Health, Labour, and the Environment: A Social Economic Analysis

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A DISSERTATION

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS

for the degree

DOCTOR OF PHILOSOPHY

GRADUATE PROGRAM IN ECONOMICS

YORK UNIVERSITY

TORONTO, ONTARIO

NOVEMBER 2018

Abstract

In this dissertation, I explore several social economic topics, including health, labour, and the environment. Although the chapters of this dissertation explore diverse subjects, the overall theme is to analyze important social issues and their policy implications. I made use of a variety of rich datasets, as well as employing various econometric analyses, often supported by a theoretical model, to examine the research topics identified in each chapter.

In Chapter 1, I explore a 1997 policy change, which altered eligibility requirements for Disability Insurance (DI). While DI in Canada provides income support to millions, it has also been criticized for creating a disincentive for labour force participation. The 1997 change affected some Canadians, but not others, creating a natural experiment setting in which to explore this policy. I found that, following the tightening of eligibility requirements, relative labour force participation for women did increase, but their level of employment did not. There was little effect for men. This distinction between labour force participation and employment is a crucial one in this context: it indicates that what may appear to be individuals returning to work after not being eligible for DI may instead be individuals returning to the labour force, but unable to find suitable employment.

In Chapter 2, I examine whether searching for health information on the internet acts as a complement or substitute for the demand for information from physicians (proxied by physician visits). I found that the effect on physician-based information hinged on an individual's prior trust in the formal medical sector: those with high prior trust tended to use health information searching on the internet as a complement for physician visits, whereas, those with low prior trust substituted away from physician visits in favour of information found online. The results were very similar when a telehealth program was examined instead of internet-based information. Further, those who were online health information searchers also tended to be more likely to use a telehealth program. This is a reassuring result, as it may mean that those who substituted out of the formal medical sector, in favour of health online information, may also be using the more quality-controlled telehealth programs.

In Chapter 3, I explore how attitudes towards the environment affect behaviours in five key areas of environmental-related household consumption: waste generation and recycling, energy use, organic food consumption, personal transport, and water use. Prior studies have not examined these areas together, often due to data restrictions, and not in the context of environmental attitudes. Using a modelling procedure that allows for the errors in these five areas to be correlated, I found that attitudes were often a more significant predictor of one's behaviour than the financially driven policy implemented in the area.

Dedication

To my parents, Michael and Rosemarie. Without you, I would not be where I am today. You have given me the gift of curiosity and an appreciation of knowledge. You have provided endless support through this long journey, without which I would not have succeeded.

To my maternal grandmother and paternal grandfather, Ida and Frank. Ida, your aspiration for me to attend graduate school planted the seed early on in my academic career, helping me to carve out a clear path, making this journey a little easier. Frank, though we never met, your passion for knowledge and the written word have lived on through your son and your columns, both of which have been an inspiration to me.

Acknowledgements

I am forever indebted to my committee members, Neil Buckley, Ida Ferrara, and Laura Salisbury, for the countless hours you have all spent discussing and editing my work, as well as the encouragement and confidence in me that all of you have provided. This dissertation would not be what it is today without your guidance, patience, and expertise.

To my all of my friends and family, I am grateful for the constant support that you have provided along this journey. Daniel, thank you for always providing your big-brother-shoulder when I needed to lean on it. Emma, thank you for always checking on my progress, and for taking a genuine interest in my research. Emily, thank you for your unwavering friendship and confidence in me. Scott, your encouragement and support towards the end of this journey have been wonderful. Papa, thank you for the numerous hours you spent editing my work – all readers of this dissertation are also implicitly grateful.

I am also thankful to my colleagues for their patience and encouragement, especially during this last year. Cindy, you have been a mentor to me, and I am grateful that you have always been willing to listen and guide, regardless of the issue at hand. Angela, Joanna, and Carmina, you have all been an inspiration to me in different ways, and I have truly appreciated your encouragement to finish my degree. Michel, your understanding and support in these last couple of months has been an unexpected gift, and I am truly grateful.

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Chapter 1

1. Labour Force Participation and Disability Insurance Eligibility: Examining the 1997 Canada Pension Plan Reform

1.1. Introduction and Literature Review

Public Disability Insurance (DI), which provides income security to disabled[1] individuals, is an important extension of the health care and social support systems in Canada, as well as in private insurance markets. Many individuals with long-term mental or physical disabilities are not able to participate substantially (if at all) in the labour force, and thus income from DI is crucial for a variety of reasons. For instance, an individual with a long-term disability may require medical specialists that are not covered under the universal health care system, and which in the absence of this income would not have access to this required care. Additionally, these individuals may be eligible for government sponsored DI, but would not qualify for DI from private insurance markets. Individual premiums from public DI programs are not risk based, and thus are more socially equitable than their private sector counterparts, while being more affordable for low-income individuals. Automated, earnings-based contributions to a public DI program reduce the costs borne by society from negative externalities which otherwise uninsured, disabled individuals may cause, such as social and healthcare costs, as well as homelessness (Employment and Social Development Canada). However, the income received from DI has been criticized for encouraging non-participation in the labour force. This, then, raises the question of the extent to which non-participation is caused by poor health versus the availability and amount of social benefits. Are DI replacement rates[2] too high? Are

[1] What qualifies a person as disabled varies across regions and nations. The specifics for Canada will be discussed in this paper.
[2] This is the amount of employment income replaced by DI benefits.

eligibility requirements too lenient? Are we losing too much economic activity because high replacement rates and/or non-stringent eligibility requirements are enticing workers to leave the labour force when they otherwise would not?

A large body of literature has emerged in an attempt to answer the above questions. More specifically, it addresses the issue of whether there is a relationship (and if so, to what extent) between labour force participation and social insurance programs such as DI. Studies, such as those conducted by Parsons (1980), Bound & Waidmann (1992), Maki (1993), Gruber & Kubik (1997), Gruber (2000), Campolieti (2001), and Baker & Milligan (2011) have used a variety of methodologies and data sources to show that both the eligibility requirements and the amount of DI benefits create a disincentive to participate in the labour force.[3] Gruber (2000), for instance, estimated the elasticity of the Canadian (excluding Quebec) labour supply non-participation with respect to DI benefits in 1987 to be between 0.28-0.36. This is a troubling finding, since these benefits are designed to aid those workers who are mentally or physically incapable of substantially working, and thus the non-participation rate should not be subject to change with benefit levels. On the other hand, Campolieti (2004) found this elasticity, again in the Canadian context, to be near zero,[4] showing that results in the literature have varied.

Disability benefits were first introduced in Canada in 1970 through the Canada Pension Plan (CPP) for the majority of Canadians, and through the Quebec Pension Plan (QPP) for residents of Quebec (Torjman, 2002). Though the CPP and QPP have varied over the years in terms of benefit amounts and eligibility requirements, they are similar in many respects. Currently, to qualify for DI benefits in Canada (both CPP and QPP), one of the eligibility requirements states that a person cannot, due to a severe and prolonged[5] physical or mental disability, be capable of pursuing regular substantial and gainful[6] employment (Employment and Social Development Canada). Another important eligibility criteria relates to the amount

[3] However, the extent and causality of this relationship has been highly debated within the literature.

[4] However, this policy change affected Quebec only, thus the study measures the elasticity of labour force non-participation with respect to benefit changes in Quebec in 1973. Campolieti explains the difference in results between this study and Gruber (2000) could be the stringency of medical screenings at the time.

[5] As stated in the Canada Pension Plan Act 42(2), "severe" is defined as being "incapable regularly of pursuing any substantially gainful occupation" and prolonged if "the disability is likely to be long continued and of indefinite duration or is likely to result in death". The QPP uses the term "permanent" instead of "prolonged", and defines "severe" as the inability to participate in any full-time work (Retraite Québec).

[6] Substantial and Gainful employment, as stated by Employment and Social Development Canada, means "[a]n occupation where the remuneration for the work performed and services rendered is at a substantially gainful amount. The substantially gainful amount is a benchmark of earnings that likely indicates whether a person is showing regular capacity for work. The substantially gainful amount is the maximum monthly CPP disability benefit. The annual amount is equal to twelve (12) times the maximum monthly CPP disability benefit. CPP payment rates are adjusted every January."

of time an individual has contributed to the Q/CPP fund. Currently, in CPP regions, an individual must have contributed in four of the last six years or three of the last six years if they have contributed for at least twenty-five years (Service Canada). In Quebec, individuals must have contributed for two of the last three years or five of the last ten years (Retraite Québec).[7]

Given the definition of what constitutes eligibility for DI, the choice to participate in the labour force for individuals with a disability should depend only on their respective ability to maintain employment and not on the accessibility or dollar amount of benefits. However, the aforementioned studies have found evidence to the contrary. Given that the Canadian government typically spends around $350 million per month on DI transfer payments to approximately 1.1% of the Canadian population (Service Canada, 2014), it is crucial to know the prevalence of wrongful claims.

Knowing the extent of wrongful claims is not solely a monetary concern. Disability insurance plays a fundamental role in Canadian society, so maintaining the integrity of the program is critical to ensuring its continued viability and longevity. If individuals on DI are capable of working, then the social cost of DI may be too high, while its intended effectiveness is too low. DI provides advantages that are often not available through private insurance or other social programs. The Q/CPP does not exclude individuals with prior medical conditions, nor does it require high premiums from "high risk" individuals. It also provides coverage (assuming eligibility requirements are met) for all working Canadians, including the self-employed (who are not eligible for Workers' Compensation or Employment Insurance). Also, unlike Workers' Compensation, the source of the disability does not matter. DI also guarantees coverage for those in the program until recovery or death, and also ensures full inflation protection. Since its inception in 1970, CPP has seen its caseload for disability claimants grow from approximately 27,000 to 283,000 by the year 2000, and currently (2017) to 337,000, which represent, respectively, 0.171%, 1.216%, and 1.189% of the Canadian population, less Quebec (Torjman 2002, Government of Canada, 2017, CANSIM 051-0001). If there is a causal relationship between DI generosity or availability, and the decision to participate in the labour force, it could have implications on the economic well-being of Canada, as well as the perceived necessity of DI and similar social programs.

[7] Individuals could also have contributed for at least half of the years of their contributory period, but not less than two years. A contributory period begins in the month following an individual's 18th birthday, and ends at retirement, age 70, or death (Retraite Québec).

DI benefits in Canada[8] are not as generous as those in the United States, though the medical exam thresholds are less stringent (Gruber, 2000; Human Resources and Development Canada, 1996; U.S. Department of Health and Human Services, 1994). This discrepancy in benefit levels is mitigated by universal health care coverage in Canada, whereas individuals in the United States may seek Social Security Disability Insurance (SSDI) for the associated automatic enrolment in Medicare[9] (Social Security Administration USA). While there are many trade-offs in the United States between state and federal levels of DI and health care benefits (so that policy changes in one system have repercussions in others), universal health care in Canada has been a consistent reality for decades and does not affect replacement rates for Canadians on DI under the Q/CPP programs. The fact that DI insurance for those with a long-term disability is not subject to the Canadian Health Act makes its role clear. However, the benefit amount and leniency of receipt must be carefully considered, since, while it may determine the sole source of income replacement for disabled Canadians, it may also have the potential to induce those otherwise capable of working to opt out of the labour force. Thus, DI policy in Canada is vastly important, as it has effects in the realms of both health and labour outcomes of Canadians.

In this study, I explore the relationship between labour force participation and DI stringency in Canada by exploiting the 1997 CPP reform. The 1997 reform only affected the CPP, so Quebec residents were unaffected. This situation provides a natural experimental setting in which to study the effects of the reform on the treatment group (Canada, less Quebec) as compared with the control group (Quebec). Gruber (2000) employed a similar strategy using the 1987 CPP reform, which saw DI flat rate amounts increase for CPP recipients but not for QPP recipients (effectively equalizing lump sum payments between CPP and QPP). As Gruber correctly identified, the benefit of this natural experimental setting, as compared with previous studies, is that it helps to solve the issue of selection bias and endogeneity; since DI benefits are a direct function of one's past earnings, individuals who collect DI may have different preferences for work force participation, and thus it might not be meaningful to examine the elasticity of labour force participation with respect to benefit amounts. To estimate the causal effect of DI on labour force participation, it is necessary to use variation in DI that is independent of individual preferences for work. This describes the setting Gruber exploits, and to some extent, the one I explore.[10]

[8] DI maximum monthly benefits in 2018 for both CPP and QPP regions were approximately $1,335 (Government of Canada; Retraite Québec).

[9] Which includes both hospital and medical insurance, though participants are only subject to eligibility after two years of being enrolled in the program.

[10] Though the CPP policy reform was an exogenous policy change - it was universally implemented in all CPP regions - its effects would only have impacted those individuals with shorter work histories, therefore, maintaining some endogeneity. This issue will be explored in the Empirical Methodology section.

Rather than directly using benefit amounts, the majority of studies that have examined the relationship between disability insurance and labour force participation have used replacement rates as the explanatory variable of interest (such as Parsons (1980), Maki (1993) who used a similar benefit-to-wage-ratio, Gruber (2000), and Campolieti (2001)). However, using replacement rates instead of benefit amounts is still problematic, as the issues of selection bias and endogeneity persist. Replacement rates, similar to benefit amounts, are also a function of one's past earnings, which (as described above) will be directly related to one's taste or preference for working. This in turn can lead to self-selection into or out of the labour force. Replacement rates for DI are a decreasing function of past earnings (i.e. DI benefits replace a lower proportion of income for high-income earners), creating an identification problem in determining whether generous replacement rates, or low-income, is the main influence on departure from the labour force. Bound (1989) argued that using replacement rates led to overestimations of the impact of DI attachment to labour force participation (including studies by Parsons (1980a, 1980b, 1982) and Slade (1984)), which led to conclusions of a nearly one-to-one drop in the labour force non-participation rate with increased DI attainment in the post-World War II era in the United States. As Bound (1989) recognized (in similar fashion to Gruber (2000)), plausibly exogenous variation arises when replacement rates (or benefit amounts) are systematically varied across time or regions (or states in his case). In the United States the DI program is run at the national level, making variation across states rare (except in the case studied by Gruber and Kubik (1997), discussed below). Even so, he rejected the standard approach of using replacement rates in favour of using rejection rates. He argued that those who unsuccessfully apply for DI (i.e. fail to make it through the medical screening) create a natural control group. Theoretically, these rejected individuals are in better health (and thus more capable of working) than those who are accepted into the program. Though he did not employ a formal econometric model, he argued that the labour force performance of this group provided an upper bound of what could be expected of beneficiaries. He found that fewer than half of these rejected applicants returned to sustained work (even amongst prime-aged men), and tended to receive 30% lower wages than their pre-disability levels. Additionally, their post-disability wage was less than 50% of their like-aged, non-disabled counterparts. From this, Bound inferred that less than half of those on DI would return to the work force had they not received benefits. Thus, Bound (1989) acknowledged the existence of the relationship between labour force attachment and DI eligibility; however, he believed that even in the absence of a DI program, many of these individuals would still have been out of the labour force. He concluded that many of the previous studies had grossly overestimated the extent of this relationship, which likely stemmed from issues of endogeneity.

There have been few studies other than Bound (1989) that examined how eligibility requirements, as opposed to benefit amounts, affected labour force participation. Two notable papers are those by Gruber and Kubik (1997) and by Campolieti (2001). As mentioned above, Gruber and Kubik examined how a 30% increase in DI rejection rates (prompted by a funding crisis) in the United States between 1977 and 1980 affected labour force participation. The rejection rate varied widely across states,[11] giving a natural experimental setting in which to examine the effects of the change. Using the National Health Interview Survey (1977-1981) they examined whether states which increased their rejection rates the most saw lower rates of labour force non-participation over the period. They argued that this plausibly exogenous across-state change helped to solve the identification and endogeneity problem suffered by previous studies. They estimated that a 10% yearly increase in denial rates led to a 2.8% decrease in labour force non-participation, specifically amongst those in better health. However, under their strictest measure of disability (those in very poor health), they were not able to find a change in labour force participation rates.

In like manner, Campolieti (2001) examined how the tightening in eligibility requirements to the CPP relative to the QPP affected labour force participation in CPP provinces relative to Quebec - the same relationship I intend to estimate. Using Statistics Canada CANSIM and *Social Security National Programs: Canada and Quebec Pension Plans*, Campolieti ran OLS regressions with labour force participation rates as the dependent variable. However, he either found a statistically significant relationship in the opposing direction as hypothesized, or one in the hypothesized direction but not statistically significant, depending on the model specification. I believe this can be attributed to his using 1994 as the year that the CPP tightened eligibility. One of the major changes that occurred in this year[12] was eliminating non-medical factors (such as unemployment rate and relevant job availability) as a consideration during the evaluation process. Campolieti also claimed that in 1994 the eligibility requirement for having been employed (and contributing to CPP) in two of the previous three years was replaced with having been employed in four of the previous six years. That is not correct. This change was part of the reform that occurred in 1997 (implemented in 1998).[13] Thus, it may not be surprising that he is unable to find statistically significant

[11] Though the implementation of new eligibility standards was set nationally, interpretation of these standards was up to individual state boards.

[12] This change was actually implemented in 1995 (Report of the Auditor General to the House of Commons, 1996)

[13] Consider the following excerpt from the *Summative Evaluation of the Canada Pension Plan Disability Program- January 2011* (Employment and Social Development Canada): Bill C-2 came into effect in January 1998. The legislative provisions were designed to emphasize the importance of significant and recent work activity (and hence contributions). In order to qualify for CPPD pension, this Bill made it necessary to have met minimum contribution requirements in four of the last six years when the person is determined to be disabled. That meant a tightening of the CPPD eligibility. Prior to 1998, the minimum contributory requirements were two of the last three years or five of the last ten years.

results; socioeconomic factors, for example, likely would not have made a sizeable contribution to eligibility considerations in 1994 due to relatively strong economic conditions.

The 1997 CPP reform that I examine brought about a change to the eligibility requirements for disability benefits. Specifically, prior to the reform, individuals had to have been employed (and contributing to the CPP) for EITHER two of the previous three years OR five of the previous ten years. The reform stipulated that individuals MUST have been employed in four of the previous six years. Thus, the CPP eligibility requirements became more stringent by emphasizing the importance of recent and significant work activity (and thus contributions); the change caused fifteen percent fewer people to be eligible for benefits (Employment and Social Development Canada). The reform only affected new applicants and not those who were already receiving benefits (Torjman, 2002). Amongst those rendered ineligible, a disproportionate number of young and self-employed workers were impacted (Employment and Social Development Canada). However, simply from the decrease in the eligible working population, it is not clear what proportion of these individuals were actually impacted by the policy change: being rendered ineligible does not mean that these individuals would have applied for DI either before or after the policy change. To examine whether more people were rejected following the policy change, Figure 1 shows applications and rejection rates over the time period leading up to, and following, the policy change. It is evident that, although applications increased slightly in 1998 from the previous year, rejection rates experienced a much higher spike: applications rose by less than 1.5%, while rejections rose by more than 19%. This helped motivate the analysis by showing that, following the reform, more individuals were rejected from the program and may have returned to work. Interestingly, these figures also show application rates dropping off in the years following 1998, which might be explained by individuals becoming aware of the policy change, and choosing to stay in the labour force longer. This drop in application rates may also explain why the rejection rate dropped significantly following the policy change, as fewer people became eligible, causing fewer people to apply, and fewer people to be rejected from the program. There is also a significant downward trend in applications leading up to the policy change. Individuals having used the DI program as a de facto Employment Insurance program might be one explanation of the general downward trend shown in Figure 1 (Torjman, 2002). If this were the case, applications would have been dropping in numbers during the time period shown, due to economic recovery.

The changes to eligibility requirements in 1998 were not the first of its kind; both the CPP and QPP programs have modified various criteria since their implementation. Prior to the changes in 1998, the

number of years of contributions to the program to qualify had changed in both CPP and QPP regions: the allowance of contributing for two of three years was added in for CPP regions in 1987 and in Quebec in 1993 (Torjman, 2002). This change for the CPP regions was one of a wider loosing of eligibility criteria. Following this change, the program also introduced the allowance of socio-economic factors (such as unemployment rates) to be considered, as well as relaxing the criteria for those aged 55-64: a disability would be considered severe if it "prevents the applicant from doing his own occupation rather than any substantially gainful occupation" (Auditor General Report, 1996). These legislative changes caused a significant increase in total benefits paid out in CPP regions (Auditor General Report, 1996). In an attempt to mitigate this increase in benefits, a policy directive issued in 1995 rescinded many of the criteria which were seen as loosening requirements for eligibility. Specifically, those aged 55-64 were no longer provided with a different definition of a "severe disability". Further, socio-economic conditions were no longer to be considered in the determination of eligibility (Ellsworth & Pearce, 1997). These changes were meant to increase the consistency in decision making, by putting the "emphasis back on the medical basis and … de-emphasiz[ing] the use of socio-economic factors." (CPP Sixteenth Actuarial Report, 1997) The change in 1995 also eliminated the attempt to define what a disability was[14], though did provide some guidelines[15] (Ellsworth & Pearce, 1997). These changes are important to consider in the context of this study, since it helps build a wider picture of how these programs have evolved, but also because these changes may have still been affecting participation in the years that I consider in my analysis. I will address this potential concern in section 1.6.2 below.

Though the 1998 reform affected the number of people eligible for disability benefits, eligibility rules related to work history would not affect labour force participation if the DI system was perfectly targeted: recall that only those who are not capable of working at any job on a regular basis are eligible to receive disability insurance. Thus, eligibility for disability insurance should not affect one's ability or decision to participate in the labour force. However, given the evidence presented from past studies (such as Gruber & Kubik, (1997) and Bound (1989)), I believe that I will see an increase in labour force participation in CPP provinces (relative to Quebec), as denied applicants re-enter the labour force. I also expect to find results smaller in magnitude or significance as compared with studies examining changes in benefit amounts (or replacement rates). I hypothesize that individuals would be more likely to consciously change

[14] Prior to the 1995 directive, a disability was defined as "any restriction or lack of ability (resulting from an impairment), to perform an activity in the manner or within the range considered normal for the human being." (Ellsworth & Pearce, 1997)
[15] Such as, "a cerebrovascular accident with paralysis, AIDS, cancer with metastasis, advanced multiple sclerosis, advanced Parkinson's disease, or almost any advanced degenerative condition" (Ellsworth & Pearce, 1997).

their behaviour when their income replacement rate is affected rather than if their eligibility is potentially affected, given that people are often highly driven by monetary outcomes.

This paper will proceed as follows. In Section 1.2. I describe the data and sample considerations, followed by Section 1.3. where I present a brief theoretical model. In Section 1.4. I discuss my empirical strategy, followed by my results in Section 1.5. In Section 1.6., I consider alternative hypotheses and other confounding factors, and finally, in Section 1.7., I provide concluding remarks.

1.2. Data, Sample, and Variables

1.2.1. Data

I use Statistics Canada's monthly Labour Force Survey (LFS) for my analyses.[16] The LFS is cross sectional in design with a six-month rotating panel. Given that six months does not provide an adequate time frame to follow individuals longitudinally in the context of my analyses, I only use a cross-section for each panel: the March and September cycles for each year. I pool these cycles from 1995 through 2000, thus providing six years of data for my analysis.

1.2.2. Sample and Variables

To examine the policy reform, I will include individual's aged 18-59. I do not include individuals 60 or older, since in Quebec eligibility requirements are not consistent with those in the rest of Canada for these individuals. Specifically, in Quebec at age 60, individuals no longer have to be incapable of working in any job to qualify for DI, but instead incapable of doing their usual work (which is a much looser requirement) (Torjman, 2002). Students were excluded from the analyses. I also only included those with low levels of (potential)[17] work history, since these were the individuals affected by the policy change.[18] A

[16] This research was supported by funds to the Canadian Research Data Centre Network (CRDCN) from the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institute for Health Research (CIHR), the Canadian Foundation for Innovation (CFI), and Statistics Canada. Although the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada.

[17] Potential, as opposed to observed, work history is defined in the Empirical Framework section.

[18] The decision to stratify by this variable, instead of including it in the interaction term is discussed in the methodology section.

low level of work history is defined as having worked for less than or equal to 48 months (or four years) at an individual's current or former job. This cut off is used, since individuals with less than four years of work history were the group affected by the policy change. Anyone with more than four years would have been eligible for DI, based on contributory period, in either CPP or QPP regions.

The LFS lacks information about DI program participation or applications. However, it does have excellent current labour market status information and thus is useful for this study since my main variable of interest is labour force participation. I compare labour force participation before and after the reform, and in CPP regions compared to Quebec, in order to examine if the change in eligibility requirements had an effect on labour decisions. A potential issue with this time period is that it suffered from loud business cycles; the 'before' period was one of recession, and the 'after' period was one of strong recovery and economic boom. This has the potential to bias the results. This means that finding an adequate treatment group,[19] for which the common trends assumption holds, is crucial. That is, in the absence of the policy change, the labour force participation rate at time t (LFP_t) would be written as the sum of provincial effects that are fixed over time, and year effects that are common across provinces: $E[LFP_t|p,t] = \theta_p + \lambda_t$, where θ_p and λ_t are provincial and year fixed effects, respectively. To find an appropriate treatment group, I consider both the Synthetic Control Method (SCM), as well as graphing and examining labour force trends across provinces. Abadie et al. (2010) rightly advocate for the use of "data-driven procedures to construct suitable comparison groups". The SCM allows for a weighted combination of units (in this case provinces) to provide a comparison to the treated unit (CPP regions), by creating the counterfactual situation for the treated region in the absence of policy change, which often provides a better comparison than any single unit could (Abadie et al. 2010). The weighted control group (i.e. a weighted group of provinces) is determined by an algorithm that gauges similarity to the treated unit in terms of relevant covariates and pre-treatment observations of the outcome variable. However, careful consideration must be taken when deciding which variables to include in an SCM procedure. As Kaul et al. (2015) identified, including the complete set of lagged pre-treatment variables can render the other controls in the model irrelevant, while primarily allowing for the outcome variable to be optimized. They argue that in order to appropriately predict the counterfactual outcome, both the covariates and the outcome variable must have influence in the model. To ensure this occurs, the solution they offered was to only include one value for the outcome variable as a predictor in the model, which would default to the average of the outcome over the pre-treatment period

[19] Normally, one would be in search of an adequate control group. In this case, the control group can only be Quebec, since the rest of Canada received the treatment (i.e. the policy change). However, any other province (or combination of provinces) could be used as the treatment group.

(Kaul et al. 2015). The SCM is also forced to ensure common levels, as opposed to common (or parallel) trends, if a complete set of lagged pre-treatment variables are included. If common levels are the focus, the model will attempt to match the level of the outcome variable between treatment and control groups in the pre-treatment era. If successful, there is a strong argument (if one ignores the reasoning of Kaul et al.) for using a control group that not only follows the same pre-treatment growth (or decline: i.e. trend matching), but also matches on the outcome's level at each pre-treatment time period. Conversely, it is also possible that a better control group could be found when examining the groups for parallel, as opposed to level, trends. In other words, as long as the pre-treatment trend is the same, the levels need not be matched.

Given these considerations, I believe it is important to consider both the automated matching resulting from the SCM, and a visual examination of the data/trends, in an attempt to find an appropriate treatment group. Before running the SCM or creating trend graphs, I collapsed the data by province, sex, and year to obtain the average labour force participation rates by these variables.

When I ran the SCM, I included the average of the outcome variable in the pre-treatment period, while controlling for mean age, education, and urban/rural status (i.e. the proportion of people living in an urban area). I also stratified by gender; given that men's and women's labour force participation rates differ greatly, I believe this stratification is important, and it is discussed in more detail in the methodology section. I considered two outcome variables in this procedure: labour force participation rate and employment rate. I will discuss the importance of distinguishing between these two outcomes further in the paper. The SCM predicted that a weighted average of Nova Scotia, New Brunswick, and Newfoundland and Labrador would be the most appropriate treatment group, as compared with the control group of Quebec, for women's labour force participation, whereas the weighted average of Newfoundland and Labrador, Ontario, Alberta, and British Columbia were predicted for the men. The weighted groups were similar in employment rates, so for the sake of consistency the same weighted groups were used. After running the SCM, I manually verified that these provinces were appropriate when considering parallel, as opposed to level, trends. The rates for the labour force participation rate, stratified by gender, are presented in Figures 1.1 and 1.2 in the Appendix A.

After examining the trends in Figure 1.2, I was concerned about including Newfoundland and Labrador in the models, even though the SCM included it as an appropriate part of the treatment groups. After 1998,

there is a spike in the participation rate for both men and women, which is likely not solely due to the policy change. However, this spike was much more pronounced for women than for men, and was more persistent than a single year disturbance. These changes in the participation rate could have been due to the collapse of the fishery and record high levels of out-migration in 1998; many left the province seeking higher paying jobs in other provinces, such as Alberta (Newfoundland and Labrador Economics and Statistics Branch, 2007). If it was primarily men migrating out of the province, this may have forced or incentivised more women to join the labour force, and could, at least partially, explain the spike in their participation rate. Given this uncertainty regarding the cause of increased labour force participation by women post-treatment, I considered two treatment groups for women: their weighted group determined by the SCM, and one that only uses Nova Scotia – it is clear from Figure 1.2 that Nova Scotia is the closest both in levels and trends to Quebec.

The sample consists of all individuals from Quebec, and all individuals from the treatment provinces selected during the methods describe above. Using these methods to determine appropriate treatment groups, as opposed to simply using Canada less Quebec, should help eliminate confounding factors that could bias the results of my analyses.

1.3. Theoretical Model

Since there is not one lone factor that would incentivise an individual to leave the labour force in search of DI benefits, it is important to examine which factors might influence this decision and in which direction. This brief theoretical model aims to do just that, and is adapted from the model presented by Parsons (1980).

To be eligible for DI, individuals must not be (substantially) employed, and thus will likely have left the labour force prior to applying for the program. It is possible that the decision to apply for the DI program was made prior to leaving the labour force. However, for simplicity, this model will not consider that temporal decision process, though the outcomes would be similar to those from the model presented below.

The decision for labour force participation would be exogenous for individuals in very poor health; their disability would dictate whether or not working was an option. However, they are not the people of interest in this study. The people of interest are those who may have been able to continue working, but were endogenously incentivized to leave the labour force. The representative individual in this model chooses between two possible courses of action: to participate or not to participate in the labour force. At the time of this decision, the utility associated with participation is known (assuming no randomness in market earnings, and for simplicity, an individual who participates in the labour force is employed with a probability equal to 1), while the utility for non-participation, at least to some extent, is not. Assuming that this individual is a utility maximizer, they will choose to leave the labour force if the expected utility of leaving is greater than that of staying in, subject to some random element, such that:

$$\Delta = E(U|NLFP) - E(U|LFP) - \varepsilon > 0 \qquad (1)$$

Utility in the model is a function of income and leisure. The random element (ε) is idiosyncratic relative utility of working. The individual does not know if transfer payments for DI will be granted (i.e. whether the individual will be approved for the program) with probability α, or rejected with probability (1-α). Equation (1) can be written more specifically as:

$$\Delta = \{\alpha(H,\phi) \cdot U(T_P,h) + [(1-\alpha)(H,\phi)] \cdot U(T_{NP},h)\} - U(wX,h-X) - \varepsilon > 0 \qquad (2)$$

where $\alpha(H,\phi)$ is the probability of receiving DI given health condition (H) and work experience (ϕ); T_P is the transfer payment given receipt of DI; T_{NP} is the transfer payment given non-receipt of DI (EI/welfare transfers in lieu of T_P; it is assumed here that $T_P > T_{NP)}$; h is total time available; w is the wage rate of the representative individual; X is the number of optimal work hours (i.e. the outcome of their own maximization problem); and $h - X$ is the number of leisure hours. The comparative statics[20] for this model show that:

[20] See Appendix A for proofs.

$$\frac{\partial \Delta}{\partial \phi} > 0 \; ; \; \frac{\partial \Delta}{\partial H} > 0 \; ; \; \frac{\partial \Delta}{\partial T_P} > 0 \; ; and \; \frac{\partial \Delta}{\partial w} < 0$$

In other words, the probability of non-participation will rise with a higher probability of being certified as disabled (which rises with a longer work history (ϕ) – the effect of interest – or a worsening health condition (H)) and a higher transfer payment (the effect explored by the majority of papers focusing on DI and labour force participation). Whereas, the probability of non-participation will fall with higher wages, since the replacement rate from DI benefits is decreasing in income. This model helps to motivate an empirical analysis: namely, to measure the extent to which ϕ, an individual's work history, affects their labour force participation decision.

1.4. Empirical Framework

1.4.1. Model Considerations

As Gruber (2000) correctly identified, the difference-in-difference approach is attractive since it allows a clean way to identify the effect of the policy change. However, with this approach it is important to consider whether an individual's behaviour changed in response to the reform, which may have occurred, for example, if individuals migrating to another province. However, in this case, there would not have been a migration incentive; if an individual had been contributing to the CPP fund and moved to Quebec, they would still receive benefits under the CPP since that is the fund to which they had been contributing (Retraite Québec).

One important consideration is whether or not to add additional interactions to the difference-in-difference term, to stratify the model, or do neither. Since the policy change only affected those with lower levels of work history, I considered stratifying by, or interacting with, a term for DI eligibility (based on one's work history). If I interacted low work history with the existing difference-in-difference interaction – which would implement a differences-in-differences-in-differences design – it would necessitate that the common trends assumption hold for the gap between the labour force participation rate of those with high and low

work histories; in other words, that the LFP gap between the two groups evolves in the same way in the treatment and control provinces. To determine whether this was appropriate, I graphed the labour force participation trajectories of both those with high and low work histories. The pre-treatment differences in labour force participation between the two groups were vastly different across provinces. Given this, I was uncomfortable assuming common trends in the high-low work history LFP gap across provinces. So, I stratified by this variable instead of interacting it.

In order to isolate individuals with low work history, I need to construct their work history based on a few variables. The LFS contains variables for how long individuals have been in their current job (if employed) or former job (if not employed),[21] which, in combination, could be used to create an individual's potential work history.[22] There are, however, two unfortunate factors concerning these two variables: firstly, approximately 14% of respondents had missing values for both variables; and secondly, these variables only accounted for an individual's current or former job, where the latter had to be within the previous year. Thus, not only is there a problem of missing data, but also one of selection bias – individuals had to have worked in the last year to have a value for work history in the data. I solved the first of these two problems by performing multiple imputation to predict values for work history, based on age, educational attainment, marital status, province, month and year surveyed, household size, an urban/rural indicator, and the year they last worked. From these imputed values, I constructed a work history for each individual who had worked, though not in the last year and thus had a missing value for both of the employment variables. Of those that had missing values for both work history variables, 99% of cases were due to individuals who had worked, but not in the last year. If they had never worked, they were given a value of zero for work history.

This imputed potential work history variable may be endogenous for two reasons: first, work history is likely to be correlated with characteristics such as ability, preferences for work, and health status, which would appear in the error term; and secondly, there may be a loop of causality between labour force participation and work history. Even though I will only stratify by this variable, I created synthetic eligibility by grouping individuals according to age, educational attainment, province, year, household size, and marital status, and taking the mean work history across these groups. This helps ensure that the second

[21] This is a derived variable based on the month and year an individual began their last job and the month and year they finished that job.

[22] Potential work history in this case is created from job duration of current and former employment.

aforementioned problem of selection bias was mitigated, and creates potential work history instead of individual work histories.

Because men and women have been differently affected by the policy change, I stratify the sample by gender.

1.4.2. Models

Similar to Gruber (2000), I started by estimating the following equation using a logistic regression, with a simple difference-in-difference estimator, to examine the post-reform change in the labour supply for CPP regions, relative to Quebec.

$$LFP_{it} = f(\beta_0 + \beta_1 CPP_i * After_t + \beta_2 \boldsymbol{X}_{it} + \gamma_i + \delta_t + \varepsilon_{it}) \quad (3)$$

where LFP_{it} is labour force participation of a person in province i at time t, CPP_i is an indicator equal to 1 if an individual lives in a province that uses CPP (which in this case is the group of CPP provinces as determined by the SCM) for DI; $After_t$ is an indicator equal to 1 the individual is observed in a year that is after the policy reform; $\boldsymbol{X}_{it}$ is a vector of observable characteristics for person i at time t (age, age squared, marital status, education, household size, dwelling ownership, urban/rural indicator); γ_i and δ_t are province and year fixed effects, respectively; and ε_{it} is the error term. Standard errors are clustered at the provincial level for all models. The coefficient of interest is β_1, which measures the labour force participation effect of being in a CPP region, relative to Quebec, and after the reform relative to before.

A similar logistic regression was also run with employed, as opposed to labour force participation rate, as the dependent variable:

$$EMP_{it} = f(\beta_0 + \beta_1 CPP_i * After_t + \beta_2 \boldsymbol{X}_{it} + \gamma_i + \delta_t + \varepsilon_{it}) \quad (4)$$

The purpose of this regression is to show whether individuals were simply re-entering the labour force, and potentially not working, or whether they found employment.

Another way to examine the policy effect is to do a within province analysis (or within any CPP region), to examine if individuals were more likely to have been out of the labour force, due to own injury or disability, before the policy change relative to after. There is a variable in the LFS that collects this information, but it does not go as far as to ask if disability benefits were applied for and received. The following equation was estimated using logistic regression:

$$DIS_{it} = f(\beta_0 + \beta_1 CPP_i + \beta_2 Before_t + \beta_3 \boldsymbol{X}_{it} + \varepsilon_{it}) \quad (5)$$

where DIS_{it} is a binary variable equal to 1 if an individual at time t was out of the labour force due to their own injury or disability, and coded 0 otherwise (either because they were in the labour force, or were out of the labour force for reasons other than injury or disability). In this equation, I use $Before_t$ (the policy change) instead of $After_t$, since I expect that more people will be out of the labour force, due to own illness or disability, before the policy change relative to after, thus this odds ratio would be positive. For this analysis, I only include CPP regions, and do not include Quebec, so no interaction term is required. The coefficient of interest is β_2.

1.5. Results

Column specifications for Tables 1.1 and 1.2 are the following: column (1) includes only females in Nova Scotia and Quebec, column (2) includes females in Newfoundland and Labrador, Nova Scotia, New Brunswick (henceforth referred to as the treatment provinces for women), and Quebec, and column (3) includes men in Newfoundland and Labrador, Ontario, Alberta, British Columbia (henceforth referred to as the treatment provinces for men), and Quebec. These specifications were determined by the SCM procedure, and explained in the data section. All regression only included those with low levels of potential work history, which was primarily defined in the Empirical Methodology section.

Table 1.1 presents the regression results of equation (3) with labour force participation as the dependent variable. The odds ratio of interest is the interaction term between CPP_{it} and $After_i$. This term indicates whether an individual was more likely to have worked after the policy change in a CPP province, relative to those in Quebec. This term is statistically significant for both regressions with females, but is not significant for males. The control variables, for the most part, have their anticipated signs; the probability of labour force participation: (i) increases with age, but at a decreasing rate; (ii) increases with higher levels of education; (iii) was higher for divorced, separated, or widowed individuals relative to married or common law individuals, but not relative to single individuals. There was not a statistically significant difference in the probability of labour force participation for single women relative to married women; however, there was a higher probability of labour force participation among single men relative to married men. This seems like a counterintuitive result; however, I also controlled for household size in the model, which may be confounding the effects of marital status.

These results show that the policy change may have enticed women to re-enter the labour force, but that it does not seem to have had the same effect on men. Women in Nova Scotia were 1.1% more likely to participate in the labour force following the policy change than women in Quebec; women in the treatment provinces were 3.1% more likely to participate than women in Quebec. Men in the treatment provinces were less likely to participate following the policy change; however, the effect was not statistically significant.

Table 1.2 presents the results from using employment as a dependent variable instead of labour force participation. The purpose of this analysis is to see if, on average, individuals were re-entering the labour force following the policy change, but were not actually able to find work, or if they became employed after re-entering the labour force. Once again, the odds ratio of interest is the interaction term. This term was only statistically significant for women in Nova Scotia, relative to Quebec. Interestingly, it indicated that women were less likely – though only 0.6% less likely – to work in Nova Scotia, relative to Quebec, even though they were more likely to have entered the labour force after the policy change, relative to before.

The interaction term was not statistically significant for women in the treatment group or for men. This result is not surprising for the men, since there was not a significant change in participation rates following the policy change. However, for women in the treatment group, it means that although they re-entered the

labour force in CPP regions after the policy change, relative to Quebec, they did not necessarily find employment.

Table 1.1: Labour Force Participation

	(1)	(2)	(3)
CPP * After	1.010**	1.029**	0.900
	(3.08)	(3.17)	(-1.60)
Widowed/Separated/Divorced	1.099***	1.086*	1.541***
	(3.33)	(2.36)	(6.91)
Single	0.987	0.995	3.395***
	(-1.23)	(-0.39)	(39.02)
Age	1.132***	1.130***	1.037
	(23.28)	(15.93)	(1.84)
Age*Age	0.998***	0.998***	0.999***
	(-61.55)	(-26.43)	(-5.54)
N	46450	69500	85050
Prob > Chi2 =	0.000	0.000	0.000

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women, treatment group: NS; (2): Women, treatment group: NS, NL, NB; (3): Men, treatment group: NL, ON, AB, BC. "Married or common-law" is the reference group for "Widowed/Separated/Divorced" and "Single". Models include a full set of control variables, listed in the methodology section. Table 1.1a in the appendix provides coefficients for all variables in the model, including those not displayed here.

Most prior studies have only examined the relationship between DI benefits or eligibility and labour force participation, but have not considered whether individuals are actually working upon re-entering the labour force. A clear distinction must be made between participating in the labour force and finding employment. If the focus is only on participation, studies may be overestimating the degree of DI misuse. The fact that women were either relatively less likely to be employed, or there was no statistical change in employment, is an interesting result; it may indicate that without disability insurance, women were forced to look for work, but were unable to find anything suitable given their capability at the time.

Table 1.2: Employment

	(1)	(2)	(3)
CPP * After	0.994*	0.972	0.827
	(-2.06)	(-1.68)	(-1.89)
Widowed/Separated/Divorced	1.045	1.029	1.180*
	(0.80)	(0.54)	(2.48)
Single	1.226***	1.225***	2.746***
	(79.46)	(15.81)	(30.71)
Age	1.141***	1.139***	1.068***
	(21.60)	(17.88)	(3.53)
Age*Age	0.998***	0.998***	0.999***
	(-36.55)	(-25.36)	(-5.85)
N	46450	69500	85050
Prob > Chi2 =	0.000	0.000	0.001

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women, treatment group: NS; (2): Women, treatment group: NS, NL, NB; (3): Men, treatment group: NL, ON, AB, BC. "Married or common-law" is the reference group for "Widowed/Separated/Divorced" and "Single". Models include a full set of control variables, listed in the methodology section. Table 1.2a in the appendix provides coefficients for all variables in the model, including those not displayed here.

Table 1.3 presents the results from examining within province, or within region, changes to labour force non-participation due to one's own illness or disability. The column specifications are as follows: column (1) includes women in all CPP provinces (i.e. Canada less Quebec), column (2) includes all men in CPP provinces, column (3) includes only women in Nova Scotia, column (4) includes women in the treatment provinces, and column (5) includes men in the treatment provinces. The variable of interest for these regressions is the $Before_{it}$ term, which indicates whether individuals had a higher probability of being out of the labour force, due to their own illness or disability, before the policy change. The only statistically significant result was for women in all CPP provinces. The positive coefficient for these women indicates that fewer of them were out of the labour force due to their own illness or disability after the policy change. In other words, some women may have been left with little choice but to re-enter the labour force, given that they were not eligible for DI. It is not surprising that the results for men were not statistically significant, given that this has been the consistent outcome from all the regressions. However, I did expect

this result to be significant in the regions of interest for women. One reason this may not have been significant is due to sample size. The prevalence of respondents having a positive value for being out of the labour force due to their own illness or disability is quite small. Therefore, there may not have been sufficient variation to create significant results.

Table 1.3: Out of Labour Force due to Own Illness or Disability

	(1)	(2)	(3)	(4)	(5)
Before	1.1577***	.9824	.9891	1.1456	1.0236
	(4.92)	(-0.31)	(-0.06)	(1.17)	(0.31)
Widowed/Separated/Divorced	1.3236***	1.2221*	1.2368	1.4054**	1.2370
	(3.53)	(2.39)	(0.75)	(3.21)	(1.68)
Single	.9359	.6294***	.9733	1.2262	.6381***
	(-0.98)	(-9.78)	(-0.12)	(1.21)	(-4.58)
Age	.9894	.9758	.9141	.9236***	.9913
	(-0.74)	(-1.32)	(-1.49)	(-7.95)	(-0.36)
Age*Age	1.0002	1.0005**	1.0012	1.001***	1.0004
	(1.74)	(2.81)	(1.59)	(9.18)	(1.39)
N	325900	315600	27400	69850	279050
Prob > Chi2 =	0.000	0.000	0.000	0.000	0.000

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women in all CPP provinces; (2) Men in all CPP provinces; (3) Women, treatment group: NS; (4): Women, treatment group: NS, NL, NB; (5): Men, treatment group: NL, ON, AB, BC "Married or common-law" is the reference group for "Widowed/Separated/Divorced" and "Single". Models include a full set of control variables, listed in the methodology section. Table 1.3a in the appendix provides coefficients for all variables in the model, including those not displayed here.

1.6. Robustness check and Considerations

1.6.1. Falsification Test

The underlying assumption in the above analyses was that there were no other changes that would be correlated to the relative labour force participation rates between CPP regions and Quebec over the time periods. This assumption would be violated, however, if the policy change was, for instance, in itself a response to differing patterns of labour force participation rates between the two regions. To test this, I performed a falsification exercise, using 1996 as the placebo policy year of implementation. I then re-estimated equation (3), the results of which are presented in Table 1.4. Column (1) gives the estimates for women in Nova Scotia, whereas column (2) includes the women's treatment provinces. The odds ratios on the interaction term are statistically insignificant for both specifications. The results from using a placebo policy support the analyses above, and help to show evidence of a causal effect of the policy change on women's labour force participation.

Table 1.4: Falsification Test: Labour Force Participation

	(1)	(2)
CPP * After	0.985	0.981
	(-1.21)	(-1.04)
N	17650	26150
Prob > Chi2 =	0.000	0.000

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women, treatment group: NS; (2): Women, treatment group: NS, NL, NB; "Married or common-law" is the reference group for "Widowed/Separated/Divorced" and "Single". Models include a full set of control variables, listed in the methodology section. Table 1.4a in the appendix provides coefficients for all variables in the model, including those not displayed here.

1.6.2. Considerations

It is also important to examine what other confounding factors may have influenced the results of this study. Generally, this would include anything that affected flows in and out of Q/CPP as well as labour force participation rates between provinces after (and including) 1998 (since anything before would have been accounted for by using the SCM method to ensure the common trends assumption holds).

As mentioned in the introduction, there were significant changes to eligibility criteria in CPP regions in 1995. These changes likely would have had the most significant impact on CPP DI participation and labour force participation rates in 1995 and 1996, both of which make up part of the 'before' period for my analysis, potentially introducing bias. However, since the changes during this period tightened the eligibility criteria, and led to decreases in CPP DI participation following the change (Auditor General Report, 1996), this would only have the effect of biasing my results downwards, thus making my results conservative estimates.

The results for women could intuitively be driven by their higher propensity to take a maternity leave (rather than a paternity leave for men), thus being out of the labour force and resulting in shorter work histories (and contributory periods). Women would then be more negatively impacted by the 1998 reform than men, which would explain why they might be more incentivized to re-join the labour force due to ineligibility for the DI program. The CPP DI program does take time spent at home raising children into consideration: there is a child-rearing provision, which exempts from the contributory period any months/years that an individual (regardless of gender) stayed home to care for a child under the age of 7 (Service Canada). The QPP has a similar exemption: any months for which the Quebec or Canadian governments paid family benefits for children under 7 were exempt from the contributory period (Retraite Québec). However, this exemption was only considered in the calculation of benefit amounts (and to determine eligibility for the child rearing provision), but did not factor into the criteria for a given number of years of work history to qualify for DI. Thus, this policy change would have had a greater impact on women who took time out of the labour force to raise children, which may help explain why the results for this analysis differ for men and women.

An important factor affecting women's participation rates occurred with the Quebec Family Policy, which began in 1997. This saw full-time kindergarten extended for 5-year olds, as well as an out-of-pocket price for childcare of five dollars per day for all four-year olds. By 1998, three year olds were included in the subsidized childcare provision, by 1999 all two-year olds were included, and by 2000 all children less than two years old were included (Baker et al, 2008). This was a major policy change, which led Baker et al. (2008) to perform analyses to examine its effects on a variety of aspects, including labour force participation of women in Quebec (as compared to the rest of Canada). Using the National Longitudinal Survey of Children and Youth (NLSCY), they found that employment rates for women in Quebec, who were part of two-parent families with children under the ages of four, rose by 7.7% as compared their counterparts in the rest of Canada. This is an interesting finding in the context of the analysis performed in this paper, since this would only bias the results downwards, thereby indicating that my results may be conservative for women. Further, since our targeted samples are very different – I am only considering those with low levels of work history, and Baker et al. is only looking at mothers with young children – I am not concerned if our findings differ.

The CPP DI program introduced another potentially confounding policy change in 1998, which was the Canada Pension Plan Disability (CPPD) Vocational Rehabilitation program. The aim of this program was to aid DI recipients to return to work, by providing training, individualizing return-to-work plans, and developing job search skills (Financial Consumer Agency of Canada). If this program successfully returned a significant number of people back to work in CPP regions following its inception, this could bias my results upwards. However, I do not believe this to be an issue. In 1998 only 230 individuals were enrolled in the program, 47% of which were successful (i.e. returned to work and ceased DI benefits). As of 2003, only 471 individuals successfully completed the program (Social Development Canada, 2004). Given the small number of successful participants, I do not believe that any potential upward bias that the program may have introduced would have significantly impacted my results.

Another potential confounding factor is the ice storm that hit central Canada, disproportionally affecting Quebec, in January of 1998. The storm knocked out the power supply to millions of residents, affecting business operations and employment. The unemployment rate jumped by 0.9 percentage points immediately following the storm, where the majority of job losses were concentrated in the areas that had been the most severely affected. Labour force participation rates, which are what this analysis is mostly concerned with, experienced a decrease of 0.4% from December 1997. However, by March (which is when

my first cross-section is drawn, the labour force participation rate in Quebec was back up to pre-storm levels (The Daily, Statistics Canada, January-March 1998). Thus, I do not believe that this would have strongly impacted my results.

Finally, any changes to programs similar to DI, such as the Employment Insurance (EI)[23] program, could have also impacted labour force participation rates, and thus my results, if they occurred during the time period that I examined. Consequently, the Employment Insurance program experienced some fairly significant changes with the Employment Insurance Act of 1996 (Employment and Social Development Canada). The Act established a new benefit structure, part of which was moving from a weeks-based to an hours-based eligibility system. The minimum qualification requirement increased from an hourly equivalent of 700 hours to 910 hours.[24] This caused EI claims in all regions of the country to fall (Kerr, 1998). This could have incentivized individuals to remain the in labour force longer (if this was an option for them), or seek other types of benefits, such as DI. The latter effect would not have been picked up in my results, since I do not observe flows into DI, but the former effect could have affected my analysis. However, since the changes to the EI program affected the entire country, any changes to the labour force participation rates from this policy would have been differenced out in the difference-in-differences analysis. Quebec did see a higher drop in claims for EI than the Atlantic Provinces did – my main treatment and control groups – following the policy change (Kerr, 1998). However, this difference was persistent throughout the before period, and likely would have continued with a similar trend in the after period,[25] which again, would have been differenced out in the analysis. For these reasons, I do not believe that this program change would have significantly affected the results of this study.

1.7. Concluding Remarks

DI is a fundamental program in Canadian society, providing a replacement income for individuals who are no longer able to work due to a long-term mental or physical disability. This program is complemented by universal health care in Canada, which in combination helps to ensure that disabled Canadians are able to afford the basic necessities of both life and health care, while contributing to the consumption side of the

[23] The Employment Insurance program provides "income support to eligible workers who are unemployed or who are absent from work due to personal illness or family-related responsibilities." (Employment and Social Development Canada)
[24] This is the minimum number of hours in the past year that an individual must have worked to qualify for regular EI benefits.
[25] Given that EI is calculated based on hours worked in the past year, if someone was ineligible in 1996 and 1997, there is no reason to believe they would become eligible in subsequent years.

economy. However, if the availability and generosity of DI entices individuals out of the labour force who would otherwise work, the program loses efficiency, credibility, and viability. Thus, studies like this one are crucial to understanding the relationship between DI eligibility requirements and labour force participation, in order for policy to be appropriately determined to prevent wrongful claims. Few have explored this relationship, particularly in the Canadian context. The majority of the literature in this area has, unsurprisingly, focused on benefit amounts, given that these tend to change more frequently and would generally be a more motivating incentive for individuals. Estimating both of these relationships has proved difficult. They are, however, made simpler in the Canadian context by exploiting the natural experimental setting created by the different provinces using different funds, i.e. the CPP and the QPP. Even so, examining the effects of eligibility requirements may be more difficult than estimating the relationship with regards to benefit amounts. Individuals tend to be highly driven by financial incentives, thus changes to benefit amounts may cause greater and more immediate labour decisions, leading to more conclusive quantitative results.

The difference-in-difference estimations show a relative rise in women's labour force participation following the policy change, whereas the same effect is not found for men. However, this effect was mostly present with participation in the labour force, whereas there was only a very small effect on employment. This indicates that the propensity for individuals to take advantage of the DI system's benefits, rather than to find gainful employment, may be minimal in Canada. This finding is reassuring, as it means that those who are receiving DI benefits should be. However, it may also mean that individuals are returning to the labour force, when they should be receiving DI, simply because they have not worked for long enough. It is clear that funds for the DI program must be obtained from somewhere. However, requiring individuals to be employed, followed by having left substantial employment before applying for DI (in order to be eligible for DI), seems counterintuitive. Finding a more appropriate method of funding, while balancing the need for strict eligibility requirements to avoid misuse of the program, may be a topic for future work.

Chapter 2

2. Information Asymmetry in an Information Age: How Physician Demand is impacted by Access to Information

2.1. Introduction and Literature Review

Asymmetric information characterizes the principal-agent problem in the healthcare sector. The principal (patient) is aware that the agent (physician) possesses greater health knowledge, thereby allowing the agent the potential to maximize their own utility, instead of that of the principal. This could occur by way of inducing demand for their services, even if additional services are not necessarily beneficial to the principal. This dynamic led Arrow (1963) to propose that imperfect information is the primary source of market failure in the healthcare sector. However, since this notion was introduced, structural changes have shifted some of the decision-making power away from the agent. Specifically, increased access to low-cost information, brought about by the widespread use of the internet, has, to some extent, narrowed the information gap between physicians and their patients. It was estimated that in 2008, 61 percent of the U.S. adult population had looked for health information online (Suziedelyte, 2012). Not only does this have a potential impact on the nature of physician-patient interactions, but it may also influence patients' demand for physician services.

Arrow also proposed that, rather than market failure, the asymmetry of information creates a market for information from the physician. This suggests that, the greater the information gap, the more the patient would be willing to 'buy' information from the physician (Smith, 2005). Health information is valuable to

consumers, since it allows them to make more rational choices for medical goods and services. As Grossman (1972) theorized, medical care is purchased as an input good into the production of health, where the relative costs and benefits of purchasing this input good are weighed. A more informed consumer would be better able to determine whether seeking physician services is necessary, thereby, theoretically, improving the marginal product of physician visits (Kenkel, 1990). However, whether a more informed consumer increases or decreases their demand for physician visits remains an empirical question, and likely depends on the relative costs and benefits of acquiring physician-based versus non-physician-based health information.

The theoretical implication of the narrowing information gap is a decrease in the demand for health information from physicians in favour of acquiring this information at lower costs elsewhere. However, non-physician health information may suffer from issues of quality on the one hand, or lack of interpretability on the other. Therefore, physician-based and internet-based health information, for example, are not likely to be perfect substitutes. Additionally, disentangling the demand for physician-provided information from the other services they supply is challenging. It is also important to consider that non-physician health information is not a single, homogeneous good or service. One might seek health information for the purposes of diagnostic information, medication choices, health insurance options, or healthy lifestyle decisions (self-care or prevention), among others. Further, not all sources of this information will provide the same advice or quality of information. Thus, each type of health information searching will have its own marginal benefits and costs, subject to preferences, relative prices, and income (Wagner et al. 2001). The combination of these factors makes it difficult to estimate the empirical relationship between the propensity to substitute physician and non-physician health information.

Most past studies have only been able to examine the changes in demand for physician visits.[26] Given this complexity, a consensus on the directional effects of health information acquired outside the principal-agent framework on physician demand has not been reached. The question therefore remains as to whether health information acts as a complement or a substitute for physician-based information and services. A complementary effect may be observed for several reasons: a more informed consumer may be more cognisant of their health status or needs, leading them to be more aware of the marginal product of medical care; or they may follow poor advice found on the internet (or other non-physician sources), causing adverse

[26] Though, Wagner et al. (2001) was a notable exception; part of their study examined phone calls to physicians (as opposed to visits), which helped disentangle the demand for information from the demand for services. The results and implications of this paper are discussed below.

health effects, thereby increasing their reliance on formal medical care;[27] conversely, they may simply have a high preference for good health, causing them to have an elevated propensity to seek health information from both physician and non-physician sources. As will be discussed further in the paper, the first two aforementioned effects would be characterized by a causal relationship, whereas, the third would not. This creates further potential issues with empirical estimation.

On the other hand, a substitution effect may be observed if an individual were able to self-diagnose or find the information they would otherwise receive from a physician on the internet (or elsewhere), thereby relieving some of their dependence on the healthcare system. A similar effect may also be observed if a more informed consumer created more productive physician-patient interactions, thus lessening the number of (previously less productive) physician visits. This last dynamic is difficult to characterize; empirically it would appear as a substitution effect, since visits to the physician would decrease. However, in reality, the non-physician information obtained would be complementing the physician's knowledge, leading to fewer, more productive visits.

Given the principle in health economics that the demand for healthcare goods and services is derived from the demand for good health (Grossman, 1972), one might expect to see a substitution effect. In other words, if good health can be achieved from either physician-based on non-physician-based health information, then the rational consumer would demand the least costly option with the same expected value to their health. This assertion assumes perfect (or near perfect) substitutability between information sources, as well as health information alone driving health outcomes. As previously mentioned, physicians provide more than health information to their patients, thus emphasizing the difficulty in extracting the demand effects of health information alone, given non-physician information searching.

The majority of previous studies have found that increased information searching has had a predominantly complementary effect on the demand for physician services (Hsieh & Lin, 1997; Kenkel 1990; Smith, 2005; Suziedelyte, 2012; Dwyer & Liu, 2013). When a substitution effect had been found, it was primarily amongst patients with low trust in their physician, with high costs to accessing primary care, or in poorer health (Wagner et al., 2001; Suziedelyte, 2012; Dwyer & Liu, 2013).

[27] Formal medical care, or the formal healthcare market, is used to denote formal (physician) versus informal (internet) information searching and not entering the market as a provider.

Suziedelyte (2012), for instance, found that e-health information seekers tend to see a physician 1.2 more times per year than non e-health information seekers. However, using individual health information seeking behaviour to predict physician visits is problematic; information seeking would be correlated with one's preference for overall good health, as previously mentioned, which would appear in the error term, making it endogenous. One way to solve this issue is to use the instrument variable (IV) approach. Suziedelyte did employ this approach, which had the effect of increasing the likelihood of physician visits for e-health seekers to a little over four more visits per year than a non e-health seeker. The IV results imply that e-health information seeking is negatively correlated with unobservable determinants on the demand for health care (Suziedelyte, 2012). When Suziedelyte investigated the relationship solely amongst those who had been diagnosed with cancer, the complementary effect persisted, but began eroding as more time passed since their initial diagnosis. This is an important contribution, since it indicates that patients might begin to substitute away from physician services as they become more familiar with their condition. Theoretically, these individuals may be less able to substitute during the diagnostic phase, but more able during the treatment phase (i.e. searching for information regarding medication or persistent symptoms, which would not necessarily require a medical professional). Additionally, as Smith (2001, 2005) argued, individuals with chronic conditions may have more incentive and ability (i.e. time) to search for health information. Whether increased health information searching acts as a complement or substitute for these individuals remains unclear.

Wagner et al. (2001), on the other hand, were able to find a substitution effect. Looking at the effects of distributing free community-wide health information, they found that demand for self-care resources increased, while demand for physician advice decreased. These effects were particularly present amongst those in poor health and with children in the household. The latter effect could be explained by a relatively high-time cost associated with seeking physician advice. Wagner et al. used the number of calls to the physician, as opposed to physician visits, for part of their empirical analysis. This is of particular importance, since disentangling the other medical services that physicians provide from their dissemination of health information, as noted above, is challenging. Using the number of phone calls to a physician would have alleviated some of this concern. However, this study was based on a quasi-experimental design, which may have suffered from some bias, and could limit the generalizability of their results.

Dwyer & Liu (2013) found a predominantly complementary effect between non-physician information searching and both entry into physician services and the number of physician visits in a year. Like Suziedelyte (2012), when IV estimation was used, it produced a higher complementary effect than directly using information searching as an explanatory variable, thus reiterating that information searching is negatively correlated with unobservable characteristics. However, they hypothesized that the sign of the relationship (i.e. complementary or substitution effect) between non-physician health information searching and physician demand, may depend on prior trust in one's physician. In other words, those with low trust in their physician may have a higher propensity to seek (and utilize) substitutes for physician advice. When they interacted non-physician health information searching with a binary variable for prior trust in one's physician, they found a substitution effect with the number of physician visits. They concluded that those less tied to the formal medical sector may be more willing to search for, and utilize, non-physician health information.

The relationship between low trust in the medical sector and its effect on willingness to participate in formal care has also been investigated in the literature. A notable study was conducted by Alsan & Wanamaker (2018), who examined the effects of the Tuskegee Study of Untreated Syphilis (TSUS). The TSUS followed approximately 600 black men from 1932-1972 in Tuskegee, Alabama, most of whom had syphilis, with the intent of monitoring the natural life course of the disease when left untreated. These men were mostly poor, and were discouraged from seeking treatment from professionals outside the study – most of the participants believed they were receiving some form of treatment within the study. The TSUS was exposed to the public by the media in 1972, at which point the study quickly shut down. Alsan & Wanamaker (2018) investigated what effect the TSUS had on participation of older black men in the health care sector following the revelation of the TSUS. They found that a one standard deviation increase in proximity to Macon County, which contains Tuskegee, reduced utilization of routine care by 0.90 interactions per year among older black men. The results of this study point to an important effect of distrust in the health care sector: those with low trust (in this case, measured by proximity to the TSUS, since these individuals would have been more exposed to the TSUS revelation, as well as may believe that they might receive the same type of care in the region) tended to be less likely to participate in routine care, were less likely to participate in other medical studies, had longer hospital stays – which is consistent with not receiving routine care – and suffered worse mortality rates (Alsan & Wanamaker, 2018). These finding reiterate those of Dwyer & Liu (2013), as they show that trust in the medical sector is vital for seeking routine care, and a lack of trust could encourage people to search elsewhere for information they may have otherwise sought from professionals.

This paper explores the effects of how accessing health information from non-physician sources may change the relationship between the principal and agent in the Canadian context. Many past studies were conducted in the American context; this distinction is important given the vast differences in the American and Canadian healthcare systems. That is, the direct cost for primary care in Canada is non-existent for most of the population, which is far from the case of the United States. In Canada, a lack of out-of-pocket costs to the consumer may decrease the propensity to substitute health information from non-physician sources, since the relative cost of acquiring information from physicians, as opposed to the internet, would be comparatively lower than in the United States. However, average prices for both broadband and mobile internet are also lower in Canada than in the United States: a study by Wall Communications Inc. (2014) found that, when both mobile and broadband prices were broken down into four tiers of comparable service, all categories but one were less costly in Canada as compared to the United States. The higher cost to accessing information online in the United States may offset some of the differences in relative costs of physician and non-physician information between the two countries.

Additionally, each Canadian province/territory operates (or has access to) unique telehealth programs, which provide an additional source of information to its citizens. Health call centres across the country provide trusted information from specially trained nurses at any time of the day. Often, preferred languages can also be accommodated; for example, in British Columbia, patients can access telehealth services in over 130 languages. In addition to advice from nurses, some jurisdictions also have the option of consulting a pharmacist about their medication questions or dieticians for healthy eating advice (Canadian Telehealth Report, 2013). This program is distinct from other non-physician sources of health information, namely the internet, since the quality of health information would be comparatively high. This distinction is important for two reasons: given its high perceived reliability, individuals may be more willing to substitute information from telehealth programs for physician information; and given that telehealth programs are purely information-based services, I can directly measure the propensity to substitute telehealth information for internet-based health information searching. As previously mentioned, physician visits may not occur strictly for informational purposes, therefore measuring the relationship between health information from physician and non-physician sources has been challenging.

The paper proceeds as follows: section 2.2. describes the data used; section 2.3. details the empirical strategy; section 2.4. discusses the results from the empirical estimation; and section 2.5. provides concluding remarks.

2.2. Data and Sample

2.2.1. Data

The data used in this study are Statistics Canada's 2015-2016 cycles of the Canadian Community Health Survey (CCHS),[28] which contains approximately 110,000 observations. The primary purpose of this data collection is health surveillance and population health research. Data are collected directly from respondents using computer assisted personal and telephone interview software and could be completed in a wide range of languages (Statistics Canada).

2.2.2. Sample

The CCHS includes core content, which is asked of all respondents and remains stable over time;[29] there is also optional content, which is only asked to respondents residing in the provinces and territories that opt into the module (Statistics Canada). This poses some issues for my analysis, since some of my key variables are part of the optional content, thus limiting my sample size. One of the main variables of interest is whether respondents searched online for health information in the last twelve months. This variable was part of the optional 'Access to health care services' module, in which only Nova Scotia, New Brunswick, Quebec, and the Yukon participated. Therefore, the sample is limited to only those three provinces and one territory, leaving approximately 10,000 observations once the data had been cleaned. Although there are some variables that I could not use, since the same provinces/territory did not opt into the content, the core content of the survey is comprehensive, and includes information on perceived health status, chronic

[28] This research was supported by funds to the Canadian Research Data Centre Network (CRDCN) from the Social Sciences and Humanities Research Council (SSHRC), the Canadian Institute of Health Research (CIHR), the Canadian Foundation for Innovation (CFI), and Statistics Canada. Although the research and analysis are based on data from Statistics Canada, the opinions expressed do not represent the views of Statistics Canada.

[29] Although core content remains stable over time, the CCHS underwent a major redesign that was implemented for the 2015 cycle; it is not recommended that cycles be pooled before and after the redesign (Statistics Canada).

conditions, evaluations of past experiences with the healthcare system, frequency of visits with primary and secondary healthcare providers, as well as sociodemographic characteristics.

All analyses were weighted using the provided survey weights.

2.3. Empirical Framework

The relationship of interest is whether individuals use non-physician health information as a complement or substitute for physician information, and whether that differs by the level of prior trust in the physician. The main equation of interest is the following:

$$PV_{it} = \beta_0 + \beta_1 I_{it} + \beta_2 TR_{it} + \beta_3 I_{it} * TR_{it} + \beta_4 X_{it} + e_1 \quad (1)$$

where PV_{it} is the number of visits that individual i had at time t with their family doctor or general practitioner, referred to hereafter as physician visits, in the twelve months preceding their response to the survey; TR_{it} is equal to 1 if individual i at time t had prior trust in their health care practitioner;[30] I_{it} is equal to 1 if individual i at time t had searched online for health information in the twelve months preceding their response to the survey;[31] X_{it} is a vector of observable characteristics: age, income, sex, health region, family size, main activity last week, perceived health status, has a regular doctor, chronic condition, as well as province/territory and year fixed effects.

2.3.1. Main Variables

Information searching is defined as having searched online for health information in the twelve months preceding the survey. About 23% of my final (weighted) CCHS sample had done so. This percentage is quite low, especially since, according to Statistics Canada's Canadian Internet Use Survey (CIUS), 67% of Canadians had searched for health information in the preceding twelve months. The main difference in

[30] This variable is more clearly defined in section 2.3.1.
[31] This variable is more clearly defined in section 2.3.1.

these results could be that the question was only asked to those in the CCHS who declared that they had required health information during this period – a limiting restriction – whereas, the question was asked to all respondents in the CIUS. I can only include in my sample those who responded positively to having required health information during the relevant period, and thus were asked to provide an answer to whether they had searched online for health information. Given the low percentage of online health information searchers in the CCHS (as compared to the potentially more representative CIUS estimate), results from this analysis will likely be conservative.

'Trust' is initially calculated as an index measuring past trust, by combining the following information that individuals were asked to provide based on their last visit to a health care provider: did the professional spend enough time with you during this last consultation? Did this professional explain things in a way that was easy to understand? Did this professional give you an opportunity to ask questions or raise concerns about your care or recommended treatment? Did this professional involve you as much as you could have been in decisions about your care or treatment? Did this professional tell you how much the recommended treatment would cost, or whether any lower cost alternatives were available? The responses to these questions were either 'yes', 'no' or 'valid skip'[32]. The 'yes' responses were coded as 1, the 'no' responses were coded as -1, and the 'valid skips' were coded as 0. Someone would have a 'valid skip' if they had not visited a health care professional in the last year. I then turned this into a binary variable for whether an individual has low prior trust or not, by summing the responses, dividing by the number of questions, and giving an individual a value of 1 for low prior trust if they had received a value less than or equal to 0. I also tried coding 0's to the high prior trust group, in which case the signs of the coefficients in the results did not change.

2.3.2. Models and Considerations

There are several considerations that should be taken into account when trying to model the above-mentioned relationships. First, non-physician health information searching may suffer from issues of endogeneity if there is some unobserved heterogeneity that drives both the propensity to seek physician services and non-physician health information; an individual's preference for good health may be driving both behaviours. Since this is difficult to measure and control for, it would appear in the error term. I

[32] Other responses, such as 'don't know' were coded as missing.

consider solving this in two ways: first, by estimating the model with variables for smoking and drinking behaviour, as well as exercise – which proxy for one's preference for good health and their degree of risk aversion – and second, by estimating the following equation to use in a two-stage instrument variable (IV) approach:

$$I_{it} = \gamma_0 + \gamma_1 highspeed_{it} + \gamma_2 educ_{it} + \gamma_3 X_{it} + e_2 \quad (2)$$

The instrument variables used in the above equation are the availability of high speed internet in the area of residence and the individual's level of education. It is unlikely that most people would choose their area of residence based on high speed internet alone, so this variable should be exogenous to the individual. It should also be a good predictor of one's propensity to use the internet (and consequently to search for health information online) but should not directly predict one's preference for good health. This variable was collected from Statistics Canada's Canadian Internet Use Survey (CIUS) and is merged with the CCHS at the Census subdivision (CSD) level – each subdivision is given a probability of highspeed internet availability, based on the average response from the CIUS respondents in that area. I examined, by CSD, both the correlation between the probability of having highspeed internet and the probability of a patient having access to a doctor; this was done to ensure that the highspeed variable would not be proxying for the unavailability of healthcare in the area, which would then be driving one's propensity to seek information outside of the formal medial sector. The correlation between these two variables was extremely low – less than 4% - therefore, I still believe the availability of highspeed internet is a strong IV.

The vector of observable characteristics for this regression is the same as in equation (1).

In like manner to Kenkel (1990), Hsieh and Lin (1997), and Dwyer and Liu (2013), I've also included education as an instrument variable. A higher education should increase an individual's ability to gain useful knowledge from health information but should not directly impact one's preference for good health. In this way, the effect of gaining useful knowledge from information searching can be separated from the effect of the need to invest in health, given one's preferences. Since I can also control for various measures on health (self-perceived health, smoking and drinking behaviours, BMI, and chronic conditions, as well as the aforementioned smoking and drinking behaviours, and exercise), education should not be picking up any effects of the potential for those with higher education to also be healthier. After controlling for health,

education does not have a significant relationship with physician visits, therefore reiterating its use as an IV.[33]

Equation (1) could then be estimated using the two-stage, instrument variable approach, with equation (2) as the first stage.

However, model consideration is also very important for this type of dependent variable (number of physician visits), as it is a count that can only take on positive integers (i.e. is left-censored) and has an over representation of low counts (i.e. is right-skewed). An OLS model may yield biased results given this type of distribution. The outcome variable also has an excess of zeros – approximately 30% of the sample did not see a physician at all in the twelve months preceding the survey. Given the above complications, and that the outcome variable displays over-dispersion,[34] my preferred model is the zero-inflated negative binomial (ZINB). This model accounts for the over-dispersed count data, skewness, and excess zeros. It also allows for the important distinction between "structural" and "sampling" zeros. A structural zero would occur if an individual does not use medical care (or more specifically never visits a physician), whereas a sampling zero would occur if an individual, by chance, did not visit a physician in the twelve months preceding the survey. These two individuals would look identical in the outcome variable, but these zeros would have been determined through different processes (e.g. different risk preferences). Given this, they should not be treated the same in the model; models with similar capabilities, such as a hurdle model, do not distinguish between these two types of zeros (Hu et al., 2011). The first stage of a ZINB model uses logistic regression to predict whether individuals should be in the structural zero group. A negative binomial model is then used to predict the number of physician visits in a year for the non-structural zero respondents.

The following equations were estimated using the ZINB model:

$$CertainZero_{it} = \alpha_0 + \alpha_1 I_{it} + \alpha_2 TR_{it} + \alpha_3 I_{it} * TR_{it} + \alpha_4 X_{it} + e_0 \quad (3)$$

[33] Results were similar when only highspeed internet availability was used as an IV, and education was instead used as a control in the models.

[34] Over-dispersion occurs when the sample variance is greater than the sample mean. A Poisson model is not appropriate when over-dispersion is present.

$$\{PV_{it}|PV \neq CertainZero\} = \beta_0 + \beta_1 I_{it} + \beta_2 TR_{it} + \beta_3 I_{it} * TR_{it} + \beta_4 X_{it} + e_1 \quad (4)$$

Unfortunately, there is not a reliable method for using an IV approach with the ZINB model. Therefore, I first employ the ZINB model without instruments, followed by IV regressions using two-stage least squares (2SLS), as well as a two-stage Poisson model. Although these models do not account for some of the complexities of the distribution of the outcome variable, they do allow for a structural model approach that is not available with the ZINB. These models will therefore be used to ensure the direction of the effect is consistent with that of the ZINB.

Errors in all models estimated were clustered at the provincial/territorial level.

As previously mentioned, it is also interesting to examine the telehealth programs in Canada, which can be carried out in a couple of ways: I can examine the substitution/complementary effect from health information searching on the internet with the use of telehealth programs, as well as the relationship between using the telehealth program and physician visits. The propensity to use a telehealth program provides an important comparison to health information searching online, since the quality of information from the telehealth programs would be relatively superior and more consistent. It is further helpful to use this program to compare the above-mentioned outcomes with the relationship of physician visits and online health information searching, since one may see a physician for reasons other than simply gaining information (whereas, one would only call a telehealth program for information).

I therefore estimate the following model to examine whether online health information searching affects the probability of using a telehealth program:

$$telehealth_{it} = \delta_0 + \delta_1 I_{it} + \delta_2 TR_{it} + \delta_3 I_{it} * TR_{it} + \delta_4 X_{it} + e_3 \quad (5)$$

I can further estimate the relationship between using a telehealth program and visiting a physician, but once again employing the ZINB model:

$$CertainZero_{it} = \omega_0 + \omega_1 teleh_{it} + \omega_2 TR_{it} + \omega_3 teleh_{it} * TR_{it} + \omega_4 X_{it} + e_4 \quad (6)$$

$$\{PV_{it} | PV \neq CertainZero\} = \varphi_0 + \varphi_1 teleh_{it} + \varphi_2 TR_{it} + \varphi_3 teleh_{it} * TR_{it} + \varphi_4 X_{it} + e_4 \quad (7)$$

In these models, *telehealth*$_{it}$ (or abbreviated *teleh*$_{it}$) indicates whether an individual contacted a telehealth program in the last twelve months.

2.4. Results

Table 2.1 presents the results from the main models, with physician visits as the dependent variable. Column (1) shows the results from a simple OLS regression. As previously mentioned, this model may yield biased results; however, it provides a baseline to help ensure the directional effects of the variables of interest are consistent across the models. The main variables have their expected signs: there was a complementary effect between searching on the internet for health information and physician visits: those who searched online for health information tended to see their physician 0.39 times more per year. Those with low prior trust tended to see their physician 0.88 fewer times per year. Similarly, those with low prior trust who were also online health information searchers also tended to see their physician 0.11 fewer times per year – the same substitution effect found by Dwyer & Liu (2013). However, the interaction term was not significant.

Columns (2)a and (2)b display the first and second stages of the ZINB model with online health information searching as the main variable of interest. The first stage of the ZINB shows the odds ratios from a logistic regression, predicting membership in the "certain zero" group (i.e. those that never see a physician, as opposed to those who happened to not see a physician in the past twelve months). The second stage presents

the exponentiated coefficients from the negative binomial regression, predicting the number of physician visits for those not in the "certain zero" group.

The results show that online health information seekers (e-Health Info in the table) with high prior trust[35] were 34% less likely to be in the "certain zero" group; put another way, they were more likely to enter into the formal healthcare market, though this result was not statistically significant. This group also tended to visit a physician 11.8% more frequently per year – results from the second stage of the ZINB – than those who did not search for online health information and had low prior trust: a complement effect. Those with low prior trust (who were not online health information seekers) were much more likely to be in the "certain zero" group and tended to have fewer physician visits per year – both of which are intuitive results. The interaction of those two variables – low prior trust and online health information searching – shows that these individuals were less likely to be in the "certain zero" group. However, once they entered the formal medical market, they tended to see a physician 8.5% less per year: a substitution effect. Even though neither of these coefficients were statistically significant, they are still interesting; the fact that this group was less likely to be in the "certain zero" group may mean that being an information searcher is more important than having low prior trust, when making the decision to seek physician services: even with low prior trust, this group still entered into the formal health care market. However, this may be due to these individuals being in worse health, thus causing their online searching behaviour, as well as entry into the more formal healthcare market. Once they did enter the healthcare market, their tendency to see their physician fewer times than those who were non-online health searchers and had high trust, means that, as Dwyer & Liu (2013) found, trust may be the important factor in extracting the substitution effect between searching for online health information and physician visits.

The result from this regression also indicate that women were less likely to be in the "certain zero" group, and tended to see a physician more often than men; those with a chronic condition were less likely to be in the "certain zero" group – though this was not statistically significant – and saw a physician more frequently than those without a chronic condition; and those with a regular doctor were much less likely to be in the "certain zero" group.

[35] The interaction term has low prior trust; the coefficient on e-Health Info must therefore be interpreted when low prior trust is equal to zero.

Table 2.1: Models for Physician Visits

	OLS	ZINB		2SLS	2SPoisson	ZINB	
	(1)	(2)a	(2)b	(3)	(4)	(5)a	(5)b
e-Health Info	0.399***	0.660	1.118***	0.518	0.424		
	(13.89)	(-1.07)	(9.59)	(0.96)	(1.23)		
Telehealth Info						0.632*	1.010
						(-2.21)	(1.93)
Prior low trust	-0.884***	14.31***	0.722*	-1.611***	-1.056***	16.03***	0.742*
	(-13.76)	(8.23)	(-2.09)	(-8.28)	(-8.15)	(11.54)	(-2.54)
e-Health Info * Prior low trust	-0.110	0.763	0.915	-2.871***	-11.31***		
	(-1.99)	(-0.62)	(-0.11)	(-4.91)	(-9.58)		
Telehealth Info * Prior low trust						0.630	0.965
						(-1.76)	(-0.73)
Chronic condition	0.187*	0.463*	1.068***	0.195*	0.173***	0.457*	1.066***
	(2.41)	(-1.98)	(16.57)	(2.45)	(4.59)	(-2.10)	(20.04)
Female	0.297***	0.363***	1.103***	0.259***	0.200***	0.423***	1.111***
	(16.25)	(-56.95)	(4.65)	(20.20)	(5.58)	(-14.19)	(5.33)
Regular doctor	0.786***	0.211***	1.358***	0.805***	0.602***	0.191***	1.332***
	(37.37)	(-11.61)	(5.52)	(8.29)	(10.55)	(-9.89)	(5.41)
N	9150	9150		9150	9150	9150	
Prob>Chi2 or F	0.001	0.000		0.004	0.001	0.000	

Note - The ZINB models have exponentiated coefficients; t statistics in parentheses, standard errors are clustered at the provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. Columns with an "a" denote the first stage (logistic regression) of a ZINB model; columns with a "b" denote the second stage (negative binomial). Table 2.1a in the appendix provides coefficients for all variables in the model, including those not displayed here.

Columns (3) and (4) show the results from the second stage of the two IV regressions. These models both reiterate the findings of the OLS and ZINB regressions. The main difference is that the interaction term in both models is significant. However, given that neither model is ideal for the outcome variable, these models are only used to strengthen the findings of the ZINB model, and not necessarily to be directly interpreted.

The results from the logistic regression for online health information searching are presented in Table 2.2. These results indicate that the variables used as instruments do significantly predict online health information searching. Although not statistically significant, the results also suggest that those with low

prior trust are less likely to be online health information searchers. This result is interesting, since one might assume that those with low prior trust would substitute away from the formal medical sector, in search of information elsewhere. However, that information is not necessarily coming from the internet; as will be discussed in the results from Table 2.3, these individuals may be using more reliable sources, such as the telehealth program instead.

Columns (5)a and (5)b from Table 2.1 show the first and second stages of the ZINB model with telehealth program usage as the independent variable of interest. The results are very similar to those for searching for information online. This may suggest that individuals do not treat health information from the internet and from a telehealth program differently, which could be concerning given the lack of quality control with online health information. However, it could also be the case that those who call a telehealth program would also be searching for health information, and that the results are simply picking up the effect of having a higher preference for health. This can be examined with the regression results in Table 2.3, which display the relationship between online searching for health information and calling a telehealth program. The results show that there was a very strong complementary effect between these two behaviours. However, interestingly, those with low prior trust in the more formal medical sector, who were not online information searchers, tended to be more likely to call a telehealth program – as mentioned above, this result is supported by the regression results in Table 2.2: those with low prior trust tend to be less likely to search online for health information, but instead may be using a telehealth program. This could be due to their past experiences – which would have provoked their low trust – making them wary of health information found online, due to the lack of quality control. Therefore, this group may not want to enter the formal health care sector, if it can be avoided, but may have a higher threshold for the quality of the health information they seek.

Contrary to those who were not online searchers, those with low prior trust who were online searchers were less likely to call a telehealth program. Even though this result was, once again, not statistically significant, the direction of the coefficient shows that those with low prior trust who are online health searchers may be substituting away from the telehealth program, even though those who were not online searchers were not. Once again, this combination of behaviours is unique: it shows that once an individual loses trust in the health care sector, and decides to search online for their information, the internet may be where they stay. If they are not also complementing this behaviour with information from more reliable sources – which we see they may not be – this could have detrimental effects to their health.

Table 2.2: Online Health Information Searching

Access to high speed internet in area	3.611*** (5.84)
Less than high school diploma or its equivalent	- -
High school diploma or a high school equivalency certificate	2.436** (3.00)
Trade certificate or diploma	2.359*** (3.71)
College/CEGEP/other non-university certificate or diploma	2.959*** (4.47)
University certificate or diploma below the bachelor's level	2.787*** (4.55)
Bachelor's degree (e.g. B.A., B.Sc., LL.B.)	3.122*** (4.26)
University certificate, diploma, degree above the BA level	3.648*** (3.92)
Low prior trust	0.927 (-1.73)
Chronic condition	1.119* (1.98)
Female	0.971 (-0.42)
Regular doctor	1.088*** (3.74)
N	9150
Prob>Chi2	0.000

Note - The ZINB models have exponentiated coefficients; t statistics in parentheses, standard errors are clustered at the provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. Table 2.2a in the appendix provides coefficients for all variables in the model, including those not displayed here.

Table 2.3: Telehealth Program Use

e-Health Info	1.917***
	(7.23)
Prior low trust	1.091*
	(1.97)
e-Health Info * Prior low trust	0.891
	(-0.86)
Chronic condition	1.091***
	(3.83)
Female	1.081
	(1.83)
N	9150
Prob>Chi2	0.001

Note - The ZINB models have exponentiated coefficients; t statistics in parentheses, standard errors are clustered at the provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. Table 2.3a in the appendix provides coefficients for all variables in the model, including those not displayed here.

2.5. Concluding Remarks

The empirical results show that prior trust in the health care sector plays an important role in determining whether online health information searching acts as a complement or substitute for seeing one's physician. Those with low prior trust were less likely to enter the formal health care sector. If they did enter, and searched for health information online, they tended to see their physician fewer times per year than those who were not online health information searchers and had high prior trust. This substitution effect is also seen when examining those with low trust who used the telehealth system. Further, online searching and telehealth usage had a complementary effect. This is a very important result, since if people are substituting away from the formal health care sector, but have a viable, quality-controlled alternative for their health information – even if it is also being complemented by online information – there exists less of a concern in obtaining poor quality information and risking suffering poor health outcomes as a result. Given this, the telehealth programs in Canada provide an invaluable service for those who choose not to enter the formal health care sector. Future work could compare Canada to a country with a similar healthcare sector, providing publicly financed healthcare but that does not offer a telehealth program (meaning that non-

physician information may be originating mostly from the internet), in order to examine the effect of providing a quality-controlled health information source to its citizens.

Chapter 3

3. The Contribution of Environmental Attitudes to Household Consumption Decisions: A Multi-County Analysis

3.1. Introduction

Over the past few decades, much of the focus of environmental policy has moved away from industrial production as the main source of pollution and from the implementation of cleaner processes toward an integrated approach that considers the life-cycle environmental impacts of goods and services, involving all actors along the product chain, including consumers. Environmental policy-making bodies have also recognized the importance of a better understanding of the decision-making processes of both companies, with stronger emphasis on their inner workings, and households, within a broader social science framework.

In response to the need to better understand the forces that drive household consumption decisions, particularly in areas where environmental effects are present but are not fully accounted for in the decision-making process as they are not borne by the decision-making units themselves, the Organization for Economic Cooperation and Development (OECD) launched the "Household Behavior and Environmental Policy" initiative in 2005 which was designed initially to review the collective understanding of environment-related household consumption decisions, and eventually to design a survey questionnaire addressing shortcomings in this understanding which would be implemented internationally at different points in time. To date, the OECD has completed two waves of data collection through web-based panels (one in 2008 and 2011), relying on slightly different survey questionnaires but covering the same five areas

of environment-related household consumption (that is, waste generation and recycling, energy use, organic food consumption, personal transport, and water use) identified as contributing to, and likely intensifying, environmental problems, and thus constituting obvious policy targets. Each of the two waves involved over 10,000 households across several countries.

In addition to their coverage of many countries and key areas of household consumption, the two OECD data sets are unique in that they originate from a survey questionnaire that: (1) builds upon the lessons arising out of the existing literatures in the five areas but also attempts to address questions that remain unanswered; (2) brings together key aspects of household behavior, namely, socio-demographic characteristics (e.g., income, age, education, household size) and attitudinal variables (e.g., environmental concerns, norms, values), thus capturing a broader spectrum of policy influences and allowing for a more accurate assessment of the direct effects of socio-demographic factors; this is particularly relevant for the income variable as, based on its effect, distributional implications of policy instruments are often derived, as well as for the investigation of complementary effects among strategies that differ in the assumptions about how behaviour can be changed (e.g., through incentives, through informational campaigns); (3) includes a broad range of policy instruments (pricing, informational, and regulatory); (4) includes questions that address the social and moral dimensions of decisions involving environmental impacts in order to capture a wider range of policy influences.

A first important contribution of this paper stems from its holistic approach to the study of household environment-related consumption. A common feature of the existing empirical studies of household consumption in the five areas is that they can only focus on one activity due to data limitations (e.g., energy or recycling) and thus fail to account for possible linkages which are likely to result from the fact that each of them affects the environment. Unfortunately, there is a tendency for consumers to underestimate the negative effects of their actions on the environment. This may simply follow from two basic considerations: (1) that the consumption of each individual represents a negligible component of a nation's or, even broader, the world's consumption so that, overall, the individual's contribution to environmental deterioration is or can be considered to be irrelevant; (2) that, no matter how future-oriented individuals may be, the time horizon of their decision-making is likely to be confined to their lifespan so that they are not able to fully capture the consequences of their actions on future generations. Whatever the reason may be, individuals are likely to ignore, at least partially, the effects of their decisions on the environment so that ways must be developed to induce individuals to internalize these effects in their decision-making.

Theoretically, even when environmental quality does not enter a household's utility function, in the presence of policies targeting the environmental effects of its consumption, decisions across the five areas may be linked through one or more of three possible constraints: (1) a threshold on environmental quality deterioration resulting from consumption, with marginal environmental costs differing across the five areas; (2) a maximum level of expenditures which comprise both policy costs, reflecting different marginal social costs across the five areas, and consumption costs; (3) a maximum allowance of time that can be devoted to reducing the environmental damage of consumption (e.g., recycling as opposed to disposed of waste at the curb; taking public transportation as opposed to driving). While, upon maximizing the household's utility with respect to consumption levels in the five areas, subject to the relevant constraints, one can arrive at a reduced form equation for each consumption activity linking its level only to the model's exogenous variables, linkages across the various equations are still possible in the empirical specification of the model via the error terms. In other words, it is possible for unobservables that affect one activity to also affect one or more of the other activities. As an example, a labour dispute in public transportation which affects the personal transport choice through the error term in the personal transport equation may affect energy use or water use through the error terms in the energy use or water use equation.

Hence, the five consumption areas combine into a seemingly unrelated (SUR) system in the sense that no endogenous variable appears on the right-hand side of the other equations; however, their errors are correlated and share a multivariate normal distribution. While estimating the five equations separately would produce consistent estimates of parameters, results would tend to be less efficient, as their generating process would ignore the full covariance structure of the multi-equation system. Needless to say, on matters of policy, the ability to predict accurately is particularly relevant as policy adjustments are administratively costly and politically unwelcoming, especially for large-scale projects.

In this paper, I apply a new but extremely flexible procedure that utilizes maximum likelihood estimation (CMP or conditional mixed process) to estimate an eight-equation model of household environment-related consumption involving water, energy, waste, transportation, and organic food. The flexibility of the CMP module rests upon its ability to deal with a multi-equation system in either a seemingly unrelated regression setup, in which the dependent variables are generated by processes that are independent except for correlated errors, or a simultaneous equation framework, in which endogenous variables influence one another. The most salient features of this tool are that the data-generating processes within the multi-

equation system can be mixed, different samples can be used for different models within the system via the inclusion of the Heckman selection model, and switching regressions can be implemented to allow for the modelling of variables to depend on the data.

Given the richness of the two datasets, particularly in terms of questions about environmental attitudes, this paper will also exploit the institutional, cultural, and policy differences across countries to gain an understanding of which factors may be driving these attitudes. While much of the focus in this area has been on studying the causal effects of attitudes on environmental behavior, a question that arises when I compare countries with different environmental tendencies is whether these tendencies/attitudes are informed/influenced/caused by institutional, cultural, and political stances, in addition to socio-demographic elements and policy instruments.

3.2. Literature Review

To the best of my knowledge, there is no study that tackles the question of what drives household consumption across the different areas/activities with environmental implications. To the extent that households do care about the environment, whether as a result of its impact on health or out of non-tangible considerations (e.g., a sense of duty), there may be important substitution and complementarity relationships across the various activities, especially through policy instruments, which would not be captured when the activities are examined separately. Furthermore, much of the work in each of the areas focuses on the effects of socio-demographic characteristics and area-specific policies; less emphasis, mostly due to data limitations, is given to environmental attitudes. In what follows, a review of each of the five areas considered in this chapter is provided, with particular attention to policy implications.

3.2.1. Waste Generation and Recycling

The focus of much of the empirical literature on waste generation and recycling is on the effects of unit pricing systems and socio-demographic characteristics. In general, the evidence available to date is uniform about the effectiveness of user charges at reducing waste and/or at increasing recycling. Most of the studies that consider unit pricing examine its impact either on waste disposal or recycling or both; however, very few of them are interested in source reduction and no study directly considers the effect of the program on consumption and/or consumption patterns. The empirical studies that address the question of source reduction do in fact draw conclusions about the impact of unit pricing on waste production by estimating its effect on a total waste variable which comprises disposed of and recycled wastes, as in Nestor and Podolsky (1998), Hong (1999), and Van Houtven and Morris (1999), or by including compostable waste in addition to unsorted and recyclable wastes, as in Dijkgraaf and Gradus (2004), or by comparing its effects on waste disposal and recycling, as in Kinnaman and Fullerton (2000).

In addition to user fees, governments often rely on recycling programs as a means of diverting waste from landfills. While recycling is not uncommon among households even in communities with flat fees, voluntary recycling participation, and no extrinsic incentives for recycling (i.e. in situations where waste disposal should be less costly in terms of time and convenience than recycling, which suggests the presence of some intrinsic or altruistic returns from recycling), recycling programs are supposed to induce households to recycle by reducing the time and inconvenience costs associated with recycling. Because recycling programs represent a quite popular waste diversion policy, very few empirical studies that look at household waste management practices have data from communities without some sort of recycling program to be able to address the question of whether such a policy is effective at increasing recycling and/or decreasing waste disposal.

The few studies that look at the performance of a curbside program relative to a drop-off program or, more generally, at how accessibility of pick-up location affects waste diversion, Jenkins *et* al. (2003), Judge and Becker (1993), and Reschovsky and Stone (1994) find that transportation costs do matter in households' recycling decisions and that recycling efforts tend to increase as collection is made more accessible. In general, households are sensitive to the time intensity of recycling activities and tend to respond favourably

to initiatives intended to reduce sorting requirements by allowing households to commingle their recyclables. Households are also responsive to changes in collection frequency (Ferrara and Missios, 2005; Judge and Becker, 1993): the more frequently recyclables are collected, the more households recycle; this may be because households value their space and/or because they derive disutility from having garbage, whether non-recyclable or recyclable, on their premises.

When recycling programs are evaluated in relation to the presence of unit pricing, the available evidence (Reschovky and Stone, 1994; Callan and Thomas, 1997) suggests that curbside recycling is more effective if combined with unit pricing, and vice versa. In general, a recycling program is expected to decrease the time and out-of-pocket costs of recycling by reducing the need of transporting recyclables to collection points or of storing them for long periods of time (this is particularly important for bulky, heavy, and potentially messy materials such as glass and plastic bottles); a unit pricing system increases instead the monetary benefits of recycling (in terms of foregone disposal cost). Both the reduction in time and effort costs and the increase in monetary benefits vary according to waste characteristics such as weight and bulkiness. Hence, a recycling program induces households to recycle items that they would typically not recycle under a unit pricing system because of their low monetary benefits, thus re-enforcing the recycling incentives households face under unit pricing. A policy mix consisting of a recycling program and unit pricing may also be appealing if the user fee cannot be set at the full social marginal cost of waste disposal for political reasons. If curbside recycling is based on mandatory participation, independently of whether unit pricing is in place, it is however not clear whether and how households' decisions over recycling are affected.

Aside from various policy instruments, the empirical literature on waste generation and recycling examines the role of socio-demographic, attitudinal, and contextual characteristics in households' decisions over waste management activities. Among the variables analyzed, income, household size and composition, education, age, and home ownership are common to most studies and almost consistently found to be significant, although not necessarily with qualitatively equal effects; less common, however, are attitudinal elements of influence, with only one study, Sterner and Bartelings (1999), directly estimating their relevance, and another study, Ando and Gosselin (2005), indirectly assessing their importance through the effect of the indicator for recycling when in public. Other issues still to be explored or expanded upon include whether there are interaction effects between policy variables and socio-demographic and attitudinal attributes; if so, it is important for policymakers to be aware of how and to what extent household and community characteristics can influence the success or failure of different policies in order to be able

to make more informed decisions and set more reasonable objectives. When it comes to socio-demographic characteristics, the empirical literature on the household solid waste problem is in fact mainly concerned with how waste disposal and recycling activities differ across different segments of the population identifiable according to some characteristic such as income, education, or age. The results of these analytical exercises are undeniably valuable as they pinpoint areas where policies are more likely to be needed and to succeed. Knowing that richer households tend to have higher recycling rates suggests, for example, that the benefit of introducing a recycling program can be more easily realized if rich communities are targeted. However, a more interesting and relevant line of questioning, as pursued only in Fullerton and Kinnaman (1996), involves determining how the effectiveness of any given policy is linked to the socio-demographics of a community. This can be achieved either by estimation of how policy-induced changes in waste disposal and recycling are affected by socio-demographic variables, as in Fullerton and Kinnaman (1996) where the effect of unit pricing is smaller in low-income households, in households that subscribe to more daily newspapers, for those with infants, and for married couples, or by inclusion of interaction variables in the waste disposal and recycling equations that capture how the policy effects vary across the population, as in Van Houtven and Morris (1999) where the presence of unit pricing is interacted with the home ownership indicator and the number of residents and, based on the estimated coefficients of the interaction terms, unit pricing is found to be more effective in larger households but less effective among home-owners.

The impact of income on waste disposal and recycling is well documented. In general, rich households tend to dispose of more waste but do not necessarily invest more or less time in recycling activities than poor households. While there seems to be conclusive evidence that the demand for garbage collection services is increasing in income, the income elasticity estimates available to date, coupled with the empirical evidence that poor households do not tend to recycle more, suggest that user charges are likely to be regressive. As pointed out in Reschovsky and Stone (1994), however, waste management involves both monetary costs as well as time costs so that determining whether the distributional effects of unit pricing are regressive involves incorporating the greater burden in terms of time the system imposes on rich people, who tend to have higher valuations of time than poor people, by encouraging recycling. Furthermore, low-income people are likely to be renters and live in multi-family dwellings, which are typically excluded from unit pricing as the benefits in terms of scale economies from the use of common waste receptacles outweigh the inefficiencies from flat charges. Given that distributional outcomes can be manipulated through lump-sum cash or in-kind transfers without efficiency being affected, the possibility of user charges being regressive does not constitute a very strong argument against their implementation. Nonetheless,

policymakers should be mindful of the problem and consider some sort of administratively feasible and affordable rebate for low-income households.

In the few studies on personal motivations and attitudes on recycling, the empirical evidence is limited. Overall these studies suggest that there is no erosion of personal motivation, at least in the presence of economic incentives in the form of user charges for waste collection (Halvorsen, 2008; Ferrara and Missios, 2012 and 2014), or that a large proportion of the positive effect of regulation is attributable to personal norms and self-efficacy beliefs (Thorgerson, 2003). There are a number of limitations in these studies, including data sets that are under-represented in terms of observations from communities with unit pricing.

3.2.2. Personal Transport Choices

Among policy measures considered in the empirical literature on personal travel, taxes on the variable cost of motoring (fuel) and on the fixed cost of motoring (purchase) are quite well documented. In general, taxes on the variable cost of motoring are found to have significant but small effects on both fuel consumption and mode choice so that high levels of taxation are required to obtain any meaningful reduction in emissions and car traffic.[36] Furthermore, the effects of the taxes on car use tend to be considerably smaller than on fuel consumption as households respond to the taxes by purchasing more fuel-efficient cars, which translates into a reduction in variable cost and, ultimately, greater car use; this rebound effect offsets, at least partially, the initial effect of the cost increase on car use. Dargay (2008) provides a review of this literature.

Taxes on car purchases are also shown to affect both fuel consumption and car use but to a lesser extent than taxes on the variable cost of motoring (OECD, 2000; Goodwin *et al*., 2004; OECD 2005). If taxes on car purchases reduce car ownership on one hand, they induce individuals to retire their cars at a later date on the other hand, so that the stock of vehicles tends to be older, less efficient, and more polluting under a car purchase taxation scheme. The effect of such a scheme on car choice is less clear, although there seems

[36] For example, the differences in car use and fuel efficiency between the U.S. and Europe can partly be explained by the difference in their fuel taxes.

to be some agreement that differential taxes can be quite effective at encouraging the purchase of cleaner vehicles (Ewing and Sarigolu, 1998; Feng *et al*., 2005).

While economic incentives in the form of taxes or subsidies have the potential of contributing to reducing emissions, the evidence does seem to imply that they are likely to yield better results if they are accompanied by other policy instruments which aim at changing individuals' attitudes, beliefs, and preferences and/or at expediting the adjustment process. More specifically, the relatively cost-insensitive demand for car travel suggests that individuals view motoring as a necessity and that they believe that they have limited capability of reducing car use by switching to other modes. Information-based campaigns can then help ensure that individuals are fully aware of all travel possibilities available to them and of the environmental implications of each of them. Although it is debatable that greater awareness results in a behavioural change, individuals are likely to be more responsive to increases in the cost of motoring (whether variable or fixed) if they know that they have access to other less expensive (and more environmentally-friendly) travel modes. Unfortunately, the few studies (Poortinga *et al*., 2003; Rienstra *et al*., 1999; Golob and Hensher, 1998; Krupnick *et al.*, 2001; Harrington *et al*., 2001) that consider the effects of attitudes and information on travel behaviour both directly and indirectly through travel-related environmental policy provide contradictory results, possibly because of differences in how attitudinal variables, which tend to be composite variables (indices), are defined and constructed. Some of these inconsistencies are expected to disappear in the context of a comparative study which allows for significant policy variation as well as homogeneity in variable definitions across the countries involved.

Another pricing policy considered in the empirical literature on personal transport is road pricing or congestion charging (Olszewski and Xie, 2005; Polak and Meland, 1994; Brownstone *et al.*, 2003). Such a pricing scheme can result in less congestion and better travel times, at least in the areas subject to the charge, but leads to increased traffic in other areas. Furthermore, road pricing is a poor instrument for inducing individuals to invest in more environmentally-friendly vehicles, unless a lower charge applies to these vehicles.

At the local level, measures such as parking restrictions, car-free residential areas, and traffic restraints, which only few studies examine thoroughly, are found to reduce car use (and emissions) in the area of concern but to have small effects on total car use and travel. Conversely, land-use measures seem to have substantial effects on both total car use and travel, although there is little reliable empirical evidence on individual preferences regarding land-use options. As is clear from the literature review, population density,

proximity to town centers, and metropolitan size reduce car ownership, car use, and total travel. Larger centers tend to have lower rates of car use because of more practicable public transport options and greater concentration of amenities such as shops, services, leisure facilities, and workplaces (Feng *et al*., 2005; Fullerton *et al*., 2004; Dargay and Hanly, 2004; Asensio *et al*., 2002). The proximity to amenities reduces total travel and car ownership and use and encourages walking, which has health benefits and promotes the social cohesion of neighborhoods. A planning issue not addressed in the literature relates to out-of-town retail centers; while they may result in longer trips, they may also reduce the number of trips, so that the overall impact on car travel is unclear, although they are often argued against because of their negative effects on the viability of city centers and, in the absence of an adequate level of public transport, equity.

In terms of the effects of individual characteristics on travel decisions, there is evidence that women and individuals living in urban areas, with lower income levels, and who are younger, older, or less educated tend to travel less, particularly by car, than men and individuals living in rural or suburban areas, with higher income levels, in their middle age, and with more education (Abreu e Silva *et al*., 2006; Feng *et al*., 2005; Steg *et al*., 2001; Johansson-Stenman, 2002). This difference is primarily a reflection of differences in transport needs and availability of options across different individuals and does not necessarily follow from environmental considerations. Low-income individuals, for example, travel less by car because they cannot afford cars and not necessarily because they care more about the environmental effects of car travel. Similar patterns are uncovered in the analysis of car choice: women, younger individuals, individuals living in urban areas, and low-income individuals tend to drive smaller and more fuel-efficient cars, probably because they are less expensive to purchase and run, and are more likely to favour the choice of environmentally-friendly vehicles (Choo and Mokhtarian, 2004; McCarthy and Tey, 1998; Ewing and Sarigollu, 1998; Dagsvik *et al*., 2002).

The relationship between environmental concern and vehicle choice is of particular relevance in the policy-making process. The available evidence does suggest that women, younger individuals, and individuals with more income and education are more concerned about the environment (McCarthy and Tey, 1998; Ewing and Sarigollu, 1998). However, studies (Fujii and Garling, 2003) also find that individuals who claim to be concerned about the environment often indicate that they intend to purchase more environmentally-friendly vehicles but there is limited evidence that they actually do so. The possibility of a substantial discrepancy between intended behaviour and actual behaviour poses some serious difficulties for policy-makers attempting to change travel behaviour in that they must rely on some measure of

environmental concern which is often based on intended rather than actual behaviour. Given the importance of environmental concern, and in light of the mixed and somewhat unappealing findings to date, further investigation is necessary to determine to what extent intentions can be relied upon in constructing a reliable measure of environmental concern.

Another determinant of personal transport which is quite extensively documented is income (Abreu e Silva *et al*., 2006; Dieleman *et al*., 2002; Giuliano and Dargay, 2006; Nolan, 2002; Simma and Axhausen, 2004; Dargay, 2005). Understanding how travel choices are affected by income is important to policy-makers in order to ascertain the distributional implications of different policy measures. In deciding which pricing policy or policy package to adopt to induce a more environmentally-conscious behaviour, policy-makers in fact not only must ensure efficient or cost-effective intervention but also an equitable distribution of the burden of intervention. Although a more equitable distribution of income can always be achieved through redistributive mechanisms, a policy that is more burdensome for low-income individuals, that is, a regressive policy, is less likely to receive public acceptance and thus less likely to be politically and social feasible.

Based on the empirical evidence gathered in a number of countries, the distributional implications of taxation in the personal transport area vary across pricing instruments. Fuel taxation, for example, is progressive up to the medium income level and then becomes regressive in three separate and independent studies (Dargay, 2005, for the U.K.; West, 2004, for the U.S.; Asensio et al., 2002, for Spain). In the last case, the switch is found to occur at lower income levels in smaller municipalities, which probably stems from the greater reliance on car travel in such areas, as confirmed in the literature. When only households with cars are considered in the U.S. study, fuel taxation is actually found to be regressive at any income level. In Bento et al. (2005), however, the nature of the distributional effects of a fuel tax hinges upon the manner in which the tax revenues are recycled to the economy: a fuel tax increase is in fact proportional under tax-based recycling but highly regressive under income-based recycling.

A tax on car purchase has positive distributional effects (Berri, 2005; Dargay, 2005: West, 2004) while a subsidy on a new fuel-efficient car is regressive given that wealthy individuals are more likely to buy new vehicles (West, 2004). Higher vehicle registration fees for more polluting cars are most burdensome for middle-income individuals and regressive for income levels in the upper half of the income distribution. A

uniform tax on miles that does not distinguish between dirty and clean cars is less regressive than an emissions tax (West, 2005). As for public transport pricing policies, subsidies are generally progressive, and taxes regressive, particularly in urban areas (e.g., Asensio et al., 2003); in Dargay (2005), subsidies are confirmed to be progressive for bus transport but found to be regressive for rail transport. In most cases, road pricing is also regressive as low-income individuals and part-time workers who use tolled roads tend to have shorter distances to travel and thus pay a larger proportion of their incomes on tolls (e.g., McQuaid and Grieco, 2005); in Santos and Rojay (2004), however, the impact of road pricing is found to be town-specific, depending upon where people live and work and what mode of transport they use, so that, when most of the drivers entering a tolled area have above average income levels, the overall effect of road pricing turns out to be progressive.

Although there are quite a few studies on personal transport which consider the distributional effects of pricing policies (Berri, 2005; Dargay, 2005; West, 2004 and 2005; Asensio *et al*., 2003), very little is known about the long-run distributional implications of such policies. Given that individuals' responsiveness to price changes increases over time as more adjustment options become viable, the welfare effects of taxes (or subsidies) are expected to decline over time. Whether this change translates into a change in how the burden of taxation is distributed across individuals depends upon whether the price elasticity of demand for the taxed transport good or service, which is a measure of responsiveness to price changes, varies across different groups. In Dargay (2005), for example, individuals living in urban areas are found to be twice as responsive to car prices and fuel prices as those living in rural areas. Given the importance of political and social feasibility/acceptability in the policy selection and implementation process, understanding how different policies affect different segments of the population and internalizing this information in the decision-making process becomes a crucial ingredient of success. As pointed out in Salomon and Mokhtarian (1997), distributional effects are almost inevitable as behavioural adjustments vary in cost and availability: low-income individuals may not be able to adopt certain measures in response to a particular policy because their resources are insufficient; individuals in certain occupations (e.g., telecommuting) may not have access to the full range of feasible responses; because of inequality in the distribution of household tasks and childcare, women may have greater constraints than men and may not be able to change their travel patterns as easily. While efficiency should not necessarily be compromised for the sake of equity, compensating mechanisms must be devised to ensure that the distributional effects of whichever policy or mix of policies is opted for are at least partially mitigated.

3.2.3. Environmentally Responsive Food Choice

There are essentially two types of attributes specific to food products: attributes which are detectable only after consumption (or experience attributes, e.g., quality) and attributes which remain unknown even after consumption (or credence attributes, e.g., food safety, environmental impact). It is because of the latter type of attributes and resulting information asymmetries that individuals tend to rely on guarantees (e.g., brand name, geographic origin), among other evaluation criteria such as quality, price, and freshness, when making choices about food products (Steenkamp, 1997).

The information asymmetries that exist in food markets give rise to adverse selection and moral hazard problems. The former refers to a market process by which there is a progressive reduction in the quality of products until only the less desirable products are available and the market fails to deliver the "high-quality" products. The latter refers to the incentive producers have to employ an effort level below that required to achieve a pre-defined quality level. In both cases, the market does not fully reward high-quality producers or punish the low-quality producers. Put it differently and with specific reference to (environmental) quality differentiated products, the market falls short of providing the socially optimal quantity of environmentally responsible products, particularly organic food.

Some of the mechanisms that emerge from empirical analyses of consumers' behaviour in relation to environmentally responsive food choice as possible solutions to the above mentioned problems (adverse selection, in particular) include reputation, quality signaling or labeling, and advertising.[37] Reputation refers to the capacity of a particular brand or trademark to inform final consumers about an overall quality level, and usually its effect is a reinforcement of the informational effectiveness of some other quality signal. For example, the reputation of a producer's brand or a distributor's private label may give further strength to claims regarding credence attributes, such as "cholesterol-free", "GMO-free", "organic" or "obtained from IPM methods."[38] In instances in which a mandatory certification is in place, such as the last two cases, reputation is likely to have a less effective supportive role. Labeling is probably the simplest method of turning an experience or credence attribute into a search attribute. Some examples of labeling include

[37] Moral hazard may be less of a problem given that, as underlined in Grolleau and Caswell (2005), it "may be mitigated to some extent by the need for producers to make significant initial investments in knowledge, skills, materials, and time to become certified." The effect of this transaction-specific asset would be a higher degree of commitment to the certification standards.

[38] GMO stands for genetically modified organism; IPM stands for integrated production management.

nutritional labeling, which provides information about nutrients, and organic labeling, which signals that organic agricultural practices are followed in the production process. Advertising represents another means for consumers to obtain information but typically not about credence attributes, although it is sometimes used by supermarket chains for statements that help clarify their positions with respect to credence attributes such as the use of biotechnologies and of environmentally friendly production methods. Standard consumer protection laws related to advertising are required to ensure that the claims made are not false. Boccaletti (2008) provides a review of the literature in this area.

The effectiveness of labeling depends on how reliable the certification system is at assuring that the practices adopted at the farm level are in line with the claim made on the label. The question of reliability is particularly relevant for organic products given that consumers are willing to pay a premium in order to buy organic products and that, as a result, profit-maximizing producers have an incentive to falsely claim that their products are organic if the probability of being discovered is sufficiently low. It is then reasonable to expect consumers to have greater trust in certification when it is regulated by governments rather than by private organisms; governments can in fact standardize the term "organic" and ensure consistency in standards across countries in addition to having the power of prosecuting violators under criminal laws. Credibility also depends on the level of the standard imposed: the higher the standard, the more difficult is its implementation throughout the supply chain (e.g., Jahn et al., 2005). Another source of uncertainty in the assessment of labeling policies is the complex relationship between consumer information and behaviour. The variability of findings in studies that attempt to estimate the impact of various labels/certifications on the purchase of organic and other environmentally responsive products does in fact suggest that these signals interact with several other factors, including the level of understanding and the overlapping of different labels and certifications (Anderson *et al*., 2005; Byrne *et al*., 1992; Hu *et al*., 2005; Chakraborty, 2005; Wang and Sun, 2003).

The asymmetric information problems (particularly, adverse selection) that exist in food markets and that result in consumers buying lower quality products than they would in the presence of perfect information is however not the only reason for suboptimality in private decisions over organic food consumption. Presumably, organic products have both private and public benefits. The private benefits relate to their positive health effects, which may not be fully captured in private decisions because of hidden information, and, possibly, to their higher sensory quality; the public benefits relate to their positive environmental effects as they do not involve the agricultural practices used for conventional products which are believed

to be more environmentally damaging and less conducive to wildlife preservation. Hence, even in the presence of perfect information, consumers are likely to demand less organic food than they should on account of its positive environmental attributes. This is confirmed by the finding that consumers care more about personal health than the environment when choosing organic food over conventional food; after all, health concerns are personal and I would expect individuals to largely ignore the effects of their decisions on the environment (Ara, 2003; Durham and Andrade, 2005; Batte *et al*., 2004; Boccaletti and Nardella, 2000). The positive externality problem that arise in the consumption of organic food is given little attention in the literature, possibly reflecting the fact that the main focus of policies concerning organic food seems to be to ensure delivery and reliability of information; in other words, existing policies (e.g., certification) tend to be targeted at the information asymmetry problems.

Although lacking from a wider range of policies, particularly in relation to the public benefits organic products are believed to provide, the existing literature on the demand for environmentally responsive products (specifically, organic products) highlights some of the most important determinants of consumers' behaviour towards the choice of (environmental) quality differentiated products (Boccaletti, 2008). The understanding of the qualitative and quantitative effects of these factors is crucial for the design of acceptable (both socially and politically) policy instruments which are also effective at stimulating consumption.

In examining the determinants of the demand for organic food, studies focus on willingness to pay (WTP) or expenditures on organic food (organic food expenditure share) or discrete choice (e.g., binary choice: organic versus conventional food; multinomial choice: organic, IPM, and other definitions of certified/uncertified ERP). Factors typically considered are: prices and income, sensory attributes (taste, texture, freshness, and nutritional benefits), environmental and (personal) health attributes, and concern about residues, pesticides, and bad ingredients (cholesterol, fat). However, attitudinal and behavioural variables are often excluded whenever the dependent variable is continuous (e.g., organic food expenditure share); in such cases, the explanatory variables typically included are income, prices, and socio-demographic variables. In general, aside from prices and income levels, the determinants of the demand for organic food considered in the literature can be categorized in five groups: (1) demographic characteristics, (2) intrinsic quality attributes (e.g., sensory variables), (3) attitudinal and behavioral variables (e.g., beliefs, concerns, views about the world), (4) marketing variables (e.g., advertising) as above touched upon, and (5) policy variables (e.g., labeling and certification) as above discussed.

In terms of socio-demographic variables, age seems to have a negative effect on organic food consumption possibly because older people are less concerned about health risks (Durham and Andrade, 2005; Magnusson and Cranfield, 2005). Gender has a significant effect with female consumers preferring organic food and showing a higher WTP, possibly because women have a higher WTP for reduction in pesticide exposure (Batte *et al*., 2004, Boccaletti and Nardella, 2000). The effect of education is unclear: higher education means more knowledge about the benefits of environmentally responsive products and thus higher demand; however, higher education may be associated with skepticism about the problems with conventional food (more educated people may be able to better understand the uncertainty around scientific information and less likely to believe that pesticides are risky) and thus lower demand for environmentally responsive products (Hearne and Volcan, 2002; Govindasamy and Italia, 1998). Household size has, for the most part, a negative effect as disposable income per person tends to be lower in larger households; in some cases, however, there is evidence of a positive effect, possibly because of higher median income levels in the surveyed areas or stronger preferences for environmentally responsive products (size could also be a proxy for certain characteristics such as package size and convenience) (Govindasamy and Italia, 1999, Shuzzler *et al*., 2003). The presence of children has contrasting effects: positive if the concern for safety dominates as organic food is perceived to be safer because of lower pesticide use; negative if the budget constraint is a priority; the probability of buying organic food relative to conventional food is higher with children below 18 years of age but decreases with family size (Batte *et al*., 2004; Loureiro *et al*., 2001). The place of residence could capture a green effect so that households in rural areas would consume more organic food; however, they may be using more pesticides or have a greater trust for conventional produce and current agricultural practices, in which case they would consume less organic food (Govindasamy and Italia, 1997; Underhill and Figueroa, 1996).

Products obtained from a lower use of chemicals are typically believed to be of lower visual quality (in terms of appearance and defects), which may however be counterbalanced by better intrinsic quality (in terms of nutritional value, taste, and safety). Variables used in the literature to address these quality considerations either refer to specific attributes such as appearance and defects or to an overall quality assessment; for example, the organic characterization is often used as an indicator of higher nutritional quality. Based on the empirical findings, appearance, followed by size, seems to be the first choice attribute considered by consumers; when significant, evidence does in fact support the hypothesis that consumers prefer absence of external defects (Hu *et al*., 2005; Rimal and Moon, 2005; Sorengaroli *et al*., 2003). There is instead limited evidence that organic products are perceived to be of better intrinsic quality, although

freshness seems to positively affect preferences for organic products (Ara, 2003; Shuzzler *et al*., 2003). If, as underlined in Grolleau and Caswell (2005), "a high level of search and experience attributes detectable by consumers before or after the purchase can support the credibility of environmental claims," it may be possible to stimulate the consumption of organic products through policies that promote research aimed at the development of process and product innovations to improve the quality (visual and intrinsic) of environmentally friendly products.

Among attitudinal and behavioral variables considered in the literature, the most relevant ones relate to the environmental impact and the health risk of food consumption. Based on the available evidence, individuals seem to prefer products obtained from techniques perceived to be more environmentally friendly; put differently, the lower the degree of perceived "environmental friendliness" of a product, the lower the price a consumer is willing to pay (Magnusson and Cranfield, 2005; Durham and Andrade, 2005). A concern for health risks, which is captured by a concern for food safety, is also expected to increase the demand for environmentally responsive products and the willingness to pay for such products. However, consumers tend to be less concerned with food safety when they have trust in food safety regulations and enforcement by public institutions. The negative relationship between the two variables (that is, food safety concern and consumers' trust in food safety regulations) implies that, by contributing to reduce food scares (e.g., Rimal et al., 2001), credible institutions and good food safety regulations ultimately result in unclear policy implications. On the one hand, a reduced food risk concern may imply that consumers perceive conventional food as free of risk, and therefore may be averse to switching to environmentally responsive products, usually sold at higher prices. On the other hand, certified environmentally responsive products may be perceived as effectively reducing food risks, and therefore the utility gain from the consumption of these products may turn out positive. The first effect could explain why risk-concerned individuals are not necessarily willing to change their consumption habits.

In general, individuals with higher income levels tend to be more oriented towards environmentally responsive products (especially certified organic products which represent the most expensive category). In some cases, however, income is found to have a negative effect on the willingness to pay for organic food; presumably, richer individuals have better access to information about pesticide risks and may have a lower degree of concern for food safety (Harris *et al*., 2000; Glaser and Thompson, 2000; Thompson and Glaser, 2001). Price differentials between organic and conventional products may vary depending on the product category but can be as high as 30 to 40 percent of regular prices; typically, the premium individuals

are willing to pay for organic products is not higher than 15 to 20 percent of the prices of corresponding conventional products. Furthermore, the demand for organic products is twice as responsive to a given price increase as the demand for conventional products (Batte *et al*., 2004; Glaser and Thompson, 2000; Thompson and Glaser, 2001; Cicia *et al*., 2002). These findings provide valuable information not only to policy-makers interested in exploring the possibility of price-based instruments to increase the market share of organic products but also to producers wishing to devise marketing strategies that reflect, to the extent possible, any variation in price and/or income sensitivity across consumers. Producers may, for example, target consumers who are very concerned about the environmental and health effects of food and that, as a result, are willing to pay a very high premium for organic food through specific and specialized marketing channels such as specialty outlets for organic products.

In sum, in designing policies to stimulate the consumption of environmentally responsive products, policy-makers should work towards ensuring that individuals perceive organic food to be effective at reducing health and environmental risks and at increasing welfare at the consumer's level. Uncertainty about the benefits and risks of both conventional and environmentally responsive products is probably the most important factor working against a proper product differentiation. Correspondingly, individuals with a higher degree of risk aversion (e.g., females, especially when they are the prime shopper in the family and their household includes children, and young people who tend to be more concerned about health risks) generally show a stronger preference for environmentally responsive products. As food safety considerations appear to be more important to individuals in their decision-making process than environmental considerations (much of the relevant literature does in fact identify chemical residues in food as a major concern to consumers), private communication should focus on health aspects while public information should emphasize environmental aspects. Once consumers are educated about the environment-related benefits of environmentally responsive products, factors such as prices as well as certification that environmentally friendly practices are indeed followed may be used as policy instruments to ensure that consumers continue to consume environmentally responsive products. Hence, policies aimed at reducing the price gap between conventional and organic products (e.g., by reducing the production cost of the latter) should be considered. Finally, policies should align the incentives of producers of organic food with the objective of avoiding future environmental and health costs; the proliferation of standards and certification systems may, for example, not be ideal as it would confuse consumers who already have difficulty in evaluating the benefits of environmentally responsive products.

3.2.4. Residential Energy Use

Residential energy use generally includes heating, hot water, and household electricity, with heating and cooling often constituting the most important components of demand. As energy is needed in support of the consumption of capital goods (e.g., air-coolers and dish-washers), the demand for energy is essentially a derived demand. Consequently, and in light of the fact that capital goods cannot be easily replaced in the short run, the demand for energy tends to be less price-elastic in the short run than in the long run; in other words, individuals' responses to energy price increases tend to be smaller in the short run. An important implication of the dynamic nature of the demand for energy is that it takes time for policies to become effective. Furthermore, responsiveness to price changes depends on substitution possibilities (e.g., lowing indoor temperatures, delaying washing schedules, and adopting cost-effective heating/cooling technology) which, if limited, imply a small own-price elasticity of demand. As these substitution possibilities vary across households, the price elasticity of demand for energy is expected to vary across the population. In Rehdanz (2005) and Reiss and White (2005), for example, the price elasticity of demand for energy is found to depend upon income; in Damsgaard (2003), it depends upon household size. There are other important demographic and contextual dimensions which are likely to impact the availability of substitution possibilities but which the empirical literature is silent about.

The evidence to date does suggest that individuals respond to economic incentives (e.g., price increases through energy taxes, which are quite common in OECD countries, are found to be very effective at reducing the demand for energy) and economists are correct in their optimistic view about individuals' response to higher energy prices over the longer term. In Taylor (1975), for example, the short- and long-run price elasticities for electricity are found to be 0.2 and 0.9, respectively, which are similar to the estimates reported in Bohi and Zimmerman (1984); more recently, in Espey and Espey (2004), the short- and long-run price elasticities for electricity, which are obtained through a meta-analysis approach, average at 0.35 and 0.85, respectively. In designing policy packages, policy makers should thus consider the time-lag that consumers need to adjust their capital stocks. The length of the lag is however not absolute but dependent upon the size of the price increase: in Reiss and White (2005), in fact, the evidence gathered from 1,300 Californian households experiencing a large energy price increase during the California energy crisis in 2000 suggests a very significant reduction in energy consumption over a two-month period. A review of the energy demand literature can be found in Kristrom (2008).

Another economic variable which is relevant in both the discrete choice of which durable goods to buy and the continuous choice of how much of its service to consume (through the use of energy), is income. Although the link between the demand for energy and income is sometimes unclear (e.g., Taylor, 1975; Dahl, 1993), the evidence does in general suggest that energy is a normal good in that its consumption increases as income increases. The steady increase in income of more than 2 percent per year in the OECD countries since 1970 has in fact resulted in a tremendous outburst in energy consumption. As in the case of the price elasticity of demand, estimates of the income elasticity tend to vary depending on the type of data (time-series, cross-section, panel), methodology, and time horizon (short-run versus long-run) so that relying upon average elasticities when trying to estimate responses to income changes may be quite misleading. In Espey and Espey (2004), for example, the income elasticity is estimated to range between 0.04 and 3.48 with a mean of 0.28 in the short-run and between 0.02 and 5.74 with a mean of 0.97 in the long-run. In more recent studies employing micro-level data from various countries (U.K. in Baker and Blundell, 1991; U.S. in Poyer and Williams, 1993; Norwey in Nesbakken, 1999; Germany in Rehdanz, 2005), smaller income elasticity estimates ranging from 0.1 to 0.2 are obtained. Little responsiveness to income changes is also detected when the focus of analysis is the demand for electricity (e.g., Damsgaard, 2003, with Swedish data; Leth-Petersen, 2002, with Danish data; Berkhout et al., 2004, with data from The Netherlands) and when heating expenditures represent a significant component of the demand for energy.

Even though it is widely documented that potential energy savings can be achieved through technological advancements, energy consumption also depends upon individuals' socio-demographic and attitudinal characteristics, in addition to the economic variables (energy price and income) above discussed. The effect of an aging population is, for example, to increase the demand for energy (e.g., Liao and Chang, 2002; Yamasaki and Tominaga, 1997); the effect of the number of children is however less clear (e.g., positive in Baker et al., 1989; negative in Rehdanz, 2005) and insignificant in quite a few studies (e.g., Leth-Petersen, 2002; Nesbakken, 1999; Vaage, 2000). As reported in Lutzenhiser (2002), other variables which appear to be relevant in explaining conservation behaviour are: ethnicity, household composition, dwelling type, and square footage (African Americans, single parents, mobile homeowners, and individuals living in large houses tend to be more conscious about energy consumption and report turning off equipment more frequently).

The effects of attitudinal variables on residential energy use, which are reviewed in Lutzenhiser (1993) and Sjöberg and Engelberg (2005), are found, for the most part, to be weak. However, recent studies of the

California energy crisis of 2001-2002 (with power shortages, blackouts, rising prices, and bankrupt utilities) seem to suggest a much greater role of (positive) attitudes towards conservation in reducing energy use. Surprisingly, a great deal of the 2001 energy demand reduction in California was triggered by changes in behaviour, rather than hardware efficiency improvements, which arose out of civic concerns and altruistic motives as opposed to responses to price increases.

Among policy instruments currently in use in the OECD countries and, to some extent, examined in the empirical literature on residential energy use, there are: (1) energy taxes, (2) appliance energy efficiency standards, (3) energy labels, (4) energy conservation grants, and (5) thermal efficiency standards. A thorough comparative analysis of these policy instruments cannot be undertaken without the underlying policy objectives being clearly spelled out. In energy policy, objectives traditionally include safety, security, affordability, and environmental friendliness. There may also be quite specific objectives such as lowering the use of electricity for heating (Sweden), improving energy efficiency in the residential sector (The Netherlands), promoting district heating (Denmark), and fighting fuel poverty (U.K.).[39] Nevertheless, there are some lessons about each of these policy instruments which can be drawn from existing empirical studies on residential energy use, as below detailed.

The impact of energy taxes is well documented and relates to individuals' responsiveness to energy price increases. From an efficiency point of view, and based on the above discussion on the short- and long-run effects of price changes, energy taxes constitute one of the most useful policy instruments; however, the evidence to date does suggest that they are also regressive so that they may not be socially desirable based on equity considerations.

Appliance energy efficiency standards, which are adopted in several countries on several products (e.g., refrigerators, air conditioners, freezers), are regulations specifying energy efficiency requirements that products must meet. According to recent reviews, they tend to be cost-effective at reducing energy use with only small adverse impacts on producers (e.g., Nadel, 2002). Efficiency standards can however have unintended consequences for international trade as they can be, and often are, used as non-tariff barriers to

[39] See Schaefer et al. (2000).

trade (fuel efficiency standards, in particular, have generated several international disputes as documented in Zhang and Assuncao, 2001).

The use of energy-efficiency labels is quite widespread, particularly for home appliances, in most, if not all, industrialized countries (Newman, 2000). They tend to be quite attractive to policy makers because of their negligible budgetary implications. While there is evidence that the context, features, design, and delivery of information are very important, energy labels cannot overcome physical and technical constraints and, as a result, do not constitute a very effective policy instrument. Even when physical and technical constraints are not binding, the effects of labels on behaviour remain highly unclear. Furthermore, as in the case of energy-efficiency standards, energy-efficiency labels may lead to efficiency losses by imposing (intended or unintended) restrictions on international trade.

Of the remaining policy instruments identified in the empirical residential energy use literature (namely, energy conservation grants and thermal efficiency standards), the evidence to date is quite favourable. In the case of energy conservation grants, which can be justified on the basis of the fact that consumers and producers often face a high implicit discount rate on energy conservation investments, debate still continues as to whether the subsidies are linked to a market failure in the import sector; in the absence of such a link (or in the absence of a market failure), subsidies are highly inefficient and thus socially costly. In the case of thermal efficiency (building) standards, the main finding points to a reduction in space heating demand in a number of countries (e.g., Schaefer et al., 2000, and Ryan et al., 1996).

In sum, none of the reviewed policy instruments (e.g., taxes/prices, appliance efficiency standards, labels, grants/incentives, thermal efficiency standards) can be defined as superior or inferior, although there is some indication that information-based options (e.g., labels) are not very effective, particularly if used in isolation. The question of which policy or which policy package to consider does require that the policy objectives be clearly identified. If an incremental efficiency improvement in energy use is sought, then moderate adjustments in standards, along with incentives to purchase more efficient equipment, may be sufficient and appropriate based on the insights about behaviour and choice available to date. However, if the objective is to maximize the reduction in energy use over a reasonable timeframe, a wider range of policy options must be considered and a deeper understanding of behaviour and choice, which draws from various disciplinary perspectives, is needed.

3.2.5. Residential Water Use

A very important feature of residential water use that most of the articles reviewed share is the estimation of households' responsiveness to increases in water charges as captured by the own-price elasticity of demand. Understanding the extent to which water demand responds to price increases has a fundamental policy dimension that is often not fully explored by policy makers because of equity considerations. Although non-pricing mechanisms do exist for inducing a reduction in water use such as restrictions on certain water usage, rationing, public information campaigns, and subsidies for using water-efficient technologies, pricing structures are viewed as being amongst the most effective means of affecting behaviour. The effectiveness of pricing schemes does however depend upon the own-price elasticity of demand: the higher the elasticity, the more sensitive consumption is to price changes. See Ferrara (2008) for a review of the water use literature.

In general, water demand is found to be relatively inelastic or irresponsive; the lowest estimate of the own-price elasticity in the available literature, from Renwick et al. (1998), Pint (1999), Espiñeira (2000), Espiñeira and Nauges (2004), and Strand and Walker (2005), averages at -0.10, which implies that a 10 percent increase in water prices yields only a 1 percent decrease in water consumption. There are however studies (Wong, 1972; Nieswiadomy and Molina, 1989; Dandy et al.,1997; Pint, 1999; Gaudin, 2006; Mazzanti and Montini, 2006) in which higher estimates averaging at -0.91 are obtained. In Pint (1999) and Mazzanti and Montini (2006), water demand is actually reported to be elastic or very responsive, with a price-elasticity of -1.24 in the former and of -1.33 in the latter.

Although the available evidence seems to point to a relatively inelastic water demand, the existence of elasticity estimates that suggest otherwise highlights the relevance of the reference price range, that is, the range of prices in the data set being analyzed. In other words, the own-price elasticity of residential water demand is likely to be price-dependent with low figures (in absolute terms) corresponding to low prices and high figures (in absolute terms) correspondingly to high prices. This dependence seems to be confirmed by Cummings et al. (2005), in which water demand becomes elastic for marginal prices above $2.33 in January and above $4.00 in July, but warrants further investigation in a study that allows for much greater price variation than has so far been possible. In Brookshire et al. (2002), for example, the difficulty of

obtaining an appropriate estimate for the own-price elasticity of residential water demand in a comparative analysis of U.S. cities is attributed to the lack of price variation over the previous 40 years.

Understanding whether and how the own-price elasticity of water demand depends on the price of water has important implications for the design of effective and efficient pricing schemes. For most of the data sets considered in the literature, the pricing structure consists of either a two-part tariff or a block system or both (multi-part tariff). A two-part tariff typically includes a fixed fee, intended for cost recovery and to ensure equity, and some variable fee which may be constant (two-part) or vary across blocks (multi-part). Each block corresponds to a certain range of water consumption and the variable fee may increase or decrease from one block to another. In the absence of the fixed fee, the pricing scheme is more accurately labeled as a block system which can be increasing, decreasing, or uniform depending on whether the variable fee increases, decreases, or remains unchanged from one block to another, respectively. If water demand becomes increasingly more inelastic as consumption increases (or, equivalently, if water demand becomes increasingly less inelastic as price increases), increasingly smaller price increases are needed, as households reduce their water consumption moving from one block to another, to induce further reduction in water consumption. An increasing block price system may indeed be the price scheme that is most consistent with the features of the relationship between the price of water and the quantity of water demanded.

In general, increasing block rates are found to be effective at reducing water consumption (Billings and Agthe, 1980; Nieswiadomy and Molina, 1989; Renwick and Archibald, 1998; Pint, 1999; Espiñeira, 2000; Cummings et al., 2005; Strand and Walker, 2005; Mazzanti and Montini, 2006) and, based on the evidence from the one study that permits the comparison (Taylor et al., 2004), appear to perform better than decreasing block rates by resulting in less water use, in contrast with both decreasing block rates and non-metered fixed monthly fees which result in more water use, when compared to constant rates. Increasing block rates may however be more conducive to inequities as water substitution possibilities may involve, once a certain consumption level is achieved, the adoption of water-saving technologies which are likely to be less accessible to low-income households, unless subsidizing programs are in place. It is indeed out of equity concerns, coupled with the fact that water is an essential commodity, that water prices are typically kept at low levels causing households to overuse and misuse water.

Independently of the type (a question for which additional empirical investigation is needed in a context that permits greater variation in pricing schemes), pricing mechanisms to regulate water consumption are deemed to be crucial to ensuring the achievement of environmental, economic, and social goals which, in turn, help achieve "sustainable development" goals (OECD, 1987; OECD, 1999). Accordingly, in many OECD countries, water reforms have been initiated in support of efficient water pricing based on long-run marginal cost considerations, with annual water prices increasing from 1 to 22 percent (OECD, 2003). These stark price increases have also triggered questions about "affordability" of water, particularly among low-income households, in response to which many OECD countries, including the United Kingdom, France, Australia, Japan, and Poland, have introduced several support measures (such as direct income assistance from the government, capped tariff rebates and discounts, and payment assistance in the form of easier payment plans). To cite some specific examples, funds are in place at local levels to help write off water debts in France; a social fund, financed through a small levy on water charges, is available for needy households in the Belgian region of Wallonia; discount tariffs are provided in Australia and the United States; charitable trusts are set up by private water utilities to pay off water debts in England and Wales.

As emphasized in OECD (2003), subsidizing water services, thus keeping water prices at low levels (and certainly below the marginal social cost of water provision), may not be the best way of addressing the problems of affordability and equity, which are particularly relevant for water given its essential nature. Water prices do seem to provide households with proper signals and should thus reflect water provision costs. At the same time, however, support measures should be devised to assist needy households. Alternatively, or in conjunction with these measures, free (or low-priced) water allowance levels could be established, as they often are, to ensure that households have access to the amount of water necessary to satisfy basic needs (e.g., drinking, cooking, and personal hygiene). Up to this threshold level, households would be quite insensitive to price changes so that pricing mechanisms may not make much sense. This consumption minimum could be, at least partially, financed through fixed fees or low-level variable fees, which may fall short of the marginal social cost of water. Although some attempt is made in the literature to estimate the minimum threshold level of water (Espiñeira and Nauges, 2004),[40] it is not clear how such a level should be determined and whether factors such as persistent characteristics of the environment and historical water use levels should be considered. One of the first challenges of policy makers is to be able to identify, through a better understanding of households' behaviour in a comparative framework of analysis, the elements that are essential to the setting of the minimum threshold level. As pointed out in

[40] The estimate is 2.6 cubic meters per capita per month.

Dandy et al. (1997), OECD (1999), and Espiñeira (2000), the free (or low-priced) allowance level should be set as low as possible as to avoid encouraging consumers to use more water than they would have to fulfill their basic needs.

For water consumption above the minimum threshold level, that is, at levels where households become price-sensitive, a pricing mechanism could be devised and supplementary programs could be introduced to alleviate inequality problems resulting from the pricing scheme. In order for both the pricing mechanism and the supplementary programs to be properly designed, it is important to have a good grasp of the effects that income has on water use decisions and of how different households, where differences are identified on the basis of any observable economic or socio-demographic characteristic, respond to water price changes. The empirical evidence to date suggests that income is a quite significant determinant of residential water use, with income elasticity estimates ranging from 0.10 to 0.71. As wealthier households tend to rely more heavily upon water-consuming durables (such as dishwashers, washing machines, and swimming pools), they are reasonably expected to consume more water. However, they also seem to be, according to findings in Renwick and Archibald (1998), less price-sensitive, cutting back their water consumption by 1.1 percent in response to a 10 percent increase in water price, compared to a 2.2 percent reduction among the moderate- to high-income households and to a 5.3 percent reduction among the low-income households. If low-income households are more responsive to price changes than high-income households, a pricing policy would shift the burden of conservation towards low-income households; to equalize the burden across the population, high-income households' excess water consumption could be regulated through restrictive measures, such as bans on certain types of landscaping and on excessive water use for swimming pools. A better understanding of the sources of differences in water consumption between low- and high-income households may help identify the particular water uses to target with restrictive instruments. Aside income, of which the effect on own-price elasticity of water demand deserves further exploration, there are other individual characteristics (e.g., household age and size, type of dwelling) that may have an impact on price responsiveness but the available literature does not permit any conclusive statement to be made about this impact. Based on the findings to date, there is some indication, for example, that older households, those living in high-density areas, and those living in multistory buildings tend to use less water but whether these groups are less or more responsive to price changes remains an open, still very relevant, question.

In sum, there seems to be support for pricing instruments as constituting an effective means of encouraging households to reduce their water consumption but, as different households may respond differently to a given price change and these differences are still to be carefully scrutinized, it is not clear what the optimal pricing scheme design would or should look like and which other (non-pricing) policy instruments could be introduced, alongside with the pricing program, to realign any inequality in the distribution of the burden of conservation resulting from the pricing program because of income differences and/or differences in responsiveness to price changes. Furthermore, for any policy to be effective, households need be fully informed about the policy; in the presence of a block pricing schedule, consumers do not seem to have a clear-cut idea about the different blocks and their corresponding prices so that they often fail to fully acknowledge the price differences across blocks (Chicoine and Ramamurthy, 1986; Nieswiadomy, 1992; OECD, 1999; Nauges and Thomas, 2000; Taylor et al., 2004; Strand and Walker, 2005; Gaudin, 2006). In Gaudin (2006), the presence of marginal price information on the water bill, next to the water consumption figure, is estimated to result into a price elasticity increase (in absolute terms) from -0.37 to -0.51; correspondingly, for a given water use reduction target, the required price increase, under a constant price elasticity assumption, can be 30 percent lower when proper price information is included on the water bill. For this same reason, that is, to ensure that households properly experience water prices and act accordingly, individual metering can quite beneficial; several studies do indeed point to the conclusion that individual metering can induce substantial reduction in water consumption, anywhere from 7 to 35 percent, by allowing households to fully realize the price signal for reducing their water demand (e.g., Edwards, 1996; Herrington, 1997; Mid-Kent, 1997; OECD, 1999; Nauges and Thomas, 2000). Many OECD countries (including Germany, Belgium, France, and the United Kingdom) are moved to individual metering systems to ensure that households have access to their own water bills, which, in turn, allow them to more accurately decide about their water usage levels.

Among the various non-pricing policies that are considered in the empirical residential water use literature (public information campaigns, subsidies for households to adopt water–efficient technologies, free distribution of water-saving devices such as low flow showerheads and toilets, rationing of water among households, restrictions on certain types of water usage such as a ban on landscape irrigation during peak hours, and mandatory installation of several water-saving systems) and that policy makers are becoming increasingly interested in, particularly in the presence of stark water scarcity and when substantial water demand reductions are required in short periods of time, restrictive measures (water rationing and water use restrictions) are shown to be more effective at reducing water consumption than voluntary measures (public information campaigns). Restrictive measures are also found to be quite effective relative to pricing

measures: in Espiñeira and Nauges (2004), for example, a one-hour restriction of water supply per day has an impact on water consumption equivalent to that of a 9 percent increase in the price of water; in Renwick et al. (1998), restrictive policies perform better than pricing policies for reductions in water use above 15 percent. While, on the benefit side, there may be valid arguments for supporting either pricing or restrictive measures, it is not clear that the two types of policies compare in terms of welfare loss. In Woo (1994), in fact, which is the only study to date that attempts to derive the welfare implications of various policies, the welfare loss, which is computed as the additional income necessary to restore an individual's level of satisfaction to its pre-policy level, is computed to be, in the presence of restrictive water supply policies, approximately 900 times larger than that under pricing policies. With such a large welfare loss gap, restrictive policies may not be reasonable substitutes of pricing instruments, although they may be opted for in conjunction with pricing instruments to alleviate the potential side-effects of higher water prices or when immediate water use reductions are sought as, based on findings in a couple of studies (Dandy et al., 1997; Nauges and Thomas, 2003), it takes households time to adjust their consumption decisions in response to price changes (long-run own-price elasticity tends to be larger, in absolute terms, that its short-run counterpart).

Of other non-pricing policies considered in the literature, low flow showerheads and low flow toilets can have a substantial impact on water use; the adoption of one of each of the two systems translates, in Renwick and Archibald (1998), into a water use reduction of 8 percent and 10 percent, respectively, thus suggesting that free distribution of water-saving technologies or programs that provide rebates to households investing in water-saving technologies can be quite effective. Furthermore, as owning lawns increases residential water consumption (Nieswiadomy and Molina, 1989; Dandy et al., 1997; Renwick et al., 1998; Domene and Sauri, 2005), landscape irrigation restriction policies can have significant effects on water demand in low-density areas where households tend to have bigger landscaped areas (Renwick et al., 1998; Renwick and Archibald, 1998). The type of landscape can also affect households' water consumption (Domene and Sauri, 2005; Hurd, 2006): the "Atlantic garden," planted with turf grass, is, for example, more water-demanding than other landscaping techniques and city planners can rely upon public campaigns to ensure that households are made fully aware of the negative effects of turf grass landscape (in Hurd, 2006, a 10 percent increase in awareness is found to lead to a substantial increase in the likelihood of adopting landscape types with less turf grass).

3.3. Theoretical Model

The following is a standard utility maximization model that was developed for this analysis. Let c denote a representative household's environment-related consumption level in support of which the household engages in $\mathbf{e}$, a vector of n environmental activities. These environment-related activities (e.g., producing garbage, using water, driving, and using electricity) can be thought of as inputs in the consumption process in the presence of diminishing marginal productivities, that is, $c_i(\mathbf{e}) > 0$ and $c_{ii}(\mathbf{e}) < 0$, for $i = 1, \dots, n$, where the former denotes the marginal product of e_i and the latter the derivative of the marginal product of e_i. The household is endowed with T amount of resources which it derives utility from directly but must also invest on the inputs according to $r_i(e_i; a_i)$, for $i = 1, \dots, n$, where a_i is a policy parameter. More specifically, I assume that $r_i(e_i; a_i)$ is a positive and convex function of e_i and a positive and concave function of a_i, that is, environmental activities require resources at an increasing rate and policies increase the resource requirements but at a decreasing rate. These environmental activities contribute to deteriorating environmental quality, E, at an increasing rate, that is, E is convex and decreasing in $\mathbf{e}$. As utility depends positively on both consumption and environmental quality, the marginal utility effect of $\mathbf{e}$ has a positive component through c and a negative component through E, but I assume the former to dominate. However, the extent of dominance depends on environmental attitudes, m, with the utility benefit from environmental quality increasing in environmental consciousness. More specifically, the magnitude of the utility benefit from environmental quality the household derives from the environment depends on its environmental attitudes: the more environmentally conscious the household is, the greater the utility from environmental quality is. Hence, I introduce $\gamma(m)$, which is increasing in m at a non-increasing rate, to scale the utility and marginal utility of environmental quality up or down according to the intensity of the environmental attitudes.

Given the above, and assuming that the utility function is additively separable in its arguments, the household's maximizing problem can be expressed as:

$$\max_{<\mathbf{e}>} U\big(c(\mathbf{e}), t, E(\mathbf{e})\big) \equiv V_c\big(c(\mathbf{e})\big) + V_t(t) + \gamma(m) V_E\big(E(\mathbf{e})\big) \qquad (1)$$

subject to:

$$T = t + \sum_{i=1}^{n} r_i(e_i; a_i), \qquad (2)$$

where t is the amount of resources earmarked for direct enjoyment, which can be referred to as leisure out of convenience, and $T - t$ is allotted to the environmental activities in support of consumption. Substituting for t from (2) into (1) and choosing the levels of the n environmental activities to maximize $U(\cdot)$, I obtain the utility-maximizing conditions as:

$$V_c' \frac{\partial c}{\partial e_i} = V_t' \frac{\partial r_i}{\partial e_i} - \gamma(m) V_E' \frac{\partial E}{\partial e_i} \qquad \text{for } i = 1, \dots, n, \qquad (3)$$

which says that the household invests in each environmental activity up to the point where the marginal utility from the incremental consumption is equal to the sum of the marginal disutility from the reduction in leisure and the marginal disutility from the additional environmental deterioration.

Through a comparative static analysis, I can easily establish that the solution to the utility-maximizing conditions, namely, $e_i(T, a_1, a_1, \dots, a_n, m)$, is an increasing function of T and a decreasing function of a_i for each i and of m. For illustrative purposes, we consider the case when $n = 2$; I can then express the marginal effects of interest on e_1 as:

$$\frac{de_1}{dT} = \frac{\begin{vmatrix} d_{1T} & d_{1e_2} \\ d_{2T} & d_{2e_2} \end{vmatrix}}{|H|} > 0, \qquad (4)$$

$$\frac{de_1}{da_1} = \frac{\begin{vmatrix} d_{1a_1} & d_{1e_2} \\ d_{2a_1} & d_{2e_2} \end{vmatrix}}{|H|} < 0, \qquad (5)$$

$$\frac{de_1}{dm} = \frac{\begin{vmatrix} d_{1m} & d_{1e_2} \\ d_{2m} & d_{2e_2} \end{vmatrix}}{|H|} < 0, \tag{6}$$

and

$$\frac{de_1}{da_2} = \frac{\begin{vmatrix} d_{1a_2} & d_{1e_2} \\ d_{2a_2} & d_{2e_2} \end{vmatrix}}{|H|} < 0, \tag{7}$$

where H the Hessian which is negative semi-definite, given a well-behaved utility function (concave in e_1 and e_2) which ensures satisfaction of the second-order conditions of the utility maximization problem. The elements of the numerators' matrices can be found in Appendix C.

3.4. Empirical Framework

As mentioned, this analysis makes use of the flexible Conditional Mixed Process (CMP) framework. This system of equations is essentially that of the Seemingly Unrelated Regressions (SUR) framework – where equations are modelled allowing for linkages in their error processes, yielding more efficient results than a single-equation OLS model would – with the addition of the options for mixed models, as well as variability in observations and variables across equations, among others (Roodman, 2010).

The following system of equations can be estimated using this framework (Roodman, 2010):

$$\underset{1\times J}{\mathbf{y}^{*\prime}} = \underset{1\times J}{\boldsymbol{\theta}'} + \underset{1\times J}{\boldsymbol{\varepsilon}'}$$
$$\underset{1\times J}{\boldsymbol{\theta}'} = \underset{1\times K}{\mathbf{x}'}\ \underset{K\times J}{\mathbf{B}}$$
$$\mathbf{y} = \mathbf{g}(\mathbf{y}^*) = \{g_1(\mathbf{y}^*), \ldots, g_J(\mathbf{y}^*)\}'$$

$$\mathbf{y}^{*\prime} = \begin{bmatrix} organic\ food_{it} \\ transportation_{it} \\ water\ behaviour_{it} \\ water\ investment_{it} \\ waste\ disposal_{it} \\ recycling_{it} \\ energy\ behaviour_{it} \\ energy\ investment_{it} \end{bmatrix}$$

and

$$\mathbf{x}' = \begin{bmatrix} environmental\ attitudes_{it} \\ policy_{it} \\ country_{it} \\ education_{it} \\ etc. \end{bmatrix}$$

where *i* and *t* denote individuals and time, respectively. The details of the variables in each vector above are discussed in the following sub-sections.

3.4.1. Data

The data used for the empirical analyses were the 2008 and 2011 cycles of the Survey on Household Environmental Behaviour and Attitudes, conducted by the Organization for Economic Cooperation and Development (OECD). These surveys were completed by online questionnaires in ten and eleven OECD member countries, respectively. The 2008 wave included: Australia, Canada, Czech Republic, France, Italy, Korea, Mexico, Norway, Netherlands, and Sweden; while the 2011 wave included: Australia, Canada, Chile, France, Israel, Japan, Korea, Netherlands, Spain, Sweden, and Switzerland. Each wave has more than 10,000 respondents, with approximately 1,000 households from each country. The sample was stratified in each country by several parameters to help ensure representativeness. I pooled the 2008 and 2011 waves together for this analysis. The empirical analysis addresses the potential concern of some countries having two observations, while others only have one.

3.4.2. Variables

3.4.2.1. Dependent Variables

As previously mentioned, I employed the CMP model to conduct the main analysis. I do not believe that the areas examined are independent of each other, and this framework allowed me to control for correlated errors across the environmental activities. The model consists of eight dependent variables, each of which is an environmentally related activity, specifically: the percentage of food purchased that was organic; the usual mode of transportation; an index for water consumption behavior; an index for investments related to water conservation; average recycling intensity; the number of bags of waste for collection; an index for energy consumption behavior; and an index for investments related to energy conservation.

The dependent variable measuring percentage of organic food refers specifically to fruits and vegetables. I could not include other types of food, as the 2011 wave of data only included this category. This variable consists of seven categories, which refer to the percentage (categorical range) of fruits and vegetables purchased that were organic.

The usual mode of transportation could consist of driving (a car or motorcycle), walking, biking, or taking public transportation. However, I collapsed this into a binary variable, since I consider the latter three options to be more environmentally friendly decisions, and the former option not to be. Therefore, the binary dependent variable measures if individuals chose an environmentally friendly mode of transportation, with this option being the reference category.

The index for water consumption behaviour was created from the following five questions, which were asked in the context of how frequently (always, often, occasionally, or never) the respondent partook in the behaviour (on a daily basis): turned off water while brushing teeth; took a shower instead of a bath specifically to save water; watered their garden in the coolest part of the day to reduce evaporation and save water; or collected rain water (e.g. in water tanks) or recycled waste water. Responses were coded from 4 to 1 (higher being better), then divided by 4.

The index for investments related to water conservation was created from the following four questions, which were asked in the context of whether the household or respondent had made investments (yes, no, already equipped, or not possible) in the past ten years for: water efficient washing machines; low volume or dual flush toilets; water flow restrictor taps/low flow shower head; or water tank to collect rain water. 'Already equipped' and 'not possible' were coded as 0, 'yes' was coded as 1, and 'no' was coded as -1. These were then summed a divided by 5.

The variable for average recycling intensity is an index that measures the percentage of recycled materials, if recycling for a given material is available to the household, across five types of recycling: glass bottles/containers, aluminum/tin/steel, paper/cardboard, plastic bottles/containers, and food or garden waste.

The variable for waste is a numerical value for the number of bags of waste the household puts out for collection in a standard week. Respondents were also asked to identify the size of the bag of waste, so that bags per week could be standardized.

The index for energy consumption behaviour was created from the following five questions, which were asked in the context of how frequently (always, often, occasionally, or never) the respondent partook in the behaviour on a daily basis: turned off lights when leaving a room; cut down on heating/air conditioning to limit energy consumption; waited until they had full loads when using washing machine or dishwasher; switched off standby mode of appliances/electronic devices. Responses were coded from 4 to 1 (higher being better), then divided by 5.

The index for investments related to energy conservation was created from the following four questions, which were asked in the context of whether the household or respondent had made investments (yes, no, already equipped, or not possible) in the past ten years for: energy-efficient-rated appliances (e.g. top rated washing machines, refrigerator); low-energy light bulbs (compact fluorescent); thermal insulation (e.g. walls/roof insulation, double-glazing); or renewable energy (e.g. install solar panels, wind turbines). 'Already equipped' and 'not possible' were coded as 0, 'yes' was coded as 1, and 'no' was coded as -1. These were then summed a divided by 4.

3.4.2.2. Independent Variables

The primary independent variable of interest in each regression was environmental attitudes. Attitudes were measured as an index ranging from -2 to 2. The index was coded this way to allow for a neutral response to be coded as 0 (thus not affecting the index, but not sitting at the lowest value of the index either). Respondents were asked to what extent they agreed (strongly agreed, agreed, disagreed, strongly disagreed, or no opinion) with several statements related to the environment. For example, one of the statements was "Environmental issues should be dealt with primarily by future generations". If respondents 'strongly agreed' with this statement, their response would have been coded as a -2, or the lowest end of the environmental attitudes scale. The four questions used for this index can be found in Table 3.1 in Appendix C.

For each regression in the CMP set up, the following set of control variables were included: age, education, income, gender, labour force status, marital status, urban/rural dwelling, home ownership, civic participation (voted in the past; member of an organization), and dwelling type. Age is a continuous variable, while the rest are categorical. Income is split into ten categories, which are different for each country (and year), to adjust for country-income levels and inflation. Education is split into four categories, which are high school or less, some post-secondary, bachelor's degree (or equivalent), and post-graduate degree.

I also included policy variables in each regression. Given that I wanted to examine the effect of different policies on each environmental activity, I included policy variables for all five areas of interest in each equation. The policy variables available looked at whether (and how) a household was charged for: water (charged by metering, not charged or flat fee); energy (charged by metering, not charged or flat fee); waste (not charged, flat fee, user-fee, frequency based charge, charge based on household size, or other); and recycling (collection type: door-to-door, drop-off, refundable deposit, non-refundable deposit).

Additional controls were added to the regressions for organic food consumption and mode of transportation; specifically, a health concern index variable (for the organic food regression) and the number of cars and commute time (for the mode of transportation regression).

3.5. Results

3.5.1. Individual and Household Characteristics

The results from the CMP regressions, which are presented in tables 3.2 to 3.6.2 in Appendix C, showed that, in general, more environmentally friendly behaviours were exhibited by those who are women, married, older, living in rural areas, more educated, and employed. The effect of income varied by dependent variable, but was often not statistically significant. However, the effect of income (whether or not it was significant) generally moved in the expected direction as predicted by past literature and the theoretical model; as income increased non-environmental activities (such as less water conservation) tended to increase as well. A notable exception was that investments made for energy efficient appliances tended to increase with higher income. This is not surprising, as this type of environmental activity hinges on one's ability to purchase (often) expensive appliances. However, this effect did not persist with investments in water efficient appliances. In this case, the effect that income had on investments did not move consistently through income groups, and its effects were not statistically significant. This discrepancy was likely due to the higher costs associated with investments for energy efficiency, which would therefore be more closely tied to income, than those for water efficiency. For example, some of the options for energy efficient investments are: a refrigerator, thermal insulation, hot water tanks, and solar panels or wind turbines. Whereas, some examples of water efficient investments are: low flow shower head, water tank for rain water, and dual flush toilets. Though the investment for water efficiency are not monetarily negligible, they are more affordable as compared to investments for energy efficiency, and are therefore less tied to income.

3.5.2. Attitudinal Factors and Policy Variables

The main objective of this paper is to determine the effect that environmental attitudes have on environmental activities. However, an arguably equally important exercise, is to compare the relative

effects of attitudes and policies on environmental activities. This comparison is what could help guide future policy; if it can be shown that activities are more influenced by one's own attitudes, than by national/regional/municipal policies, then a closer examination of the factors affecting attitudes, and how they can fit into policy development, should be considered. Unfortunately, this is a difficult comparison to make. Attitudes are represented by an index in the model, and treated as a continuous variable, while the majority of the policy variables are categorical (e.g. whether or not a household is charged for electricity). Thus, a direct comparison between how each of these variables effects behaviours is difficult. However, simply knowing whether either, or both, attitudes and policies have a relationship with environmental activities is a big step towards determining the most appropriate environmental policies. Even though the direction of causation is not determined by this analysis, I believe it is unlikely that environmental activities, for example conserving water, would cause pro-environmental attitudes. Further, I treated environmental attitudes as exogenous in this model, meaning that they are not chosen by individuals on a temporal basis. Given both of these arguments, I are confident that if a causal relationship exists between attitudes and activities, it would be that attitudes are causing an individual to adjust their activities, and not the reverse. Additionally, a benefit of the CMP framework is that it controls for correlated errors across regressions. Thus, if there is an unobservable factor driving environmental decisions, this framework will help mitigate that effect.

The CMP results showed that both attitudes and policies (which are generally monetary in nature) play an important role in an individual's decisions regarding environmental activities. The details of these results are presented in the tables found in Appendix C. The only activity for which attitudes were statistically insignificant was the water behaviour index. The other seven regressions all showed that attitudes and environmental activities have statistically significant relationships, and in the expected direction (e.g. the more pro-environmental an individual claimed to be, the more they tended to recycle and the less waste they tended to generate, for example). Some of the strongest results (in terms of magnitude of the coefficient and statistical significance) were seen with recycling/waste, taking environmentally friendly modes of transportation, and organic food consumption.

When comparing the effect on behaviours from environmental attitudes and a given policy (e.g. behaviour: energy consumption; policy: metered for energy usage), it was often the case that only environmental attitudes were statistically significant, or at least showed greater statistical significance than the policy. For instance, both of the energy regressions (energy behaviour index and energy investment index) presented a

strong relationship between the dependent variables and environmental attitudes, but the policy variable was not statistically significant for the behaviour index, and only significant at the five percent level for the investment index. The same was true for the number of bags of waste; stronger environmental attitudes were correlated with generating fewer bags of waste, but how individuals were charged for waste did not seem to impact the number of bags they generated. Some of the policy variables were significant, namely those for water charges and whether households had door-to-door pick up for recycling (as opposed to drop-off facility, or returning recycling to the manufacturer), but in most cases environmental attitudes were also significant (with the exception of water behaviour index as the dependent variable). In addition to including an environmental behaviour's 'own' policy (e.g. behaviour: energy consumption; 'own' policy: metered for energy usage) in each regression, I also included all policy variables. As shown in the theoretical model, other policy variables may also have an impact on a given environmental activity. Specifically, equation (7) shows that another behaviour's policy variable can still be effective in decreasing non-environmental activities. This may occur because being charged for each bag of waste, for example, may help an individual realize the impact of, not only creating too much waste, but also wasting electricity or water. As the theoretical model predicted, this was seen in a few of the regressions. For example, the method by which households are charged for waste is statistically significant in the regression for water consumption behaviour. Another example is that metering (or not) for water usage was correlated to energy consumption.

Even after controlling for 'own' and other policy variables, the results showed that environmental attitudes seemed to be at least as important, if not more so, in shaping environmental behaviour than monetary policies were. For example, if people are more likely to curb their energy consumption because they are aware of, and care about, its environmental impacts – as opposed to curbing their consumption because they are charged for it – policy makers may consider trying to shape attitudes instead of (or in addition to) trying to control consumption by monetary policies alone. If this strategy is to be considered, it is then important to know what affects (or at least correlates to) an individual's environmental attitudes.

I ran a simple linear regression with environmental attitudes as the dependent variable to see which factors are correlated to these attitudes. The results of this regression are presented in Table 3.7, found in Appendix C. The results showed that women, those with higher levels of education, and those who had voted (for any party/candidate) in a recent election (for any level of government) tended to have stronger pro-environmental attitudes. The country in which an individual resided also played a strong role in attitudes, with Chili reporting the highest average attitudes, and Italy the lowest. Interestingly, policy variables were

also correlated with one's attitude towards the environment. This result shows that the effect of a policy on behaviour may actually be driven by changing one's attitude as opposed to, or at least in addition to, the financial concerns alone. For instance, those who had a frequency fee for their waste collection tended to have higher environmental attitudes. This could be because a per unit fee brought awareness of the perils that excess garbage has on the environment, shaping attitudes, and thus affecting behaviour. Therefore, financially driven policies may actually have more beneficial and long-term effects than has been previously realized. Analyses beyond the scope of this chapter would need to be conducted to further explore this relationship.

Of the other significant factors affecting attitudes, education may be the strongest candidate when considering the potential for policy interventions. If a government wanted to pursue the idea of increasing environmental activities by increasing environmental attitudes, the means to which these attitudes could be shifted may be through higher levels of education. As previously alluded to, this simple linear regression does not determine the direction, nor prove the existence, of causation. It could be the case that those with more pro-environmental attitudes would be enticed to get a higher education to learn more about the environment or other related subjects. It could also be the case that an unobserved factor, such as preferences, causes individuals to seek a higher education and to be more pro-environmental. If this is the case, it is unlikely that lowering tuition costs, for example, in order to increase education, thereby increasing environmental attitudes and shaping environmental behaviours, would be an effective policy. However, simply knowing the demographics of those that already have pro-environmental attitudes, allows a policy to target those for whom attitudes could be improved, and provides a basis for future work.

3.5.3. Model Considerations

Several model considerations and robustness checks were taken into account in the empirical analyses. I wanted to test if environmental attitudes affected environmental behaviours differently by factors such as country, income group, urban or rural setting, education level, or year of the survey. To do so, I created interaction terms with each of these factors and environmental attitudes to test whether any of them were significant (performed individually). Overwhelmingly, the results of these interaction terms were not statistically significant. This means that, even if attitudes varied across countries, for example, the affect that these attitudes had on behaviours, were robust.

I also considered stratifying the sample by country (or countries), based on mean levels of attitudes. The models with interaction terms of countries and attitudes have the benefit of being able to provide a test of significance between the parameter estimates, which would be lost when stratifying. However, given the large number of countries, and potential for different distributions in attitudes between countries, the stratified models may be better able to capture different relationships between attitudes and behaviours. Further, the model with all countries included restricts the other parameters and intercepts in the model to be fixed/equal for all countries when interpreting the interaction terms, whereas running the model for countries separately allows these to differ. Therefore, I ran the model for each country, and found that the relationship between attitudes and behaviours was not homogenous between countries. The countries with the highest (Chili) and lowest (Italy) average attitudes did not have a consistently significant relationship between attitudes and the dependent variables; the relationship was mildly significant for one or two behaviours, but overwhelmingly, a significant relationship did not exist. The countries that were in the middle of the distribution for attitudes exhibited the strongest relationships between attitudes and behaviours. A possible explanation for this is that these countries tended to have a wider distribution for attitudes; with greater variation in attitudes, it would be easier for a model to pick up the effect of an increase in attitudes on behaviours. However, if the distribution of attitudes was narrower and/or significantly skewed to the right or left (as was seen with Italy and Chili, respectively), this lack of variation in attitudes would make it harder for a model to capture this relationship.

I also examined the possibility that environmental attitudes do not have a linear relationship with behaviours. In order to include a square term for attitudes, I converted the attitude index into positive integers. Recall that the attitude index could range from -2 to 2, since I wanted to code "no opinion" responses in the middle of the distribution, and as zeros. However, these values would pose a problem when squared, since -2 and 2 would give the same squared term, thereby treating people at opposite ends of the distribution the same. Four of the eight models had statistically significant coefficients for the squared term, all of which produced convex functions for environmental attitudes with the given behaviour. However, two of these were actually parabolas, meaning that, initially, increasing attitudes actually decreased the likelihood of "good" environmental behaviours. This is a curious finding, and it is not entirely clear why this would be the case. However, this finding might help explain why attitudes with a right skewed distribution did not produce results consistent with those for attitudes with more normal distributions.

In order to adjust for some countries having two years of observations, while others only had one, I weighted the double entries by half. This created approximately equal observations for each country in the sample when the weights were applied. I also re-ran the models only on countries that were in the survey in both waves. These specifications produced very similar results.

Finally, to account for the potential of within country correlation or heteroscedasticity, the errors were clustered at the country level. Although fixed country effects were also included in the models, these would only account for within country, time-invariant heterogeneity.

3.6. Concluding Remarks

The CMP framework allowed for the environmental-related behaviours to be correlated through their unobservables, providing an opportunity to study these behaviours in a more comprehensive way than what was conducted in the past. The results overwhelmingly showed that environmental attitudes have a strong relationship with related behaviours: the more an individual reported caring about the environment, the more action they took to preserve it. This may seem like an obvious and intuitive result, but environmental policies and prior literature have primarily focused on financially driven measures, as was detailed in the literature review section. The results from this analysis also reiterated that financially driven policies are an effective tool, however, it should now be clear that they may not be the only affective measures. The effects of financial policies may also affect behaviour both directly and indirectly by shaping one's attitudes. The results from the simple regression of environmental attitudes showed that, in addition to policy variables, parameters such as education and civic engagement are important determinants of attitudes.

Determining the best course of action for combating environmental degradation is a very timely concern. Governments at all levels should be evaluating the most effective course of action to modifying environmental-related behaviours, in order to ensure the sustainable and responsible practices of its citizens. This analysis has shown that environmental attitudes are a significant predictor of behaviours, which should be considered when policies are formed.

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Appendix A: Chapter 1

Figure 1.1: CPP Applications and Rejection Rates

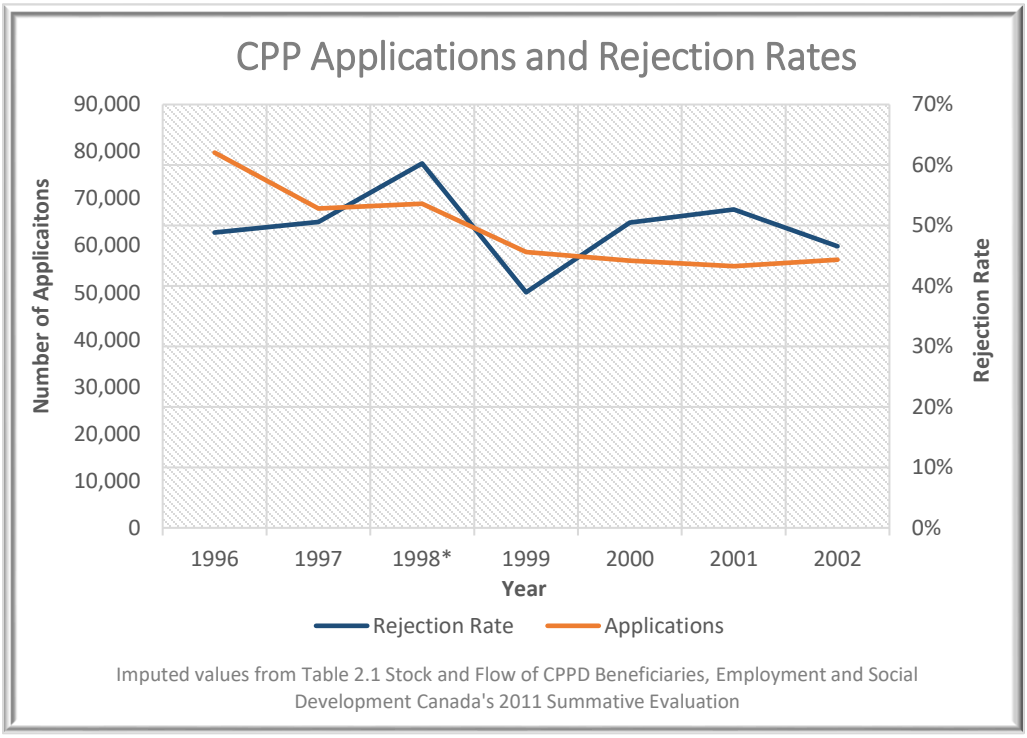


Figure 1.2: Women's Participation Rate by Province

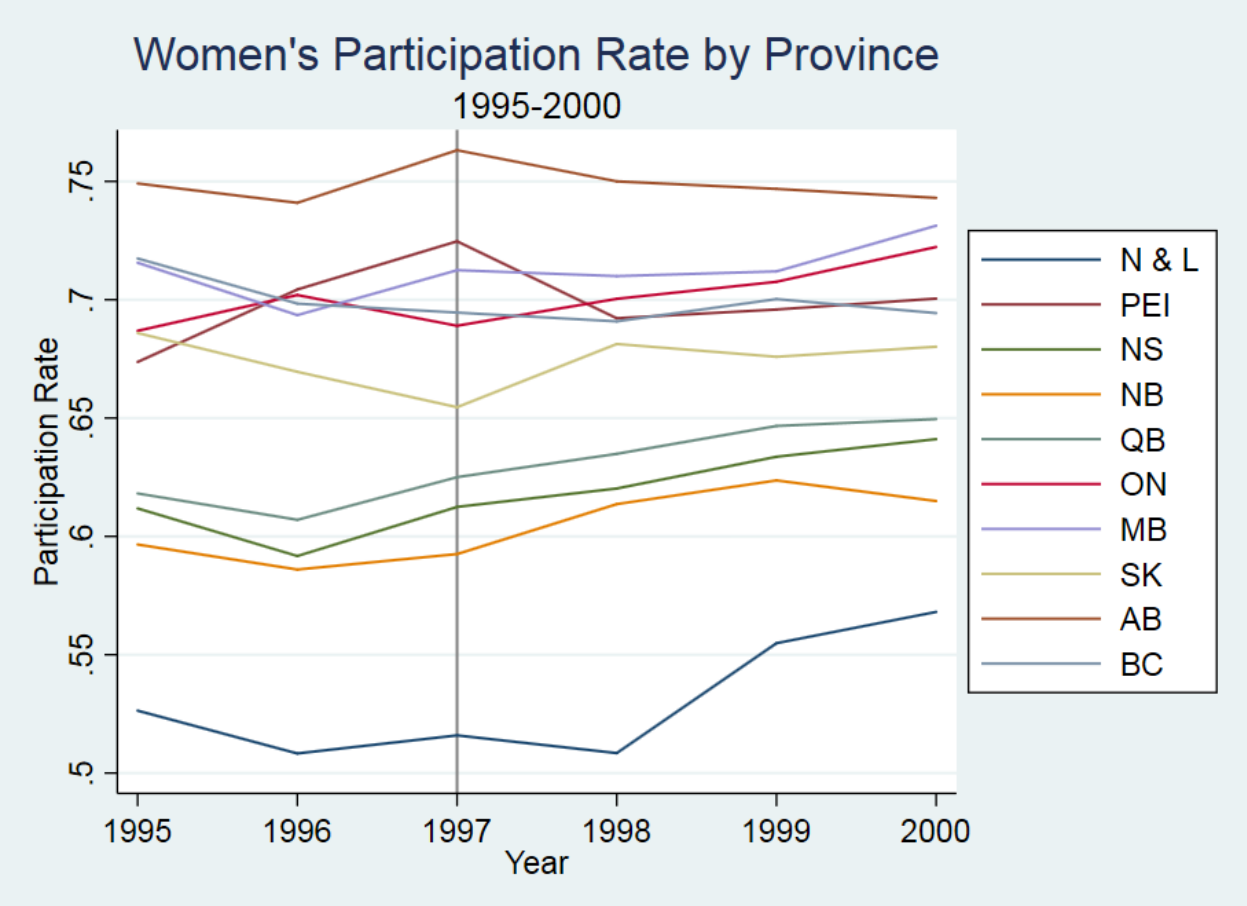
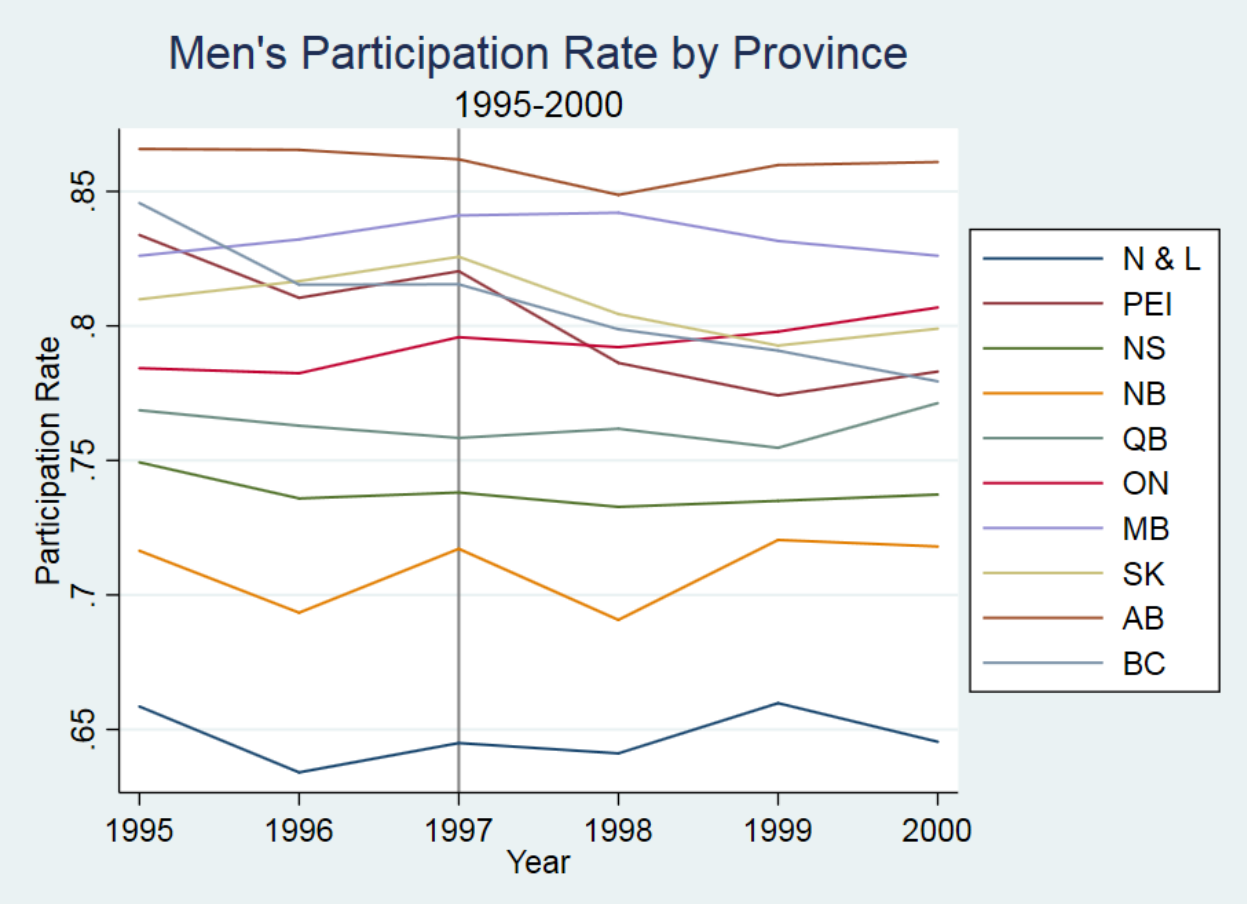


Figure 1.3: Men's Participation Rate by Province



Proofs for Theoretical Model

$\Delta = \{\alpha(H,\phi) \cdot U(T_P,h) + [(1-\alpha)(H,\phi)] \cdot U(T_{NP},h)\} - U(wX, h-X) - \varepsilon > 0$

1. $\frac{\partial \Delta}{\partial \phi} = \frac{\partial \alpha}{\partial \phi} \cdot U(T_p,h) - \frac{\partial \alpha}{\partial \phi} \cdot U(T_{NP},h)$

If the utility of receiving transfer payments is greater than the utility of not receiving transfer payments (i.e. $U(T_p,h) > U(T_{NP},h)$), given that an individual has left the labour force, then:

$\frac{\partial \Delta}{\partial \phi} > 0$

2. $\frac{\partial \Delta}{\partial H} = \frac{\partial \alpha}{\partial H} \cdot U(T_P,h) - \frac{\partial \alpha}{\partial H} \cdot U(T_{NP})$

The same rationale from 1. (above) holds, meaning that:

$\frac{\partial \Delta}{\partial H} > 0$

3. $\frac{\partial \Delta}{\partial T_P} = \alpha(H,\phi) \cdot \frac{\partial U}{\partial T_P}$

Assuming that transfer payments have a non-negative impact on utility:

$\frac{\partial \Delta}{\partial T_P} > 0$

4. $\frac{\partial \Delta}{\partial w} = -\frac{\partial U}{\partial w} < 0$

Models with all Control Variables Displayed

Table 1.1a: Labour Force Participation

	(1)	(2)	(3)
CPP * After	**1.010****	**1.029****	**0.900**
	(3.08)	**(3.17)**	**(-1.60)**
Married/Common Law	-	-	-
	-	-	-
Widowed/Separated/Divorced	1.099***	1.086*	1.541***
	(3.33)	(2.36)	(6.91)
Single	0.987	0.995	3.395***
	(-1.23)	(-0.39)	(39.02)
Age	1.132***	1.130***	1.037
	(23.28)	(15.93)	(1.84)
Age*Age	0.998***	0.998***	0.999***
	(-61.55)	(-26.43)	(-5.54)
Year: 1995	-	-	-
	-	-	-
Year: 1996	0.934***	0.928***	0.963
	(-21.20)	(-8.54)	(-0.73)
Year: 1997	1.057*	1.029	0.963
	(2.37)	(0.77)	(-0.54)
Year: 1998	1.026	0.998	1.014
	(1.23)	(-0.04)	(0.31)
Year: 1999	1.057**	1.049*	0.979
	(3.26)	(2.15)	(-0.68)
Year: 2000	1.162***	1.193***	1.739**
	(6.25)	(3.75)	(3.02)
Nova Scotia	-	1.148***	
	-	(37.37)	

Quebec	1.258***	1.458***	2.420***
	(15.92)	(28.28)	(16.84)
Newfoundland & Labrador		-	-
		-	-
New Brunswick		1.245***	
		(16.82)	
Ontario			2.935***
			(39.90)
Alberta			4.294***
			(54.56)
British Columbia			2.763***
			(35.09)
March	-	-	-
	-	-	-
September	1.013	1.055	1.172***
	(0.62)	(1.04)	(4.54)
Education: grade 8 or less	-	-	-
	-	-	-
Education: grade 9-10	1.418***	1.457***	1.675***
	(180.75)	(11.52)	(8.66)
Education: grade 11-13	1.700***	1.746***	2.017***
	(9.68)	(9.35)	(5.78)
Education: high school grad	2.837***	2.896***	3.547***
	(30.85)	(25.25)	(8.01)
Education: some post-secondary	3.185***	3.339***	3.418***
	(24.12)	(16.14)	(6.26)
Education: certificate or diploma	3.661***	3.918***	4.803***
	(18.22)	(12.64)	(8.88)

Education: community college	6.325***	6.497***	6.082***
	(68.29)	(60.79)	(7.02)
Education: university below bachelors	4.468***	4.446***	3.884***
	(14.90)	(21.25)	(4.91)
Education: bachelor's degree	7.872***	8.299***	7.755***
	(165.85)	(33.43)	(9.16)
Education: above bachelor's degree	9.080***	9.213***	8.178***
	(39.88)	(44.03)	(7.89)
Rural	-	-	-
	-	-	-
Urban	1.256***	1.299***	1.177
	(8.74)	(7.78)	(1.74)
Remote	1.439***	1.494***	0.846
	(19.01)	(11.26)	(-0.62)
Household size: 1	-	-	-
	-	-	-
Household size: 2	0.945*	0.931**	1.023
	(-2.36)	(-2.85)	(0.25)
Household size: 3+	0.514***	0.530***	0.944
	(-315.02)	(-17.03)	(-0.57)
Dwelling owned: no mortgage	-	-	-
	-	-	-
Dwelling owned: with mortgage	0.610***	0.611***	0.649***
	(-74.51)	(-61.28)	(-5.58)
Dwelling rented	0.544***	0.529***	0.486**
	(-16.84)	(-11.71)	(-3.23)
N	46450	69500	85050

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women, treatment group: NS; (2): Women, treatment group: NS, NL, NB; (3): Men, treatment group: NL, ON, AB, BC.

Table 1.2a: Employed

	(1)	(2)	(3)
CPP * After	**0.994***	**0.972**	**0.827**
	(-2.06)	**(-1.68)**	**(-1.89)**
Married/Common Law	-	-	-
	-	-	-
Widowed/Separated/Divorced	1.045	1.029	1.180*
	(0.80)	(0.54)	(2.48)
Single	1.226***	1.225***	2.746***
	(79.46)	(15.81)	(30.71)
Age	1.141***	1.139***	1.068***
	(21.60)	(17.88)	(3.53)
Age*Age	0.998***	0.998***	0.999***
	(-36.55)	(-25.36)	(-5.85)
Year: 1995	-	-	-
	-	-	-
Year: 1996	0.942***	0.944***	0.994
	(-6.92)	(-5.54)	(-0.26)
Year: 1997	1.081**	1.049	1.057
	(3.06)	(1.09)	(1.43)
Year: 1998	1.067***	1.050*	1.240***
	(5.15)	(2.12)	(10.17)
Year: 1999	1.174***	1.161***	1.276***
	(7.34)	(5.31)	(8.79)
Year: 2000	1.407***	1.431***	2.424***
	(95.56)	(14.74)	(9.65)
Nova Scotia	-	1.392***	
	-	(92.92)	

Quebec	1.218***	1.672***	2.413***
	(22.74)	(44.72)	(15.32)
Newfoundland & Labrador		-	-
		-	-
New Brunswick		1.459***	
		(26.45)	
Ontario			3.581***
			(64.39)
Alberta			5.332***
			(75.01)
British Columbia			3.211***
			(43.42)
March	-	-	-
	-	-	-
September	1.074***	1.102**	1.371***
	(3.47)	(2.68)	(7.90)
Education: grade 8 or less	-	-	-
	-	-	-
Education: grade 9-10	1.341***	1.410***	1.437***
	(102.44)	(5.89)	(10.01)
Education: grade 11-13	1.582***	1.643***	1.721***
	(7.96)	(6.76)	(9.95)
Education: high school grad	2.787***	2.857***	2.938***
	(28.62)	(21.05)	(11.08)
Education: some post-secondary	2.974***	3.122***	2.818***
	(23.58)	(14.98)	(8.21)
Education: certificate or diploma	3.198***	3.476***	3.452***
	(16.66)	(10.12)	(10.33)
Education: community college	5.595***	5.809***	5.145***

	(67.87)	(45.01)	(21.40)
Education: university below bachelors	4.012***	4.192***	3.710***
	(14.28)	(13.80)	(7.75)
Education: bachelor's degree	6.594***	7.068***	6.545***
	(71.74)	(22.33)	(17.58)
Education: above bachelor's degree	7.672***	7.894***	7.385***
	(41.52)	(34.59)	(13.30)
Rural	-	-	-
	-	-	-
Urban	1.314***	1.383***	1.176*
	(10.23)	(6.37)	(2.24)
Remote	1.405***	1.432***	0.968
	(19.52)	(20.32)	(-0.15)
Household size: 1	-	-	-
	-	-	-
Household size: 2	0.866**	0.851**	0.923**
	(-2.79)	(-3.27)	(-3.07)
Household size: 3+	0.511***	0.520***	0.798***
	(-19.42)	(-25.74)	(-9.47)
Dwelling owned: no mortgage	-	-	-
	-	-	-
Dwelling owned: with mortgage	0.556***	0.557***	0.603***
	(-44.06)	(-38.85)	(-9.08)
Dwelling rented	0.479***	0.471***	0.464***
	(-108.05)	(-26.12)	(-6.05)
N	46450	69500	85050

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women, treatment group: NS; (2): Women, treatment group: NS, NL, NB; (3): Men, treatment group: NL, ON, AB, BC.

Table 1.3a: Out of Labour Force due to Own Illness or Disability

	(1)	(2)	(3)	(4)	(5)
Before	**1.1577*** **	**.9824**	**.9891**	**1.1456**	**1.0236**
	(4.92)	**(-0.31)**	**(-0.06)**	**(1.17)**	**(0.31)**
Married/Common Law	-	-	-	-	-
	-	-	-	-	-
Widowed/Separated/Divorced	1.3236***	1.2221*	1.2368	1.4054**	1.2370
	(3.53)	(2.39)	(0.75)	(3.21)	(1.68)
Single	.9359	.6294***	.9733	1.2262	.6381***
	(-0.98)	(-9.78)	(-0.12)	(1.21)	(-4.58)
Age	.9894	.9758	.9141	.9236***	.9913
	(-0.74)	(-1.32)	(-1.49)	(-7.95)	(-0.36)
Age*Age	1.0002	1.0005**	1.0012	1.001***	1.0004
	(1.74)	(2.81)	(1.59)	(9.18)	(1.39)
Nova Scotia	2.065***	1.729***		1.985***	
	(88.39)	(70.79)		(57.06)	
Newfoundland & Labrador	-	-		-	-
	-	-		-	-
Prince Edward Island	1.700***	1.339***			
	(31.63)	(13.94)			
New Brunswick	2.586***	1.527***		2.376***	
	(73.19)	(62.15)		(172.23)	
Ontario	1.364***	1.370***			1.156
	(25.07)	(9.09)			(0.96)
Manitoba	1.623***	1.424***			
	(33.83)	(17.33)			
Saskatchewan	1.518***	1.498***			
	(21.43)	(83.21)			

Alberta	1.806***	1.542***			1.362
	(27.1)	(21.13)			(1.88)
British Columbia	1.933***	1.419***			1.209
	(30.63)	(13.68)			(1.16)
March	-	-	-	-	-
	-	-	-	-	-
September	0.994	1.103	0.97	1.058	1.026
	(-0.23)	(1.02)	(-0.19)	(1.01)	(0.36)
Education: grade 8 or less	-	-	-	-	-
	-	-	-	-	-
Education: grade 9-10	0.909	0.871			
	(-0.80)	(-1.62)			
Education: grade 11-13	0.688**	0.807			
	(-2.78)	(-1.41)			
Education: high school grad	0.499***	0.552***			
	(-7.39)	(-4.24)			
Education: some post-secondary	0.583***	0.548***			
	(-6.63)	(-4.86)			
Education: certificate or diploma	0.666***	0.567***			
	(-6.25)	(-5.03)			
Education: community college	0.521***	0.367***			
	(-9.82)	(-16.43)			
Education: university below bachelors	0.454**	0.435***			
	(-3.08)	(-3.82)			
Education: bachelor's degree	0.319***	0.252***			
	(-13.71)	(-12.20)			
Education: above bachelor's degree	0.205***	0.150***			
	(-7.39)	(-10.10)			
Low Education			-	-	-

			-	-	-
High Education			0.645**	0.585***	0.584***
			(-2.61)	(-7.20)	(-7.26)
Household size: 1	-	-	-	-	-
	-	-	-	-	-
Household size: 2	1.051	1.019	1.429	1.095	0.95
	(0.33)	(0.34)	(0.97)	(0.45)	(-0.41)
Household size: 3+	0.922	1.132*	1.258	1.03	1.058
	(-0.48)	(2.13)	(0.64)	(0.18)	(0.47)
Dwelling owned: no mortgage	-	-	-	-	-
	-	-	-	-	-
Dwelling owned: with mortgage	1.550***	1.826***	1.686**	1.639***	1.883***
	(6.05)	(10.25)	(2.84)	(17.86)	(8.1)
Dwelling rented	1.094	1.146**	0.704	1.078	1.03
	(1.44)	(2.63)	(-0.78)	(0.22)	(0.15)
N	325900	315600	27400	69850	279050

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women in all CPP provinces; (2) Men in all CPP provinces; (3) Women, treatment group: NS; (4): Women, treatment group: NS, NL, NB; (5): Men, treatment group: NL, ON, AB, BC

Table 1.4a: Falsification Test

Dependent Variable: Labour Force Participation

	(1)	(2)
CPP * After	**0.985**	**0.981**
	(-1.21)	**(-1.04)**
Married/Common Law	-	-
	-	-
Widowed/Separated/Divorced	0.990***	1.001
	(-3.36)	(0.09)
Single	0.947***	0.970
	(-22.58)	(-1.06)
Age	1.108***	1.100***
	(49.08)	(10.75)
Age*Age	0.998***	0.998***
	(-1731.16)	(-16.03)
Year: 1995	-	-
	-	-
Year: 1996	0.932***	0.930***
	(-67.67)	(-21.71)
Nova Scotia	-	1.138***
	-	(17.58)
Quebec	1.212***	1.368***
	(11.45)	(15.02)
Newfoundland & Labrador		-
		-
New Brunswick		1.242***
		(12.63)
March	-	-
	-	-

September	0.994	1.023
	(-0.16)	(0.45)
Education: grade 8 or less	-	-
	-	-
Education: grade 9-10	1.455***	1.481***
	(150.86)	(18.61)
Education: grade 11-13	1.898***	1.912***
	(16.60)	(16.58)
Education: high school grad	2.923***	2.985***
	(31.53)	(25.19)
Education: some post-secondary	3.559***	3.603***
	(36.59)	(28.45)
Education: certificate or diploma	3.783***	3.988***
	(11.74)	(11.76)
Education: community college	6.549***	6.821***
	(938.75)	(38.43)
Education: university below bachelors	6.714***	6.687***
	(43.37)	(51.35)
Education: bachelor's degree	8.606***	9.327***
	(33.61)	(18.75)
Education: above bachelor's degree	8.502***	9.166***
	(14.86)	(13.32)
Rural	-	-
	-	-
Urban	1.237***	1.310***
	(21.53)	(4.97)
Remote	0.965***	1.202
	(-15.90)	(0.68)

Household size: 1	-	-
	-	-
Household size: 2	0.880**	0.862**
	(-2.58)	(-2.84)
Household size: 3+	0.477***	0.489***
	(-88.63)	(-29.06)
N	17650	26150

Note - Exponentiated coefficients; t statistics in parentheses, Standard errors clustered at provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. (1): Women, treatment group: NS; (2): Women, treatment group: NS, NL, NB;

Table 1.5: Means

Labour Force Participation	0.795
Employment	0.701
Age	32.73
Male	0.444
Work History (months worked in current and/or previous job)	21.39

Appendix B: Chapter 2

Models with all Control Variables Displayed

Table 2.1a: Models for Physician Visits

	OLS	ZINB		2SLS	2SPoisson	ZINB	
	(1)	(2)a	(2)b	(3)	(4)	(5)a	(5)b
e-Health Info	0.399***	0.660	1.118***	0.518	0.424		
	(13.89)	(-1.07)	(9.59)	(0.96)	(1.23)		
Telehealth Info						0.632*	1.010
						(-2.21)	(1.93)
Prior low trust	-0.884***	14.31***	0.722*	-1.611***	-1.056***	16.03***	0.742*
	(-13.76)	(8.23)	(-2.09)	(-8.28)	(-8.15)	(11.54)	(-2.54)
e-Health Info * Prior low trust	-0.110	0.763	0.915	-2.871***	-11.31***		
	(-1.99)	(-0.62)	(-0.11)	(-4.91)	(-9.58)		
Telehealth Info * Prior low trust						0.630	0.965
						(-1.76)	(-0.73)
Chronic condition	0.187*	0.463*	1.068***	0.195*	0.173***	0.457*	1.066***
	(2.41)	(-1.98)	(16.57)	(2.45)	(4.59)	(-2.10)	(20.04)
Female	0.297***	0.363***	1.103***	0.259***	0.200***	0.423***	1.111***
	(16.25)	(-56.95)	(4.65)	(20.20)	(5.58)	(-14.19)	(5.33)
Regular doctor	0.786***	0.211***	1.358***	0.805***	0.602***	0.191***	1.332***
	(37.37)	(-11.61)	(5.52)	(8.29)	(10.55)	(-9.89)	(5.41)
BMI	0.0122	1.003	1.005***	0.0142**	0.000516	1.012	1.005***
	(2.01)	(0.15)	(13.88)	(3.02)	(0.18)	(0.64)	(10.21)
Smokes daily	-	-	-	0.344***	0.0469	-	-
	-	-	-	(4.10)	(0.80)	-	-
Smokes occasionally	-0.287	1.139	0.894*	0.0489	0.0849	1.145	0.902*
	(-2.61)	(0.72)	(-2.16)	(0.38)	(1.12)	(0.98)	(-2.05)
Does not smoke	-0.317*	0.993	0.877**	-	-	1.008	0.883**
	(-3.18)	(-0.06)	(-3.18)	-	-	(0.06)	(-3.08)

Regular drinker	-	-	-	0.0591	-0.0464	-	-
	-	-	-	(1.28)	(-0.80)	-	-
Occasional drinker	0.0944	0.485	0.988	0.122	0.0478	0.435	0.981
	(2.10)	(-1.26)	(-0.36)	(1.79)	(0.69)	(-1.54)	(-0.56)
Did not drink in last year	0.108*	2.610	1.187*	-	-	2.555	1.177*
	(5.41)	(1.73)	(1.98)	-	-	(1.90)	(1.99)
Exercised in the last week	-0.0156	0.560***	0.955***	-0.0161*	-0.0330	0.568***	0.957***
	(-0.45)	(-18.29)	(-4.05)	(-2.01)	(-0.86)	(-7.55)	(-4.46)
Did not exercise in last week	-	-	-			-	-
	-	-	-			-	-
Perceived health:							
Excellent	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
Very good	0.295*	0.902	1.244***	0.359***	0.296***	0.996	1.256***
	(3.58)	(-0.76)	(7.22)	(5.47)	(5.84)	(-0.03)	(6.91)
Good	0.729*	1.092	1.577***	0.870***	0.499***	1.246***	1.601***
	(3.40)	(0.98)	(9.22)	(4.77)	(8.71)	(3.30)	(8.89)
Fair	1.751**	0.956	2.084***	1.883***	0.798***	1.046	2.122***
	(7.31)	(-0.17)	(178.50)	(9.19)	(10.43)	(0.17)	(91.78)
Poor	2.447***	2.108	2.279***	2.778***	0.853***	2.538	2.362***
	(21.76)	(0.96)	(69.21)	(13.97)	(7.15)	(1.53)	(95.51)
Age							
15-24	-	-	-			-	-
	-	-	-			-	-
25-44	-0.114	0.234***	0.867			0.257***	0.872
	(-1.16)	(-3.60)	(-1.94)			(-3.89)	(-1.95)
45-64	-0.246*	0.138***	0.811***			0.131***	0.812***
	(-3.94)	(-5.76)	(-3.83)			(-8.27)	(-4.10)
65-74	-0.692*	0.0598***	0.659***			0.0740***	0.666***
	(-3.79)	(-6.62)	(-3.73)			(-8.77)	(-3.68)
75+	-0.256	0.0130	0.768**			0.0354**	0.768**
	(-1.47)	(-1.07)	(-2.77)			(-2.80)	(-3.01)
Age (continuous)				-0.00969**	0.00187		
				(-2.95)	(0.99)		
Married/common-law	-	-	-	-	-	-	-
	-	-	-	-	-	-	-

Widowed/separated/divorced	0.304*	0.291*	1.124***	0.350***	0.180***	0.320**	1.124***
	(4.83)	(-2.41)	(4.13)	(9.04)	(3.62)	(-3.27)	(4.05)
Single	0.0202	1.140	1.121*	0.0174	0.157**	0.997	1.125*
	(0.24)	(0.31)	(2.03)	(0.24)	(3.27)	(-0.01)	(2.02)
Main activity last week:							
Working	-		-	-	-		-
	-		-	-	-		-
Vacation	0.0570*		1.011	-0.125*	0.126		1.002
	(3.67)		(0.78)	(-2.39)	(1.00)		(0.11)
Looking for paid work	0.538		1.273***	0.689*	0.107		1.289***
	(2.58)		(3.31)	(2.52)	(1.05)		(3.38)
Student	-0.0197		1.010	-0.00382	-0.00406		1.005
	(-0.17)		(0.27)	(-0.06)	(-0.04)		(0.11)
Caring for children	0.483		1.315*	0.755**	0.252		1.336*
	(1.48)		(2.10)	(2.62)	(1.69)		(2.36)
Household work	0.215		1.126	-0.162	0.0463		1.120
	(0.31)		(0.49)	(-0.28)	(0.33)		(0.46)
Retired	0.191		1.115*	0.132	-0.000		1.111*
	(1.51)		(2.09)	(0.59)	(-0.00)		(1.96)
Maternity/paternity leave	2.227*		2.664***	2.207***	0.813***		2.733***
	(3.71)		(9.57)	(3.45)	(4.52)		(9.67)
Long-term illness	3.053*		1.977***	3.073***	0.576***		1.973***
	(4.71)		(13.47)	(4.70)	(6.00)		(13.08)
Volunteering	0.268		1.021	0.205	0.102		1.003
	(0.78)		(0.17)	(0.71)	(0.62)		(0.03)
Care-giving (not for children)	0.261		1.040	0.0965	-0.0289		1.044
	(1.14)		(0.62)	(0.39)	(-0.14)		(0.71)
Other	0.363		1.256**	0.419	0.240*		1.252**
	(1.54)		(2.66)	(1.86)	(2.39)		(3.09)
Income	1.06e-08	1.000***	1.000	0.000**	0.000	1.000***	1.000
	(0.03)	(-5.16)	(-1.49)	(2.66)	(1.34)	(-5.66)	(-0.74)
Education:							
Less than high school	-		-				-
	-		-				-
High school or equivalent	0.829		1.266***				1.301***

	(2.03)		(3.59)				(4.33)
Trade certificate	0.687		1.256***				1.278***
	(1.93)		(5.47)				(6.14)
College diploma	0.591		1.169***				1.195***
	(1.53)		(3.43)				(4.03)
University certificate	0.839		1.314***				1.345***
	(1.85)		(4.31)				(4.95)
Bachelor's degree	0.562		1.152*				1.183**
	(1.62)		(2.38)				(2.98)
Above bachelor's degree	0.777		1.291***				1.331***
	(2.26)		(4.10)				(4.91)
Collection period:							
Jan-15	-		-				-
	-		-				-
Apr-15	-0.0400		0.966				0.978
	(-0.44)		(-0.74)				(-0.56)
Jul-15	-0.0546		0.956				0.957
	(-0.50)		(-0.80)				(-0.85)
Oct-15	0.127		1.059				1.062
	(2.00)		(1.41)				(1.62)
Jan-16	0.357		1.142**				1.149***
	(2.68)		(2.97)				(3.52)
Apr-16	0.0360		1.011				1.018
	(0.38)		(0.20)				(0.33)
Jul-16	-0.00784		0.949*				0.957**
	(-0.12)		(-2.19)				(-2.99)
Oct-16	0.124*		1.079*				1.085**
	(4.37)		(2.14)				(2.97)
Nova Scotia	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
New Brunswick	-0.306***	1.484	0.900***	1.152***	0.424***	1.716***	0.909***
	(-17.60)	(1.55)	(-5.24)	(39.92)	(10.38)	(3.32)	(-5.95)
Quebec	-1.191***	1.552	0.628***	0.830***	0.355***	1.756**	0.631***
	(-29.91)	(1.69)	(-111.44)	(23.29)	(7.02)	(3.22)	(-96.74)

Yukon	-0.405***	-	0.906*	0.940***	0.433***	-	0.912*
	(-26.55)	-	(-2.14)	(64.66)	(6.33)	-	(-2.10)
Constant	1.202			5.273***	21.39		
	(1.54)			(4.95)	(.)		
N	9150	9150		9150	9150	9150	

Note - The ZINB models have exponentiated coefficients; t statistics in parentheses, standard errors are clustered at the provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001. Columns with an "a" denote the first stage (logistic regression) of a ZINB model; columns with a "b" denote the second stage (negative binomial).

Table 2.2a: Online Health Information Searching

Access to high speed internet in area	3.611***
	(5.84)
Less than high school diploma or its equivalent	-
	-
High school diploma or a high school equivalency certificate	2.436**
	(3.00)
Trade certificate or diploma	2.359***
	(3.71)
College/CEGEP/other non-university certificate or diploma	2.959***
	(4.47)
University certificate or diploma below the bachelor's level	2.787***
	(4.55)
Bachelor's degree (e.g. B.A., B.Sc., LL.B.)	3.122***
	(4.26)
University certificate, diploma, degree above the BA level	3.648***
	(3.92)
Low prior trust	0.927
	(-1.73)
Chronic condition	1.119*
	(1.98)
Female	0.971
	(-0.42)

Regular doctor		1.088***
		(3.74)
BMI		-
		-
Smokes daily		1.195
		(0.93)
Smokes occasionally		1.102
		(0.59)
Does not smoke		-
		-
Regular drinker		0.853*
		(-2.47)
Occasional drinker		0.776***
		(-8.54)
Did not drink in last year		1.110***
		(6.98)
Exercised in the last week		-
		-
Did not exercise in last week		0.986***
		(-9.65)
Perceived health:		
	Excellent	-
		-
	Very good	0.756***
		(-7.83)
	Good	0.916
		(-1.95)
	Fair	1.01
		-0.35
	Poor	0.838
		(-0.52)
Age		
	15-24	1.068
		(1.11)
	25-44	0.870

		(-1.47)
	45-64	1.452**
		(2.81)
	65-74	1.297***
		(11.49)
	75+	0.953
		(-0.82)
Married/common-law		0.857
		(-0.69)
Widowed/separated/divorced		2.615***
		(4.09)
Single		0.912
		(-0.31)
Main activity last week:		
	Working	1.000***
		(7.32)
	Vacation	-
		-
	Looking for paid work	2.436**
		(3.00)
	Student	2.359***
		(3.71)
	Caring for children	2.959***
		(4.47)
	Household work	2.787***
		(4.55)
	Retired	3.122***
		(4.26)
	Maternity/paternity leave	3.648***
		(3.92)
	Long-term illness	-
		-
	Volunteering	1.161***
		(15.94)

	Care-giving (not for children)	1.156* (2.09)
	Other	1.095 (1.67)
Income		1.032 (0.30)
Education:		
	Less than high school	1.065*** (6.00)
	High school or equivalent	0.955 (-0.34)
	Trade certificate	1.232 (1.84)
	College diploma	- -
	University certificate	0.915 (-1.57)
	Bachelor's degree	0.791*** (-4.48)
	Above bachelor's degree	- -
Nova Scotia		- -
New Brunswick		1.088*** (3.74)
Quebec		- -
Yukon		1.087*** (6.32)
N		9150

Note - The ZINB models have exponentiated coefficients; t statistics in parentheses, standard errors are clustered at the provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001.

Table 2.3a: Telehealth Program Use

e-Health Info		1.917***
		(7.23)
Prior low trust		1.091*
		(1.97)
e-Health Info * Prior low trust		0.891
		(-0.86)
Chronic condition		1.091***
		(3.83)
Female		1.081
		(1.83)
BMI		1.010***
		(4.03)
Smokes daily		-
		-
Smokes occasionally		1.205
		(1.78)
Does not smoke		0.879***
		(-3.29)
Regular drinker		-
		-
Occasional drinker		1.011
		(0.19)
Did not drink in last year		1.219***
		(3.30)
Exercised in the last week		1.030
		(0.95)
Did not exercise in last week		-
		-
Has regular doctor		0.941***
		(-5.13)
Perceived health:		-
	Excellent	-

	Very good	1.055* (2.09)
	Good	0.983 (-0.25)
	Fair	0.926 (-0.70)
	Poor	0.867 (-1.24)
Age		-
	15-24	-
	25-44	1.126 (0.88)
	45-64	0.535*** (-4.21)
	65-74	0.274*** (-9.14)
	75+	0.145*** (-9.39)
Married/common-law		- -
Widowed/separated/divorced		0.825*** (-11.39)
Single		0.482*** (-22.26)
Main activity last week:		
	Working	- -
	Vacation	0.954 (-0.92)
	Looking for paid work	1.118 (1.23)
	Student	0.864* (-2.39)
	Caring for children	0.957 (-0.27)

	Household work	1.638**
		(2.91)
	Retired	1.163
		(1.58)
	Maternity/paternity leave	3.136***
		(10.89)
	Long-term illness	1.187
		(1.60)
	Volunteering	1.202
		(0.97)
	Care-giving (not for children)	3.146***
		(3.80)
	Other	1.345***
		(3.93)
Income		1.000***
		(-10.51)
Education:		
	Less than high school	-
		-
	High school or equivalent	1.637***
		(4.42)
	Trade certificate	1.831***
		(4.57)
	College diploma	2.151***
		(5.30)
	University certificate	2.571***
		(15.79)
	Bachelor's degree	2.059***
		(5.56)
	Above bachelor's degree	2.225***
		(4.58)
Collection period:		
	Jan-15	-
		-
	Apr-15	1.141***

		(4.76)
	Jul-15	1.211***
		(4.41)
	Oct-15	0.976
		(-0.68)
	Jan-16	1.024
		(0.52)
	Apr-16	1.029
		(0.53)
	Jul-16	0.888*
		(-2.17)
	Oct-16	1.193***
		(9.72)
Nova Scotia		-
		-
New Brunswick		0.799***
		(-58.89)
Quebec		2.133***
		(270.50)
Yukon		0.831***
		(-8.35)
N		9150

Note - The ZINB models have exponentiated coefficients; t statistics in parentheses, standard errors are clustered at the provincial level. Significance Level: *p<0.05 **p<0.01 ***p<0.001.

Table 2.4: Means

Number of physician visits in last 12 months	1.65
e-health information searcher	0.226
Telehealth user	0.271
Prior trust in physician	0.683
Chronic condition	0.350
Regular doctor	0.759
Age (continuous)	46.42
Smoker	0.134
Drinker	0.657
Male	0.494

Appendix C: Chapter 3

The elements of the numerators' matrices for the theoretical model are as follows:

$$d_{1T} = V_t'' \frac{\partial r_1}{\partial e_1} < 0,$$

$$d_{2T} = V_t'' \frac{\partial r_2}{\partial e_2} < 0,$$

$$d_{1a_1} = -V_t'' \frac{\partial r_1}{\partial e_1}\frac{\partial r_1}{\partial a_1} + V_t' \frac{\partial^2 r_1}{\partial e_1 \partial a_1} > 0,$$

$$d_{2a_1} = -V_t'' \frac{\partial r_1}{\partial a_1}\frac{\partial r_2}{\partial e_2} > 0,$$

$$d_{1a_2} = -V_t'' \frac{\partial r_2}{\partial a_2}\frac{\partial r_1}{\partial e_1} > 0,$$

$$d_{2a_2} = -V_t'' \frac{\partial r_2}{\partial e_2}\frac{\partial r_2}{\partial a_2} + -V_t' \frac{\partial^2 r_2}{\partial e_2 \partial a_2} > 0,$$

$$d_{1m} = -\gamma' V_E' \frac{\partial E}{\partial e_1} > 0,$$

$$d_{2m} = -\gamma' V_E' \frac{\partial E}{\partial e_2} > 0,$$

$$d_{1e_2} = V_c'' \frac{\partial c}{\partial e_1}\frac{\partial c}{\partial e_2} + V_c' \frac{\partial^2 c}{\partial e_1 \partial e_2} + V_t'' \frac{\partial r_1}{\partial e_1}\frac{\partial r_2}{\partial e_2} + \gamma \left(V_E'' \frac{\partial E}{\partial e_1}\frac{\partial E}{\partial e_2} + V_E' \frac{\partial^2 E}{\partial e_1 \partial e_2} \right) < 0,$$

and

$$d_{2e_2} = V_c'' \left(\frac{\partial c}{\partial e_2}\right)^2 + V_c' \frac{\partial^2 c}{\partial e_2^2} + V_t'' \left(\frac{\partial r_2}{\partial e_2}\right)^2 - V_t' \frac{\partial^2 r_2}{\partial e_2^2} + \gamma \left[V_E'' \left(\frac{\partial E}{\partial e_2}\right)^2 + V_E' \frac{\partial^2 E}{\partial e_2^2} \right] < 0.$$

Table 3.1: Environnemental Attitude Index Questions					
	Strongly disagree	Disagree	Agree	Strongly agree	No opinion
Environmental impacts are frequently overstated					
Environmental issues should be dealt with primarily by future generations					
Environmental issues will be resolved primarily through technological progress					
Environmental policies introduced by the government to address environmental issues should not cost me extra money					

Table 3.2: Conditional Mixed Process Models: Organic Food

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	0.0983***	0.129**	0.132**	0.1	-0.00944
	(-3.64)	(-2.93)	(-3.15)	(-1.8)	(-0.19)
Health concern (index)	0.0904*	0.0205	-0.018	-0.0146	0.357***
	(-2.23)	(-0.41)	(-0.26)	(-0.15)	(-3.35)
Canada	-	-			
	-	-			
Netherlands	-0.128***	-0.201***			
	(-3.35)	(-5.19)			
France	0.339***	0.307***			
	(-15.15)	(-8.96)			
Mexico	0.910***				
	(-10.08)				
Italy	0.537***				
	(-6.55)				
Czech Republic	0.437***				
	(-5.8)				
Sweden	0.262***	0.161**			
	(-7.22)	(-2.77)			
Norway	-0.036				
	(-0.55)				
Australia	-0.124***	-0.105***			
	(-5.91)	(-3.33)			
Korea	0.660***	0.609***			
	(-16.99)	(-8.99)			
Chili	0.449***				
	(-6.54)				
Israel	-0.483***				
	(-9.69)				
Japan	0.124**				
	(-2.9)				
Spain	0.429***				
	(-7.77)				
Switzerland	0.623***				
	(-10.13)				
Water charge: metering	-0.0316	-0.0506	-0.00288	-0.324	0.0383
	(-1.44)	(-1.27)	(-0.04)	(-1.34)	(-0.37)
Water charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Waste charge: no charge	-	-	-	-	-

	-	-	-	-	-
Waste charge: flat fee	0.0165	0.114**	0.116	-0.085	0.332
	(-0.48)	(-2.73)	(-1.45)	(-0.81)	(-0.61)
Waste charge: user-fee	0.106***	0.229***	0.228	-0.213	0.55
	(-3.32)	(-6)	(-1.82)	(-0.90)	(-0.98)
Waste charge: frequency fee	0.0778	0.248**	0.147	-0.363	0.422
	(-0.93)	(-3.28)	(-0.68)	(-0.60)	(-0.71)
Waste charge: based on household size	-0.0213	0.155	0.848**	-0.21	0.22
	(-0.33)	(-1.79)	(-2.74)	(-0.22)	(-0.41)
Waste charge: other	0.0364	0.137*	0.073	-0.0284	0.0875
	(-0.73)	(-2.3)	(-0.41)	(-0.11)	(-0.15)
Electricity charge: meter	-0.0499	-0.117	-0.0851	0.0628	0.226
	(-0.91)	(-1.85)	(-0.73)	(-0.28)	(-0.95)
Electricity charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Recycling collection: door to door	-0.00411	-0.0946	-0.276**	0.343	-0.0274
	(-0.07)	(-1.65)	(-2.86)	(-1.87)	(-0.16)
Recycling collection: drop-off	0.0918*	0.0671	-0.0334	0.337*	-0.0294
	(-2.01)	(-0.87)	(-0.32)	(-2.02)	(-0.19)
Recycling collection: refundable deposit	0.184	0.194	0.175	0.465	0.839
	(-1.85)	(-1.68)	(-1.2)	(-1.28)	(-1.77)
Recycling collection: non-refundable deposit	0.229	0.289*	0.0271	-0.793	0.0463
	(-1.67)	(-2.52)	(-0.1)	(-1.11)	(-0.06)
High school or less	-	-	-	-	-
	-	-	-	-	-
Some post-secondary	0.0943***	0.0840*	0.0819	-0.129	0.123
	(-3.53)	(-2.57)	(-0.87)	(-0.75)	(-1.08)
Bachelor's degree	0.116***	0.127***	0.15	-0.11	0.0671
	(-5.54)	(-5.91)	(-1.36)	(-0.55)	(-0.67)
Post graduate degree	0.0772	0.111**	0.175	-0.437*	0.370*
	(-1.4)	(-3.03)	(-1.59)	(-2.48)	(-2.52)
Male	-	-	-	-	-
	-	-	-	-	-
Female	0.107***	0.0602*	0.139*	0.0905	0.14
	(-5.5)	(-2.23)	(-1.99)	(-0.95)	(-1.77)
Age	0.00188	-0.00149	-0.00745**	0.00503	0.00414
	(-1.23)	(-0.73)	(-2.62)	(-1.13)	(-1.12)
Employed	-	-	-	-	-
	-	-	-	-	-
Unemployed	-0.00898	0.038	0.149	-0.192	0.101
	(-0.19)	(-0.62)	(-1.09)	(-0.88)	(-0.46)
Not in labour force	-0.0277	-0.0218	-0.0909	0.00128	0.00586

		(-1.18)	(-1.02)	(-1.16)	(-0.01)	(-0.06)
Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	0.00472	0.00351	-0.13	0.0306	0.0676
		(-0.1)	(-0.08)	(-0.93)	(-0.16)	(-0.35)
	3	0.018	0.023	-0.0735	0.218	0.228
		(-0.33)	(-0.66)	(-0.56)	(-0.95)	(-1.3)
	4	-0.00659	0.000251	0.0246	0.183	0.244
		(-0.11)	0	(-0.17)	(-0.85)	(-1.34)
	5	-0.0773	0.0408	0.0549	-0.193	-0.112
		(-1.78)	(-1.23)	(-0.39)	(-0.76)	(-0.67)
	6	-0.0574	0.0208	-0.107	0.0602	0.256
		(-0.99)	(-0.48)	(-0.77)	(-0.27)	(-1.49)
	7	-0.0509	0.0678	-0.22	-0.341	0.0667
		(-1.16)	(-1.14)	(-1.52)	(-1.58)	(-0.39)
	8	-0.0497	0.0606	0.0197	-0.00864	0.0274
		(-0.96)	(-1.83)	(-0.13)	(-0.04)	(-0.17)
	9	-0.0308	0.0672	-0.043	-0.0409	0.205
		(-0.56)	(-1.52)	(-0.31)	(-0.24)	(-1.34)
	10	-0.0737	0.185**	0.0184	-0.327*	-0.421*
		(-0.81)	(-3.19)	(-0.1)	(-2.08)	(-2.16)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		0.0772*	0.0542	0.138	-0.0237	0.0202
		(-2.07)	(-0.77)	(-1.02)	(-0.21)	(-0.17)
Living alone		-0.0736*	0.0113	0.062	-0.256	0.0489
		(-2.04)	(-0.57)	(-0.65)	(-1.22)	(-0.36)
Living as a single parent		-0.0746	-0.00572	0.0196	-0.00665	0.141
		(-1.81)	(-0.13)	(-0.13)	(-0.03)	(-0.72)
Sharing a house/flat with non-family members		-0.0484	0.0208	0.099	-0.518*	0.154
		(-0.74)	(-0.66)	(-0.61)	(-2.11)	(-0.66)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-
Apartment in a building with > 12 apartments		-0.0573*	-0.0442	0.085	-0.0265	-0.077
		(-2.27)	(-0.76)	(-0.63)	(-0.11)	(-0.83)
A detached house		-0.0293	-0.163**	-0.049	0.168	-0.103
		(-0.58)	(-2.63)	(-0.37)	(-0.8)	(-0.80)
A semi-detached / terraced house		-0.0713	-0.134**	0.0183	-0.253	0.138
		(-1.61)	(-2.79)	(-0.12)	(-1.07)	(-1.04)
Other (specify)		-0.0319	-0.127	-0.154	-0.286	0.365
		(-0.40)	(-1.70)	(-0.93)	(-0.81)	(-1.46)
Isolated dwelling (not in a town or village)		-	-	-	-	-

	-	-	-	-	-
Rural	-0.0963*	-0.0695	-0.202	0.455	0.0127
	(-2.15)	(-0.54)	(-1.35)	(-1.63)	(-0.07)
Suburban (fringes of a major town/city)	-0.0366	-0.043	-0.0669	0.774**	-0.0444
	(-0.75)	(-0.43)	(-0.46)	(-2.78)	(-0.32)
Urban	-0.0217	-0.0743	-0.142	0.695**	0.0567
	(-0.38)	(-0.64)	(-0.97)	(-2.88)	(-0.4)
Respondent or someone in household owns the home	-	-	-	-	-
	-	-	-	-	-
Not owned	-0.012	-0.0425	-0.191	0.0783	-0.0894
	(-0.38)	(-1.18)	(-1.95)	(-0.79)	(-0.84)
Voted (in any election) in last 6 years	-	-	-	-	-
	-	-	-	-	-
Hasn't voted	0.0157	0.0706*	0.0696	-0.0855	0.0832
	(-0.43)	(-1.96)	(-0.79)	(-0.80)	(-0.5)
Participates in any organization	-	-	-	-	-
	-	-	-	-	-
Does not participate in an organization	-0.230***	-0.260***	-0.234***	-0.185	-0.306***
	(-8.42)	(-10.46)	(-3.37)	(-1.75)	(-3.82)
N	15100	8300	1400	600	1100
Prob>Chi2	0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.3: Conditional Mixed Process Models: Personal Transport

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	0.123***	0.117***	0.127*	0.0715	0.104
	(-11.32)	(-5.68)	(-2.31)	(-0.91)	(-1.75)
Number of cars owned by the household	-0.420***	-0.472***	-0.418***	-0.628***	-0.230***
	(-9.06)	(-9.92)	(-4.68)	(-7.68)	(-4.88)
Commute time: less than 15 minutes	-	-	-	-	-
	-	-	-	-	-
Commute time: 16 to 30 minutes	-0.508***	-0.560***	-0.561***	-0.147	-0.914***
	(-8.36)	(-8.69)	(-4.94)	(-0.96)	(-7.48)
Commute time: 31 to 45 minutes	-0.296**	-0.393**	-0.237	0.618**	-0.530*
	(-3.03)	(-2.97)	(-1.67)	(-3.02)	(-2.22)
Commute time: 46 minutes to 1 hour	-0.0176	-0.139	-0.272	0.582**	-0.555*
	(-0.16)	(-1.22)	(-1.36)	(-2.81)	(-1.97)
Commute time: more than 1 hour	0.156	0.0332	0.405	0.834**	-0.0148
	(-1.01)	(-0.18)	(-1.44)	(-3.26)	(-0.03)
Canada	-	-			
	-	-			
Netherlands	0.478***	0.527***			
	(-8.49)	(-14.14)			
France	0.171***	0.226***			
	(-3.68)	(-6.56)			
Mexico	0.117				
	(-1.95)				
Italy	0.505***				
	(-4.27)				
Czech Republic	0.629***				
	(-9.97)				
Sweden	0.492***	0.534***			
	(-8.78)	(-14.1)			
Norway	0.800***				
	(-12.52)				
Australia	0.119***	0.121***			
	(-5.37)	(-4.12)			
Korea	0.401***	0.466***			
	(-6.5)	(-4.65)			
Chili	0.746***				
	(-10.32)				
Israel	-0.0557				
	(-0.85)				
Japan	0.670***				

	(-13.75)				
Spain	0.595***				
	(-6.23)				
Switzerland	0.564***				
	(-6.26)				
Water charge: metering	-0.0555	-0.0411	-0.231*	-1.332**	-0.0978
	(-1.39)	(-0.55)	(-2.10)	(-2.58)	(-0.75)
Water charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Waste charge: no charge	-	-	-	-	-
	-	-	-	-	-
Waste charge: flat fee	-0.0167	-0.0732	0.0199	0.206	1.337*
	(-0.40)	(-1.02)	(-0.18)	(-1.37)	(-2.28)
Waste charge: user-fee	0.013	-0.0879	0.507*	0.581	0.874
	(-0.14)	(-0.75)	(-2.57)	(-1.32)	(-1.41)
Waste charge: frequency fee	0.0158	-0.135	0.0528	0.152	1.124
	(-0.16)	(-1.51)	(-0.15)	(-0.27)	(-1.68)
Waste charge: based on household size	0.0937	-0.00753	0.229	0	1.377*
	(-1.03)	(-0.06)	(-0.45)	(.)	(-2.36)
Waste charge: other	0.068	-0.131	-0.437	0.318	1.761**
	(-0.85)	(-1.21)	(-1.77)	(-0.67)	(-2.6)
Electricity charge: meter	-0.0104	-0.102	-0.102	0.736*	0.205
	(-0.10)	(-1.12)	(-0.66)	(-2.06)	(-0.67)
Electricity charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Recycling collection: door to door	0.0965	0.149**	0.279*	0.359	-0.378*
	(-1.26)	(-3.24)	(-1.99)	(-1.28)	(-2.04)
Recycling collection: drop-off	0.022	0.0307	0.275	-0.0883	0.0541
	(-0.34)	(-0.35)	(-1.81)	(-0.42)	(-0.32)
Recycling collection: refundable deposit	0.167*	0.287***	0.32	-0.646	-0.0733
	(-2.47)	(-4.12)	(-1.42)	(-1.28)	(-0.12)
Recycling collection: non-refundable deposit	0.343*	0.204	0.708	1.465	0.629
	(-2.32)	(-1.23)	(-1.39)	(-1.32)	(-0.71)
High school or less	-	-	-	-	-
	-	-	-	-	-
Some post-secondary	0.048	0.0177	0.079	-0.132	0.277*
	(-1.23)	(-0.71)	(-0.62)	(-0.50)	(-1.99)
Bachelor's degree	0.0619	0.103	0.0945	-0.147	0.289*
	(-1.2)	(-1.8)	(-0.63)	(-0.52)	(-2.39)
Post graduate degree	0.0121	0.128*	0.25	-0.336	-0.025
	(-0.21)	(-2.11)	(-1.6)	(-1.35)	(-0.13)
Male	-	-	-	-	-
	-	-	-	-	-

Female		0.0954**	0.0753	0.0426	0.223	0.0893
		(-3.06)	(-1.07)	(-0.44)	(-1.74)	(-0.93)
Age		-0.00288	-0.00668**	-0.00827*	-0.0176**	0.0134**
		(-1.11)	(-2.90)	(-2.00)	(-2.75)	(-3.28)
Employed		-	-	-	-	-
		-	-	-	-	-
Unemployed		0.163*	0.226*	0.480**	0.00294	0.354
		(-2.48)	(-2.2)	(-2.85)	(-0.01)	(-1.03)
Not in labour force		0.291***	0.360***	0.360**	0.690**	0.329**
		(-3.75)	(-6.21)	(-2.92)	(-3.16)	(-2.88)
Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	-0.0913	-0.0612	0.2	0.406	0.0262
		(-1.47)	(-0.99)	(-1.03)	(-1.33)	(-0.11)
	3	-0.143	-0.0457	0.0849	0.241	-0.224
		(-1.74)	(-0.52)	(-0.43)	(-0.68)	(-1.02)
	4	-0.184*	-0.028	-0.118	0.218	-0.371
		(-2.15)	(-0.36)	(-0.57)	(-0.59)	(-1.73)
	5	-0.114	-0.0948	-0.189	-0.274	-0.148
		(-1.86)	(-1.47)	(-0.92)	(-0.95)	(-0.72)
	6	-0.153*	-0.01	-0.21	0.299	-0.372
		(-2.32)	(-0.11)	(-1.04)	(-0.96)	(-1.76)
	7	-0.121	-0.102	0.118	0.0205	-0.430*
		(-1.57)	(-1.00)	(-0.6)	(-0.07)	(-2.14)
	8	-0.0885	0.00855	0.139	0.0806	-0.116
		(-1.17)	(-0.08)	(-0.69)	(-0.29)	(-0.58)
	9	-0.0746	0.104	0.225	-0.466*	-0.307
		(-1.06)	(-1.21)	(-1.15)	(-2.09)	(-1.53)
	10	-0.153	0.203	0.793***	-0.391	0.179
		(-1.42)	(-1.48)	(-3.39)	(-1.87)	(-0.49)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		0.428***	0.320***	0.364*	0.214	0.566***
		(-9.96)	(-8.19)	(-2.16)	(-1.23)	(-3.82)
Living alone		-0.107*	-0.0536	0.114	-0.605*	-0.0821
		(-2.14)	(-0.77)	(-0.84)	(-2.56)	(-0.47)
Living as a single parent		-0.0885	-0.164*	-0.201	0.578	0.328
		(-0.83)	(-2.04)	(-0.88)	(-1.85)	(-0.99)
Sharing a house/flat with non-family members		0.368***	0.370***	0.387	-0.2	0.409
		(-4.41)	(-7.23)	(-1.68)	(-0.51)	(-1.32)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-

Apartment in a building with > 12 apartments	0.0677	-0.0218	-0.0164	0.0162	0.152
	(-1.49)	(-0.23)	(-0.09)	(-0.04)	(-1.34)
A detached house	-0.156**	-0.192	-0.113	-0.179	-0.351*
	(-2.89)	(-1.70)	(-0.63)	(-0.51)	(-2.23)
A semi-detached / terraced house	-0.0113	-0.0336	0.171	-0.0767	-0.0282
	(-0.25)	(-0.30)	(-0.85)	(-0.20)	(-0.18)
Other (specify)	-0.0945	-0.107	-0.0442	0.578	-0.456
	(-0.97)	(-0.81)	(-0.20)	(-0.78)	(-1.44)
Isolated dwelling (not in a town or village)	-	-	-	-	-
	-	-	-	-	-
Rural	0.279***	0.253	-0.0688	-0.192	0.0721
	(-4.47)	(-1.62)	(-0.20)	(-0.27)	(-0.3)
Suburban (fringes of a major town/city)	0.519***	0.571***	0.334	-0.0677	0.343
	(-11.19)	(-3.87)	(-1.02)	(-0.09)	(-1.85)
Urban	0.664***	0.623***	0.585	0.0774	0.430*
	(-10.19)	(-4.48)	(-1.79)	(-0.11)	(-2.33)
Respondent or someone in household owns the home	-	-	-	-	-
	-	-	-	-	-
Not owned	0.0213	0.0299	0.027	-0.00633	0.149
	(-0.74)	(-0.81)	(-0.2)	(-0.04)	(-1.16)
Voted (in any election) in last 6 years	-	-	-	-	-
	-	-	-	-	-
Hasn't voted	0.0613	-0.0165	-0.0947	-0.261	0.0585
	(-1.48)	(-0.33)	(-0.78)	(-1.63)	(-0.32)
Participates in any organization	-	-	-	-	-
	-	-	-	-	-
Does not participate in an organization	-0.0722*	-0.0848**	-0.0408	-0.0252	0.0392
	(-2.15)	(-2.90)	(-0.42)	(-0.18)	(-0.4)
Constant	0.269	0.557*	0.346	2.361*	-1.555*
	(-1.39)	(-2.52)	(-0.68)	(-2.45)	(-2.07)
N	15100	8300	1400	600	1100
Prob>Chi2	0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.4.1: Conditional Mixed Process Models: Water Behaviour

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	0.00716	-0.00165	0.0334	0.0650*	0.0512
	(-0.5)	(-0.06)	(-1.52)	(-2.2)	(-1.94)
Water charge: metering	0.108***	0.127**	0.127**	0.292	0.0874
	(-3.56)	(-3.2)	(-3.16)	(-1.91)	(-1.56)
Water charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Canada	-	-			
	-	-			
Netherlands	-0.172***	-0.156***			
	(-7.64)	(-8.13)			
France	0.0920***	0.0882*			
	(-4.01)	(-2.52)			
Mexico	0.166***				
	(-5.4)				
Italy	0.341***				
	(-7.46)				
Czech Republic	-0.133***				
	(-4.21)				
Sweden	-0.242***	-0.235***			
	(-12.24)	(-6.26)			
Norway	-0.548***				
	(-26.54)				
Australia	0.324***	0.311***			
	(-17.67)	(-12.01)			
Korea	-0.379***	-0.341***			
	(-14.02)	(-7.26)			
Chili	-0.0587				
	(-1.89)				
Israel	-0.263***				
	(-7.04)				
Japan	-0.905***				
	(-46.40)				
Spain	-0.0521				
	(-1.16)				
Switzerland	-0.109***				
	(-4.44)				
Waste charge: no charge	-	-	-	-	-
	-	-	-	-	-
Waste charge: flat fee	0.0634***	0.0701***	0.0943*	-0.00484	0.469**
	(-3.73)	(-4.8)	(-2.27)	(-0.09)	(-2.8)
Waste charge: user-fee	0.116**	0.0884	0.111	-0.294	0.441*
	(-3.13)	(-1.58)	(-1.46)	(-1.88)	(-2.29)
Waste charge: frequency fee	0.196***	0.196***	0.128	0.0752	0.406
	(-7.79)	(-12.67)	(-1.31)	(-0.29)	(-1.86)
Waste charge: based on household size	0.0825***	0.0867**	0.248	1.257***	0.432**
	(-5.72)	(-2.59)	(-1.41)	(-5.35)	(-2.64)
Waste charge: other	0.0363	0.0780*	0.0123	-0.0283	0.431*
	(-0.98)	(-2.05)	(-0.15)	(-0.22)	(-2.18)

Electricity charge: meter		0.0657*	0.0711*	0.159*	-0.0295	-0.0765
		(-2.08)	(-2.03)	(-2.57)	(-0.23)	(-0.55)
Electricity charge: no charge or flat fee		-	-	-	-	-
		-	-	-	-	-
Recycling collection: door to door		0.116***	0.0960**	0.0131	0.102	0.043
		(-4.46)	(-3.14)	(-0.27)	(-1.08)	(-0.56)
Recycling collection: drop-off		0.105***	0.130***	0.0582	0.062	-0.0193
		(-3.89)	(-5.91)	(-1.09)	(-0.78)	(-0.27)
Recycling collection: refundable deposit		0.135**	0.133*	-0.00358	0.424*	-0.00574
		(-2.68)	(-2.34)	(-0.04)	(-2.01)	(-0.03)
Recycling collection: non-refundable deposit		0.173*	0.265***	0.315*	0.0519	0.670*
		(-2.4)	(-4.3)	(-2.1)	(-0.16)	(-2.47)
High school or less		-	-	-	-	-
		-	-	-	-	-
Some post-secondary		0.00584	-0.00256	-0.0746	0.0634	0.0398
		(-0.37)	(-0.10)	(-1.71)	(-0.7)	(-0.74)
Bachelor's degree		0.000887	0.0204	-0.0613	0.105	-0.0292
		(-0.06)	(-1.07)	(-1.15)	(-1.08)	(-0.55)
Post graduate degree		0.0529**	0.0226	-0.0576	0.107	-0.0146
		(-2.94)	(-0.56)	(-1.00)	(-1.21)	(-0.16)
Male		-	-	-	-	-
		-	-	-	-	-
Female		0.0900***	0.0882**	0.0138	0.00164	0.118**
		(-5.59)	(-3.12)	(-0.38)	(-0.03)	(-2.91)
Age		0.00449***	0.00495***	5.25E-06	0.00373	0.00753***
		(-4.58)	(-4.38)	0	(-1.59)	(-4.02)
Employed		-	-	-	-	-
		-	-	-	-	-
Unemployed		-0.0303	-0.0253	0.0393	0.114	-0.231
		(-1.34)	(-0.83)	(-0.56)	(-1.1)	(-1.73)
Not in labour force		0.00736	0.0123	0.0609	0.0174	-0.0444
		(-0.52)	(-0.74)	(-1.53)	(-0.27)	(-0.92)
Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	0.0114	0.0373	-0.0293	-0.024	-0.213*
		(-0.53)	(-1.33)	(-0.42)	(-0.22)	(-2.09)
	3	0.0122	-0.00581	-0.0585	-0.0894	0.0374
		(-0.4)	(-0.17)	(-0.83)	(-0.80)	(-0.41)
	4	-0.00536	0.0239	0.05	-0.0653	-0.000477
		(-0.18)	(-0.93)	(-0.67)	(-0.61)	(-0.01)
	5	-0.0128	-0.00437	0.003	0.0148	0.0641
		(-0.35)	(-0.10)	(-0.04)	(-0.12)	(-0.75)
	6	-0.034	-0.0187	-0.0576	-0.0114	-0.154
		(-1.28)	(-0.41)	(-0.77)	(-0.10)	(-1.63)
	7	-0.0384	-0.0202	-0.0232	-0.054	-0.156
		(-1.54)	(-1.38)	(-0.30)	(-0.49)	(-1.75)
	8	-0.0488	-0.04	-0.0889	-0.173	-0.00439
		(-1.89)	(-1.06)	(-1.10)	(-1.47)	(-0.05)
	9	-0.0388	-0.0457	-0.0285	-0.0386	-0.0514
		(-1.80)	(-1.46)	(-0.40)	(-0.44)	(-0.62)

	10	-0.0856***	-0.0508	-0.0776	-0.179*	-0.217
		(-3.29)	(-1.48)	(-0.86)	(-2.09)	(-1.44)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		0.0177	0.001	-0.0673	-0.0153	0.213***
		(-0.6)	(-0.04)	(-0.94)	(-0.23)	(-3.55)
Living alone		-0.0342	-0.0708**	0.00813	0.0392	0.0409
		(-1.71)	(-3.13)	(-0.15)	(-0.4)	(-0.59)
Living as a single parent		-0.0419	-0.082	0.0186	0.0947	0.0974
		(-1.44)	(-1.90)	(-0.27)	(-0.95)	(-0.63)
Sharing a house/flat with non-family members		-0.0315	-0.0412	0.0185	0.0388	0.0421
		(-1.00)	(-1.32)	(-0.19)	(-0.23)	(-0.33)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-
Apartment in a building with > 12 apartments		-0.106***	-0.0903**	-0.183*	-0.134	-0.192***
		(-3.43)	(-2.72)	(-2.37)	(-0.90)	(-3.83)
A detached house		0.325***	0.411***	0.437***	0.281*	-0.0261
		(-5.19)	(-4.01)	(-5.58)	(-2.08)	(-0.39)
A semi-detached / terraced house		0.272***	0.304**	0.273**	0.254	0.0682
		(-4.82)	(-2.96)	(-3.08)	(-1.77)	(-0.99)
Other (specify)		0.159**	0.214*	0.184	0.174	-0.0565
		(-2.78)	(-2.36)	(-1.89)	(-0.77)	(-0.50)
Isolated dwelling (not in a town or village)		-	-	-	-	-
		-	-	-	-	-
Rural		-0.0265	-0.0722	-0.0309	0.0675	0.0666
		(-0.98)	(-1.42)	(-0.34)	(-0.25)	(-0.75)
Suburban (fringes of a major town/city)		-0.0898***	-0.135*	-0.0226	0.116	-0.0982
		(-3.57)	(-2.12)	(-0.25)	(-0.43)	(-1.33)
Urban		-0.116***	-0.154**	-0.0577	0.0561	-0.0845
		(-4.82)	(-2.80)	(-0.63)	(-0.21)	(-1.14)
Respondent or someone in household owns the home		-	-	-	-	-
		-	-	-	-	-
Not owned		-0.0727***	-0.0888***	-0.0536	-0.0584	0.0551
		(-3.61)	(-3.71)	(-1.03)	(-1.12)	(-1.06)
Voted (in any election) in last 6 years		-	-	-	-	-
		-	-	-	-	-
Hasn't voted		-0.0624***	-0.0338	-0.068	-0.104	-0.0691
		(-3.49)	(-1.18)	(-1.45)	(-1.83)	(-0.85)
Participates in any organization		-	-	-	-	-
		-	-	-	-	-
Does not participate in an organization		-0.103***	-0.114***	-0.167***	-0.0387	-0.104*
		(-8.12)	(-7.60)	(-4.73)	(-0.75)	(-2.51)
Constant		2.088***	2.043***	2.267***	2.003***	2.250***
		(-27.6)	(-15.7)	(-13.35)	(-5.59)	(-8.1)
N		15100	8300	1400	600	1100
Prob>F		0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.4.2: Conditional Mixed Process Models: Water Investment

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	0.0284***	0.0244*	0.0363	0.0618*	0.0351
	(-4.92)	(-2.2)	(-1.87)	(-2.42)	(-1.59)
Water charge: metering	0.0591***	0.0351*	0.0428	0.0759	0.0431
	(-4.92)	(-2.52)	(-1.19)	(-0.68)	(-0.91)
Water charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Canada	-	-			
	-	-			
Netherlands	0.190***	0.166***			
	(-9.29)	(-9.83)			
France	0.181***	0.166***			
	(-13.01)	(-9.61)			
Mexico	0.115***				
	(-5.54)				
Italy	0.0112				
	(-0.41)				
Czech Republic	0.423***				
	(-20.34)				
Sweden	-0.00588	-0.011			
	(-0.36)	(-0.67)			
Norway	-0.0637***				
	(-4.19)				
Australia	0.301***	0.299***			
	(-32.17)	(-29.71)			
Korea	-0.243***	-0.242***			
	(-20.51)	(-18.22)			
Chili	-0.131***				
	(-7.11)				
Israel	0.151***				
	(-6.27)				
Japan	-0.351***				
	(-25.19)				
Spain	0.0353				
	(-1.32)				
Switzerland	-0.0192				
	(-0.73)				
Waste charge: no charge	-	-	-	-	-
	-	-	-	-	-

Waste charge: flat fee	0.00734	0.0481	-0.0217	-0.00737	0.0911
	(-0.34)	(-1.31)	(-0.59)	(-0.16)	(-0.53)
Waste charge: user-fee	0.0481*	0.0696	0.00361	0.0723	0.34
	(-2.14)	(-1.78)	(-0.05)	(-0.49)	(-1.8)
Waste charge: frequency fee	0.0724*	0.109*	0.0506	0.151	0.151
	(-2.03)	(-2.07)	(-0.52)	(-0.78)	(-0.74)
Waste charge: based on household size	0.00879	0.0713*	0.211	0.341**	0.0468
	(-0.25)	(-2.13)	(-1.73)	(-2.74)	(-0.27)
Waste charge: other	0.0365	0.0788	-0.0537	-0.0549	0.201
	(-1.44)	(-1.38)	(-0.74)	(-0.37)	(-0.99)
Electricity charge: meter	-0.0239	-0.0137	-0.00658	0.0253	-0.0513
	(-1.34)	(-0.53)	(-0.13)	(-0.21)	(-0.39)
Electricity charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Recycling collection: door to door	0.105***	0.0576	-0.0214	0.213**	0.146*
	(-5.03)	(-1.86)	(-0.52)	(-2.76)	(-2.12)
Recycling collection: drop-off	0.0780***	0.0709	0.00253	0.0754	0.139*
	(-4.74)	(-1.74)	(-0.05)	(-1.05)	(-2.17)
Recycling collection: refundable deposit	0.128***	0.05	-0.0498	0.253	0.0582
	(-3.65)	(-1.1)	(-0.71)	(-1.43)	(-0.26)
Recycling collection: non-refundable deposit	0.0786	0.0658	0.153	-0.132	0.319
	(-1.57)	(-0.69)	(-1.16)	(-0.46)	(-0.9)
High school or less	-	-	-	-	-
	-	-	-	-	-
Some post-secondary	0.00906	0.0145**	-0.000693	-0.037	-0.0351
	(-0.77)	(-2.58)	(-0.02)	(-0.52)	(-0.73)
Bachelor's degree	0.0065	0.0258*	0.0101	-0.0268	0.0152
	(-0.43)	(-2.27)	(-0.21)	(-0.33)	(-0.33)
Post graduate degree	0.00899	0.0278*	0.0228	-0.140*	0.0251
	(-0.56)	(-2.06)	(-0.44)	(-1.96)	(-0.33)
Male	-	-	-	-	-
	-	-	-	-	-
Female	0.00488	0.0104	0.0225	0.0155	0.027
	(-0.47)	(-1.88)	(-0.72)	(-0.36)	(-0.76)
Age	0.00163*	0.00257***	0.00474***	0.00204	-0.000495
	(-2.23)	(-4.29)	(-3.48)	(-1)	(-0.33)
Employed	-	-	-	-	-
	-	-	-	-	-
Unemployed	0.0139	-0.0236	0.00412	-0.0168	-0.135
	(-0.5)	(-0.71)	(-0.07)	(-0.21)	(-1.35)
Not in labour force	0.00122	0.0103	-0.0246	-0.0158	0.0236
	(-0.14)	(-0.85)	(-0.66)	(-0.29)	(-0.57)

Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	0.00356	0.0454	-0.0823	0.0306	0.173*
		(-0.14)	(-1.25)	(-1.40)	(-0.34)	(-2.03)
	3	-0.0109	0.00884	-0.171**	-0.179	0.0829
		(-0.42)	(-0.22)	(-2.77)	(-1.94)	(-1.04)
	4	-0.0161	0.0296	-0.0675	0.0116	-0.0325
		(-0.60)	(-0.98)	(-1.07)	(-0.11)	(-0.42)
	5	-0.00562	0.0417	-0.102	-0.0904	0.0613
		(-0.24)	(-1.18)	(-1.47)	(-0.87)	(-0.83)
	6	-0.0223	0.0406	-0.109	-0.0929	-0.0453
		(-1.17)	(-1.47)	(-1.59)	(-0.95)	(-0.59)
	7	-0.0337	0.0138	-0.155*	-0.260**	-0.0851
		(-1.32)	(-0.41)	(-2.24)	(-2.86)	(-1.15)
	8	-0.0153	0.0271	-0.167*	-0.17	0.0502
		(-0.76)	(-0.7)	(-2.55)	(-1.58)	(-0.69)
	9	-0.00654	0.0128	-0.0342	-0.025	0.0512
		(-0.53)	(-0.54)	(-0.50)	(-0.30)	(-0.72)
	10	-0.0499*	0.00782	-0.162*	-0.129	-0.116
		(-2.09)	(-0.17)	(-2.03)	(-1.62)	(-0.96)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		-0.0704***	-0.0154	-0.00426	-0.00856	-0.128*
		(-3.65)	(-0.39)	(-0.06)	(-0.16)	(-2.47)
Living alone		-0.0674***	-0.0594**	-0.0293	0.0448	-0.149**
		(-4.26)	(-2.66)	(-0.64)	(-0.56)	(-2.59)
Living as a single parent		-0.0358	0.0272	0.0929	0.0805	-0.171
		(-1.29)	(-1.13)	(-1.59)	(-0.9)	(-1.37)
Sharing a house/flat with non-family members		-0.0285	0.0513	0.198*	-0.0662	-0.129
		(-0.81)	(-0.91)	(-2.35)	(-0.54)	(-1.17)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-
Apartment in a building with > 12 apartments		0.0037	-0.0116	-0.0207	-0.0268	-0.0803
		(-0.15)	(-0.42)	(-0.35)	(-0.26)	(-1.90)
A detached house		-0.011	0.0109	-0.00898	-0.125	0.0495
		(-0.29)	(-0.62)	(-0.15)	(-1.37)	(-0.88)
A semi-detached / terraced house		-0.0259	0.00116	0.0735	-0.186	-0.105
		(-0.95)	(-0.12)	(-1.02)	(-1.82)	(-1.79)
Other (specify)		-0.0343	0.00771	-0.0576	0.0384	-0.222**
		(-0.80)	(-0.2)	(-0.80)	(-0.25)	(-2.76)
Isolated dwelling (not in a town or village)		-	-	-	-	-
		-	-	-	-	-

Rural	-0.0745**	-0.0309	0.0344	-0.264	-0.139
	(-2.63)	(-0.66)	(-0.44)	(-0.89)	(-1.72)
Suburban (fringes of a major town/city)	-0.111***	-0.0917	-0.029	-0.335	-0.124
	(-4.27)	(-1.87)	(-0.37)	(-1.14)	(-1.86)
Urban	-0.109***	-0.0579	0.0131	-0.333	-0.132*
	(-3.44)	(-1.06)	(-0.17)	(-1.15)	(-1.99)
Respondent or someone in household owns the home	-	-	-	-	-
	-	-	-	-	-
Not owned	-0.0493**	-0.0386	0.0293	-0.0886	-0.0374
	(-3.04)	(-1.60)	(-0.64)	(-1.92)	(-0.87)
Voted (in any election) in last 6 years	-	-	-	-	-
	-	-	-	-	-
Hasn't voted	-0.0562***	-0.0609***	-0.102*	-0.0276	-0.0748
	(-3.97)	(-4.43)	(-2.51)	(-0.55)	(-1.11)
Participates in any organization	-	-	-	-	-
	-	-	-	-	-
Does not participate in an organization	-0.0986***	-0.0840***	-0.114***	-0.241***	-0.131***
	(-9.48)	(-9.32)	(-3.60)	(-5.43)	(-3.80)
Constant	-0.222**	-0.370***	-0.269	0.1	-0.137
	(-2.86)	(-5.56)	(-1.91)	(-0.29)	(-0.54)
N	15100	8300	1400	600	1100
Prob>F	0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = $p < 0.05$, ** = $p < 0.01$, and *** = $p < 0.001$; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.5.1: Conditional Mixed Process Models: Waste Disposal

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	-0.147**	-0.168***	-0.213***	0.119	0.139
	(-2.62)	(-11.02)	(-3.55)	(-0.75)	(-1.32)
Waste charge: no charge	0	0	0	0	0
	(.)	(.)	(.)	(.)	(.)
Waste charge: flat fee	-0.0474	0.0629	0.15	0.0249	-0.012
	(-0.81)	(-0.54)	(-1.44)	(-0.08)	(-0.01)
Waste charge: user-fee	-0.13	0.0364	0.00432	1.478	-0.562
	(-1.36)	(-0.22)	(-0.02)	(-1.61)	(-0.47)
Waste charge: frequency fee	-0.0299	0.0772	0.998*	-0.084	-0.065
	(-0.26)	(-0.35)	(-2.27)	(-0.08)	(-0.05)
Waste charge: based on household size	0.0755	0.0432	0.791	-2.233**	0.32
	(-0.41)	(-0.28)	(-1.11)	(-3.24)	(-0.28)
Waste charge: other	0.011	-0.0224	0.0148	1.355	-1.051
	(-0.08)	(-0.20)	(-0.09)	(-1.56)	(-0.81)
Canada	-	-			
	-	-			
Netherlands	-0.0634	0.0551			
	(-0.53)	(-0.42)			
France	0.582***	0.668***			
	(-5.94)	(-4.77)			
Mexico	1.496***				
	(-12.51)				
Italy	1.769***				
	(-8.53)				
Czech Republic	0.227				
	(-1.43)				
Sweden	1.745***	1.758***			
	(-26.26)	(-23.04)			
Norway	-				
	0.365***				
	(-5.31)				
Australia	1.231***	1.186***			
	(-19.46)	(-11.8)			
Korea	-	-0.403*			
	0.523***				
	(-4.00)	(-2.17)			
Chili	2.259***				
	(-15.06)				
Israel	3.024***				
	(-26.08)				
Japan	0.261*				
	(-2.36)				
Spain	2.469***				
	(-16.84)				
Switzerland	-				
	0.450***				
	(-4.00)				
Water charge: metering	0.165*	0.0437	-0.0254	0.728	0.222

		(-2.32)	(-0.47)	(-0.27)	(-1.16)	(-0.96)
Water charge: no charge or flat fee		-	-	-	-	-
		-	-	-	-	-
Electricity charge: meter		-0.0745	-0.138	0.0387	-0.799	0.365
		(-0.55)	(-1.76)	(-0.26)	(-0.98)	(-0.59)
Electricity charge: no charge or flat fee		-	-	-	-	-
		-	-	-	-	-
Recycling collection: door to door		-0.540**	-0.527***	-0.421***	-0.244	-1.774***
		(-3.22)	(-3.79)	(-3.30)	(-0.48)	(-5.34)
Recycling collection: drop-off		-0.319***	-0.325**	-0.137	-0.172	-0.806*
		(-3.81)	(-2.96)	(-0.96)	(-0.42)	(-2.47)
Recycling collection: refundable deposit		0.141	0.0677	-0.0168	-0.0194	-0.707
		(-0.58)	(-0.24)	(-0.07)	(-0.02)	(-0.93)
Recycling collection: non-refundable deposit		0.252	0.694	1.225*	-2.344	0.802
		(-0.97)	(-1.61)	(-1.99)	(-1.61)	(-0.62)
High school or less		-	-	-	-	-
		-	-	-	-	-
Some post-secondary		-0.0233	0.0000469	-0.173	-0.247	-0.0807
		(-0.61)	0	(-1.54)	(-0.54)	(-0.35)
Bachelor's degree		-0.0764	-0.108**	-0.0658	0.0123	-0.0428
		(-1.17)	(-2.71)	(-0.49)	(-0.02)	(-0.20)
Post graduate degree		-0.021	-0.0904	-0.016	-0.294	-0.429
		(-0.43)	(-1.19)	(-0.09)	(-0.66)	(-1.21)
Male		-	-	-	-	-
		-	-	-	-	-
Female		0.0876	-0.0143	-0.128	0.025	0.0292
		(-1.57)	(-0.21)	(-1.46)	(-0.1)	(-0.17)
Age		-0.00136	-0.0128**	-0.0186***	0.0282*	0.00894
		(-0.30)	(-2.63)	(-5.08)	(-2.18)	(-1.29)
Employed		-	-	-	-	-
		-	-	-	-	-
Unemployed		-0.0389	-0.0226	-0.0746	0.552	-0.588
		(-0.37)	(-0.35)	(-0.43)	(-1.08)	(-1.49)
Not in labour force		-0.0112	-0.0278	-0.0361	-0.00335	0.286
		(-0.20)	(-0.25)	(-0.39)	(-0.01)	(-1.39)
Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	-0.0911	0.00605	0.0275	-0.301	-0.593
		(-1.31)	(-0.08)	(-0.18)	(-0.60)	(-1.48)
	3	0.0414	0.0132	-0.0103	1.071	-0.0303
		(-0.45)	(-0.14)	(-0.08)	(-1.72)	(-0.07)
	4	-0.156	-0.0427	0.337*	-0.0262	-0.652
		(-1.53)	(-0.39)	(-2.05)	(-0.05)	(-1.59)
	5	-0.0669	0.153	0.594**	-0.0307	-0.564
		(-0.62)	(-1.1)	(-3.04)	(-0.05)	(-1.51)
	6	0.0686	0.163	0.343*	0.43	-0.880*
		(-0.44)	(-1.2)	(-1.97)	(-0.78)	(-2.28)
	7	0.0504	0.119	0.354*	-0.342	-0.212

		(-0.53)	(-0.64)	(-2.17)	(-0.63)	(-0.52)
	8	0.0802	0.271	0.642***	0.749	-0.435
		(-0.85)	(-1.93)	(-3.34)	(-1.3)	(-1.15)
	9	0.1	0.312*	0.354*	0.171	-0.266
		(-1)	(-2.32)	(-2)	(-0.38)	(-0.68)
	10	0.318**	0.496*	0.177	0.0636	-0.0484
		(-2.7)	(-2.39)	(-0.82)	(-0.15)	(-0.08)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		0.304*	0.00234	0.0745	0.484	0.0443
		(-1.99)	(-0.02)	(-0.38)	(-1.43)	(-0.18)
Living alone		-1.096***	-1.013***	-0.528***	-1.572***	-1.589***
		(-5.86)	(-3.89)	(-4.19)	(-3.48)	(-7.83)
Living as a single parent		-0.331*	-0.00158	0.103	-1.815***	-1.020*
		(-2.09)	(-0.01)	(-0.43)	(-3.86)	(-1.96)
Sharing a house/flat with non-family members		-0.378**	-0.187	0.153	-0.479	-0.345
		(-2.80)	(-0.76)	(-0.66)	(-0.47)	(-0.77)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-
Apartment in a building with > 12 apartments		0.132**	0.0174	0.398*	0.453	0.0946
		(-2.79)	(-0.26)	(-2.12)	(-0.63)	(-0.49)
A detached house		-0.0946	0.0593	0.0784	-0.459	0.0559
		(-0.99)	(-0.45)	(-0.43)	(-0.70)	(-0.2)
A semi-detached / terraced house		0.0432	0.0417	-0.199	-0.752	0.674*
		(-0.4)	(-0.35)	(-1.07)	(-1.07)	(-2.18)
Other (specify)		-0.246	0.022	0.152	-0.391	-0.802*
		(-1.95)	(-0.19)	(-0.74)	(-0.47)	(-2.56)
Isolated dwelling (not in a town or village)		-	-	-	-	-
		-	-	-	-	-
Rural		0.190*	0.307	0.0177	1.361	0.224
		(-2.38)	(-1.81)	(-0.09)	(-1.19)	(-0.59)
Suburban (fringes of a major town/city)		0.418***	0.602**	0.151	2.596*	0.635*
		(-4.53)	(-3.02)	(-0.73)	(-2.2)	(-2.08)
Urban		0.453***	0.471*	0.371	2.137	0.683*
		(-5.98)	(-2.53)	(-1.8)	(-1.89)	(-2.28)
Respondent or someone in household owns the home		-	-	-	-	-
		-	-	-	-	-
Not owned		-0.0331	0.073	-0.00491	0.157	-0.212
		(-0.42)	(-0.88)	(-0.03)	(-0.56)	(-1.04)
Voted (in any election) in last 6 years		-	-	-	-	-
		-	-	-	-	-
Hasn't voted		0.217*	0.262*	0.326*	0.00199	0.776*
		(-2.54)	(-2.14)	(-2.41)	(-0.01)	(-2.11)
Participates in any organization		-	-	-	-	-
		-	-	-	-	-
Does not participate in an organization		-0.0527	-0.0137	0.0125	-0.314	-0.231
		(-1.53)	(-0.35)	(-0.14)	(-1.23)	(-1.33)
Constant		2.309***	2.542***	2.462***	2.294	3.940**

	(-7.1)	(-12.69)	(-6.39)	(-1.43)	(-2.72)
N	15100	8300	1400	600	1100
Prob>F	0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.5.2: Conditional Mixed Process Models: Recycling

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	0.133***	0.161***	0.194***	0.16	0.197***
	(-4.95)	(-11.33)	(-5.52)	(-1.89)	(-4.22)
Recycling collection: door to door	0.350**	0.315***	0.269**	1.026***	1.146***
	(-2.62)	(-6.47)	(-3.22)	(-4.23)	(-6.01)
Recycling collection: drop-off	0.141*	0.106	0.000368	0.452	0.394*
	(-2.06)	(-1.6)	0	(-1.94)	(-1.98)
Recycling collection: refundable deposit	0.0356	-0.0196	-0.0678	0.811	-1.171*
	(-0.44)	(-0.23)	(-0.51)	(-1.74)	(-2.51)
Recycling collection: non-refundable deposit	-0.102	-0.201	-0.205	0.81	0.766
	(-0.90)	(-1.51)	(-0.77)	(-1.14)	(-1.35)
Canada	-	-			
	-	-			
Netherlands	-0.09	-0.106*			
	(-1.91)	(-2.13)			
France	-0.318***	-0.329***			
	(-10.56)	(-5.35)			
Mexico	-1.217***				
	(-23.28)				
Italy	-0.167*				
	(-2.57)				
Czech Republic	-1.148***				
	(-20.25)				
Sweden	0.0907	0.0782			
	(-1.63)	(-1.25)			
Norway	-0.136**				
	(-2.94)				
Australia	-0.157***	-0.169***			
	(-6.20)	(-5.71)			
Korea	-0.319***	-0.243**			
	(-6.38)	(-2.94)			
Chili	-1.455***				
	(-19.90)				
Israel	-0.628***				
	(-7.53)				
Japan	-1.801***				
	(-29.42)				
Spain	-0.435***				
	(-4.83)				
Switzerland	-0.07				

		(-0.96)				
Water charge: metering		-0.0000263	-0.00859	-0.0316	-0.900*	0.0166
		(-0.00)	(-0.18)	(-0.51)	(-2.38)	(-0.16)
Water charge: no charge or flat fee		-	-	-	-	-
		-	-	-	-	-
Electricity charge: meter		0.0643	0.0776	0.0675	-0.175	-0.0305
		(-1.27)	(-1.82)	(-0.63)	(-0.49)	(-0.11)
Electricity charge: no charge or flat fee		-	-	-	-	-
		-	-	-	-	-
Waste charge: no charge		-	-	-	-	-
		-	-	-	-	-
Waste charge: flat fee		0.0572*	0.100*	0.0271	-0.0652	0.795*
		(-2.12)	(-2.26)	(-0.39)	(-0.40)	(-2.11)
Waste charge: user-fee		0.0677	0.0183	-0.126	-0.196	0.748
		(-1.44)	(-0.24)	(-1.04)	(-0.61)	(-1.89)
Waste charge: frequency fee		-0.0184	0.0523	-0.547*	-0.729*	0.545
		(-0.24)	(-0.47)	(-2.16)	(-2.27)	(-1.18)
Waste charge: based on household size		0.106*	0.0313	-0.0898	0.487	0.809*
		(-2.49)	(-0.6)	(-0.47)	(-1.07)	(-2.16)
Waste charge: other		0.143*	0.285**	0.0877	0.874*	0.984*
		(-2.13)	(-3.15)	(-0.74)	(-2.1)	(-2.16)
High school or less		-	-	-	-	-
		-	-	-	-	-
Some post-secondary		0.00788	-0.0256	-0.0509	-0.222	0.131
		(-0.26)	(-0.68)	(-0.67)	(-0.92)	(-1.27)
Bachelor's degree		0.0762**	0.0662*	0.0124	0.0816	0.133
		(-3.27)	(-2.46)	(-0.14)	(-0.29)	(-1.38)
Post graduate degree		0.0802*	0.0188	-0.127	-0.168	-0.179
		(-2.11)	(-0.55)	(-1.25)	(-0.68)	(-1.05)
Male		-	-	-	-	-
		-	-	-	-	-
Female		0.0605*	0.0525*	0.0289	0.145	0.0794
		(-2.52)	(-2.52)	(-0.49)	(-1.01)	(-1.04)
Age		0.00578***	0.00555***	0.00657**	0.00656	0.00333
		(-4.25)	(-4.09)	(-2.64)	(-0.93)	(-0.99)
Employed		-	-	-	-	-
		-	-	-	-	-
Unemployed		-0.00925	-0.00728	0.0156	0.499	-0.216
		(-0.24)	(-0.22)	(-0.14)	(-1.73)	(-0.94)
Not in labour force		-0.0204	-0.0161	-0.034	-0.442**	-0.0896
		(-1.23)	(-0.63)	(-0.53)	(-2.72)	(-0.97)
Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	0.00371	0.0517	-0.0968	0.038	-0.239
		(-0.07)	(-0.9)	(-0.88)	(-0.14)	(-1.25)
	3	0.0478	0.0998	-0.240*	-0.0355	-0.182
		(-0.79)	(-1.16)	(-2.08)	(-0.13)	(-1.04)
	4	0.0788	0.136*	-0.043	0.175	-0.155
		(-1.34)	(-2.19)	(-0.38)	(-0.55)	(-0.92)
	5	0.0709	0.0999	-0.376**	0.257	-0.0474

		(-1.09)	(-0.9)	(-2.93)	(-0.76)	(-0.29)
	6	0.0632	0.119	-0.254*	-0.0934	-0.103
		(-1.33)	(-1.23)	(-2.18)	(-0.32)	(-0.61)
	7	0.123**	0.121	-0.103	0.199	-0.0058
		(-2.66)	(-1.5)	(-0.95)	(-0.52)	(-0.04)
	8	0.103*	0.0926	-0.197	0.239	0.158
		(-2.05)	(-1.31)	(-1.60)	(-0.8)	(-1.04)
	9	0.117*	0.11	-0.224	0.546*	0.106
		(-1.97)	(-1.09)	(-1.93)	(-2.04)	(-0.69)
	10	0.128*	0.0916	-0.264	0.309	0.156
		(-2.25)	(-0.84)	(-1.92)	(-1.37)	(-0.73)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		-0.0125	-0.0386	0.186	0.283	-0.0362
		(-0.43)	(-0.55)	(-1.78)	(-1.43)	(-0.33)
Living alone		-0.0332	-0.007	0.0276	-0.25	-0.00796
		(-1.61)	(-0.38)	(-0.32)	(-0.74)	(-0.06)
Living as a single parent		-0.125*	-0.0662	0.0113	-0.0405	-0.227
		(-2.20)	(-1.14)	(-0.08)	(-0.14)	(-0.66)
Sharing a house/flat with non-family members		-0.0369	-0.113**	0.028	0.655	-0.462
		(-0.44)	(-3.03)	(-0.17)	(-1.79)	(-1.81)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-
Apartment in a building with > 12 apartments		0.000994	0.0584	0.0445	0.476	-0.0157
		(-0.03)	(-1.12)	(-0.33)	(-1.18)	(-0.17)
A detached house		0.049	0.0992	0.206	-0.402	-0.0378
		(-1.11)	(-1.28)	(-1.59)	(-1.10)	(-0.32)
A semi-detached / terraced house		0.0499	0.119	0.262	-0.218	-0.13
		(-1.23)	(-1.78)	(-1.77)	(-0.55)	(-1.04)
Other (specify)		-0.131*	-0.0233	0.245	0.203	-0.341
		(-2.13)	(-0.25)	(-1.58)	(-0.31)	(-1.68)
Isolated dwelling (not in a town or village)		-	-	-	-	-
		-	-	-	-	-
Rural		-0.0514	0.0593	0.109	-0.829	0.13
		(-1.08)	(-0.79)	(-0.81)	(-1.75)	(-0.81)
Suburban (fringes of a major town/city)		-0.0997	-0.0069	0.0733	-0.81	-0.255*
		(-1.78)	(-0.07)	(-0.53)	(-1.75)	(-1.97)
Urban		-0.117*	-0.0349	0.108	-0.685	-0.235
		(-2.12)	(-0.36)	(-0.78)	(-1.58)	(-1.86)
Respondent or someone in household owns the home		-	-	-	-	-
		-	-	-	-	-
Not owned		-0.0572**	-0.100***	-0.161	0.0586	0.00134
		(-2.78)	(-4.26)	(-1.80)	(-0.36)	(-0.01)
Voted (in any election) in last 6 years		-	-	-	-	-
		-	-	-	-	-
Hasn't voted		-0.161***	-0.174***	-0.143	-0.197	-0.116
		(-6.56)	(-6.37)	(-1.72)	(-1.30)	(-0.86)
Participates in any organization		-	-	-	-	-
		-	-	-	-	-
Does not participate in an organization		-0.0903**	-0.0912**	-0.00111	-0.0507	-0.0427

	(-3.05)	(-2.90)	(-0.02)	(-0.34)	(-0.56)
Constant	3.303***	3.186***	3.434***	3.827***	2.527***
	(-28.54)	(-18.77)	(-12.72)	(-4.73)	(-4.63)
N	15100	8300	1400	600	1100
Prob>F	0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.6.1: Conditional Mixed Process Models: Energy Behaviour

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	0.0485***	0.0527***	0.0304	0.0660*	0.0685***
	(-6.51)	(-9.11)	(-1.51)	(-1.98)	(-3.56)
Electricity charge: meter	0.0678*	0.0319	0.117*	-0.0566	-0.0856
	(-2)	(-0.78)	(-2.11)	(-0.28)	(-0.82)
Electricity charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Canada	-	-			
	-	-			
Netherlands	0.00796	0.013			
	(-0.45)	(-0.61)			
France	0.028	0.0306			
	(-1.88)	(-1.46)			
Mexico	0.173***				
	(-7.43)				
Italy	0.0384				
	(-1.2)				
Czech Republic	-0.150***				
	(-5.16)				
Sweden	-0.495***	-0.499***			
	(-39.66)	(-25.50)			
Norway	-0.236***				
	(-10.55)				
Australia	-0.121***	-0.126***			
	(-10.82)	(-7.67)			
Korea	-0.0165	-0.0175			
	(-0.64)	(-0.71)			
Chili	0.0543**				
	(-2.97)				
Israel	-0.025				
	(-1.78)				
Japan	-0.375***				
	(-17.86)				
Spain	0.160***				
	(-8.35)				
Switzerland	-0.159***				
	(-6.35)				
Waste charge: no charge	-	-	-	-	-

		-	-	-	-	-
Waste charge: flat fee		-0.011	-0.00447	0.0906*	-0.0668	0.464*
		(-0.66)	(-0.11)	(-2.43)	(-1.07)	(-1.96)
Waste charge: user-fee		-0.0336	-0.0201	0.0367	-0.167	0.409
		(-1.50)	(-0.46)	(-0.6)	(-1.13)	(-1.66)
Waste charge: frequency fee		-0.0128	0.0377	0.0798	-0.578*	0.249
		(-0.37)	(-0.79)	(-0.8)	(-2.31)	(-0.93)
Waste charge: based on household size		0.0105	-0.0159	0.0623	0.355*	0.489*
		(-0.37)	(-0.33)	(-0.4)	(-2.12)	(-2.08)
Waste charge: other		0.015	0.0627	0.163*	-0.0777	0.681**
		(-0.39)	(-1.32)	(-2.32)	(-0.41)	(-2.63)
Water charge: metering		0.0754***	0.0581*	0.0399	0.32	0.189***
		(-3.54)	(-2.52)	(-1.16)	(-1.51)	(-4.06)
Water charge: no charge or flat fee		-	-	-	-	-
		-	-	-	-	-
Recycling collection: door to door		0.0661***	0.0558*	0.0134	0.182	0.0847
		(-3.83)	(-2.23)	(-0.3)	(-1.65)	(-1.38)
Recycling collection: drop-off		0.0441*	0.0432	-0.0279	0.0446	0.0282
		(-2.46)	(-1.34)	(-0.59)	(-0.52)	(-0.5)
Recycling collection: refundable deposit		0.0246	-0.0316	-0.0931	0.471*	-0.198
		(-0.71)	(-0.54)	(-1.28)	(-2.44)	(-0.72)
Recycling collection: non-refundable deposit		-0.0463	0.0405	0.221	-0.503	-0.146
		(-0.93)	(-0.74)	(-1.52)	(-1.56)	(-0.36)
High school or less		-	-	-	-	-
		-	-	-	-	-
Some post-secondary		0.00387	-0.0043	0.00897	-0.13	-0.00805
		(-0.22)	(-0.18)	(-0.22)	(-1.27)	(-0.18)
Bachelor's degree		0.0068	-0.00801	-0.0472	-0.0849	-0.0277
		(-0.31)	(-0.33)	(-0.97)	(-0.77)	(-0.65)
Post graduate degree		0.0115	0.0164	-0.0444	-0.159	-0.0467
		(-0.44)	(-0.56)	(-0.82)	(-1.60)	(-0.61)
Male		-	-	-	-	-
		-	-	-	-	-
Female		0.105***	0.122***	0.0910**	0.0424	0.0656*
		(-5.9)	(-4.18)	(-2.89)	(-0.79)	(-2.06)
Age		0.00192***	0.00178**	-0.000457	0.00665**	0.00233
		(-3.43)	(-2.94)	(-0.33)	(-2.73)	(-1.69)
Employed		-	-	-	-	-
		-	-	-	-	-
Unemployed		-0.0265	-0.0235	0.0243	0.0611	0.0112
		(-1.30)	(-0.76)	(-0.41)	(-0.71)	(-0.12)
Not in labour force		0.00883	0.0162	0.0165	-0.0649	-0.0311
		(-0.69)	(-1.65)	(-0.45)	(-0.95)	(-0.85)
Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	-0.0236	0.0192	0.0117	0.102	0.0413
		(-1.10)	(-1.06)	(-0.17)	(-0.85)	(-0.52)
	3	-0.0331	-0.0432	-0.0153	-0.0252	0.07
		(-1.79)	(-1.58)	(-0.23)	(-0.18)	(-0.95)

	4	-0.0273	-0.0441*	-0.037	-0.0558	0.0786
		(-1.25)	(-2.45)	(-0.52)	(-0.44)	(-1.12)
	5	-0.0585*	-0.0426	-0.00954	-0.00113	0.0937
		(-2.10)	(-1.69)	(-0.14)	(-0.01)	(-1.36)
	6	-0.0388	-0.0137	0.0477	0.0526	0.0803
		(-1.35)	(-0.42)	(-0.68)	(-0.43)	(-1.13)
	7	-0.0786***	-0.0519*	-0.12	0.0326	-0.0471
		(-4.56)	(-2.18)	(-1.66)	(-0.29)	(-0.67)
	8	-0.0867***	-0.0727***	-0.117	-0.0737	-0.0165
		(-4.10)	(-4.88)	(-1.56)	(-0.69)	(-0.25)
	9	-0.0622**	-0.0513***	-0.00517	-0.0765	0.0357
		(-3.19)	(-4.77)	(-0.07)	(-0.83)	(-0.52)
	10	-0.128**	-0.0802***	-0.0753	-0.212*	-0.209
		(-3.27)	(-3.99)	(-0.91)	(-2.24)	(-1.83)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		-0.0763**	-0.0581	-0.0826	-0.0472	-0.0509
		(-2.93)	(-1.31)	(-1.24)	(-0.66)	(-1.08)
Living alone		0.0101	0.0142	0.0209	0.0461	-0.0139
		(-0.69)	(-0.61)	(-0.43)	(-0.42)	(-0.23)
Living as a single parent		0.0377***	0.0593***	0.0695	0.0408	0.0378
		(-3.92)	(-4.6)	(-0.99)	(-0.42)	(-0.34)
Sharing a house/flat with non-family members		-0.0148	0.0172	0.0491	0.134	0.0555
		(-0.41)	(-0.31)	(-0.69)	(-1.08)	(-0.54)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-
Apartment in a building with > 12 apartments		-0.0291	-0.0585*	-0.125	-0.154	-0.0418
		(-1.73)	(-2.34)	(-1.78)	(-1.31)	(-1.06)
A detached house		0.0176	-0.00546	-0.0398	-0.145	0.0298
		(-0.96)	(-0.20)	(-0.60)	(-1.53)	(-0.57)
A semi-detached / terraced house		0.0149	-0.00369	-0.0397	-0.0459	-0.00896
		(-1.04)	(-0.27)	(-0.55)	(-0.45)	(-0.18)
Other (specify)		0.0468	0.0389**	0.0054	-0.201	0.0244
		(-1.79)	(-2.64)	(-0.07)	(-1.18)	(-0.31)
Isolated dwelling (not in a town or village)		-	-	-	-	-
		-	-	-	-	-
Rural		-0.0273	0.0107	0.0746	0.229	0.0763
		(-0.99)	(-0.32)	(-0.92)	(-0.84)	(-1.14)
Suburban (fringes of a major town/city)		-0.0646*	-0.00263	0.0673	0.304	-0.0714
		(-1.96)	(-0.10)	(-0.81)	(-1.12)	(-1.32)
Urban		-0.0355	-0.00332	0.0564	0.242	-0.0358
		(-1.17)	(-0.12)	(-0.67)	(-0.91)	(-0.68)
Respondent or someone in household owns the home		-	-	-	-	-
		-	-	-	-	-
Not owned		-0.00393	-0.0205	0.000373	0.0264	0.00224
		(-0.24)	(-0.85)	(-0.01)	(-0.44)	(-0.05)
Voted (in any election) in last 6 years		-	-	-	-	-

	-	-	-	-	-
Hasn't voted	-0.0221	-0.0055	-0.0192	0.0793	-0.0032
	(-1.07)	(-0.17)	(-0.47)	(-1.22)	(-0.05)
Participates in any organization	-	-	-	-	-
	-	-	-	-	-
Does not participate in an organization	-0.0430**	-0.02	-0.0649*	-0.0416	-0.0558
	(-2.61)	(-0.99)	(-2.04)	(-0.69)	(-1.77)
Constant	3.087***	3.081***	3.131***	2.902***	2.666***
	(-68.21)	(-73.16)	(-21.05)	(-7.52)	(-9.3)
N	15100	8300	1400	600	1100
Prob>F	0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.6.2: Conditional Mixed Process Models: Energy Investment

	(1)	(2)	(3)	(4)	(5)
Environmental attitude (index)	0.0183***	0.0160**	0.0304*	-0.00111	0.024
	(-4.32)	(-2.84)	(-2.2)	(-0.07)	(-1.42)
Electricity charge: meter	0.0235	0.0526*	0.0644	0.0482	-0.0127
	(-1.24)	(-2.44)	(-1.8)	(-0.65)	(-0.12)
Electricity charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Canada	-	-			
	-	-			
Netherlands	0.0646***	0.0423***			
	(-4.74)	(-5.02)			
France	0.0763***	0.0520***			
	(-7.81)	(-3.94)			
Mexico	-0.0343				
	(-1.82)				
Italy	0.142***				
	(-6.34)				
Czech Republic	0.215***				
	(-8.69)				
Sweden	-	-			
	0.0865***	0.0987***			
	(-5.07)	(-5.52)			
Norway	0.00372				
	(-0.2)				
Australia	0.0770***	0.0606***			
	(-7.5)	(-4.92)			
Korea	-	-0.115***			
	0.0893***				
	(-5.60)	(-12.41)			
Chili	-0.137***				
	(-6.45)				
Israel	0.0605*				

	(-2.47)				
Japan	-0.264***				
	(-18.20)				
Spain	-0.0462				
	(-1.90)				
Switzerland	-0.0379*				
	(-2.09)				
Waste charge: no charge	-	-	-	-	-
	-	-	-	-	-
Waste charge: flat fee	0.0164	0.0297	0.0333	-0.0161	0.213**
	(-1.27)	(-1.38)	(-1.33)	(-0.52)	(-3.24)
Waste charge: user-fee	0.0135	0.0239	0.0383	-0.102	0.347***
	(-0.83)	(-1.27)	(-0.85)	(-1.20)	(-3.55)
Waste charge: frequency fee	0.0236	0.0554	-0.0609	-0.00985	0.0685
	(-1)	(-1.83)	(-0.75)	(-0.08)	(-0.47)
Waste charge: based on household size	0.0209	0.0551**	0.257*	0.135	0.240***
	(-1.2)	(-2.66)	(-2.36)	(-1.01)	(-3.79)
Waste charge: other	0.0313	0.0688***	0.084	0.0532	0.279*
	(-1.7)	(-6.63)	(-1.95)	(-0.62)	(-2.53)
Water charge: metering	0.00376	0.0224	-0.0143	-0.0236	-0.0424
	(-0.44)	(-1.45)	(-0.59)	(-0.31)	(-1.16)
Water charge: no charge or flat fee	-	-	-	-	-
	-	-	-	-	-
Recycling collection: door to door	0.0581**	0.0381	0.0352	0.153**	0.111*
	(-2.83)	(-1.53)	(-1.14)	(-2.77)	(-2.21)
Recycling collection: drop-off	0.0465**	0.0456	-0.0153	0.0801	0.0236
	(-2.71)	(-1.79)	(-0.45)	(-1.84)	(-0.49)
Recycling collection: refundable deposit	0.0726**	0.0367	-0.0385	0.186	-0.467*
	(-2.75)	(-1.66)	(-0.77)	(-1.67)	(-2.53)
Recycling collection: non-refundable deposit	0.0706	0.0372	0.0252	0.122	0.244
	(-1.77)	(-0.63)	(-0.23)	(-0.62)	(-1.01)
High school or less	-	-	-	-	-
	-	-	-	-	-
Some post-secondary	0.00611	0.0204*	0.0367	0.035	-0.0395
	(-0.51)	(-2.14)	(-1.34)	(-0.79)	(-1.09)
Bachelor's degree	-0.00353	0.0128	0.0386	0.0643	-0.0219
	(-0.31)	(-1.13)	(-1.15)	(-1.31)	(-0.60)
Post graduate degree	0.0273*	0.023	0.0859*	0.0061	0.000797
	(-2.5)	(-1.34)	(-2.45)	(-0.14)	(-0.02)
Male	-	-	-	-	-
	-	-	-	-	-
Female	0.00891	0.0271**	-0.00253	-0.0367	0.0392
	(-1)	(-3.17)	(-0.12)	(-1.32)	(-1.5)
Age	0.000754	0.00122	0.00163	-0.00231	-0.0000331
	(-1.43)	(-1.95)	(-1.71)	(-1.72)	(-0.03)
Employed	-	-	-	-	-
	-	-	-	-	-
Unemployed	0.00471	0.00572	-0.0558	0.0293	-0.176*

		(-0.27)	(-0.25)	(-1.46)	(-0.57)	(-2.37)
Not in labour force		0.0166	0.0212	-0.00435	-0.0507	0.0495
		(-1.56)	(-1.49)	(-0.17)	(-1.37)	(-1.61)
Income: ranges per category vary by country	1	-	-	-	-	-
		-	-	-	-	-
	2	0.000843	0.0320*	0.0205	0.103	0.0211
		(-0.05)	(-2.52)	(-0.48)	(-1.85)	(-0.33)
	3	-0.00238	0.023	-0.0949*	-0.0475	0.0142
		(-0.13)	(-0.89)	(-2.07)	(-0.78)	(-0.24)
	4	0.00379	0.00201	-0.00906	-0.0909	0.0342
		(-0.29)	(-0.1)	(-0.20)	(-1.17)	(-0.58)
	5	0.00146	0.0235	-0.0282	0.0593	0.00525
		(-0.12)	(-1.49)	(-0.60)	(-0.91)	(-0.09)
	6	0.0121	0.0296	-0.0236	0.0907	0.00703
		(-0.79)	(-1.13)	(-0.51)	(-1.54)	(-0.12)
	7	0.0159	0.0439	0.00239	0.086	-0.0004
		(-0.82)	(-1.55)	(-0.05)	(-1.38)	(-0.01)
	8	0.0561***	0.0618***	-0.00893	0.101	0.124*
		(-3.38)	(-3.94)	(-0.18)	(-1.77)	(-2.35)
	9	0.0508***	0.0478***	0.00885	0.0124	0.0644
		(-4.77)	(-4.95)	(-0.19)	(-0.25)	(-1.15)
	10	0.0646***	0.0680*	-0.0358	0.0801	-0.0484
		(-4.28)	(-2.35)	(-0.60)	(-1.69)	(-0.51)
Married or living as a couple		-	-	-	-	-
		-	-	-	-	-
Living with parents or other relatives		-0.0612**	-0.0213	0.0913*	0.0282	-0.100*
		(-3.14)	(-0.55)	(-1.98)	(-0.76)	(-2.56)
Living alone		-0.0619***	-0.0555***	-0.0663*	0.0575	-0.0288
		(-4.15)	(-4.03)	(-2.13)	(-1.02)	(-0.62)
Living as a single parent		-0.0221	-0.00318	0.0473	0.0485	-0.0674
		(-1.37)	(-0.11)	(-0.96)	(-0.81)	(-0.64)
Sharing a house/flat with non-family members		-0.0743	-0.0585	0.0329	0.116	-0.0349
		(-1.92)	(-1.91)	(-0.59)	(-1.28)	(-0.51)
Apartment in a building with < 12 apartments		-	-	-	-	-
		-	-	-	-	-
Apartment in a building with > 12 apartments		0.016	-0.011	-0.0703	0.0592	-0.0212
		(-1.09)	(-0.59)	(-1.41)	(-0.75)	(-0.66)
A detached house		0.00602	-0.0206	-0.08	-0.0282	0.109*
		(-0.27)	(-0.88)	(-1.59)	(-0.40)	(-2.51)
A semi-detached / terraced house		-0.0105	-0.0521***	-0.0754	-0.0179	0.0461
		(-0.73)	(-3.71)	(-1.37)	(-0.23)	(-1.15)
Other (specify)		0.0329*	0.0144	-0.0182	0.101	0.0827
		(-2.28)	(-0.86)	(-0.31)	(-0.8)	(-1.39)
Isolated dwelling (not in a town or village)		-	-	-	-	-
		-	-	-	-	-

Rural	-0.0663***	-0.0156	0.0731	-0.149	-0.0557
	(-3.46)	(-0.48)	(-1.53)	(-1.09)	(-1.03)
Suburban (fringes of a major town/city)	-0.0786***	-0.0288	-0.0135	-0.227	-0.0439
	(-4.39)	(-1.01)	(-0.28)	(-1.65)	(-0.94)
Urban	-0.0783***	-0.0268	0.0306	-0.260*	-0.0716
	(-4.29)	(-0.72)	(-0.64)	(-1.96)	(-1.55)
Respondent or someone in household owns the home	-	-	-	-	-
	-	-	-	-	-
Not owned	-0.0215	-7.89E-06	0.00835	-0.0649*	-0.0511
	(-1.68)	(-0.00)	(-0.25)	(-2.20)	(-1.58)
Voted (in any election) in last 6 years	-	-	-	-	-
	-	-	-	-	-
Hasn't voted	-0.0339**	-0.0423***	-0.0395	-0.0335	-0.0642
	(-3.13)	(-4.23)	(-1.31)	(-1.09)	(-1.23)
Participates in any organization	-	-	-	-	-
	-	-	-	-	-
Does not participate in an organization	-0.0717***	-0.0821***	-0.0563*	0.00073	-0.0571*
	(-6.90)	(-4.77)	(-2.50)	(-0.03)	(-2.19)
Constant	-0.033	-0.144*	-0.081	0.00624	-0.0216
	(-0.83)	(-1.99)	(-0.81)	(-0.03)	(-0.14)
N	15100	8300	1400	600	1100
Prob>F	0.000	0.000	0.000	0.000	0.000

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.7: OLS Regression: Environmental Attitudes

	coefficient	t-stat
Less than High School	-	-
High School Graduate	0.09***	(5.12)
Some Post-Secondary	0.149***	(7.55)
Bachelor's Degree (BA)	0.144***	(6.91)
Did not vote recently	-0.075***	(-3.57)
Does not belong to an organization	-0.15***	(-11.19)
Canada	-	-
Netherlands	0.026	(0.76)
France	-0.065*	(-1.96)
Mexico	-0.285***	(-6.97)
Italy	-0.44***	(-10.5)
Czech Republic	0.264***	(5.73)
Sweden	0.159***	(4.78)
Norway	-0.329***	(-8.51)
Australia	-0.079**	(-2.46)
Korea	-0.158***	(-4.23)
Chili	0.295***	(6.86)
Israel	0.26***	(6.38)
Japan	-0.272***	(-6.92)
Spain	-0.228***	(-5.33)
Switzerland	0.173***	(4.09)
Female	0.149***	(11.19)
Age	-0.001	(-1.77)
Water charge: no charge or flat fee	0.012	(0.65)
Waste charge: flat fee	0.008	(0.38)
Waste charge: user-fee	-0.028	(-1.07)
Waste charge: based on household size	0.027	(0.86)
Electricity charge: meter	0.029	(0.85)
Recycling collection: drop-off	0.128***	(5.48)
Recycling collection: non-refundable deposit	-0.215***	(-3.44)
2011	-0.00677	(-0.10)
High school or less	-	-
Some post-secondary	0.0903**	(3.05)
Bachelor's degree	0.149***	(4.57)
Post graduate degree	0.144**	(3.22)
Voted (in any election) in last 6 years	0.0746***	(4.4)
Hasn't voted	-	-

Participates in any organization		-	-
Does not participate in an organization		-0.150***	(-7.08)
Employed		-	-
Unemployed		0.00132	(0.05)
Not in labour force		-0.0117	(-0.56)
Income: ranges per category vary by country	1	-	-
	2	-0.00377	(-0.14)
	3	0.04	(1.83)
	4	0.006	(0.21)
	5	0.0198	(0.61)
	6	0.0489	(1.6)
	7	0.0517	(1.57)
	8	0.0501	"(2.09)"
	9	0.0801*	(2.41)
	10	0.0161	(0.58)
Married or living as a couple		-	-
Living with parents or other relatives		0.0397	(1.6)
Living alone		0.0468**	(3.15)
Living as a single parent		0.0591**	(3)
Sharing a house/flat with non-family members		0.104*	(2.31)
Apartment in a building with < 12 apartments		-	-
Apartment in a building with > 12 apartments		-0.027	(-1.58)
A detached house		-0.00849	(-0.50)
A semi-detached / terraced house		-0.0196	(-0.68)
Other (specify)		0.101	(1.86)
Isolated dwelling (not in a town or village)		-	-
Rural		0.014	(0.32)
Suburban (fringes of a major town/city)		0.0172	"(0.33)"
Urban		0.0296	"(0.57)"
N		9000	
Prob>F		0.000	

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001

Table 3.8: Conditional Mixed Process Models: Correlation Coefficients

	(1)	(2)	(3)	(4)	(5)
cut_1_1	-0.291	-0.605***	-1.085***	-0.803	0.307
	(-1.82)	(-3.40)	(-3.65)	(-1.72)	(-0.46)
cut_1_2	0.524***	0.291*	-0.179	-0.0979	0.957
	(-3.67)	(-2.05)	(-0.60)	(-0.21)	(-1.42)
cut_1_3	1.000***	0.787***	0.291	0.385	1.249
	(-7)	(-5.1)	(-0.98)	(-0.82)	(-1.86)
cut_1_4	1.604***	1.363***	0.791**	1.125*	1.721*
	(-10.62)	(-7.08)	(-2.65)	(-2.38)	(-2.56)
cut_1_5	2.125***	1.928***	1.261***	1.730***	2.093**
	(-13.61)	(-8.64)	(-4.19)	(-3.64)	(-3.11)
cut_1_6	2.685***	2.527***	1.908***	2.567***	2.407***
	(-14.23)	(-11.56)	(-5.98)	(-5.14)	(-3.56)
lnsig_3	-0.439***	-0.453***	-0.484***	-0.540***	-0.426***
	(-36.46)	(-28.36)	(-24.57)	(-19.35)	(-19.10)
lnsig_4	-0.608***	-0.595***	-0.589***	-0.663***	-0.587***
	(-42.17)	(-37.14)	(-36.30)	(-28.50)	(-35.18)
lnsig_5	0.830***	0.666***	0.403***	1.107***	0.970***
	(-10.73)	(-6.63)	(-8.55)	(-35.46)	(-34.15)
lnsig_6	0.0802*	0.044	-0.0119	0.162***	0.155***
	(-2.13)	(-1.23)	(-0.53)	(-4.87)	(-7.86)
lnsig_7	-0.616***	-0.617***	-0.626***	-0.588***	-0.676***
	(-29.85)	(-27.84)	(-31.46)	(-16.46)	(-32.09)
lnsig_8	-0.900***	-0.893***	-0.970***	-1.101***	-0.882***
	(-41.39)	(-56.44)	(-50.36)	(-45.57)	(-42.44)
atanhrho_12	0.0539*	0.0119	0.0384	0.117	0.0025
	(-2.48)	(-0.45)	(-0.68)	(-1.82)	(-0.04)
atanhrho_13	0.141***	0.149***	0.161***	0.149***	0.152***
	(-9.23)	(-6.65)	(-4.65)	(-3.56)	(-3.83)
atanhrho_14	0.101***	0.122***	0.120***	0.0897*	0.0808*
	(-9.01)	(-17.09)	(-3.63)	(-2.03)	(-2.11)

atanhrho_15	0.0549**	0.0618**	0.181***	0.0274	-0.0126
	(-2.87)	(-2.64)	(-6.04)	(-0.63)	(-0.35)
atanhrho_16	0.0713***	0.0290**	0.00774	0.196**	0.0403
	(-3.86)	(-2.97)	(-0.22)	(-3.13)	(-0.93)
atanhrho_17	0.105***	0.114***	0.111***	0.168**	0.0890*
	(-7.58)	(-6.41)	(-3.29)	(-3.16)	(-2.35)
atanhrho_18	0.0887***	0.0933***	0.127***	0.145***	0.183***
	(-5.05)	(-8.95)	(-3.67)	(-3.35)	(-4.74)
atanhrho_23	0.0442**	0.0135	0.0271	0.00305	0.0251
	(-3.15)	(-0.66)	(-0.62)	(-0.05)	(-0.55)
atanhrho_24	0.00855	0.0328	0.0442	0.00804	-0.0253
	(-0.66)	(-1.41)	(-0.97)	(-0.14)	(-0.55)
atanhrho_25	-0.00719	-0.0153	0.0237	0.0316	0.0271
	(-0.63)	(-0.98)	(-0.55)	(-0.52)	(-0.6)
atanhrho_26	0.0373**	0.0304	0.0302	0.09	0.0515
	(-2.65)	(-1)	(-0.65)	(-1.06)	(-1.07)
atanhrho_27	0.0238	0.0151	-0.0784	0.227***	-0.0353
	(-1.23)	(-0.66)	(-1.70)	(-3.48)	(-0.77)
atanhrho_28	-0.00155	0.0239	-0.0127	-0.143*	-0.0164
	(-0.11)	(-1.25)	(-0.28)	(-2.22)	(-0.35)
atanhrho_34	0.223***	0.254***	0.235***	0.274***	0.235***
	(-12.7)	(-8.88)	(-8.17)	(-6.75)	(-7.57)
atanhrho_35	-0.0392**	-0.0420**	-0.0125	-0.0820*	-0.0431
	(-2.90)	(-2.97)	(-0.44)	(-2.10)	(-1.33)
atanhrho_36	0.127***	0.102***	0.0936***	0.198***	0.206***
	(-8.76)	(-11.21)	(-3.3)	(-3.58)	(-6.47)
atanhrho_37	0.295***	0.286***	0.304***	0.406***	0.345***
	(-21.25)	(-22.05)	(-10.13)	(-8.14)	(-11.09)
atanhrho_38	0.112***	0.110***	0.104***	0.186***	0.211***
	(-7.93)	(-7.23)	(-3.58)	(-4.54)	(-6.55)
atanhrho_45	-0.0156	-0.0205	0.0121	-0.0711	-0.0559
	(-1.07)	(-1.34)	(-0.4)	(-1.84)	(-1.81)
atanhrho_46	0.0929***	0.0754***	0.000573	0.0825	0.167***
	(-6.99)	(-4.2)	(-0.02)	(-1.44)	(-5.14)

atanhrho_47	0.170***	0.185***	0.177***	0.292***	0.180***
	(-16.14)	(-14.1)	(-6.39)	(-7.03)	(-5.76)
atanhrho_48	0.283***	0.295***	0.317***	0.289***	0.307***
	(-18.16)	(-17.09)	(-10.94)	(-7.37)	(-9.41)
atanhrho_56	-0.0827***	-0.113***	-0.113***	-0.0685	-0.0912**
	(-5.92)	(-7.83)	(-3.98)	(-1.19)	(-2.81)
atanhrho_57	-0.0527***	-0.0697***	-0.0298	-0.081	-0.0125
	(-3.60)	(-4.90)	(-1.14)	(-1.86)	(-0.41)
atanhrho_58	-0.00946	-0.00479	0.0523	-0.0269	-0.0650*
	(-0.97)	(-0.41)	(-1.6)	(-0.69)	(-2.05)
atanhrho_67	0.115***	0.0856***	0.0519	0.199***	0.223***
	(-6.34)	(-4.45)	(-1.73)	(-3.32)	(-6.96)
atanhrho_68	0.0974***	0.0843***	0.0565*	0.068	0.133***
	(-8.21)	(-7.08)	(-2)	(-1.22)	(-4.17)
atanhrho_78	0.138***	0.164***	0.189***	0.131**	0.203***
	(-10.15)	(-13.75)	(-6.2)	(-2.94)	(-6.58)
N	15100	8300	1400	600	1100

Notes: t statistics in parentheses; * = p < 0.05, ** = p < 0.01, and *** = p < 0.001; (1) = main model, (2) = only countries with 2 observations (i.e., countries in both 2008 and 2011), (3) = Canada only, (4) = Chili only (higher average env att), (5) = Italy only (lowest average env att).

Table 3.9: Mean Environmental Attitude by Country

Country	Mean	N
Chili	0.5460	1,027
Israel	0.5081	1,168
Switzerland	0.4392	1,089
Czech R	0.4276	701
Sweden	0.3840	2,018
Canada	0.2688	2,125
Netherlands	0.2106	2,316
France	0.1869	2,302
Australia	0.1617	2,002
Korea	0.1225	2,116
Spain	0.0718	1,101
Mexico	0.0253	1,009
Japan	-0.0187	1,043
Norway	-0.0805	1,019
Italy	-0.1320	1,417

Table 3.10: Means

Variable	Mean	N	Min	Max
Personal transport (env. Friendly)	0.557	18678	0	1
Water behaviour index	2.547	22453	0	4
Water investment index	-0.159	22453	-1	1
Waste (# of bags)	3.010	21366	0	14
Energy behaviour index	3.233	21014	1	4
Energy investment index	-0.073	22452	-1	1
Male	0.488	22453	0	1
Age	42.534	22453	18	77