financial or monetary motives (Asensio & Delmas, 2015; Bolderdijk et al., 2013; Schwartz et al., 2015). This complements the evidence that financial information has only limited potential to change behaviour (Nemati & Penn, 2020), with financial information being as ineffective as energy saving tips and technical information. A meta-analysis of informational interventions found that financial feedback may even lead to higher energy consumption under certain circumstances (Delmas et al., 2013). A different meta-analysis (Mi et al., 2021), concluded that providing monetary information may promote energy conservation, but that this is on average less effective than non-monetary behavioural interventions. This research is often used to suggest that people may not be primarily motivated by economic self-interest when engaging in pro-environmental behaviours (Evans et al., 2013). It is however important to note that evidence on the effectiveness of economic information and appeals does not say anything about the effectiveness of economic instruments and actual monetary incentives and disincentives.

While multiple meta-analyses and systematic review show that behavioural interventions generally have small effects, there is evidence that some may be more effective than others (Delmas et al., 2013; Mi et al., 2021; Nemati & Penn, 2020; Nisa et al., 2019). Antecedent approaches such as goal setting and commitment interventions produce larger effects than other behavioural interventions (Abrahamse et al., 2005; Nisa et al., 2019), in particular where they are combined with consequence elements, such as rewards and feedback (Mi et al., 2021). Social-comparison based interventions, which involve comparative information about the performance of salient others, also produce larger effects, although the evidence from multiple meta-analyses is mixed. While Nisa et al's (2019) reported small effects from social-comparison based intervention, Mi et al. (2021) concluded that social influence interventions were superior to other types of intervention. Delmas et al. (2013) reported that comparative feedback has the highest treatment effect of all interventions, but that this effect is non-significant due to social comparison studies having small sample sizes. Nisa et al. (2019) observed that in particular commitment studies rely on self-selected samples which may inflate their results.

<a> 3. Economic Instruments

 3.1 Types of economic instruments

Economic instruments are a type of policy intervention that try to change behaviour through financial incentives. At the most basic level, economic incentives such as rewards and charges provide positive or negative reinforcement to behave in a certain way (Maki et al., 2016). Economic instruments can change behaviour by making polluting options less attractive ('push' measures) or by making lower-impact options more attractive ('pull' measures) (Drews & van den Bergh, 2016). That is, subsidies and rewards can be used to incentivise low-impact behaviours, while taxes and charges can be used to disincentivise high-impact behaviours, respectively.

Incentives can be introduced at smaller geographic scales, such as a congestion charge at a city level, or can be more wide ranging, such as an economy-wide carbon tax. Here, upstream approaches refer to instruments that provide price incentives at the stage where fossil carbon first enters the economy, typically where products and services are being produced (Hardisty et al., 2019). Downstream approaches refer to those that provide incentives where carbon is being used, i.e. by consumers (Ekins & Dresner, 2004).¹ The distinction is important because they may have different effects. First, upstream taxes typically have a broader reach than downstream taxes as the costs filter down to a wider range of goods used by the consumer. That is, where an economy-wide carbon tax would make all high-carbon products more expensive, a downstream plastic bag charge would only make specific (plastic) bags more expensive. Second, economic instruments may lead to substitution effects whereby producers replace the disincentivised component with something else (ibid). For example, an upstream sugar tax not only has the potential to change the behaviour of consumers (by disincentivising products with a high sugar content), but also incentivises manufacturers to reduce the sugar content of their products (Pell et al., 2021). Both mechanisms lead to the desired effect of lowered sugar intake. While the behavioural literature typically examines effects of 'economically downstream' incentives at smaller scales, we complement our analysis with economic literature looking at incentive effects at economically upstream scales.

 3.2 Effectiveness of economic instruments

<c> 3.2.1 Downstream taxes and charges

Downstream taxes and charges have been used across the world to discourage the use of single-use items, most notably single-use plastic bags. Research from various high and low income countries show large reductions in plastic bag usage after the introduction of a charge (Convery et al., 2007; Dikgang et al., 2012a, 2012b; Homonoff, 2013; Poortinga et al., 2013; G. O. Thomas et al., 2019; G. O. Thomas et al., 2016). Evidence suggests that the effectiveness of plastic bag

¹ Note that the upstream-downstream distinction for economic instruments is different to the one used in the psychological literature (cf., Verplanken & Wood, 2006).

charges is largely independent of their size; that even small charges can have surprisingly large effects (Homonoff, 2013); and that effects can be maintained over a long period of time (Poortinga et al., 2016; Warmington, J. et al., 2016).

Downstream economic incentives have also been used to discourage the use of disposable coffee cups, and include both charges and discounts. In a rapid evidence review for the Scottish Government, Poortinga et al. (2019) identified eight field studies that tested the effectiveness of coffee cup charges. Results from these interventions show that charges can help to discourage the use of disposable coffee cups. In contrast to plastic bag charges, the effectiveness of cup charges is dependent on their size. Whereas most of the lower charges only marginally increased sales of drinks in reusable cups, the higher charges produced more substantial changes. The effects of a cup charge are smaller than for plastic bag charges and are dependent on a range of contextual factors (Poortinga et al., 2019). In particular, coffee cup charges tend to be more effective in 'closed' workplace settings where people can be expected to be regular customers than in 'open' high-street settings where purchases may be more spontaneous for 'on-the-go' consumption. Overall, this suggests that the effectiveness of a charge on disposable items is at least to some extent determined by how easy it is to adapt to them by e.g. bringing your own bag or reusable container.

The evidence base for discounts as an incentive to change environmentally-relevant behaviours is smaller, with only a handful of studies being published in the academic literature. The available evidence suggests that discounts are not as effective as charges on disposable items. Poortinga and Whitaker (2018) tested a number of measures to promote the use of reusable coffee cups, including a charge on disposable cups and a discount for using reusable cups. They concluded that, in contrast to a charge, a discount is not effective. Other studies equally show that replacing a discount with a charge can increase reusable cup usage (Fisher, 2008; Sidhu et al., 2018). Homonoff (2013) found that a small charge decreased disposable bag usage by a substantial amount, but that a bonus for not using plastic bags had virtually no effect (Homonoff, 2013).

Research on congestion charges, another typical downstream economic measure, shows that they can reduce private car use in favour of public transport and active travel. The congestion charge that was introduced in London in 2003 reduced traffic volumes by about 18% in its first year, with private cars showing the largest decrease (Santos et al., 2006; Santos & Shaffer, 2004). A scheme introduced in Singapore in 1998 reduced morning traffic volumes by 45%, again with the largest reduction in private cars (Willoughby, 2000). Traffic fell by about 21% in the first year of operation of the Ecopass scheme in Milan (Cavallaro et al., 2018; Percoco, 2013). Congestion charges are also effective in the longer term. Börjesson et al. (2011) show that the Stockholm congestion charge had a substantial effect on traffic volumes even when it was temporarily suspended. They also suggest that long-term effects may exceed short-term effects due to people establishing new travel habits over time (Börjesson et al., 2012). Here it is important that people have viable and affordable alternatives, such as public transport and active travel.

Several meta-analyses and systematic reviews have assessed the effects of different types of downstream economic incentives on different types of environmentally-relevant behaviours. Maki et al. (2016) identified 22 intervention studies that used economic incentives to influence

recycling, transport behaviours and energy conservation (Maki et al., 2016, 2021). The majority of studies used positive incentives (i.e. rewards), with only one study using a disincentive (i.e. a 'pay-as-you-throw' fee for household waste disposal). They concluded that incentives have a small-to-moderate positive effect on the different types of pro-environmental behaviour. They also found that pro-environmental behaviours may be maintained even after incentives have been removed, although the systematic review does not specify over what period these effects have been observed. Maki and colleagues further concluded that incentives with a variable structure (e.g. a lottery) are more effective than those with a fixed schedule (e.g. cash or coupon). Maki et al. (2016) found little variability in the effects of the incentives on different types of behaviour. An important aspect of economic incentives - namely their size - was not analysed. It is therefore not clear to what extent larger incentives are more effective than smaller incentives. Overall, however, the meta-analysis provides good evidence that rewards can be used to promote pro-environmental behaviour across different domains.

In a systematic review of 40 studies, Wynes et al. (2018) compared the effectiveness of different types of behavioural interventions to reduce greenhouse gas emissions in the domains of transport, diet and household energy use. These interventions included economic incentives as well as various other antecedent and consequence behavioural strategies, such as goal setting and feedback. Economic rewards were identified as the most effective intervention to reduce personal vehicle use. Importantly, they concluded that both incentives (rewards) for positive action and disincentives (charging) for negative actions can produce significant emission reductions. Rewards were however deemed less effective in reducing household energy use, with feedback being identified as the most effective intervention in that area (Wynes et al., 2018).

In a meta-analysis of 122 studies, Khanna et al. (2021) compared the effectiveness of a range of economic incentives (such as peak pricing and rewards) and other behavioural interventions (such as information provision, feedback, social norms and goal setting/commitment approaches) to reduce household energy consumption. Largely in line with Wynes et al. (2018), they concluded that both monetary and non-monetary interventions are able to reduce household energy use, but that economic incentives tend to have larger effects (Khanna et al., 2021). Khanna et al. (2021) did not find significant differences between monetary rewards and charges, suggesting that they are equally effective.

Mi et al. (2021) came to a different conclusion than Khanna et al. (2021). After reviewing evidence from 112 field trials to promote energy-conservation behaviour, using both monetary and non-monetary interventions, Mi et al. (2021) concluded that economic incentives can be used to promote household energy conservation, but that they are less effective than non-economic behavioural interventions. Mi et al. (2021) further compared the effects of economic incentives versus interventions that inform consumers about the economic costs or savings potential of their energy use. They found that the difference between these two types of intervention was non-significant. In addition, the authors do not find differences between findings from Western and Eastern countries. Overall, the results from this meta-analysis suggest that economic instruments may only have relatively small effects in the domain of household energy use.

<c> 3.2.2 Upstream taxes and charges

To complement the psychological literature, we considered some economic research that examined the effects of more upstream economic instruments, such as taxes and charges, or permit trading systems. In the context of climate change, various countries nowadays have implemented carbon taxation or a cap-and-trade system, one of the two main forms of so-called “carbon pricing”. These instruments are not aimed at consumers directly, but impose a cost where carbon enters the economy. At the highest level, the cost is borne by the producers of fossil fuels, or somewhere lower down the supply chain (e.g. an oil refinery). Most, if not all, of these additional production costs are typically passed on to consumers (Erutku, 2019). Upstream instruments such as carbon pricing can reduce carbon emissions in multiple ways: they can lead to (a) lower carbon intensities by incentivising more carbon-efficient production and/or (b) behaviour change away from carbon-intensive products and services if the costs are passed on to consumers. Existing research found relatively small, but positive effects from carbon pricing. For example, Green (2021) reviewed 37 quantitative evaluations of carbon pricing policies that have been introduced around the world since 1990. The studies suggest that the aggregate reductions from carbon pricing on emissions are limited (Green, 2021). Specifically, she estimates that annual emission reductions from carbon pricing are typically between 0% and 2%. These relatively small effects may be due to the price of carbon having been set too low and the policies being replete with exemptions for certain industries or sectors. In fact, despite recent modest progress, no OECD country has levels and coverages of carbon pricing that are needed to reach climate targets (OECD, 2021). The review by Green (2021) notes that “low prices are pervasive” and suggests that “pricing will work better after a certain threshold is surpassed”. Evidence for this point is provided, for example, by a large-scale empirical study using data for 142 countries over a period of two decades (Best et al., 2020). It compared countries that had or had not implemented a carbon price within that period. It found that annual carbon emission growth was about 2% lower in countries that had a carbon price. Moreover, the authors estimate that an increase of €1 per tonne of carbon reduces annual emission growth in subsequent years by a further 0.3%. Overall, while there is a broad consensus among economists that a low-carbon transition is improbable without carbon pricing as a key policy instrument (van den Bergh & Botzen, 2020), and scientists from other disciplines also show favourable attitudes to this policy (Cologna et al., 2021), others argue that carbon pricing is not sufficient and that more ambitious and context-sensitive policy mixes are needed (Rosenbloom et al., 2020).

 3.3 How do economic instruments work?

Economic instruments provide incentives and disincentives, often with the intention to internalise environmental costs and benefits into the decision making of consumers or other actors in the supply chain of products and services. In essence, these economic incentives (e.g. rewards and subsidies) and disincentives (e.g. charges and taxes) provide either positive or negative reinforcement to behave in a certain way through their price signal (Maki et al., 2016). In terms of the behaviour change wheel (Michie et al., 2011), economic instruments are intended to influence the motivation to stop an old or start a new behaviour through the intervention function of incentivisation. This is informed by rational choice theory in which people are considered actors that base their decisions on formal or informal cost-benefit analysis. For example, a charge raises

the cost of plastic bags, after which demand for them falls (Dikgang et al., 2012b). While this is certainly part of the explanation, it is not sufficient to fully explain their effects. Poortinga et al. (Poortinga et al., 2013; G. O. Thomas et al., 2019; G. O. Thomas et al., 2016) have argued that, rather than being just an economic instrument, a plastic bag charge also has psychological effects by acting as a 'habit disruptor'. A charge may deliver a 'demand shock' because consumers are suddenly asked to pay for something that they were used to getting for free (Dikgang et al., 2012b). This forces people to think about whether they want or need the plastic bag. The charge thus makes the decision to use a plastic bag a deliberative one rather than something that is done out of habit. In terms of the behaviour change wheel, this means that, rather than through incentivisation, a charge impacts on behaviour by changing the system of motivation from automatic to reflective (Michie et al., 2011). The 'habit disruption' interpretation is supported by observations that even relatively small plastic bag charges lead to large reductions in bag usage and that the effects are similar across a wide range of socio-economic groups (Homonoff, 2013; G. O. Thomas et al., 2019).

The concept of the 'pain of paying' (Zellermayer, 1996) holds that consumers experience a payment as a loss, which is associated with negative emotions. The pain of paying is felt more strongly when the parting of money is more salient or visible. This can explain why visible cash payments are considered more painful than less visible credit card payments (ibid). The visibility or saliency of a tax or a charge is what may drive behaviour change. This is supported by the economic literature showing that the effects of environmental taxes are distinct from other price effects. For example, Rivers and Schaufele (2015) compared the effects of the carbon tax on the demand for gasoline with equivalent price changes due to market fluctuations. They found a stronger response to the carbon tax than to an equivalent increase in market price (Rivers & Schaufele, 2015). Similar effects were found in other studies that examined the impact of gasoline taxes on consumer behaviours (Baranzini & Weber, 2013; Li et al., 2014). Charges, taxes or price changes can be expected to be less effective where they are less visible or salient, as behaviour change is then solely driven by price effects. That does however not mean that less visible taxes are not able to change behaviour. Economically upstream fat and sugar taxes imposed on food manufacturers are still able to shift consumer demand away from high-fat meat and dairy products (Jensen et al., 2016) and high-sugar drinks (Pell et al., 2021), even if they are invisible to the consumer.

The pain of paying may also provide an explanation as to why charges are more effective than discounts (Homonoff, 2013; Poortinga & Whitaker, 2018). Because charges are experienced as a loss, they are felt more intensely than gains of an equal size and thus provide a stronger incentive to change behaviour than discounts (cf. Kahneman & Tversky, 1979). That is however not the only explanation. The framing of an incentive also provides normative signals about what is the most common and approved behaviour (Lieberman et al., 2019). Where having to pay extra for a disposable item through a charge communicates that *not* using the disposable item is the default option, a discount for not using a disposable item suggests that the incentivised behaviour is optional. Across a series of experiments, Lieberman et al. (2019) show that charges project stronger perceptions that the incentivised behaviour is the descriptive and injunctive norms, and that this in turn leads to stronger behavioural intentions to behave in the desired way. There is however no empirical evidence available to show the extent to which the differential effects

between charges and discounts can be attributed to monetary loss aversion or information leakage about social norms.

Economic incentives may have indirect psychological effects in addition to the more direct price effects they are designed to provide. These indirect psychological effects may reinforce ('crowd in') the direct price effects. For example, we have already seen that charges may act as a habit disruptor (Thomas et al., 2019); and there is also evidence that contingent payments and rewards can encourage the development of a habit that then may be maintained even after the incentives have been removed (Charness & Gneezy, 2009; Cooke et al., 2011). In both cases, these habit-related processes help to strengthen the direct effects of the economic incentives. However, economic incentives can also undermine ('crowd out') the effectiveness of economic incentives (Rode et al., 2015). Various scholars have therefore argued that economic instruments could have unintended consequences (Bolderdijk & Steg, 2015; Gneezy et al., 2011). In particular, economic instruments may diminish people's motivation for pro-environmental behaviour. Self-determination theory postulates that by providing an extrinsic motivation, economic instruments may undermine people's intrinsic motivation to engage in a behaviour due to reduced perceptions of autonomy in performing the behaviour (Deci & Ryan, 1985; Ryan & Deci, 2000). According to Bolderdijk and Steg (2015), a key risk of using economic incentives is that it may change the decision frame from an ethical to an economic/business one. This undermines the influence of normative considerations, limits opportunities for identity signalling ('image motivation') and absolves moral responsibility for doing the right thing (also see Rode et al., 2015). These psychological processes may weaken the effectiveness of economic incentives and could even produce counter-productive outcomes. For example, payments may lead to fewer blood donations, as they could undermine moral considerations for doing so (Mellström & Johannesson, 2008); providing incentives to 'do good' (e.g. donations to a charity) removes the signal of that behaviour showing that someone is a good person, as others are no longer able to distinguish whether it is done voluntarily or because of the external incentive (Ariely et al., 2009); and the introduction of a fine for late-collections of children at day-care centres can backfire, as the payment can be seen as compensation for the late coming (Gneezy & Rustichini, 2000).

The literature provides some evidence for crowding effects but is overall inconclusive. A systematic review conducted by Rode et al. (2015) concluded that incentives can both reduce and increase internal motivation for conservation; and noted that many of the reviewed studies did not find any significant effects. A number of individual studies show that financial incentives can lead to an effect opposite to the one intended. For example, a meta-analysis on information and price strategies by Delmas et al. (2013) found that financial feedback can lead to an increase in energy use rather than conservation. Perino et al. (2014) tested the effects of a subsidy on environmentally 'clean' products and a neutrally framed price change of the same magnitude on real purchasing decisions in a UK supermarket. They found a crowding effect in that the neutrally framed price change led to more purchases of cleaner products compared to the equivalent price change induced by a subsidy (Perino et al., 2014).

Evidence showing that economic incentives are doing more harm than good however appears incidental rather than systematic. For example, a systematic review concluded that there are no significant differences between monetary and non-monetary incentives in the quantity of blood

donated (Niza et al., 2013), despite some individual studies reporting an effect (Mellström & Johannesson, 2008). Furthermore, the meta-analyses previously discussed in this chapter show that economic incentives can be highly effective in promoting pro-environmental behaviour, at least in most domains (Maki et al., 2016; Wynnes et al., 2018). This seems to suggest that, even where economic incentives have psychological effects working in the opposite direction, these indirect effects are not strong enough to crowd out the more direct (price and non-price) effects of these measures. Overall, however, there is scant empirical research on motivation crowding within the environmental behaviour domain.

<a> 4. Combining Economic and Behavioural Interventions

This chapter so far has shown that both economic and non-economic interventions can motivate behaviour in a pro-environmental direction, even if the impacts are often small. It is a logical next step to call for combinations of policies to achieve stronger effects (Mundaca et al., 2019; Nisa et al., 2020). Policy mixes may also be the result of complex policy environments, in which actors implement measures at multiple scales to reach environmental and non-environmental goals (Rogge et al., 2017).

It is plausible to assume that combinations of economic and behavioural instruments are more effective: distinct instruments may appeal to distinct motivations or mechanisms underlying behaviour change; and one instrument may offset potentially counterproductive effects of another. Indeed, some of the previously mentioned meta-analyses point to superior effects of policy mixes compared to effects of individual policies (e.g. Khanna et al., 2021). However, a review that focused exclusively on experimental studies concluded that there is little evidence for positive policy synergy between incentives and behavioural interventions, and in certain circumstances may lead to reduced effectiveness (Drews et al., 2020). For example, an experimental study that examined how a carbon tax interacts with a moral message in influencing food choices in an online supermarket found that the instruments individually reduced the carbon footprint of consumers' food basket, but there was no evidence for any positive (or negative) synergy between them (Panzone et al., 2018). In addition, the meta-analysis by Maki et al. (2016) found that combining financial incentives with non-financial incentives led to statistically non-significant changes in pro-environmental behaviour. All this is not to suggest that policy combinations cannot be useful, but it shows that achieving synergies is not as easy as one might think. Drews et al. (2020) further argue that there is a paucity of good quality evidence, with existing research often having methodological limitations such as missing control groups. Environmental psychologists can play a role here by designing high-quality future studies testing optimal combinations of economic and behavioural instruments. This may involve synergies of policy effectiveness, but can also address other important aspects of environmental behaviour change policy, such as policy acceptance.

<a> 5. Conclusions

 5.1 Summary of findings

This chapter reviewed the evidence whether economic instruments, such as taxes, charges and rewards, are effective in changing environmentally-relevant behaviours in comparison with other behavioural interventions. The literature shows that charges can be highly effective in discouraging the use of single-use items, most notably single-use plastic bags. Behavioural strategies, such as persuasive normative messages (de Groot et al., 2013) or voice prompts at supermarket tills (Ohtomo & Ohnuma, 2014), may also achieve reductions, but these tend to be smaller than for bag charges. A charge tends to be more effective when there are clear and easy alternatives that allow the consumer to adapt to the charge, e.g. by bringing your own reusable bag or container. Policies that provide more environmentally friendly alternatives, for example through mugshare and/or deposit return schemes (Poortinga et al., 2019) or by the provision of reusable cups (Novoradovskaya et al., 2021), can establish behaviour change and help increase the effectiveness of economic incentives (Poortinga & Whitaker, 2018)

The findings of multiple meta-analyses and systematic reviews covered in this chapter suggest that economic instruments have a larger impact on pro-environmental behaviour than information-based interventions both in the short and long term, at least in most behavioural domains. Nisa et al. (2019) conclude that behavioural interventions only have a very small positive effect on climate change mitigation behaviours, and that informational strategies are the least effective. Nemati and Penn (2020) similarly report that information-based interventions have a relatively small impact on water and energy conservation behaviour. Maki et al. (2016; 2020) found that interventions that use economic incentives had moderately-sized effects on pro-environmental behaviours, with larger standardised effect sizes than those reported by Nisa et al. (2019) and Nemati and Penn (2020).

Systematic reviews that directly compare economic incentives with other behavioural interventions conclude that economic incentives are the most effective (Khanna et al., 2021), in particular in reducing personal car use which is associated with high levels of carbon emissions (Wynes et al., 2018). The results for household energy use are however mixed. Whereas Khanna et al. (2021) found that economic incentives elicit more pronounced behaviour change, Mi et al. (2021) reported that non-economic behavioural interventions produce higher levels of change. While several studies included measures beyond the intervention periods themselves, Nisa et al. (2019) concluded that there is no evidence that effects of behavioural interventions are maintained after the end of the intervention. In contrast, Maki et al. (2016) report that economic incentives may have sustained effects even after their removal.

 5.2 Gaps in the literature

The chapter identified a number of gaps in the literature that need to be addressed in the future. It showed that economic instruments can be used to change environmentally-relevant behaviour.

However, there is a lack of good-quality research to test theoretical ideas and assumptions about how different economic instruments work and showing the conditions under which they are more or less successful. In particular, while there are convincing theoretical reasons to suggest that economic instruments may lead to unintended and sometimes counterproductive outcomes, there is limited empirical evidence of motivation crowding within the environmental behaviour domain. Furthermore, it seems that most research on motivation focuses on positive reinforcements, such as rewards for conservation behaviour (Maki et al., 2016). This is in contrast to economists' focus on motivating emission reductions through negative reinforcement through, for example, carbon pricing.

Another gap that should be addressed is on potential synergies between economic incentives and behavioural interventions, to identify more and less productive combinations of measures. While many assume that policy mixes are more effective than individual measures, there is surprisingly little research on the topic. In addition, research on policy design for behaviour change could show how to address problems with certain economic instruments, notably the underpinnings of public resistance to carbon pricing. Many political scientists and some economists favour that carbon pricing revenues are redistributed across households so to increase public acceptance of the policy. However, such transfers may generate additional income which in turn may trigger further emissions. Psychological approaches based on, for example, mental accounting may help to counter such effects (Hahnel et al., 2020).

It is important to point out that most of the evidence discussed in this chapter comes from developed countries. For example, earlier discussed literature reviews (e.g., Wynes et al., 2018; Khanna et al., 2020) overwhelmingly cover studies only from the Western world. It would be useful to conduct more research in other parts of the world to examine to what extent the presented insights are generalisable. With respect to carbon pricing, several high-level efforts in this direction have been undertaken recently, such as the publication of the Handbook on Carbon Taxation for Developing Countries (UN Tax Committee, 2021).

Finally, it has to be noted that, just as for behavioural interventions, high-quality field experiments evaluating the effects of economic instruments are scarce (Nisa et al., 2019); often with non-random allocation to the intervention and comparator groups, attrition and missing data, and poorly applied measures (Michie et al., 2018). There is clear need for higher quality field studies that address the limitations of existing research on both behavioural and economic interventions.

** 5.3 Further considerations**

While the review suggests that economic instruments can produce better results than behavioural interventions, they are not a cure-all that can or should be used to change any behaviour in any context. The chapter has shown that economic instruments may be less effective in specific behavioural domains (Mi et al., 2021), and there are clear limitations and concerns relating to their use. The reach of downstream economic instruments, just like behavioural interventions, is usually limited to the individuals and behaviours targeted by the intervention. This raises questions as to whether they are sufficient for the profound systemic changes needed to respond

to the climate crisis (Nielsen et al., 2020; Whitmarsh et al., 2021). Economists therefore consider carbon pricing a crucial element of climate policy to reduce carbon emissions across the economy. While aggregate reductions of existing carbon pricing so far have been limited (Green, 2021), there is evidence to suggest that this is due to their design. Most importantly, they have been set too low to fully incorporate the costs of carbon. A distinct drawback of carbon pricing is that they have been proven to be controversial and sometimes face fierce resistance (for example, as shown by the Yellow Vest protests against a rise in the French carbon tax). This may jeopardise their effective implementation.

Carbon taxes are far less popular than subsidies (Levi, 2021) or regulatory and voluntary policies (Rhodes et al., 2017), and simply naming a policy a 'tax' rather than something else reduces its acceptability (Hardisty et al., 2019). 'Tax aversion' may explain why people are more sensitive to "taxes" than to other equivalent costs (Rivers & Schaufele, 2015). A key factor in the low public acceptability of environmental taxes is that they are perceived as regressive and unfair (Clayton, 2018; Dreyer & Walker, 2013; Maestre-Andrés et al., 2019). Perceptions of distributional unfairness notably derive from poorer households spending a larger share of their available income on energy-intensive goods, which may be exacerbated by carbon pricing. A literature review suggests that perceived fairness and in turn the acceptability of carbon pricing can be improved by channelling the revenues back to people in order to compensate for such distributional effects (Maestre-Andrés et al., 2019). Policy design has also been shown to be relevant in the case of food taxes aimed at emission reductions, which can receive more public support when they are integrated into packages of policies that people are more positive about (Fesenfeld et al., 2020). In addition, perceived unfairness can result from procedural policy aspects, such as low trust in governments and politicians (Maestre-Andrés et al., 2019). Together, this shows that attention needs to be paid to the specific design and procedure of carbon pricing schemes for them to be introduced successfully.

<a> 6. Practical Implications for Behaviour Change

Practitioners can be confident that well-designed economic instruments can result in pro-environmental behaviour change. As shown above, economic instruments tend to show better results than many other behavioural interventions; and evidence regarding the often-voiced problem of motivation crowding out resulting economic incentives is rather thin. There are however a number of design considerations that may determine their effectiveness, including but not limited to the type of (dis)incentive, the size and scope of the incentive, and the naming of the instrument.

While any economic instrument will have a direct effect through the price signals they provide, effects tend to be larger where they are more visible and felt as a loss. This suggests that specific disincentives (such as charges) that have to be paid separately can be particularly effective in changing specific behaviours. Positive incentives (such as contingent payments) can be used to promote behaviours that may turn into longer-lasting habits. However, the incentives need to be implemented so that there is sufficient time for the habits to form (cf., Lally et al., 2010).

Economic incentives have several advantages over behavioural interventions, most notably that they are more easily implemented at scale through legislation and that they can be more easily expanded in terms of reach and intensity. For example, a plastic bag charge can be increased (Convery et al., 2007) and a congestion charge widened (Ait Bihi Ouali et al., 2021). In contrast, more messaging does not necessarily lead to stronger effects and behavioural interventions that work locally may not do so at the national level (Bird et al., 2021).

While the chapter has shown that the size of the incentive does not always matter for downstream economic instruments where they provide a habit disruption effect, upstream economic instruments (such as a carbon tax) are more reliant on the price signals they provide. The size of upstream economic incentives is therefore more likely to be important than of downstream ones. Furthermore, upstream economic instruments provide benefits over downstream economic instruments in terms of their scope, and thus may be more appropriate to establish broader changes across the economy.

We highlighted above that economic disincentives (e.g. taxes) are often unpopular among the general public. However, for some of the downstream charges the opposite is true. The Irish 'plastax' (a tax on plastic shopping bags introduced in 2002) has been described as the most popular tax in Europe (Convery et al., 2007). Furthermore, there is evidence that people become more accepting of environmental charges after they have been introduced, in particular where they can be easily adapted to (Nilsson et al., 2016; Poortinga et al., 2013; Schuitema et al., 2010; G. O. Thomas et al., 2019). This shows that the provision of viable and affordable alternatives to the disincentivised behaviour should be an integral part of the design of economic instruments in order to help their effectiveness and acceptance.

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