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Greening Household
Behaviour: Overview of
Results from Econometric
Analysis and Policy
Implications

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Zachary Brown**

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ENVIRONMENT DIRECTORATE

ENVIRONMENT WORKING PAPER No. 79 - GREENING HOUSEHOLD BEHAVIOUR: OVERVIEW OF RESULTS FROM ECONOMETRIC ANALYSIS AND POLICY IMPLICATIONS

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ABSTRACT

The second round of the OECD Survey on Environmental Policy for Individual Behaviour Change (EPIC) was implemented in 2011. A publication providing an overview of the survey data from over 12 000 households in eleven countries (Australia, Canada, Chile, France, Israel, Japan, Korea, the Netherlands, Spain, Sweden and Switzerland) is available.¹ Follow-up econometric analyses were conducted in each of the thematic areas covered (energy, food, transport, waste and water), as well as on cross-domain comparisons in environmental attitudes and behaviours.² This report presents a synthesis of main results from econometric analysis using the data from the 2011 EPIC survey, as well as policy implications.

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RÉSUMÉ

La deuxième édition de l'enquête de l'OCDE sur la politique de l'environnement et le comportement individuel (EPIC) a été réalisée en 2011. Une publication offrant une première vue d'ensemble des données recueillies auprès de plus de 12 000 ménages dans onze pays (Australie, Canada, Chili, Corée, Espagne, France, Israël, Japon, Pays-Bas, Suède et Suisse) est disponible.³ Des analyses économétriques complémentaires ont ensuite été effectuées dans chacun des domaines thématiques considérés (énergie, alimentation, transports, déchets et eau). Les attitudes et les comportements vis-à-vis de l'environnement ont par ailleurs fait l'objet de comparaisons transversales.⁴ Ce rapport présente une synthèse des principaux résultats des analyses économétriques réalisées à partir des données de l'enquête de 2011 ainsi que les implications pour les politiques publiques.

Classification JEL : C51, D11, D12, H23, Q18, Q21, Q25, Q28, Q41, Q42, Q48, Q58, Q53, R41, R48.

Mots-clés: véhicules électriques, efficacité énergétique, investissement de l'énergie, attitudes envers l'environnement, enquête ménages, étiquetage, aliments biologiques, recommandation d'action, recyclage, énergies renouvelables, transports, conservation de l'eau, investissement dans l'eau, production de déchets, prévention de la production de déchets, consentement à payer (CAP).

¹ See OECD (2014).

² See Ehreke, Jaeggi and Axhausen (2014); Kriström and Kiran (2014); Millock (2014); Palatnik *et al.* (2014); Nauges (2014) and Brown (2014).

³ OCDE (2014)

⁴ Ehreke, Jaeggi et Axhausen (2014); Kriström et Kiran (2014); Millock (2014); Palatnik *et al.* (2014); Nauges (2014) et Brown (2014).

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EXECUTIVE SUMMARY

A good understanding of the determinants of households' decisions towards the environment is key to help government better design policies promoting "greener" behaviour. This report is based on the Environmental Policy and Individual Behaviour Change (EPIC) survey, carried out in 2011 in five areas: energy, food, transport, waste and water. The second of its kind, the survey collected information from more than 12 000 households across Australia, Canada, Chile, France, Israel, Japan, Korea, the Netherlands, Spain, Sweden and Switzerland.⁵

This report presents the main findings from econometric analysis in each of the five environmental domains examined and draws main policy implications. It complements the overview of the survey responses provided in OECD (2014) by offering further insights into what factors affect people's environmental behaviour and what policy measures really work.

The results clearly stress the importance of providing the right price incentives to spur behavioural change. The econometric analysis of the 2011 EPIC survey reaffirms the importance of pricing policies in driving water-related behaviour at home, in line with the 2008 survey. Respondents for whom water use is individually metered are more likely to undertake all five water-saving behaviours examined in the survey. In addition, being charged individually for water use significantly increases the likelihood of purchasing water-efficient devices. Metered households are also more likely to take water efficiency into account when last purchasing either a washing machine or a dishwasher. Besides, waste charges based on the volume or weight of waste disposed of are found to be effective. Households subject to pay-as-you-throw (PAYT) schemes report lower levels of mixed waste (-20%). PAYT also increases the separation of recyclables from mixed waste (glass). Unit-based charging schemes for waste appear to promote waste prevention behaviour such as choosing food items with less packaging. Household's decision to compost food waste is encouraged too, as expected, by the existence of PAYT billing systems.

A distinct contribution of the EPIC survey is the attention paid to attitudinal characteristics. The econometric analysis shows the central role played by awareness and attitudes towards the environment and the need to take them into account when examining the effect of environmental policies. As in the first survey round, concerns for the environment are found to increase the likelihood of undertaking a number of greener behaviours including energy-saving behaviours and investments in water-saving devices. Those who are most concerned about the environment are also more likely to use public transport, to drive less when they own a car and they display a higher willingness to pay (WTP) a price premium for electric vehicles relative to conventional vehicle. In addition, environmental concerns strongly determine expenditures and WTP for organic food compared to conventional substitutes and it is an even stronger determinant of expenditures and WTP for meat and poultry labelled as taking animal welfare into account. There is ample evidence that attitudes towards the environment strongly matter and governments can have a role in forging them. Well-designed information campaigns to raise people's environmental awareness can be expected to induce a change in behaviour as well as educational programmes.

⁵ The first EPIC survey was carried out in 2008 and the results are presented in OECD (2011).

While incentive-based policy instruments are one of the strongest measures for achieving policy objectives, appropriate targeting and design of information-based instruments can have substantive impacts. The survey data gives some useful indications to do so by looking at differences across households' socio-demographic characteristics. In the light of responses, male respondents appear for instance to be less engaged in water-saving behaviours as well as younger generations. Younger respondents also seem to invest less in water-efficient devices. In addition, younger respondents are less likely to use organic labels and tend to produce more food waste. Targeting these groups can increase the impact of awareness campaigns.

The econometric analysis highlights as well the need to account for variation in responses to policy measures across household groups when designing and targeting financial incentives. The ownership status of households appears for instance to have an important effect on the decision to invest in energy-efficient appliances and in some water-efficient devices such as water tanks or dual flush toilets. Measures addressing this issue of split incentive between landlords and tenants may be needed to ensure a wider market penetration of equipment with lower impact on the environment. On the other hand, among households who have invested in such equipment, there is no significant difference in terms of income between those who received grants and those who did not. This suggests that support programmes in place in the countries surveyed are generally not targeted at low income groups. While targeting subsidies to specific groups may entail substantial administrative costs, there can be a risk of free riding behaviour in a general scheme.

Moreover, the survey provides evidence of possible adverse distributional effects of some environmental policies. Results confirm that low-income households spend a larger proportion of their income on electricity. The income elasticity of electricity demand is estimated at 0.14. Complementary measures may be required to support priced-based policies in order to address potential regressive distributional impacts of higher electricity price.

Finally, the findings emphasize the importance of operating on the supply side to complement demand side measures. Governments can lead the way by encouraging the supply of adequate environmentally-related public services to foster greener lifestyles. The survey notes numerous examples in which the provision of relevant services can bring about changes in behaviour. Good public transportation is the most important factor encouraging people to drive less and influencing car ownership. Developing alternative modes of transport, such as cycling paths, also clearly matters. One respondent out of four is not willing to pay anything more for an electric car compared to a conventional one. The availability of adequate infrastructure for electric cars (i.e. charging facilities) also appears in data as a key element to steer demand for electric vehicles.

In a similar way, the presence of any type of collection for recyclables is found to increase recycling participation and waste separation levels. Proximity to recycling bins has an impact and recyclable waste separation is the highest for door-to-door collection. Expanding recycling services from drop-off to door-to-door collection of separated materials is associated with approximately 25% less mixed waste generation in a number of countries. The characteristics of water supply also matter. The percentage of households drinking tap water varies widely and those satisfied with the quality of their tap water (taste and health aspects) are found to be less likely to consume bottled water.

To conclude, survey results stress the importance of combining a variety of well-designed instruments to stimulate behavioural changes. One size does not fit all when targeting households.

OVERVIEW AND SYNTHESIS OF RESULTS FROM ECONOMETRIC ANALYSIS USING THE 2011 HOUSEHOLD SURVEY

Based on a sample of more than 12 000 respondents in eleven countries, this synthesis report summarises main results from the 2011 OECD periodic surveys on Environmental Policy and Individual Behaviour Change (EPIC) and draws evidence-based policy recommendations. It builds on earlier work and supplements the overview of the 2011 survey data presented in OECD (2014) with key findings from appropriate econometric models developed to refine the understanding of the drivers of environmental behaviour.

To give a first overall picture of the dataset, the work reported in OECD (2014) used, for the most part, descriptive analysis, while this report uses more comprehensive statistical tools to add new insights and to identify in particular causal relationships between policies and behaviours in the five sectors examined (energy, food, transport, waste and water). Undertaking the formal empirical analysis of the data across countries goes beyond looking at the existence of correlations between two variables. It allows examining how a change in one variable affects another variable, holding the other factors fixed, to analyse the specific effects of households' socio-demographic characteristics, attitudes towards the environment and policy context.

While formal econometric modeling brings a number of advantages relative to purely descriptive statistical analysis, it does not replace it, making this report and the analysis in OECD (2014) truly complementary. The results of econometric analysis in each of the thematic areas covered in the survey are summarised in the report as well as findings from comparisons in environmental attitudes and behaviours using spatial effects.⁶

The report also examines some cross-cutting issues and draws policy recommendations on the determinants of change towards greening behaviour based upon the results of formal empirical data analysis. Main area-specific findings are presented as well as more general policy implications on the role of different instruments. Finally, the report shows the ways forward and points to key issues to be further examined with the implementation of future rounds of the EPIC survey.

1. Learning from OECD EPIC Surveys

1.1 Objective

Evaluating the performance of policy is an important step in the efficient allocation of public resources. Yet, the evaluation of public policy is a complicated task and performance can be hidden for instance by the absence of baseline indicators. It is arguably even more challenging to evaluate the performance of environmental policies, and not just because of difficulties in valuing the benefits of a given level of improved environmental quality which these policies seek to achieve. In addition, policymakers have an imperfect understanding of how people will respond to a given policy, and thus the impact on the level of environmental quality itself. The evaluation of environmental policies aimed at changing the behaviours of individuals (rather than firms) is particularly challenging, since many of these behaviours (e.g. energy and water conservation efforts) are not easily observed with normal economic data.

⁶ The full results of the econometric analysis are in Ehreke, Jaeggi and Axhausen (2014); Kriström and Kiran (2014); Millock (2014); Palatnik *et al.* (2014); Nauges (2014), for the five thematic areas examined in the survey and in Brown (2014) for cross-domain comparisons in environmental attitudes and behaviours.

Furthermore, even when economic statistics provide some indication of these behaviours, the picture, such statistics provide, may be too limited to fully evaluate a policy.

The OECD contributes to evidence-based environmental policy guidance through the implementation of periodic large-scale household surveys. EPIC Surveys provide a unique common framework to gather evidence on how households respond to different environmental policies, how these policies interact in terms of their behavioural impacts and the role of households' attitudes towards environmental. By collecting this information over time and across diverse populations and broad geographic areas, EPIC addresses many of the challenges encountered in conducting sound policy analysis.

Based on responses from a large sample of households across a number of countries and five thematic areas (energy use, water use, transport choices, food consumption, and waste generation and recycling), the EPIC survey data analysis offers new insights to support the design of more effective and efficient policies targeting household greener behaviour while taking social aspects into account.

The second round of the EPIC Survey⁷ was implemented early 2011 in 11 countries: Australia, Canada, Chile, France, Israel, Japan, Korea, the Netherlands, Spain, Sweden and Switzerland. Approximately 1 000 households were surveyed in each country resulting in a total of more than 12 200 households.

The 2011 questionnaire was developed with the inputs from the Advisory Committee composed of national experts. It is largely based on that used in the 2008 round to ensure some comparability. However, refinements were made and new areas explored: eco-innovation, knowledge, policy preferences and country-specific questions. As in the 2008 survey, information was collected on household characteristics (e.g. age, income,⁸ education), environmental attitudes (e.g. concerns for the environment) and policy factors influencing household behaviours in the five areas considered such as the use of economic incentives (e.g. waste charges, grants to buy alternative-fuel cars) or eco-labels (e.g. energy efficiency of appliances and buildings, organic food).⁹

The two rounds of the EPIC Survey were implemented using the Internet and responses to the questionnaire were collected by means of online household panels in different countries. For representativity, the sample was stratified in each country according to different parameters: age, gender, region and socio-economic groups.¹⁰ Six countries were involved in the two rounds (Australia, Canada, France, Korea, the Netherlands and Sweden), and five new countries took part in the 2011 survey: Chile, Israel, Japan, Spain and Switzerland.¹¹

⁷ The first survey was carried out in 2008 in ten countries with a sample of more than 11 000 respondents and the main results were presented in the OECD (2011).

⁸ It should be noted that important measurement errors generally occur when measuring income in household surveys and that results suggesting that income has no impact of the dependent variable in econometric estimates need to be qualified accordingly.

⁹ The full 2011 EPIC Survey questionnaire in English is provided in OECD (2014) in Annex A. The links to the electronic versions of the online questionnaires implemented in the eleven countries surveyed are available in OECD (2014) in Annex B

¹⁰ The quota targets relative to the sample, by country, are provided OECD (2014) in Annex B as well as more details on the survey implementation including the selection of the survey provider, the technology used, the quota sampling and the response times.

¹¹ It should be noted that the same respondents cannot be targeted over the years.

This synthesis report presents the main survey results focussing on the findings of follow-up analysis data in the five domains examined using econometric methods and policy implications.

1.2 Distinctive features of EPIC surveys

OECD EPIC surveys collect a unique set of information permitting the analysis of households' responses to different policies and incentives, and how these responses are affected by attitudes. They have the following distinctive features:

- collect *comparable household-level data across many countries*. By collecting data from representative samples which is commensurable across countries, EPIC enables the statistical evaluation of the effect of a given type of policy in different countries, which can be used to generate recommendations for improving the design of environmental policies. This is a unique public sector data collection initiative focused on household-oriented environmental policies. Efforts are made to ensure large geographical coverage of the survey and the representativity of the sample across different age groups, gender, socio-economic status and location of residence.
- examine the *effect of various types of environmental policy instruments* targeting households. The survey looks at the impacts of economic incentives on decision-making (e.g. electricity and waste charges, grants to install solar panels) and the role of instruments based on the provision of information to consumers (e.g. eco-labels). Access to goods and services that facilitate the adoption of greener behaviour is also considered (e.g. provision of waste collections and recycling services, differentiated “green” energy, public transport). The impacts of direct regulation, such as water use or parking restrictions can be analysed as well.
- study in parallel a *range of domains* where households exert pressure on the environment. While existing surveys on environmental behaviours generally focus on one or two policy domains, EPIC asks households about their behaviours across five areas: energy and water use, transport choices, food consumption and waste generation and recycling. By collecting this information in a single questionnaire, EPIC can analyse how policies in one domain induce spillover effects in other domains. It can also analyse how and why responses to similar policies (e.g. unit-based charges) may vary across domains.
- collect detailed *data on respondent's characteristics*. A key advantage of micro data at the level of individual households is that they allow more precise assessment of how responses to policy depend on contextual factors. EPIC collects information on respondents' socio-demographic characteristics (income, age), home ownership status (owners, renters) and residential area (rural, urban). In addition, information on the characteristics of respondents' local environment (e.g. air quality) is collected in the survey as well as household postal codes.
- look at the *impacts of policy measures on environmental behaviours* in the five areas covered (e.g. switching off stand-by mode of appliances, use washing machines with full loads, sorting materials for recycling), as well as *on investment decisions* (e.g. buying top-rated energy or water-efficient appliances, electric cars; investing in thermal insulation, solar panels).
- examine the role of *households' environmental attitudes, concerns and norms* which is more rarely covered. EPIC also collects and analyses indicators of individual subjective well-being, an area which is being increasingly recognized by the OECD as important to inform policies.
- study policy *impacts from the perspective of both individuals and households*. In some cases, environmentally-significant decisions are made at the level of the individual (e.g. membership in

a NGO). In other cases, the relevant unit is the household (e.g. car purchase). The wording of the survey questions has been designed in such a manner to ensure that this distinction is captured in the subsequent analysis. In addition, respondents who are not responsible for household-level decisions are excluded from the sample.

- take into account *households' level of awareness of the policy framework*. Analyses of price-based instruments generally assume that households are fully-informed of the policy framework and respond in a manner which reflects their underlying preferences. However, it is by no means evident that households have the information necessary to make decisions which reflect their preferences. In many cases, they may even be unaware of the prices. EPIC surveys allow to take into account awareness in evaluating instrument performance.
- collect information on *public attitudes towards policies*. Another important area analysed by EPIC is the level of expressed support for government policy, since public acceptance can be one of the biggest barriers to implementation. For example, in many cases, trade-offs arise between economic efficiency of a policy and its political feasibility. Having quantitative data on policy support, and understanding when and why it may change, can help assess this trade-off.
- draw policy implications *comparing responses across countries, households groups, and environmental areas*.

1.3 Data sources and limitations

As in all studies involving primary data collection, there can be a sample bias when implementing a survey. Rigorous efforts were made at stratification and quota sampling. The sampling strategy involved stratification across region, gender, age and socio-economic status. The degree to which the country-level samples are representative of the national population is presented for a number of key variables in OECD (2014) in Annex B.¹² However, in some countries (e.g. Chile and Switzerland) not all of these parameters could be included. Nonetheless, as Annex B in OECD (2014) shows, deviations in excess of 20 per cent from representativity across these variables, for which quotas were set, were very limited. Response bias can be a second concern. It should be noted that such a bias is not specific to using internet panel-based surveys and responses can be biased by the interviewer in face-to-face interviews and telephone surveys. Given that the subject matter of the OECD survey is not related to information technologies or Internet, except for a very small number of questions (i.e. investment in “smart” meters), there is little reason to believe that this would result in a systematic bias.

It is also important for the reader to bear in mind the fact that all of the data used in the analyses reported here are based upon survey responses. This survey elicited respondents' stated preferences and perceptions. Therefore statistics reported here which relate to objective, verifiable indicators should be interpreted with caution and in some cases there may be ‘measurement error’. On the one hand, this may relate to the dependent variable used in the studies. For example, estimates of waste generation and recycling rates may be inexact for some respondents. Similarly, estimates of the percentage of fresh fruit and vegetables consumed which is organic may also be inexact. On the other hand, some respondents may be mistaken about the precise nature of the policy measures to which they are subject. For example, it is possible that some respondents may not be aware that a given policy exists in their country. Similarly, some respondents may mistakenly believe that a policy exists in their country, when in fact it does not. However, it is important to note that for all questions in which there was significant potential for such “measurement error”, respondents were given the option to respond that they “did not know” if such a policy was in place. This may relate to both “carrot” (i.e. grants for investment in energy-efficient devices,

¹² Practitioners wishing to use the statistics and data herein are invited to review that material.

scrappage bounties for motor vehicles) and “stick” approaches (i.e. price-based measures). Given the large sample size, such observations should not affect the results in an important way. However, in order to ensure robustness of the results, a large number of models were estimated, including models with different country samples. Attention is drawn to important differences.

In general, readers should view these data as exactly what they are: the self-reported behaviours, attitudes and perceptions of representative samples of households from eleven OECD countries. Bearing the limits of such data in mind, it is important to recognise their advantages: information on households’ knowledge and perceptions about environmental issues – increasingly recognised as a crucial factor for better understanding behavioural responses to environmental policies – is rarely analysed at such level of detail. Moreover, for many variables such as discrete choices about whether or not a given purchase has been made, there is likely to be very little deviation from a more formal household consumer survey.

2. Area-specific conclusions and policy implications from econometric analysis

What are the main insights provided by the EPIC survey results on the impact of different policy measures on household behaviour in the five domains examined where households exert particular environmental pressures?

Governments use a variety of measures to promote water and energy conservation at home ranging from economic instruments such as water charges or incentives to install energy-efficient equipment, to direct regulation with energy efficiency standards or temporary water restrictions. Information-based instruments also play an important role with labelling to promote energy-efficient products and information campaigns to raise awareness on water scarcity.

To decrease waste generation, the main instruments targeting household’s behaviour adjustments are waste generation and management charges, collection services (door-to-door vs. drop-off) and deposit-refund systems. For personal transport choices, the broad range of policies include fuel taxes, fuel consumption and CO₂ labels for cars, emission standards, subsidies for alternative-fuel vehicles, parking restrictions and the provision of public transport and cycling paths. In the case of food, the survey focusses on measures targeting directly households, that is to say public information campaigns and labelling (organic and animal welfare).

2.1 Determinants of household energy use

Factors driving energy-saving behaviours and investments in energy-efficient appliances at home

The OECD survey asked respondents how often they were performing a number of energy-saving activities. Descriptive statistics suggest that there is a potential for further households’ engagement in energy-saving behaviours and that important differences exist between countries.¹³ Follow-up work using econometric models provides insights on residential energy demand and the factors affecting energy conservation.

Residential energy demand can be considered as a step process in which household decisions are made in stages. In a first step the consumer decides whether or not to buy a durable, in a second step, the characteristics of the durables are considered and, finally, decisions are made about the frequency and intensity of use. The discrete/continuous type of decision highlights the fact that there may be substantial

¹³ In the survey, 40 per cent of the respondents reported that they “occasionally” or “never” turn off the stand-by mode and only a fourth reported that they take energy costs into account when changing primary residence (see OECD, 2014).

differences between how households respond to changes in policy in the short and long run. The income elasticity of electricity demand is estimated at 0.14, consistent with conventional wisdom, at least if interpreted as a short-run elasticity.¹⁴ This also indicates that increasing electricity prices tend to have disproportionate welfare impacts on low-income households, in line with other studies. Household size, a rough proxy for disposable income, has a strongly positive impact on demand. Multi-dwelling residences consume less energy than isolated ones, and so too do individuals who live in urban areas. Membership in an environmental organization is strongly related to electricity consumption.

The results from econometric analysis indicate that households concerned by the environment are more likely to undertake energy-conservation behaviours as well as to invest in energy efficient appliances. Because roughly 90% of the households report individual metering, it is difficult to predict the effect of metering on consumption and energy saving practices. Findings also show that the homeownership status of respondents matters. There is an “owner-occupier” effect in the purchase of energy efficient devices across a range of devices, in particular for relatively immobile investments such as windows and thermal insulation. This pattern can be explained by the importance of “split incentives”, with renters being less likely to recover the sunk costs associated with such investments. An owner-occupier is estimated to be 15% more likely than a tenant to have invested in energy efficient windows, and 19% more likely to have invested in thermal insulation.¹⁵ This is consistent with a high fixed cost being recovered over a relatively long time horizon.

Conditional on purchasing an energy efficient device, tenants are as likely as owner-occupiers to apply for a government grant. Curiously, owner-occupiers tend to be less likely to have obtained government grants for “thermal insulation” and “wind turbines”. Because owner-occupiers are significantly more likely to own these devices, tenants might be more likely to exert an effort to obtain a grant or subsidy to reduce the capital expenditure involved. Data is however too sparse to allow robust statistical tests.

While the descriptive analysis in OECD (2014) suggested that the ability to identify an energy label lowered energy consumption, although the effect was small, the formal econometric modelling did not substantiate this finding.

Demand for renewable energy

The review of descriptive statistics suggested that there is a significant unmet household demand for electricity generated from renewable sources. Respondents’ stated willingness-to-pay (WTP) for renewable energy is on average about 10% over and above the existing annual bill for a complete re-mix of electricity supply with “green” energy only.¹⁶ However, there is significant variation across countries with the Dutch respondents showing the lowest mean WTP. The lack of confidence in the actual modification of the supply mix appears as one of the main motivations for not willing to pay anything.

The results of econometric analysis provide insights on what lies behind these findings. They indicate that reported level of WTP for renewable energy is driven by attitudes toward the environment. Concerns for the environment and membership in an environmental organization play a prominent role in the residential market for renewable energy, consistent with earlier studies. The difference between members

¹⁴ The analysis of cross-section data is usually interpreted as more of a long run than a short run elasticity.

¹⁵ Controlling for other important household characteristics that may have an effect on the purchase of energy efficient device.

¹⁶ It should be noted that stated WTP is generally higher than revealed WTP in the literature and that results should be qualified accordingly.

and non-members is more pronounced at high levels of WTP. Economic factors have an effect as well, though a more limited one. Importantly, income drives the decision whether or not to pay something for renewable energy, but not the level of the WTP.

Looking at demographic characteristics, the findings suggest that older individuals have a lower WTP. Furthermore, there is no significant rural-urban divide and neither is there a significant difference between those who live in apartments and those in isolated dwellings. Similarly, employment and marital status appear not to affect either participation or amount of WTP for renewable energy.

2.2 Determinants of household water conservation

The survey collects data on five different water-saving behaviours¹⁷ and investment in water-saving equipment.¹⁸ The data overview shows significant differences across countries. The proportions of households reporting always undertaking water-saving habits in Australia and France are often among the highest of all countries, which may be a consequence of active water-saving campaigns in Australia and a relatively high price of water in France. The adoption of water-efficient devices appears to vary by country, as well, and the percentage of stated adoption of low-flow shower heads and taps and water tanks is the highest in Australia and the lowest in Japan.

The follow-up econometric analysis of factors affecting water conservation behaviours indicates that households who report being individually metered and whose bill depends on actual water consumption are unambiguously more likely to exhibit pro-environmental behaviours in terms of water use, including undertaking water-saving behaviours and purchasing water-efficient devices. The findings suggested that the impact of being individually charged for water may differ across countries, possibly because the price of water varies from one country to another. Among all the respondents, three quarters report facing volumetric charges with individual water metering. The highest reported rate is found in Japan and the lowest is in Canada and Sweden, water-abundant countries.

Respondents who declare being charged on the basis of their water use are more likely to ‘always’ turn off the water while brushing teeth, plug the sink when washing dishes by hand, water garden in the coolest part of the day, and collect rainwater or recycling wastewater. The impact is significant except for taking showers instead of baths.

Being charged on the basis of actual water use also increases the likelihood of purchasing water-saving equipment such as low-volume or dual-flush toilets, water flow-restrictor taps/low-flow shower heads and water tank to collect rainwater. Metering increases as well the likelihood of taking water efficiency into account when purchasing of a washing machine or a dishwasher. Respondents from Australia, France and Spain are the most likely to take water efficiency into account when investing in relevant appliances.

The results also confirm earlier findings about the significance of attitudinal variables. Social norms, attitudes and opinions about the environment in general do matter in explaining households’ water-saving behaviours and investments. The factors that have the strongest impact are: being a member or supporting an environmental organisation, expressing concern about the environment and voting in elections. These

¹⁷ The water-saving habits examined in the EPIC survey are: turning off the water while brushing teeth; plugging the sink when washing dishes by hand; watering garden in the coolest part of the day; collecting rainwater or recycling wastewater and taking showers instead of baths.

¹⁸ Water-saving investments considered on the survey are: low-volume or dual-flush toilets; water flow-restrictor taps/low-flow shower head and water tank to collect rainwater.

factors are good predictors of the likelihood to take water efficiency into account when purchasing a washing machine or a dishwasher too.

In addition, decisions related to water conservation appear to differ significantly according to respondent's socio-demographic characteristics (e.g. age, gender, household size, income). The effect of age is ambiguous but, in most cases, older respondents are found to be more likely to undertake water-saving behaviours and to invest in water-efficient equipment. In general, female respondents are more likely to undertake water-saving behaviours than males. The analysis also confirms that household size matters; larger households are more likely to invest in water-efficient appliances and to take water efficiency into account. Yet, the size of the household does not appear as significant, in general, in models describing the likelihood of undertaking water-saving behaviours.

Education is not found significant, in general, while results show that income has a negative effect on the likelihood to undertake water-saving behaviours. However, there is no strong and consistent relationship between income and investment in water-saving equipment. Results indicate that high income households are less likely to invest in water tanks while income is found to have a positive, but non-significant, effect for the other two types of devices.

The survey collects as well data on whether or not respondents benefited from government (or utility company) financial support to make an investment in the three types of water-efficient appliances considered. The fact that the question was asked only to respondents who had purchased the device limits the analysis of the impact of subsidy programmes on the likelihood to purchase the equipment. Future rounds of the EPIC survey will allow further examining this question. What can be said at this stage is that financial support for use of low-flow taps and showerheads is the most common subsidy and that Australia, Canada, France and Israel are the countries where water-related subsidy programmes seem to be the most frequent. Besides, households who benefited from a subsidy and those who did not, do not appear to differ in terms of income.

The survey also allows looking at the factors driving respondents' decision to use the water efficiency label in the countries surveyed where such a label is available: Australia, Israel and the Netherlands. Overall, respondents are well aware of the labels displayed and a vast majority of them reported understanding its meaning. Findings indicate that those who express higher concern about the environment and support environmental organisations are more likely to use water-efficiency labels. Individual water metering has an impact as well.

Finally, respondents' satisfaction with the quality of tap water and sources of drinking water is examined. The overview of the data shows that the percentage of households reporting that they drink tap water varies widely in the countries surveyed from about 5% in Korea to 90% in the Netherlands and Sweden. The econometric analysis of factors affecting drinking habits regarding tap water underlines the influence of households' demographic characteristics (age, education, and living environment) and attitudes towards the environment. Older respondents and respondents who believe that environmental issues are overstated are less likely to drink tap water whereas respondents living in town and suburban areas are more likely to do so. The perception of tap water quality strongly predicts drinking habits and the consumption of bottled water. As expected, respondents' level of satisfaction with the taste and the health impacts of tap water increases the likelihood to drink water from the tap, either straight or purified/filtered/boiled.

2.3 Determinants of personal transport choices

Factors driving car ownership and the choice of alternative modes of transportation

Findings from econometric models indicate that income and household size are strong determinants of car ownership while pro-environmental attitudes are not found to have a significant impact on car ownership and car use.

Results confirm that improving access to public transport and developing infrastructures for alternative modes of transport (e.g. cycling) is key to influencing households' car purchase and use decisions. Households' choice to use non-motorized modes depends heavily on the proximity of the destination. The further away the destination and the higher the travel time savings are for car mode, the less households use alternative modes. Also, households who do not have a car tend to use these modes more often. Attitudinal variables play only a minor role.

In a similar way, the more accessible the existing public transport infrastructure, the more it is used. Again, car ownership plays an important role. Car ownership itself is predominantly determined by absolute income. As expected, the higher the household income, the greater the probability of owning a car. Other important factors are relative competitiveness against other modes (positive) and accessibility of the public transport system (positive), both heavily determined by the existing infrastructure. The main policy recommendation is to engage actively in spatial planning and to build high quality infrastructure (cycling path and public transport facilities).

The analysis of the most important aspects in respondent's car choice indicates that safety, reliability and price are overwhelmingly ranked first. Fuel consumption appears as the most important attributes for those valuing environmental aspects. This group also ranks safety and reliability high. Looking at attitudes towards policies, respondents supporting government actions to reduce motor vehicle CO₂ emissions give more importance to environmental aspects while households' income has a negative impact on the ranking of this car characteristic.

Willingness-to-pay a premium for an electric car

Respondents state, on average, that they are willing-to-pay 20% more for an electric vehicle compared to a conventional one. Stated willingness-to-pay a price premium for an electric car is by far the highest in the Netherlands. One out of four respondents is not willing to pay anything more for electric car compared to a conventional one; the main reason being that they think that they should not have to pay extra for an electric vehicle, followed by infrastructure availability.

Findings from econometric analysis show that concern for the environment increases the WTP a price premium for an electric car. Surprisingly and at odds with the literature, household income is found to have no significant impact. However, households reporting that they trust information about the environmental impact of products, those better educated about the environmental impact of private transport, and those in favour of government actions to reduce CO₂, tend to have a higher WTP. Yet, results for willingness-to-pay for electric vehicles have to be interpreted carefully, as there is still very little information and knowledge about electric vehicles existing among the people and answers differ extensively.

2.4 Determinants of food consumption

The data collected on food focussed mainly on the consumption of organic food and the consumption of animal welfare labelled products. The overview of survey responses presented in OECD (2014) suggests that there is wide variation across countries in terms of the levels of recognition and trust in labels. Reported trust in the new EU organic food label varies for instance from 47% in Sweden to 83% in the

Netherlands among respondents who recognised it. Since there is a close link between reported expenditures and label recognition and trust, this has implications for policy makers.

Individuals that are the most likely to use the national organic label are those that are members of environmental organisations. Individuals that are the most likely to trust the national organic label are those who rank environmental concerns as the most important and those that have a high value on the trust index. Socio-demographic factors, such as age or education have a very small effect. The survey findings indicate that trust in both national and supra-national (e.g. EU) organic labels is closely linked to overall levels of trust placed in governments, scientists, and commercial entities. The impact of organic food and animal welfare labelling is however not easy to assess because trust in labels is endogenous to decisions to purchase these products.

Findings from econometric models indicate that environmental attitudes and behaviour (membership in environmental organisations) are the strongest determinants of organic food expenditures. The survey data shows that households ranking environmental concerns before health concerns in their food choices have higher expenditures on organic fruit and vegetables, all else equal. Demographic characteristics (age, presence of children) play a more limited role to explain organic food purchases and expenditures. Women and older households tend to consume more organic food. The presence of children under 5 years of age in the household seems to matter as well. “Lower prices” is ranked as the most important factor encouraging respondents to increase their consumption of organic food in all countries.

The median willingness-to-pay for fresh fruits and vegetables is highest in Korea and Switzerland, and lowest in Australia and Canada. In the models, the WTP for organic food is found to increase with years of education and income, as in other studies, and with the score on a general trust index. Respondents that rank environmental concern higher than health concerns in their food choices are also willing to pay more for organic produce, as are urban residents compared to rural residents.

The survey also assesses the determinants of animal welfare, an issue less often analysed in the literature. The reported median willingness-to-pay for meat and poultry that takes animal welfare into account varies from 10% to 20%. Fewer variables are statistically significant in expenditures and WTP for animal welfare labelled meat and poultry. In the econometric analysis, income is never significant in explaining expenditure or WTP for animal welfare labelled products. The marginal effects of the environmental attitudinal variables are larger than for organic fruit and vegetables. The share of such purchases may thus remain rather stable over time and be little affected by food scares. There is a possibility, though, that respondents to the EPIC survey interpreted organic largely as including animal welfare and the specific numbers relating to animal welfare expenditures and WTP must be interpreted with caution. The conclusions on organic food are more robust and corroborated by existing results.

Environmental awareness is found in the models to increase WTP for organic fruit and vegetables compared to conventional substitute and to increase WTP for meat and poultry labelled as taking animal welfare into account. In addition, the 2011 survey data show that households ranking environmental concerns higher than health concerns in their food choices are significantly more likely to purchase organically labelled products. Findings indicate that the decision to purchase organic food also strongly depends on income, contrary to the decision to consume products respecting animal welfare. This suggests that, in spite of the trend towards a better availability and a lower price of organic products, price is still a barrier to an increased demand.

2.5 Determinants of household waste reduction

The overview of the survey data shows that household reported waste generation varies greatly across the countries surveyed (highest in Israel and lowest in Korea). Looking at waste containing hazardous

materials, such as electronic components and old or unused medicines, they are commonly disposed of inappropriately with general mixed waste and rates are particularly high for younger people.

The analysis carried out using econometric models gives a better understanding of factors affecting households' decisions related to waste. Findings regarding the links between household socio-economic characteristics and waste generation generally confirm previous studies. Mixed waste generation is found to increase with household size and income. Across all surveyed countries, a 1 per cent increase in household income is associated with an average 0.12 per cent increase in mixed waste generation volumes, holding other factors constant. On the other hand, higher-income households are also more likely to separate recyclable materials, though not enough on average to offset their greater waste generation. In addition, whilst larger households produce more waste, *per capita* generation declines with household size, with each additional person in a household associated with only a 30% increase in waste generation on average.

The econometric models show that attitudinal factors also have an influence on household waste generation. Respondents considering waste generation as a serious environmental issue facing the world generate a lower volume of waste. This is particularly the case in Australia, Japan, Sweden and Switzerland. In addition, those sceptical about the importance of environmental issues have higher waste generation rates than others.

Similarly, whether or not individuals belong to environmental organizations is the most important factor predicting waste prevention efforts as measured in the survey (e.g. use of reusable shopping bags, choose items with less packaging etc.). Members in environmental organizations are between 10% and 20% more likely than non-members to engage in waste prevention efforts. Civic engagement is also found to be a significant determinant of waste prevention together with the age of the respondents.

Moreover, the presence of a PAYT system strongly predicts whether individuals engage more frequently in waste prevention. Japan, Korea and Switzerland are three countries with a significant proportion of households subject to pay-as-you-throw waste charges (PAYT). Results confirm that charging households according to PAYT has a significant impact on reducing waste generation. Paying for mixed waste disposal by weight or volume also increases the propensity to compost.

Results from the survey imply that households charged for waste collection services via pay-as-you-throw (PAYT) generate between 16% and 20% less mixed waste, compared to households charged through other means. In general, the survey results suggest that the most effective policy approach to reduce mixed waste generation is to combine a PAYT waste charge with intensive recyclable materials collection services; the most intensive service being door-to-door collection of all separated materials. Combining a PAYT mixed waste charging system with door-to-door recycling services reduces waste generation by 34% relative to a case with only door-to-door recycling service, and by nearly 50% compared to setting in which no recycling service or PAYT system is available. Yet, this policy package is also typically among the most expensive to implement, and so, more precise quantitative information is needed on expected impacts of such policies, to be weighed against their additional expense.

There are cross-country differences on the complementary role of measures. In Canada, the Netherlands, Sweden, and Switzerland, expanding recycling services from drop-off to door-to-door collection of separated materials is associated with between 23% and 27% less mixed waste generation. In these countries, the combination of PAYT charging with door-to-door collection of recyclables is complementary, with 40% less waste generation relative to a drop-off only collection service with no PAYT system in place. In other countries, however, the direct impacts of recyclables collection services are not found to be statistically significant, although the presence of such services appears necessary to bring about the environmental benefits of PAYT billing systems. It is found that households subject to

unit-based charges tend to separate more, suggesting that PAYT systems indeed work in part by channelling more recyclable materials away from the mixed waste stream.

Lastly, the problem of food waste is receiving increasing attention in a number of countries and the EPIC survey provides some unique comparative data on this topic. Overall, respondents report that approximately 10% of the food brought at home is thrown away, with significant cross-country variation. Households in Korea and Israel report the highest percentages, and France and Switzerland the lowest. The econometric analysis gives a better understanding of the main factors affecting food waste. The results indicate that while income has no significant impact on the declared amount of food waste, age, employment status and gender matter. Older respondents and the unemployed tend to waste less food. Household size is not significant but the presence of children under 5 years of age has a positive and significant impact on food waste. Stronger environmental attitudes decrease the amount of food reported food waste.

Unexpectedly, the negative relationship between composting and food waste is not confirmed in most of the countries surveyed. The decision to compost household food waste appears to be encouraged by waste fees based on the volume or weight of waste collected. The estimation results indicate that respondents that are the most likely to compost are older, with larger households and with less income. Several attitudinal and behavioural variables have a significant and positive impact on composting including participation in an environmental organisation, voting in elections or ranking the environment as the most important issue facing the world.

To sum-up, the findings from econometric analysis in the five thematic areas covered in the EPIC survey indicate that attitudinal factors and the policy context more frequently predict environmental behaviour in the domains examined than socio-economic and demographic characteristics.

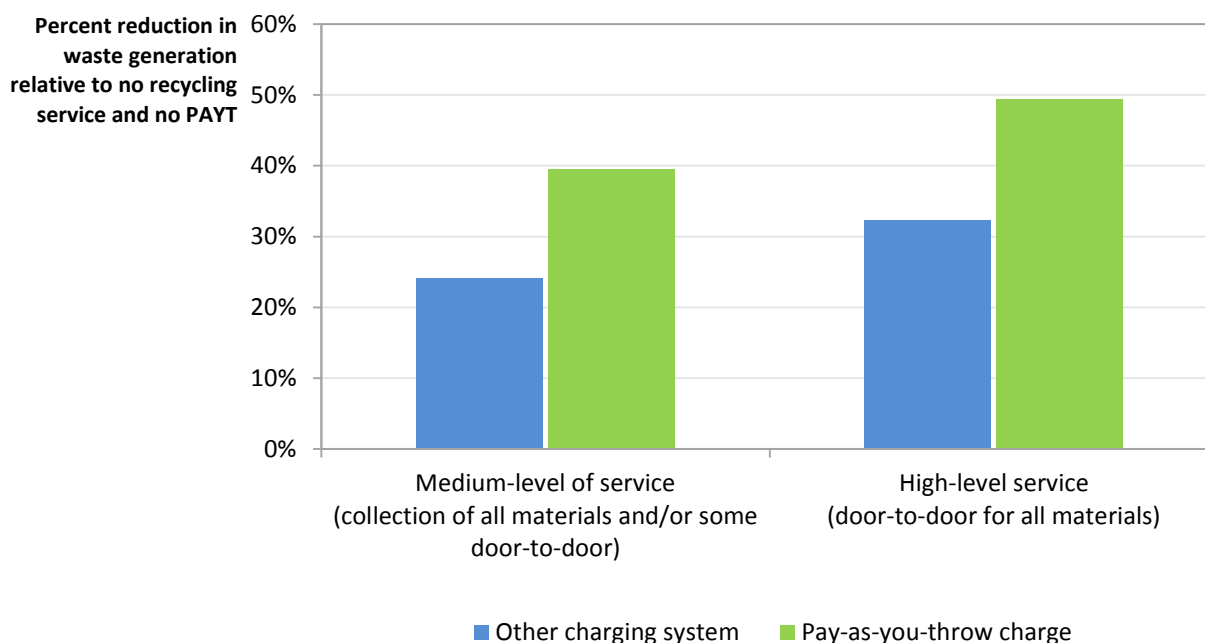
3. Cross-cutting issues

3.1 Accounting for interactions between policy measures

For most environmental domains, there are a variety of potential instruments for achieving policy objectives. These policies can be complements or substitutes. Assessing which is the case is important for the cost-effective use of public resources and the EPIC survey data is well-suited for providing insight on interactions between instruments.

The combined effect of the two measures may exceed the sum of the individual impacts of the two when introduced alone (*i.e.* they are strong complements). As an example, EPIC provides quantitative guidance on how unit-based waste charges (so-called pay-as-you-throw or PAYT systems) and recycling programs affect household waste generation when combined. Figure 1 shows the mean estimated impact of PAYT and recycling programs of varying intensity. In general, the combination of pay-as-you-throw (PAYT) waste charging with waste collection and recycling services is estimated to reduce mixed waste generation by at least 40 per cent in the case of medium-level service and as much as 50 per cent in the case of high-level service (see the green bars in Figure 1), relative to a situation without any separation services or PAYT. This compares to between a 24 per cent and 39 per cent reduction in mixed waste resulting from a recycling service alone, without PAYT (comparing the blue to the green bars in Figure 1). Because nearly every occurrence of PAYT in the dataset coincided with a medium to high level of recycling service, the impact of PAYT alone – without meaningful recycling services – could not be evaluated with any statistical precision.

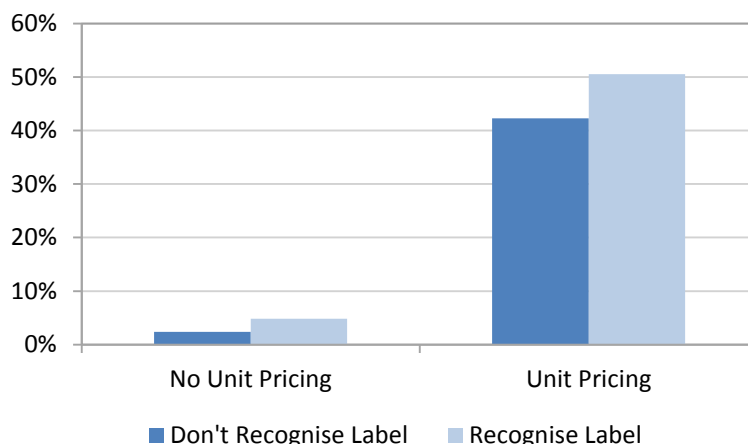
Figure 1. Estimated impacts of pay-as-you-throw pricing and recycling service availability



Note: Based on econometric analysis controlling for a range of factors which are correlated with the presence or absence of recycling and waste charging policies, and for whether or not respondents were aware of the services and charging systems in their community. Chile, Korea, and Japan are removed from this regression due to data commensurability issues. Empty bars on the left indicate that estimated impact is not statistically significant.

In certain cases, the effect of one policy can be additional to that of another (*i.e.* they are weak complements). The EPIC survey provides an illustration in the area of water conservation. Respondents were asked to indicate if they had taken water efficiency into account in the purchase of dishwashers or washing machines. Individually, both the presence of unit water pricing and recognition of water-efficiency labels has a positive and significant effect on purchase decisions. Indeed, the estimated marginal effects of the two are almost identical (approximately 0.1). However, the mean impact of unit pricing is much greater, as shown in Figure 2. Moreover, the percent increase in respondents who recognise the labels and take water-efficiency into account is approximately the same whether there is unit pricing or not. This indicates that the measures are weak complements.

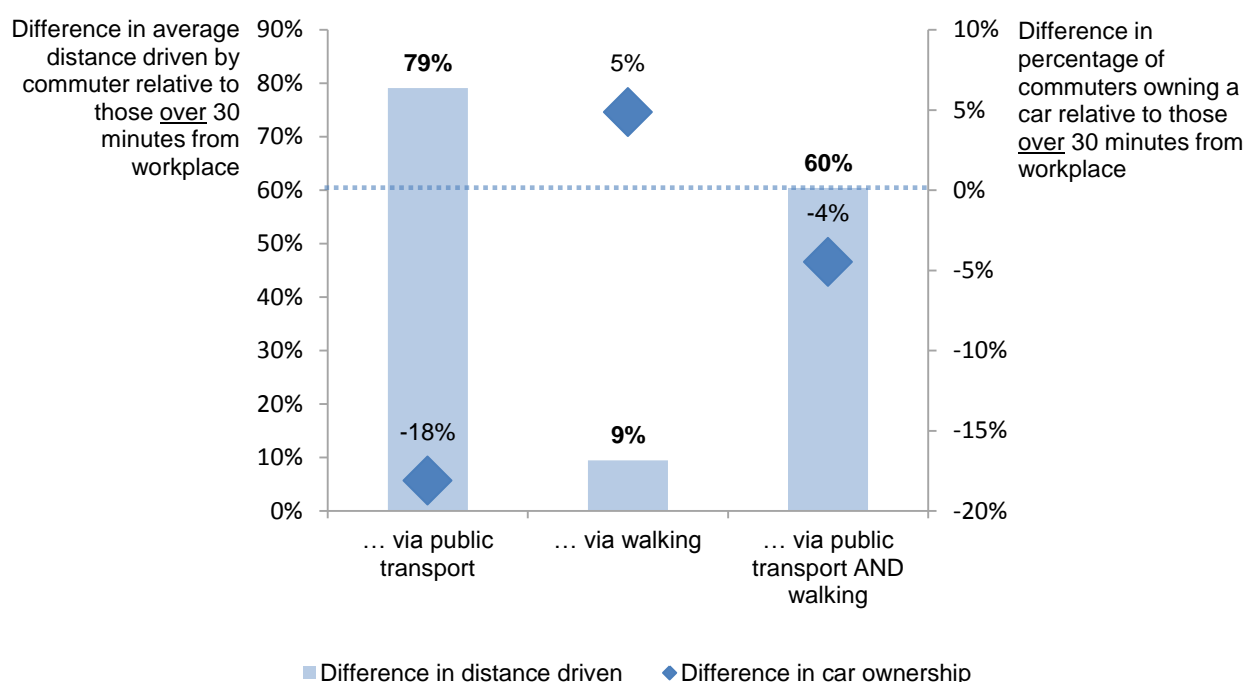
Figure 2. The effects of unit water pricing and label recognition on taking energy efficiency into account in appliance purchases



Conversely, in some cases, one policy may actually undermine another (*i.e.* a case of strong substitutes). In other cases, the effect of one measure makes the introduction or retention of another measure redundant (*i.e.* they are weak substitutes).

The analysis of the survey results in the area of personal transport choices provides an example of potential policy substitutability – and the potential gains from policy targeting measures. The data focusing on decisions to commute via car, public transport, or by walking to work (Figure 3) shows how the average amount of driving per commuter is affected by increasing accessibility to public transport and/or making it more feasible to walk to work. Being within 30 minutes of one’s workplace by *both* public transport and by foot decreases driving rates by 60 per cent on average, more than the walking-only case and less than the case with only increased public transport access. Furthermore, whereas increased public transport access is associated with an 18 per cent decrease in the likelihood of owning a car, being within 30 minutes by foot of one’s workplace – but without any change in public transport access – implies a 5 per cent *increase* in the likelihood of the average commuter owning a car. Being within 30 minutes of one’s workplace via foot *and* public transport is associated with a 4 per cent lower probability of car ownership. These numbers suggest that policies focused on congestion-reduction may want to first target public transport investments in areas where walkability is limited.

Figure 3. Driving and car ownership effects of average commuter being within 30 minutes of workplace



Note: Impacts econometrically estimated from a Heckman selection model, where weekly vehicle kilometres travelled is the dependent variable and car ownership (binary) is the selection variable. The instrumental variables in the selection equation are region-level averages of (a) car ownership, (b) use of car scrappage schemes, (c) participation in local elections, and (d) number of children in the household. All estimated impacts shown in the figure are statistically significant at the 5 per cent level.

3.2 Accounting for variation in responses to policy measures across household characteristics

The EPIC surveys suggest that demographic factors can play an important mediating role in affecting the impact of different policy measures. While incentive-based policy instruments clearly appear to have one of the strongest measures for achieving policy objectives, appropriate targeting and design of information and awareness campaigns can have substantial impacts to induce behavioural change as well.

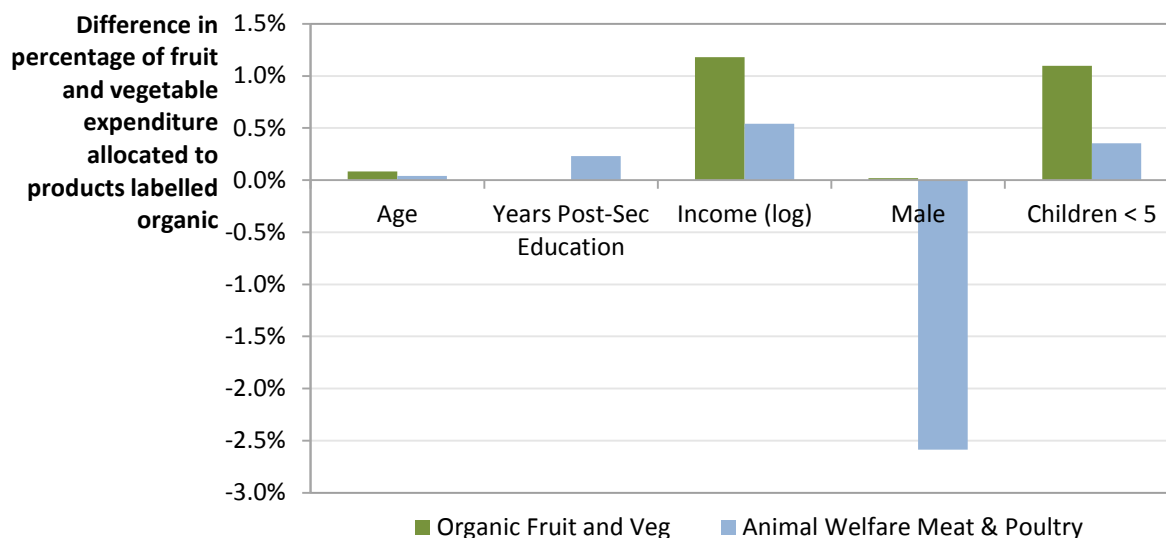
An example can be seen in the area of water consumption and conservation. Analysis of the survey data implies that the presence of volumetric pricing appears to result in an average 5 per cent increase in the frequency of water conservation efforts (of course, there will be significant variation around this mean depending upon the level and structure of water tariffs).¹⁹ However, demographic factors also appear to have an important effect on water conservation behaviours. For example, younger, male respondents are 6 per cent less likely to engage in these behaviours. This suggests that awareness campaigns targeting this demographic group which brought their behaviour in line with other groups would complement volumetric water pricing.

In the area of food, there are striking differences in the relationship between different demographic factors and self-reported percent of expenditures on fruit and vegetables allocated to organic products on

¹⁹ The behaviours included in the analysis are (1) turning off the water while brushing one's teeth, (2) collecting rainwater or recycling wastewater, and (3) using water-efficiency labels when buying appliances.

the one hand and meat and poultry which takes animal welfare into account on the other (see Figure 4). While age, income and the presence of children have positive and significant impacts, the effects on organic fruit and vegetables are approximately three times the magnitude. Conversely, years of post-secondary education only has an effect on animal welfare meat and poultry (the coefficient for organic fruit and vegetables being insignificant). Male respondents have much lower per cent expenditures on meat and poultry which take animal welfare into account, while the difference for organic fruit and vegetables is insignificant.

Figure 4. The effects of demographic characteristics on food choices



3.3. Accounting for environmental and social attitudes and norms in policy design

On distinct contribution of the EPIC surveys is the attention paid to the role of attitudinal characteristics (e.g. environmental concerns and norms). Results based on the EPIC data indicate that, in many areas, attitudinal characteristics play a role in affecting environment-related choices. While other attitudinal measures in the data were found to predict certain behaviours, such as agreement with statements about altruism and inter-generational equity or stated levels of concern about specific environmental problems, environmental organisation membership was found to be consistently and strongly associated with behaviours spanning all the thematic areas. Membership in an environmental organisation is for instance a strong predictor of whether or not respondents are willing-to-pay a price premium for electricity generated from “green” sources and the difference between members and non-members is more pronounced at high levels of willingness-to-pay (WTP). It also predicts a small reduction in expenditures on electricity, controlling for correlated factors.

In terms of policy implications, involvement in environmental organizations is best understood as a revealing indicator of attitudes rather than a lever by which the government can affect behaviour. An in-depth econometric analysis highlights this point, by investigating the relationship between stated environmental attitudes and indicators of civic engagement (e.g. including membership in environmental organizations, but also voting in local elections, charity membership, etc.).²⁰ The analysis finds that greater levels of civic engagement appear to lead in fact to more sceptical attitudes about environmental claims and issues. Yet at the same time, those less sceptical about the importance of environmental problems are a

²⁰ See (Brown, 2014).

priori more predisposed to engaging in their communities, including in particular becoming involved in environmental organizations.

3.4. Accounting for local context

The collections of households' postal codes is a particularly valuable component of the EPIC survey which permits placing households on a map (after anonymising the data) and merging with geo-spatial data from geographic information systems (GIS). Adopting a spatial perspective is useful to understand environmental activism and awareness as the previous section shows. This feature has numerous other policy applications, including an examination of how household wellbeing (measured in the survey) varies with environmental quality (as measured, for example, by air quality monitoring stations and compiled in GIS databases).

One of the analytical reports based on the data provides an analysis of how life satisfaction and in particular satisfaction with local environmental attributes varies with different independently measured indicators of environmental quality and urbanity, including air quality.²¹ The main conclusion of the analysis is that in order to have unbiased estimates of the effect of environmental conditions on life satisfaction, it is important to ensure that the measures of environmental quality are unbiased and 'cleaned' of correlated factors. This has been achieved through the inclusion of independently assessed air quality measures combined with satellite-based indicators of urbanity and with subjectively assessed noise levels and access to green space. Clearly, this is less likely to be true of pollutants which are less tangible and for which the impacts are not well-known.

Including only a subset of these variables in the regression – or using subjective, survey-based measures of environmental quality in place of a mechanically measured variable, when the latter is available – results in estimates that are less precise and which are more difficult to interpret for economic analysis. Based on the findings, the monetary value of potential air quality improvements is assessed. The survey results also indicate that environments which respondents perceive as noisy and lacking in access to green space have a significantly detrimental impact on life satisfaction.

In addition, significant localized patterns were found with regard to attitudes and engagement.²² For example, environmentally motivated households tended to live in neighbourhoods with like-minded households. And more civically engaged households (particularly those involved in charity organizations) tended to live near other civically engaged households. These types of patterns highlight the point that responses to environmental policy are likely to cluster spatially, as a function of neighbourhood characteristics.

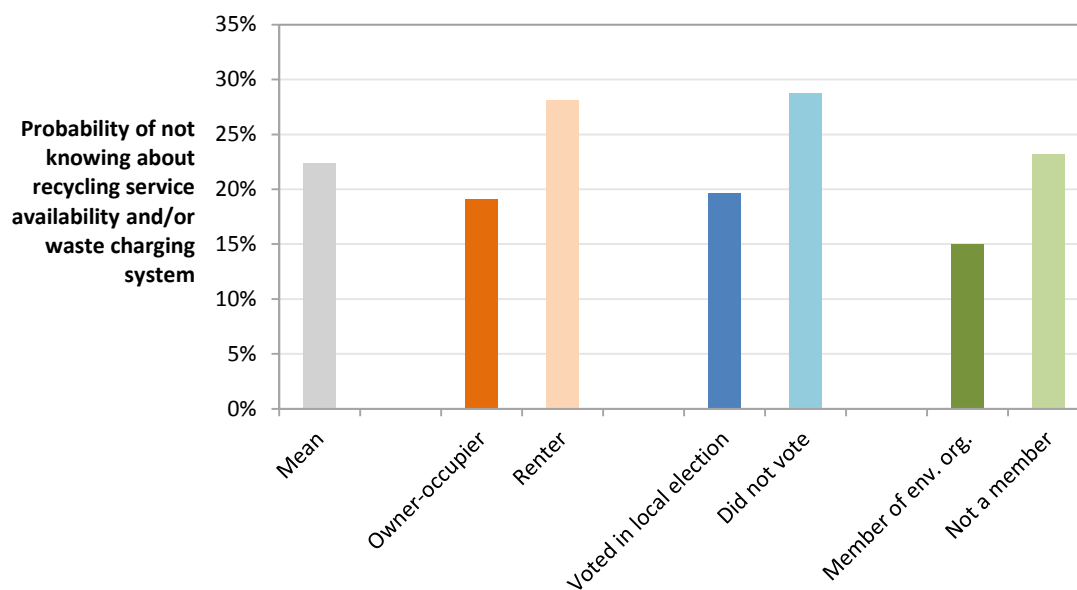
3.5. Accounting for awareness and acceptance of policy measures

Most studies assume that there is perfect information with respect to the policy framework in place. However, this is not always the case. For example, one quarter of the surveyed respondents stated that they were not aware of the recycling services and/or waste charging system in place in their community. Furthermore, the analysis identifies key respondent attributes – whether or not their household owns their home, their levels of political and environmental activism – which predict their awareness of the waste collection systems in their community (Figure 5).

²¹ See Silva, J. and Z. Brown (2013).

²² See in particular Table 2 in Brown (2014).

Figure 5. Household awareness of waste charging systems and recycling programs



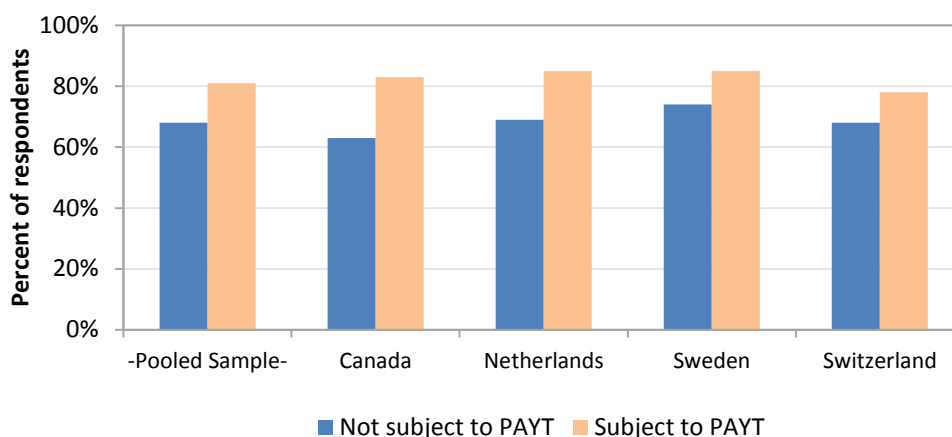
Note: Estimated marginal probabilities from a Probit regression model controlling for other factors

In addition, households may be aware, but do not accept or support a given policy. Understanding the determinants of constituency support for different policies is important because such support can determine whether the policy is implemented. Environmental taxes stand out as a clear example. Although such taxes are often an efficient means for simultaneously improving the fiscal solvency of governments and correcting for environmental externalities, public support for these instruments is often low, which has impeded their implementation in many OECD countries.

However, evidence shows that policy support is not set in stone. EPIC gathers information on respondents' stated levels of support for a number of different policies, including fuel tax increases and pay-as-you-throw (PAYT) billing for mixed waste charges. In the case of PAYT, analysis of the data suggests that support is likely to be greater for those subject to a scheme (see Figure 6). This result persists even when controlling for broad attitudinal patterns: views on fairness and reciprocity in the provision of public goods, and views on whether households should bear any costs associated with environmental policy measures. This finding raises important questions for how *ex ante* public policy support should be used to gauge *ex post* acceptance, and in turn what this means for policymakers.²³ If a municipality knows that the community is opposed to the introduction of a PAYT system, yet also is reasonably confident that views towards such a system will change after its introduction, what is the best course of action? It is clear that public communication of the environmental and economic benefits of PAYT (and environmental taxes in general) should be an important component in the development and rollout of policy.

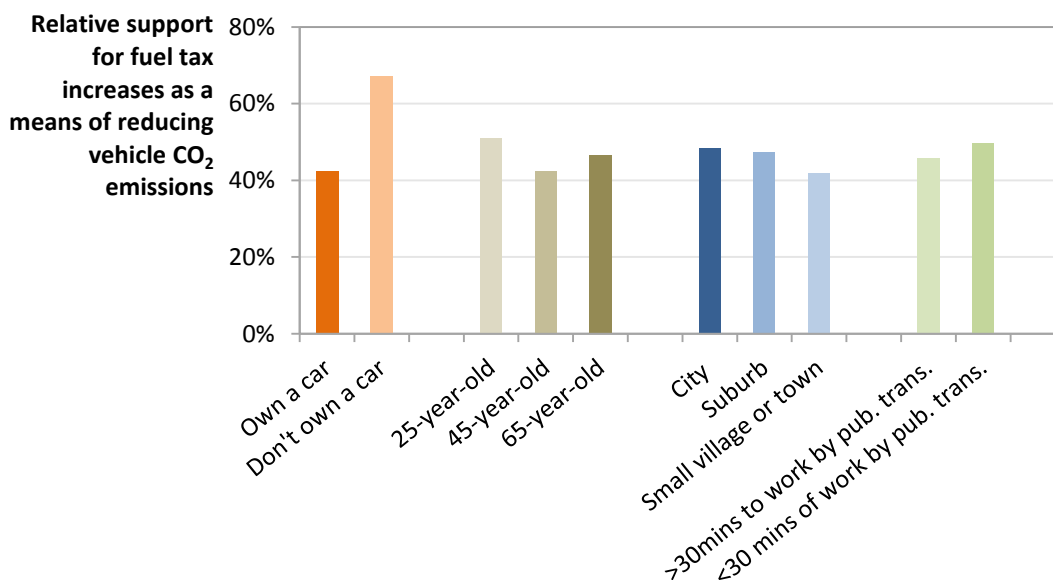
²³ A point should be taken into account: what is the *a priori* opinion of populations with regard to a given public policy? Where policies are implemented with populations that are favourable, to PAYT systems for instance, one can expect households subject to this type of scheme to be more supportive than those who are not subject to it. This result does not mean that the opinion of individuals has improved as a result of the implementation of the policy.

Figure 6. Support for PAYT and exposure to policy



What determines support or opposition for increased environmental taxes? Taking the example of fuel taxes, Figure 7 shows the factors that were found to significantly determine such support. Obviously, owning a car is a significant determinant, with those not owning a car over 20 per cent more supportive on average. Middle-aged individuals, who likely face the most life constraints in their ability to modify travel behaviour in response to such a tax increase, tend to be the least supportive of such a policy. Similarly, populations in towns and villages, where car use is often more of a necessity, are less supportive of such a policy. Among commuters, those with good public transport access (*i.e.* having less than a 30 minute commute via public transport) were more supportive of higher fuel taxes.

Figure 7. Relative support for higher fuel taxes

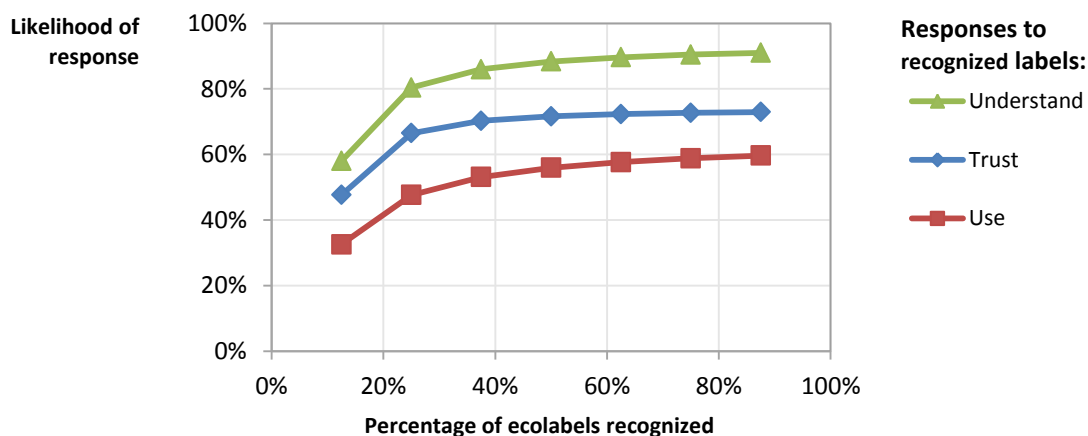


3.6 Comparing policy impacts across environmental domains and evaluating spillovers

One key advantage of the EPIC survey is to collect data in different environmental areas. This allows analysing how household reported attitudes and behaviours can interact across domains. One possible example of possible spillover effects is the notion of ‘label fatigue’ which has gained traction in policy discussions. With the increasing proliferation of ecolabels in many OECD countries, there is a concern that the seeming effectiveness of any given label might be diluted, as respondents become ‘fatigued’ and confused from an overload of this sort of information. To study this (and other aspects related to labelling), respondents in the EPIC survey were presented with ecolabels spanning all of the themes in the survey, from labels for car efficiency to organic food, appliance water/energy efficiency and product recyclability. Each respondent was exposed to between six and thirteen ecolabels; for each label the respondent was asked if s/he recognized, understood, trusted and used the label. A summary of these data is provided in OECD (2014). By econometrically analysing how the likelihood of a respondent understanding, trusting and using ecolabels is affected by overall label recognition, we can partially test this notion of labelling fatigue. Stated simply, when people recognize relatively more labels, are they more or less likely to understand/trust/use any given label, controlling for other factors such as environmental attitudes, education, income, etc.?

Figure 8 shows results from such an analysis. Somewhat contrary to the notion of ecolabel fatigue, the analysis implies that the likelihood of understanding, trusting and using any given label – from among those recognized – increases with the proportion of labels recognized, but at a decreasing rate. However, this current analysis does not control for ‘selection effects,’ i.e. the likelihood that respondents who recognize lots of ecolabels may possess unobserved factors which correlate with understanding, trust and use. This highlights a policy-relevant area for future analysis with additional data.

Figure 8. Estimated response to any given ecolabel, by overall label recognition



Other cross-domain analysis reveals how environmental attitudes mediate the effects of incentive-based policies in different ways, depending on the domain. Econometric analysis with the survey data also investigated how environmental attitudes interact with unit-based (i.e. marginal) pricing for waste collection and water use, and time-of-use pricing for electricity consumption in determining waste generation and water/energy conservation. While incentive-based policies all appear effective in yielding intended behavioural responses, differences arise in terms of which attitudinal group appears to generate the majority of the response. For example time-of-use electricity pricing and unit-based water pricing policies are found to achieve the bulk of their measured behavioural response among households with -

‘environmentally motivated’ worldviews. In contrast, unit-based charging for waste collection (i.e. PAYT) achieves the majority of its impact by affecting the behaviours of environmentally sceptical individuals.

4. Main Policy Implications

Policy recommendations: Energy

- Governments can promote strategies to meet household demand for electricity generated from renewable sources not currently satisfied. The demand for renewables can be encouraged by measures increasing consumer trust in service providers’ capacity to actually shift generation to renewable sources.
- Governments can play an important role in promoting households’ investments in energy efficiency and renewable energy and the role of grants and targeting of these measures needs to be better understood.²⁴ There are for instance substantial differences between owner-occupiers and tenants, across many dimensions
- Targeting subsidies for energy efficiency upgrades at owner-occupiers would appear to have little effect on investment rates, except possibly for relatively high-cost and sunk investments such as thermal insulation and high-efficiency windows. This would be particularly important for tenants due to the existence of split incentives between capital and operating costs.
- An important task for governments may be to bolster information campaigns raising people’s environmental awareness given its significant impact on energy-saving behaviour and investments, and well as on WTP for renewable energy.
- Targeted awareness campaigns are more likely to be effective compared to general information. Information on own and similar household energy consumption might be particularly effective.
- Additional measures may be required to support priced-based policies in order to address potential regressive distributional impacts of higher electricity price. This could include providing direct income support to low-income households so as not to distort price signals.

Policy recommendations: Water

- Encourage the widespread implementation of individual water metering and charging households for water based on their actual consumption as it clearly favours households’ water saving behaviours and investments in water-efficient equipment, as well as the use of water efficiency labels where available.
- Address the lack of knowledge among respondents about whether and how they are charged for water consumption and their level of consumption. Results show that those who do not know how they are charged for water consumption are less likely to take water efficiency into account

²⁴ For instance, while the data shows that just above 15 per cent of the energy-related investments recorded in the survey received government financial support, this result does not necessarily imply that these programmes need to be broadened in the countries surveyed. On the one hand, investment who have benefited from public support would have perhaps been made even in the absence of this support. On the other hand, to limit these effects, it may be wise to target public funds on household groups with difficult access to private credits to finance their investments.

and to always undertake some water-saving behaviours. Pricing consumption on a volumetric basis contributes to tackling this informational issue.

- Take into account the significant role played by attitudes and concerns about the environment in general when designing policies as they do matter in explaining households' water-related behaviours and investments decisions. Information campaigns and education can play a role in promoting environmental awareness and thus spurring water-conservation behaviours and investments in water-efficient devices.
- Consider the socio-demographic characteristics of households to target policy measures. Gender, age and household size are often found significant in explaining behaviour and investment decisions related to water. Older respondents and larger households are more likely to conserve water. Men are less likely to undertake water-saving behaviours in general and to use water efficiency labels. Campaigns to raise awareness targeted at these groups may be more effective. The question of how grants to invest in water-efficient devices can usefully be targeted needs to be further examined.
- Improve households' information about water quality to change drinking behaviour regarding tap water. Satisfaction about the taste and safety of tap water strongly affects the decision to consume tap water. Communication campaigns building confidence in tap water quality based on the provision of observed water quality information could contribute to reducing bottled water consumption.

Policy recommendations: Transport

- To encourage households' demand for alternative mode of transport, providing adequate infrastructure to decrease travel time appears as crucial. Socio-economic characteristics of households, except for income, have almost no influence. Even attitudinal variables have a relatively small impact compared to existing infrastructures. The travel time advantage of the car mode is by far the most influential variable.
- The provision of information about the environmental impact of cars can be expected to influence the choice of fuel type and to increase demand for electric vehicles.
- The availability of adequate infrastructures (e.g. charging facilities) is key to support the uptake of alternative-fuel vehicles.

Policy recommendations: Food

- Building trust in labels is a key determinant of their effectiveness and governments can have an important role to play. This is a particular challenge in a marketplace where the use of labels is proliferating.
- Communication campaign and public education raising environmental awareness can play a key role to promote organic food consumption and these are more likely to be effective if targeted at males and younger adults who consume less organic food.
- Government policy to increase food waste separation may focus on food waste collection systems in urban areas, and promoting composting in rural areas. Information campaigns on food waste targeting younger adults and households with small children would be most effective.

- Policies measures targeting the supply side and resulting in a decrease in the organic food price premium compared to conventional products.

Policy recommendations: Waste

- Waste charges based on volume (or weight) are effective. Waste generation tends to be approximately 20 per cent lower with pay-as-you-throw charges, compared to households charged through other means. Unit-based systems also increase the separation of recyclables from mixed waste (glass), favour waste prevention and encourage the decision to compost food waste.
- Household characteristics and stated concerns for the environment affect waste generation and waste separation levels. These factors have implication for the design of information-based instruments.
- Information campaigns to sensitive households on waste-related issues are more likely to be effective when primarily targeting younger generations as they appear to be less engaged in waste separation, waste prevention and proper disposal of waste containing hazardous materials.
- Accounting for possible interactions between policy measures matters. Combining a PAYT waste charge with intensive recyclable materials collection services such as door-to-door collection appears as the most effective policy approach. Yet, this policy package is among the most expensive to implement. This is an example where instruments strongly complement each other. There can be cross-country differences in the complementary role of measures.

Other policy recommendations across domains

- Price-based measures introduced by governments have a strong role to play to spur greener behaviour. Households charged according to the amount they consume are for instance more likely save water and waste generation tends to be significantly lower with PAYT charges.
- Survey findings indicate that socio-economic and demographic characteristics have a particularly significant effect for energy and water-saving behaviours and investments. The appropriate targeting of measures to reflect variation in responses to policy across household characteristics can have substantial impacts to induce behavioural change (e.g. tenant/landlord, income) and need to be further investigated. However, the costs associated with the targeting of policies must be born in mind.
- Attitudes and environmental concerns play a significant role in shaping behaviours. The econometric analysis indicates that household's attitudes towards the environment displays the highest frequency of statistically significant impacts for habitual behaviours compared to the decision to invest. Attitudinal characteristics and the policy context were more frequently found to predict environmental behaviour than socio-economic and demographic characteristics. Government can have a role in forging them. Well-designed information campaigns and education programmes to raise people's environmental awareness can induce greener behaviours, provided that they are able to target the less sensitized to environmental issues and the least likely to adopt the desired environmentally-friendly behaviours.
- Providing relevant environment-related public services to complement demand side measures is central to bring about changes in behaviour: good public transport is the most important factor

encouraging people to drive less; proximity to recycling bins reduces waste generation and increases recyclable waste separation.

- Accounting for the policy acceptance is important. The public's attitude towards incentive-based environmental policies can evolve over the time but the opinion *a priori* of populations with regard to public policies that affect them need to be taken into account as well. Support may increase as citizens acquire more experience and familiarity with such policies. Public communication of the environmental and economic benefits of environmental taxes in general could be an essential component in the development and rollout of policy.
- Accounting for possible interactions across measures (complementarities, substitutes) is important for the cost-effective use of public resources. The impact of policies can interact in one area and across environmental domains. The existence of spillovers needs to be further examined. Households who adopt greener behaviour in one area may be more likely to do the same in another area.

5. Moving Forward

The first two rounds of the EPIC survey (2008 and 2011) have generated insights that go beyond the standard economic prescriptions in environmental policy, which tend to focus on the end-of-pipe impacts of prices and market-based instruments. The surveys clearly demonstrate the need to open up the 'black box' of household decision-making. Households' awareness and attitudes towards environmental issues mediate the effects of environmental policy. Different mixes of environmental attitudes can cause a given policy to yield divergent effects.

Lessons learned from previous surveys, building on the inputs from the EPIC Advisory Committee and from other experts, have highlighted a number of opportunities for insightful new policy analysis to develop as more rounds of the survey are implemented. Some of the possible directions to move forward with greatest added value are highlighted below.

The 2011 survey underlined the value of further linking survey responses to the environmental policy context of the countries surveyed, in order to develop **country-specific policy assessment**. In future EPIC surveys, specific measures introduced could be identified by participating countries, as often as possible, and explicitly named in the questionnaire. This would permit to give a feedback on selected measures of particular interest to governments. Tailored policy recommendations could for instance be formulated on the impact of programmes implemented to encourage environmental-friendly investments (e.g. energy and water-efficient appliances, "green" cars), the effect of charging schemes (e.g. water, waste) or the influence of ecolabels. As demonstrated in previous rounds, EPIC also has the capacity of pinpointing in which segment of the population policy awareness may be lacking. This is important for enhancing uptake (e.g. smart metering).

There is also a potential to expand the **analysis of financial support programmes** and more accurately assess how they affect investment decisions over time in the redesign of the questionnaire. The measurement of appliance investment could for instance be improved by focusing questions on ownership (e.g. number of appliances and top-rated ones) rather than purchase. Information could be more systematically collected by asking all respondents if they are aware of existing schemes (e.g. rebates, preferential loans), whether the respondents actually benefited from it or not.²⁵ If respondents are eligible

²⁵ In the 2011 EPIC survey, the question was filtered on those who made the investments.

and did not access the programme, they could be asked what the main reasons are. This additional data would provide useful insights for the design and targeting of grants.

The survey questionnaire could be expanded to look more systematically at **behavioural responses to ecolabels** and the issue of trust. When examining the question of label recognition, use, understanding and trust, the role of label characteristics could be further examined. This would allow to better understand how the impact of ecolabels may vary according to a number of factors such as: whether the label is government lead or results from a private initiative, its national or international geographical coverage, whether it is certified by a third party or not, or according to the “private” or “public” dimension of the label.²⁶ The number of competing labels in the marketplace could be taken into account as well.

There remains a potential for policy analysis of the EPIC data which focuses more on **trends over time**. This potential will grow as more rounds of data are gathered. Keeping the core of the questionnaire in the next rounds of the survey would ensure additional data comparability, although there are some limitations with cross-sectional survey data of the type analysed here.²⁷ To facilitate more advanced policy analysis of time-trends in various countries and regions, more efforts and planning would need to be devoted to merging the different rounds of the data into one, commensurable database. This would permit observation of key outcomes for the same region over time.

Designing environmentally effective and economically efficient policies, while ensuring that social concerns such as distributional effects are simultaneously addressed, is one of the challenges facing governments. The EPIC survey is well-suited for examining the **distributional effects of policies**. In future rounds, efforts will be made to gather information more systematically on energy consumption-expenditure data and to collect data on water consumption and expenditures as well. These results would allow to further analyse the distributional impacts of an electricity and water price change across different household groups (e.g. income, tenants/landlords, rural/urban).

To expand the survey insights on spatial issues, the results could be further linked to **related outside data sources**.²⁸ A valuable component of the EPIC survey is the collection of ‘high-resolution’ data on each household’s location down to postal codes which allows placing households on a map. This feature has numerous policy applications by facilitating the analysis of how community/municipality characteristics influence behaviours. This includes the examination of how household wellbeing, as measured in the survey, varies with EPIC survey data on respondents’ satisfaction with local environment (e.g. air, water) and how this compares with objective environmental quality obtained by merging postal codes with geo-spatial data from geographic information systems (GIS). Going forward, there are a number of unexploited opportunities such as exploring the relationship between different urban environment and life satisfaction. To better understand the impact of the “urban sprawl” phenomenon on household wellbeing and provide policy insights on land use, the household survey dataset could be coupled with data on urban structure and transport. The EPIC survey data could also be applied to

²⁶ Private benefits associated to the use of the label are reflected in factors such money saving (e.g. energy efficiency labels) or expected health benefits (e.g. organic food) while the “public” dimension can be associated with factors such as environmental benefits or impacts on animal welfare.

²⁷ EPIC is not structured as a panel survey (i.e. observations for the same households over multiple years). In each survey round, new samples of households are drawn, rather than interviewing the same households across rounds. The latter approach is scientifically preferable but much more costly. However, future analysis could merge data across rounds, aggregated to sub-regional levels. Besides, there exist complementary ‘quasi-panel’ methods for analysing longitudinal household survey data.

²⁸ There are other ways to usefully link survey data with outside data sources. In future survey rounds, the analysis of households’ water consumption could also draw upon comparison with secondary water data (e.g. Global Water).

estimating household demand for transport by mode choice as a function of different factors including residential location, as well as to examining inequalities in access to environmental amenities (e.g. green spaces) or exposure to dis-amenities (e.g. waste disposal facilities) and how these vary according to household characteristics (e.g. income).

The broad topical coverage of EPIC can also be used for further analysis of **how policies in different domains interact**. For example, in coming years it is likely that more governments will adopt unit-based pricing for both drinking water provision and mixed waste collection. EPIC data can be used to analyse, at a high level of detail, how households respond to the combined effects of these incentive-based instruments. “Behavioural spillovers” are likely to exist in that, as household members are induced by incentives to become more aware of their consumption in one domain, they may become more aware of their consumption in other domains.

Finally, to complement large-scale cross-country surveys, targeted interim surveys could be implemented to provide timely policy support. Such surveys can be used for an effective evaluation of a specific policy that a country is planning to ‘roll out’. The evaluation could be carried out through two successive survey rounds, before and after policy implementation. Possible applications include the rollout of smart meters, price incentives for residential water conservation, congestion charging schemes or other price-based environmental instruments targeting household behaviour. This analysis could build upon the work on behavioural and experimental economics, which has identified a range of issues that could be potentially relevant for environmental policy design. The EPIC surveys can **cast light on how responses and attitudes towards specific environmental policies actually differ from those predicted**. The issue of inertia to change (e.g. reluctance to switch electricity provider) could for instance be further examined, as well as the role of social norms in promoting pro-environmental behaviours (e.g. effect of providing information on energy or water consumption of similar households).

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