

# UNIVERSITY OF GOTHENBURG school of business, economics and law

# Do past habits affect present household waste recycling levels among individuals?

## A study on university students in Sweden

Mutasim Billah & Ugne Antanelyte

Supervised by Arnaldur Stefansson

Department of Economics Graduate School, School of Business, Economics and Law, University of Gothenburg, Sweden

#### Acknowledgement

We would like to thank our friends and families for the encouragement, our proposal supervisor João Vaz and classmates for valuable feedback since the genesis of our thesis idea, and our supervisor Arnaldur Stefansson, for patiently and meticulously guiding us through every step of the research process. We would also like to thank each other, as we have contributed to the existing body of evidence that two people with wildly different personalities and in love with each other can pursue and complete a research project without losing their spark and sanity.

#### Abstract

The body of literature in environmental economics broadly documents the role of household waste recycling in determining the quality of the environment. Social norms and attitudes closely affect recycling behavior among individuals. However, the influence of habits on the adoption of pro-environmental behavior, especially recycling, is an avenue that remains largely under-discussed. Following a theoretical framework based on reference dependence and the theory of planned behavior, we investigate whether past recycling behavior, after controlling for preferences, can affect current recycling levels. We survey university students in Sweden and find distinctions between recycling practices of local and international respondents. While there is a convergence in recycling behavior among the two subsamples, the existing gap can be explained by habit formation. We conclude that lower past recycling levels and norms can hold back individuals from fully adopting a recycling practice to local levels in a new society that recycles at a greater degree.

## Table of Contents

1. Background and literature	4
2. Theoretical Framework	6
2.1 Reference-dependent utility	6
2.2 Theory of planned behavior	9
3. Data and methodology	10
3.1 Survey design and specification	10
3.2 Descriptive statistics	12
4. Analysis and results	17
5. Conclusion	19
References	21
Appendix 1: Survey	23
Appendix 2: Additional tables	26

#### 1. Background and literature

The average individual living in Sweden produces roughly 470 kilograms of household waste every year of which about 160 kg goes to material recycling and nearly 70 kg of it into mechanical biological treatment (Avfall Sverige, 2020). Citizens complying, at varying degrees, with the system that expects them to sort and dispose of waste in a proper manner play an important role in this process. Paired with Swedish immigration statistics, the relationship between pro-environmental behavior and social norms creates another window of interest. Over 82,000 immigrants moved to Sweden in 2020 from many countries that have significantly different norms and practices compared to Swedish ones (Statistics Sweden, 2021). Sweden ranks 8th among 180 countries in the Environmental Performance Index calculated by the Yale Center for Environmental Law & Policy (Environmental Performance Index, 2021), which uses 32 performance indicators in 11 categories to measure the environmental health of countries. This observation leads to curiosity regarding the extent to which immigrants can adopt the average pro-environmental practices in Sweden compared to the average Swede.

Prior studies explored the dynamics of society, environment and behavior in various contexts. Kurz, Linden, and Sheehy (2007) found that having a "sense of community" increases the likelihood of recycling, and emulating collective action can improve pro-environmental behavior over isolated individual actions. Videras, Owen, Conover and Wu (2012) argue that information and resources that a person acquires through people they know and social norms they follow, have an impact on their behavior. Hence, how big the network is and how tight the relationships are may influence information transmission and how the norms influence behavior (Videras, et al., 2012). This leads to our research question: "Do past household recycling habits affect current levels of recycling?"

Discussion relating to habit in the context of recycling is still rare in existing literature as of the duration of our study. However, prior studies assessing the connection between habit and environment aided in building the foundation of our research question. Lakhan (2015) studied the incidence of recycling among first and second-generation South Asian immigrants in Canada and found the former to have significantly lower self-reported recycling levels and be less receptive to mechanisms that encourage recycling. Miafodzyeva, Andersson (2013) studied recycling behavior in Järva, Stockholm, a Brandt, and multicultural area, and found that attitudes significantly determine recycling levels whereas satisfaction with recycling facilities and community identity do not. Knussen and Yule (2008) did a cross-sectional survey study in Glasgow, Scotland to see how past recycling behavior and lack of habit can explain a previous failure to recycling, and concluded that past behavior has a significantly strong positive relationship with intention to recycle but having no significant effects on actual self-reported recycling levels. These three studies made foundational contributions to our research idea. We aimed to develop upon them by addressing the limitations of these studies in terms of formulating a theoretical framework that demonstrates the dynamics of past habits and social norms.

In economic literature, several reasons for variations in pro-environmental behavior have been found, including social norms (Czajkowski, Zagórska, & Hanley, 2019, Kurz et al., 2007; Videras et al., 2012;), how individuals perceive themselves as a part of society, in terms of close ties with friends and neighbors (Videras et al., 2012), differences in attitude towards the act of recycling and the environment (Czajkowski, Kądziela, & Hanley, 2014, Czajkowski, Hanley, & Nyborg, 2017), and to what extent individuals find it easy or difficult to perform the act of sorting and disposing waste (Czajkowski et al., 2014). Hage, Söderholm, and Berglund (2009) found that variables regarding the perception of others' recycling behavior is an important factor in how much an individual recycles. Leventoğlu (2017) found that habit formation affects relative bargaining power, emphasizing the influence of past repeated behavior on decision making. Löfgren (2003) studied the role of habit in utility derived from environmental quality, proposing to treat "experience of past states of environmental quality" as a "habit stock" in reference to which present environmental quality is measured. Löfgren and Nordblom (2006) analyzed implications for optimal environmental tax in the context of consumption of a habitual good that has negative environmental spillover effects. These studies, while not directly assessing the relationship between past recycling habits and present recycling levels, elucidate how habitual behavior can affect different aspects of decision-making, indicating that past habits can have significant implications for the utility of recycling.

As we aim to conduct a first-stage study to test the hypothesis that past recycling behavior affects present recycling levels, we focus on two key areas in an attempt to improve upon the existing body of literature. Firstly, to demonstrate how past habits can affect utility derived from the act of recycling and therefore the decision to recycle, we build part of our theoretical framework upon the existing literature on reference-dependent utility (Köszegi & Rabin, 2006, 2007). Then, to account for attitudes, social norms and the extent to which individuals perceive control of their own behavior, i.e. the non-habit determinants of one's recycling behavior, we draw from the theory of planned behavior (Ajzen, 1991). We keep the focus on household packaging waste disposal, something that is performed more frequently, and can thus elicit habit more clearly, compared to disposal of old furniture or clothes that are less frequent, and may thus be less habitual. We collect the data required for our assessment by surveying university students in Sweden where they respond to questions regarding their past and present levels of household waste recycling as well as questions that aid in eliciting their relevant attitude, interpretation of local norms, and how they evaluate the cost of recycling itself. Given our logistical and budgetary limitations, having conducted the research during a global pandemic, we work with a sample that is to some extent distanced from being an ideal representation of the Swedish population. However, the resultant subsamples of individuals who are local to the country and individuals who recently relocated from different societies, systems, and therefore different habits, allow us to examine the effect of past habits in a clearer manner compared to prior studies assessing this relationship.

Following our analysis, we find that there is a significant effect of past recycling habits on present recycling levels, when other factors and preferences such as social norms and

attitudes are controlled for. We also show in our theoretical framework that past habits can affect present recycling levels through social norms pertaining to one's previous place of residence, and find a significant effect of past social norms on current recycling levels.

Our study leaves a minimal impact on the respondents upon their participation as their involvement in academia implies little interference to their normal routines, being in higher likelihood for familiarity with surveys and research process compared to the average citizen. One area of concern is dealing with respondents from many different cultural backgrounds requiring accounting for potential discomfort in revealing household waste recycling practices as some may find it private. We minimize it through anonymization of our survey, which also keeps in accordance with regulations defined by the GDPR. We acknowledge, however, that there may remain scope for self-selection in completed surveys, as pro-environment respondents are more likely to participate and/or complete the survey. In addition, being reliant on their self-reported levels of recycling may lead to some self-image bias, which may result in both over-reporting and under-reporting recycling levels and attitude, depending on how the respondents perceive themselves and their environmental concerns. Keeping that in mind, we have sequenced and composed the questionnaire such that queries regarding current recycling levels appear neutral rather than investigative or appreciative, and questions regarding past habits are asked in the end to avoid giving respondents the impression of being profiled according to their background.

The paper will proceed as follows. In Section 2, we outline the theoretical framework based on reference-dependent utility and the theory of planned behavior, leading to our hypotheses. In Section 3, we discuss how we collect the data through a survey design and provide a summarized look at the descriptive statistics to illustrate our sample. In Section 4, we analyze how past habits of recycling as well as past norms may affect present recycling levels, and discuss the statistical significance of our variables of interest. In Section 5, we draw economic implications and conclude our paper.

#### 2. Theoretical Framework

#### 2.1 Reference-dependent utility

To eliminate any possible ambiguity related to habit, we need to establish some theoretical specificity for what habit means in the context of this study. Camerer and Loewenstein (2004) argued that predictions regarding utility can be improved by introducing "habit formation" into utility functions such that utility in current period is determined in part by the reference point of previous consumption, in line with Carroll (2000). Hodgson (2004) studies that mechanisms of habit are "largely unconscious", they may act against awareness, and that habit is a "propensity" to behave in a certain manner in "particular class of situations". The focus on propensity is in line with our hypothesis as we essentially look at the degree to which the average individual avoids recycling given a lack of recycling habits.

We draw from reference dependence in prospect theory (Köszegi & Rabin, 2006, 2007) to form our hypothesis that past habits can hold back individuals who have previously (and

recently) lived in areas or societies that have low or negligible levels of household waste recycling from adopting the recycling habit as much as individuals who have consistently been living in a system of recycling, despite the former group having established a life in country that practices recycling more extensively. Although Köszegi and Rabin (2006, 2007) largely deal with monetary gains and losses and loss-aversion in terms of investment, savings and consumption bundles, we depart from this type of stylized monetary approach to fit the own context of our assessment of whether previous habits of individuals being their reference dictate how they behave today. We therefore construct a simple utility-based approach to formulate a recycling decision mechanism.

Let us suppose an individual's utility of recycling can be expressed as:

$$U(R_t) = B(R_t) - C_j(R_t),$$

Where  $R_t$  is the level of recycling in period t and j is the society indicator.  $B(R_t)$  is the personal benefit function expressed as

$$B(R_t) = b \cdot R_t$$

and  $C_i(R_t)$  is the hassle cost of society *j* expressed as

$$C_j(R_t) = c_j \cdot R_t^2$$

We define hassle cost as the sum of all non-monetary and monetary costs (such as effort and time) pertaining to sorting, temporarily storing, and disposing of the packaging materials. The individual will optimize her utility of recycling at  $U'(R_t) = 0$ , which means the optimal recycling level would be:

$$R^*_t = rac{b}{2 \cdot c_j} = a^0_j$$

Now, we introduce social norms as:

$$U^n(R_t) = B(R_t) {-} C_j(R_t) {-} N(R_t {-} R_j)$$

where  $U^n$  is the utility of recycling when social norms are introduced,  $R_j$  is the socially expected level of recycling as understood by the individual in society *j*. Social norms can be expressed as  $N(R_t - R_j) = n \cdot (R_t - R_j)^2$ . As before, the individual will optimize her utility of recycling at  $U'(R_t) = 0$ , which means the optimal recycling level would be:

$$R^*_t = rac{b+2\cdot n\cdot R_j}{2\cdot (c_j+n)} = lpha^n_j + eta^n_j R_j$$

Let us now introduce habit formation into the utility function and express  $U^h$ . We start with a simplified assumption that there are only two periods. In the first period, the individual's utility simply includes the benefits and costs of recycling, but in the second period, it also includes the gap between recycling level in period 2 and recycling level in period 1. The sum of utilities in the two periods can be expressed as:

$$\sum_{t \in \{1,2\}} U^h(R_t) = \Big(B(R_1) - C_j(R_1)\Big) + \Big(B(R_2) - C_k(R_2) - H(R_2 - R_1)\Big)$$

Where  $U(R_t) = B(R_t) - C_j(R_t)$  is the utility when t=1 and  $U_h(R_2) = B(R_2) - C_k(R_2) - H(R_2 - R_1)$  is the utility including habit formation when t=2, where the habit component can be expressed as  $H(R_t - R_{t-1}) = h \cdot (R_t - R_{t-1})^2$ 

Therefore, the optimized level of recycling that the individual will perform in periods 1 and 2 respectively will be:

$$R_1^*=lpha_j^0 
onumber \ R_2^*=rac{b+2\cdot h\cdot R_1}{2\cdot (c_j+h)}=lpha_j^h+eta_j^hR_1$$

If we include both social norms and habit formation , the optimum recycling level for period 1 is

$$R_1^* = lpha_j^n + eta_j^n R_j$$

and for period 2,

$$R_2^* = rac{b}{2(c_k+n+h)} + rac{n}{c_k+n+h}R_k + rac{h}{c_k+n+h}R_1 
onumber \ = lpha_k + eta_kR_k + \delta_kR_1$$

This leads us to our main hypothesis:

*Hypothesis 1:* An individual with a low past recycling level in the previous social context will have a low current recycling level, after controlling for her subjective norm of the current social context.

In addition,  $R_1$  can be expressed in terms of  $R_j$ , the socially expected recycling level in the previous society, as:

$$lpha_k+\delta_klpha_j^n+eta_kR_k+\delta_keta_j^nR_j\ =lpha_{jk}+eta_kR_k+eta_{jk}R_j$$

Now, by comparing the expression for utility with only social norms and utility including both social norms and habit formation, we can draw the hypothesis that without habit formation the social norms in the first period,  $R_j$  should be redundant for the level of recycling in the second period (i.e. the parameter on this measure is zero). We therefore draw an additional hypothesis from the framework above since past recycling level is a function of past socially expected level of recycling.

*Hypothesis 2:* An individual with a low socially expected level of recycling in her previous social context will have a low current recycling level, after controlling for her subjective norm of the current social context.

#### 2.2 Theory of planned behavior

The Theory of Planned Behavior developed by Ajzen (1991) captures motivational factors that impact behavior, or how much effort an individual is willing to put in order to perform the behavior. In this theory, not all behaviors are willful, that is a person deciding to perform or not to perform the behavior. Some non-motivational factors, such as skills, time, money, and cooperation with other people may play a role in the performance of a behavior; collectively they represent actual control over an individual's behavior (Ajzen, 1991).

Hence, Theory of Planned Behavior presumes three main components of intention: attitudes towards behavior, subjective norm and perceived behavioral control (PCB) (Ajzen, 1991). Attitudes relate to the degree to which an individual has favorable or unfavorable views towards the specific behavior, while subjective norms concern social pressure a person receives to perform or not to perform the behavior in question. (Ajzen, 1991). Perceived behavioral control is the perceived difficulty to perform behavior taking into account anticipated obstacles and hindrances (Ajzen, 1991). Norm is subjective since every individual has his or her own interpretation of what the norm of a certain society is. As norms cannot be objectively measured, and all that matters for an individual's actions is how she perceives the norm to be, the subjective aspect of norm is important to note and it plays an important role in our study and formulation of the second hypothesis.

Theory of Planned behavior helps us control for non-habit elements of a person's behavior and acknowledge that intention and habits may act as complements or opposing forces. Ajzen (2002) explains that Intentions have a significant influence on behavior. However some individuals may fail to execute their intentions and instead turn back to their past behavior (Ajzen, 2002). This postulation is of central importance to our thesis. We are interested to find out whether people coming from non-recycling environments are likely to be held back by their past practices, especially despite reporting similar understanding of present norms and showing considerably positive attitudes towards the environment. Ajzen (2002) notes that if an individual's attitudes and intentions are somewhat indifferent, ambivalent and uncertain, they may not be able to provide clear guidelines to activity; in that case past behavior may to a large extent predict later behavior. This argument strengthens the justification for accounting for the aforementioned components of behavior to shed more light on to what degree past habits influence recycling decisions today.

#### 3. Data and methodology

#### 3.1 Survey design and specification

To understand the impact of habit on the level of recycling, we distinguish between native Swedes who are expected to have a fairly linear trend in their recycling practices and internationals who have had a relatively abrupt shift in their manner of living by essentially moving from one set of cultures and systems to another. We expect the discontinuity in social context to leave traces of past behavior. Therefore, the ideal sample would include a proportionally large enough and representative immigrant sub-sample that satisfies a few requirements.

First, they would have a lack of prior experience in household recycling (before coming to Sweden) or experience of recycling differently from the manner in and the extent to which it is commonly done in Sweden. They would also have a general minimum understanding of household recycling and material sorting. Secondly, they would have to be sufficiently diverse such that any unobservable cultural aspects of recycling behavior that differ between regions are thinned out. Third, the sub-sample would include a fair proportion of recent immigrants so that any stickiness to past recycling behavior is more pronounced, as the average person is expected to become more receptive to local norms and cultures the more time they spend in a place. Ideally, we would observe the behavior over a large sample representative of the population in Sweden.

With our budgetary and time limitations accounted for, we designed the survey with university students in mind, conducted exclusively on the internet to follow local guidelines during the coronavirus pandemic. An advantage of surveying university students in the context of our study was that given their educational level and lifestyle (location, social exposure, type of accommodation etc.) we could assume, in general, there would be little variation in the extent to which they are aware of the concept of recycling and local practices pertaining to it.

The survey was sent out via email to approximately 4500 students at the University of Gothenburg, most of whom study at the School of Business, Economics & Law. We received 347 responses from this group. It was also shared to groups on Facebook for students of Chalmers Institute of Technology, Uppsala University and international students in Sweden at different universities, and we received an additional 78 responses. There was no missing data in the responses due to the design of the survey that made it obligatory to submit a response for each question to proceed further. The survey can be found in full in Appendix 1.

The survey had three sections. In the first section, respondents stated their age, gender, nationality, whether or not they are an international student, their current level of education and field of study, the term when the study program began and what type of accommodation they live in. Furthermore, if they were local students, they were asked if they had lived in another country immediately before starting the study program, where, and how long. The international students were asked if they had lived in another country immediately before coming to Sweden, where and how long. International students were also asked when they arrived in Sweden.

In the second section, they were asked to report the percentage of each category of household packaging waste they sort, i.e. paper, plastic, glass, metal and 'pant', which is the Swedish term for metal cans and plastic bottles of beverage that are deposited into designated kiosks in exchange for store credit or cash. They could select among five options: 0%, 25%, 50%, 75% and 100%. Then they were asked to rate statements on a scale from 1 for "strongly disagree" to 7 for "strongly agree" to elicit their attitudes, interpretation of local norm and to what extent they find it easy or difficult to recycle (which makes up the perceived behavioral control, according to the theory of planned behavior). There were three statements under each of the three components.

Attitude scores were taken by the statements "I find the process of sorting and recycling distasteful" (reversed for uniformity with the other questions), "Recycling is good for the environment", and "I feel like a good person when I recycle". These statements address the task, care for environmental quality and self-image respectively. Statements that pertained to subjective norm are "Proper sorting and recycling of materials are part of the Swedish norm", "Swedish authorities expect me to properly sort and recycle packaging waste", and "People I personally know in Sweden generally consider recycling to be important". These statements cover the range of social, legal or municipal, and peer pressure an individual may face while making her recycling decisions. For each of these six statements, a higher score would indicate greater pro-environmental tendencies. Finally, to elicit how easy or difficult they find recycling (perceived behavioral control), they are shown the statements "It requires too much time to sort packaging waste", "The process of sorting and recycling takes too much effort", and "I do not have enough information about how to sort and recycle". These statements address the non-monetary costs of time, effort and information gap pertaining to the household recycling process. Thus, for each of these three statements, a higher score would indicate lower pro-environmental tendencies.

The data on recycling levels and the statement scores were all recorded individually and then we generated additional variables to generate the mean recycling level *(recnow)* for each individual by taking the average of recycling levels of all five categories. We also generated their mean scores on attitude *(att)*, subjective norm *(norm)*, and perceived behavioral control *(pbc)* by taking the average rating for all three statements in each group.

The third section of the survey asked the respondents to answer the same questions as in the second section, except that they would have to report their recycling levels and rate the nine above-mentioned statements for their previous time period, which, for the Swedish students

pertained to before the beginning of their current study program, and for the international students, before their arrival in Sweden. From the average past recycling levels and average scores on statements for attitude, subjective norm and PBC, we generated the variables *recpast, attpast, normpast* and *pbcpast* respectively.

This allowed us to specify the empirical model according to the first hypothesis, to test the effect of past recycling levels on present recycling levels, controlled for preferences as below—

 $recnow_i = eta_0 + eta_1 \cdot norm_i + eta_2 \cdot att_i + eta_3 \cdot pbc_i + eta_4 \cdot abroad_i + eta_5 \cdot recpast_i + eta_6 \cdot (abroad_i \cdot recpast_i) + eta_7 \cdot female_i + eta_8 \cdot edulevel_i + eta_9 \cdot age_i + eta_{10} \cdot agesq_i + \epsilon_i$ 

where  $recnow_i$  is the current average recycling level,  $recpast_i$  is the average recycling level in the previous time period,  $abroad_i$  is the dummy variable that assumes the value of 1 for international students, 0 otherwise;  $female_i$  is the gender dummy, and  $edulevel_i$  is the categorized current level of education of the respondent. We take age-squared besides age to account for any non-linear effect of age that may be present.

For our second hypothesis, we specified the empirical model below to test the effect of subjective norm in the previous period (*normpast*) on current recycling level.

 $recnow_i = eta_0 + eta_1 \cdot norm_i + eta_2 \cdot att_i + eta_3 \cdot pbc_i + eta_4 \cdot abroad_i + eta_5 \cdot normpast_i + eta_6 \cdot (abroad_i \cdot normpast_i) + eta_7 \cdot female_i + eta_8 \cdot edulevel_i + eta_9 \cdot age_i + eta_{10} \cdot agesq_i + \epsilon_i$ 

#### 3.2 Descriptive statistics

We have a sample of 427 students of which roughly one-fourth are international students. 84% of the respondents study in the discipline of business, economics, law, and social sciences. 91% of the respondents are currently studying either a bachelor or master degree program (by nearly equal proportions). The sample has an approximate 3:2 female-to-male ratio, and international students are slightly less than one-third of our respondent sample. We had two respondents who reported to have non-binary gender whom we have excluded from our study for the convenience of using gender as a binary dummy. This brings our sample size to 425 respondents.

21 international students lived elsewhere before coming to Sweden, and 29 Swedish students have lived elsewhere before starting their current study program. While the duration of stay was at least a year or longer for roughly half of them, the others range between 1 and 11 months. Since we don't have clear empirical evidence of how long it takes for an individual to adopt a new habit, the Swedish respondents who have lived in another country before the start of their study program and international respondents who lived in another country before coming to Sweden are excluded from our analysis.

Gender	Local	International	Total
Female	194	60	254
Male	132	39	171
Total	326	99	425
Field of study			
Arts and Humanities	3	7	10
Business, Economics & Law	267	46	313
Computer Science, IT and Engineering	7	15	22
Health and Medical Care	5	5	10
Natural and Life Sciences	4	9	13
Other	6	6	12
Social Science	34	11	45
Total	326	99	425
Current level of education			
Not a student	8	1	9
Bachelor	191	9	200
Master	105	81	186
PhD	11	7	18
Other	11	1	12
Total	326	99	425
"Have you lived in another country before the start of your study			
program/before coming to Sweden?"	207	70	275
No	297	/8	5/5
Total	326		425
10(a)	520		423
Type of accommodation			
Own house/villa	15	1	16
Own room/apartment with kitchen	169	43	212
Shared apartment with non-student(s)	35	14	49
Shared apartment with other student(s)	22	12	34
Student corridor, shared kitchen	12	29	41
With my parents	73	0	73
Total	326	99	425
Table 1: Summary of des	criptive sta	tistics	

#### Tabulation of continent

	Freq.	Percent	Cum.
Africa	8	8.08	8.08
Asia	21	21.21	29.29
Dual Citizen	2	2.02	31.31
Eurasia	2	2.02	33.33
Europe	59	59.60	92.93
North America	4	4.04	96.97
South America	3	3.03	100.00
Total	99	100.00	

Table 2: Distribution of continent among international respondents

Table 2 shows the continental distribution of countries of nationality of the international respondents. 60% of the respondents come from Europe and 21% from Asia.

Summary of recycling levels, expressed in percentages	Mean	Std. Dev.	N
Present recycling levels among locals	83.052	18.037	326
Present recycling levels among internationals	72.071	26.774	99
Past recycling levels among locals	78.865	20.978	326
Past recycling levels among internationals	47.071	31.307	99
Summary of subjective norm, attitude and planned behavioral control, scored on a scale of 1-7 Note: Higher is pro-environmental (except for planned behavioral control where lower is pro-environmental)	Mean	Std. Dev.	Ν
Subjective norm (locals, present)	5.546	1.025	326
Subjective norm (internationals, present)	5.633	1.133	99
Subjective norm (locals, past)	5.502	1.114	326
Subjective norm (internationals, past)	3.993	1.720	99
Attitude (locals, present)	6.043	0.868	326
Attitude (internationals, present)	6.057	0.883	99
Attitude (locals, past)	4.736	0.827	326
Attitude (internationals, past)	4.875	0.958	99
Planned behavioral control (locals, present)	2.368	1.179	326
Planned behavioral control (internationals, present)	2.838	1.441	99
Planned behavioral control (locals, past)	2.669	1.485	326
Planned behavioral control (internationals, past)	3.539	1.861	99

Table 3: Summary of past and present recycling levels and preferences for local and international respondents

Table 3 outlines the mean levels of present and past recycling for local and international students as well as the means of past and present scores on the subjective norm, attitude, and PBC statements. We see a small change in recycling levels among the locals, by just above 1% while for the international respondents it is a 25% growth. There is almost no difference between the local and international respondents for the mean scores on attitude and subjective norm, and only a small difference in PBC, indicating that internationals on average find it slightly harder to sort and recycle compared to locals. The only category where locals show substantial growth is in attitude statements, with a 1.3 point improvement in attitude from past to present. Across the table, the international respondents show noticeable improvement in pro-environmental attitudes and behavior between past and present situations.

We can illustrate the relationship between the past and present observations for these variables with the help of binned scatter plots that follow. It may be insightful to examine

this while accounting for the distribution of which continents the international respondents belong to further understand the patterns we observe.



Figure 1: Binned scatter plot of present recycling level against past recycling level



Figure 2: Binned scatter plot of present recycling level against past recycling level, controlled for demographics and preferences

Figure 1 provides a crude view of the relationship between past recycling and present recycling levels among locals and internationals. There is a stronger correlation between past and present levels among locals while for the internationals it is a flatter line.

Even when we control for attitude, subjective norm, perceived behavioral control, and demographic variables, we see this line for internationals is considerably flatter (about one-third the slope) compared to locals, as shown in Figure 2. This is in line with our assumption that for the locals, in the absence of a change in society or situation, their recycling levels remain fairly steady whereas for the internationals it undergoes a readjustment as they find themselves in a different state.



Figure 3: Binned scatter plot of current attitudes against past attitudes



Figure 4: Binned scatter plot of current subjective norm score against past subjective norm score



Figure 5: Binned scatter plot of current perceived behavioral controls against past perceived behavioral controls

Figure 3 is a binned scatter-plot between past and present attitude scores. Respondents who have had a fairly low attitude towards environment practices in the past have, in general, maintained the same level of attitude in the present and it is true for both local and international students.

The binned scatter plot between present and past norms as shown in Figure 4 indicates an interesting difference between native Swedes and internationals. While Swedes seem to have a fairly stable subjective interpretation of local norms over time, the flat line for internationals indicates that on average they have a similar interpretation of Swedish local norms regarding recycling practices, irrespective of the norms they had in their past country of residence.

Figure 5 shows the relationship between, to what extent the task of recycling has been easy or difficult for these individuals based on the time, effort, and information required to perform sorting on household packaging waste. Interestingly again, we see that individuals that have reported recycling to be a difficult task in the past, both among local and international respondents, have maintained their response for recycling at present time.

#### 4. Analysis and results

To analyze the effect of past habits on present levels of recycling, we use the ordinary least squares method. In accordance with our hypotheses as outlined in section 3.1, our key variables of interest are past recycling levels and past social norms.

In table 4 we list the regression results for our hypotheses. We use five model specifications to show the effects. Model 1 only includes subjective norm, attitude, and perceived behavioral control. In Model 2, we introduce the international dummy, past recycling level and the interaction between past recycling level and the international dummy. Model 3 is specified for our first hypothesis test to check the effect of past recycling level on the current recycling level where we build upon Model 2 and add demographic variables. Model 4 is similar to Model 2, except that instead of past recycling levels, we use past subjective norms.

Model 5 is specified for our second hypothesis to check the effect of the past subjective norm (i.e. previous socially expected level of recycling) on the current recycling level, and builds upon Model 4 to include demographic variables.

Variables	Model 1	Model 2	Model 3	Model 4	Model 5
Subjective norm	2.202*	1.104	1.180	4.175**	4.027**
	(0.964)	(0.734)	(0.736)	(1.358)	(1.363)
Attitude	1.527	1.675	2.129*	1.845	2.259
	(1.247)	(0.929)	(0.970)	(1.228)	(1.282)
Perceived behavioral control	-5.767***	-1.369*	-1.413*	-5.259***	-5.240***
	(0.828)	(0.667)	(0.670)	(0.843)	(0.847)
International (dummy variable)		29.12***	26.79***	-31.72**	-33.86***
		(4.576)	(4.760)	(9.594)	(9.660)
Past recycling level		0.695***	0.687***		
		(0.0445)	(0.0448)		
Past subjective norm				-2.498	-2.302
				(1.418)	(1.424)
International × Past recycling level		-0.339***	-0.308***		
		(0.0673)	(0.0687)		
International × Past subjective norm				4.907**	5.169**
				(1.868)	(1.879)
Female (dummy variable)			-1.992		-1.500
			(1.584)		(2.092)
Level of education			-0.441		0.349
			(1.069)		(1.407)
Age			1.247		2.260
			(1.475)		(1.939)
Age-squared			-0.0167		-0.0326
			(0.0261)		(0.0343)
Constant	73.06***	13.94	-7.006	74.37***	36.47
	(9.118)	(7.603)	(21.95)	(9.496)	(29.06)
Ν	375	375	375	375	375
$\mathbb{R}^2$	0.166	0.542	0.549	0.205	0.218

Standard errors in parentheses

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

Table 4: Coefficient table for OLS regressions

In Model 3 we see the interaction term between being an international with a past recycling level is negative (-0.339) and significant at 1% level. This adjusted with the coefficient of past recycling level which is 0.695 (also significant at 1% level) yields that for the average international, the coefficient of past recycling level would be 0.356, meaning a 1% rise in past recycling level, after controlling for preferences (including the new social norms) would lead to a 0.36% rise in present recycling level. This coefficient is meaningful for the international students since they have had a change in a social context, and not as meaningful for the local respondents as they have remained in the same society and hence past recycling level has no reason to not affect present recycling levels for them.

In Model 5 we see the interaction term between being an international with the past subjective norm is 5.169 and significant at 5% level. On the other hand, the coefficient of the past subjective norm is -2.302 and not significant. Therefore the effective coefficient of past norms for the international respondents is 2.867, meaning a 1-point rise in the score of the past subjective norm would lead to a 2.87% increase in recycling level for international respondents. The non-significant result on the coefficient of the past subjective norm is understandable if we recall the binned scatter plot for past and present norms, as expected, for the local students and hence without accounting for that collinearity we would be misguided to think that past norms have a negative effect on the recycling level for the locals.

Table A2 in Appendix 2 contains two additional columns where we restrict the sample to master degree students only since 90% of international respondents are master program students whereas nearly the majority (nearly 60%) of Swedish respondents are bachelor program students. Model 6 and Model 7 are the 'master students only' restrictions for Model 3 and Model 5 respectively. We see no significant effect of demographic variables such as age, gender, and level of education, while the coefficients of perceived behavioral control are significant across all models.

#### 5. Conclusion

With this study, given a dearth of focus on habits in recycling behavior in existing literature, we aimed to conduct a first-stage research, in order to contribute an opening discussion relating to the importance and effect of habit on pro-environmental behavior. Our results indicate that after accounting for preferences and attitudes, recycling done by the average individual in one social context accounts for nearly a third of the recycling she will perform in the next social context. The factor which carries over this habit, our results suggest, are the norms of the former society.

What it implies for environmental policy-making is a need to find mechanisms that aid a realignment with local norms, or rules, if any, when a host society receives a significant inflow of foreign entrants who may be accustomed to pro-environmental practices to a lesser degree. Although social norms can be subjective, systems can be designed in manners that eliminate ambiguity and facilitate the understanding and adoption of environmentally beneficial lifestyles and habits, especially when individuals are aware, educated, and receptive of new information, regardless of their eventual actions that may not be results of entirely conscious decision-making. Our proposition is supported by the study by Cialdini, Reno, and Kallgren (1990) where they postulate that being reminded of the social norms increases the likelihood of individuals following them.

What is true for most, if not all surveys is that respondents are put in a position to translate their behavior into measures and preferences in strictly defined categories. We understand that it is likely for our respondents to both over-report and under-report their recycling levels depending on how they evaluate their own actions and with what degree of accuracy they can recall their 'past selves' for certain questions we asked. The offsetting of biases of opposite directions by one another would certainly be more convincing had we been analyzing responses from a very large sample representing all relevant age groups, backgrounds, and regions of Sweden. However, as we had maintained earlier, we base our conclusions on the premise that having a sample of university students allows us to work on a more homogeneous section of the population where demographic factors become secondary, as our results have indicated.

While we acknowledge the limitations of having a narrow body of literature to build upon and budgetary and logistical limitations pertaining to being international graduate students during a pandemic, our results are a potential gateway for a broader study under this topic. Given that the environment is increasingly becoming a mainstream topic and climate concerns are being discussed and examined across disciplines, it is only fitting that similar research will stem forward in the future, which we hope to be a part of following the completion of this study,

#### References

Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179-211.

Ajzen, I. (2002). Residual Effects of Past on Later Behavior: Habituation and Reasoned Action Perspectives. *Personality and Social Psychology Review* 6(2), 107-22.

Avfall Sverige (2020), *Swedish Waste Management 2019*. Available at: \*\*<u>https://avfallsverige.se/fileadmin/user\_upload/Publikationer/SAH\_2019\_publ20\_eng.pdf</u> (Accessed: 20 November 2020)

Camerer, C., & Loewenstein, G. (2004). Behavioral economics: past, present, and future. In: Camerer, C., Loewenstein, G., Rabin, M. (eds.) *Advances in Behavioral Economics* (pp. 3–51). Princeton University Press, Princeton

Carroll, C. (2000). Requiem for the Representative Consumer? Aggregate Implications of Microeconomic Consumption Behavior. *American Economic Review, Papers and Proceedings,* 90(2), 110–15.

Cialdini, R., Reno, R., & Kallgren, C. (1990). A Focus Theory of Normative Conduct: Recycling the Concept of Norms to Reduce Littering in Public Places. *Journal of Personality and Social Psychology*, 58(6), 1015-1026.

Czajkowski, M., Hanley, N., & Nyborg, K. (2017). Social Norms, Morals and Self-interest as Determinants of Pro-environment Behaviours: The Case of Household Recycling. *Environmental and Resource Economics* 66(4), 647-670.

Czajkowski, M., Kądziela, T., & Hanley, N. (2014). We Want to Sort! Assessing Households' Preferences for Sorting Waste. *Resource and Energy Economics* 36(1), 290-306.

Czajkowski, M., Zagórska, K., & Hanley, N. (2019). Social Norm Nudging and Preferences for Household Recycling. *Resource and Energy Economics* 58.

Environmental Performance Index (2021). *Environmental Performance Index*. Available at: <u>https://epi.yale.edu/epi-results/2020/component/epi</u> (Accessed: 18 May 2021)

Hage, O., Söderholm, P., & Berglund, C. (2009). Norms and economic motivation in household recycling: Empirical evidence from Sweden. Resources. *Conservation and Recycling*, 53(3), 155-165.

Hodgson, G. (2004). Reclaiming habit for institutional economics. Journal of Economic Psychology, 25(5), 651-660.

Knussen, C., & Yule, F. (2008). "I'm Not in the Habit of Recycling": The Role of Habitual Behavior in the Disposal of Household Waste. *Environment and Behavior, 40*(5), 683-702.

Köszegi, B., & Rabin, M. (2006). A model of reference-dependent preferences. Quarterly Journal of Economics, Cxxi(4), 1133-1166.

Köszegi, B., & Rabin, M. (2007). Reference-Dependent Risk Attitudes. American Economic Review, 97(4), 1047-1073.

Kurz, T., Linden, M., & Sheehy, N. (2007). Attitudinal and Community Influences on Participation in New Curbside Recycling Initiatives in Northern Ireland. *Environment and Behavior* 39(3) (2007): 367.

Lakhan, C. (2015). Differences in self reported recycling behavior of first and second generation South Asians in Ontario, Canada. *Resources, Conservation and Recycling*, *97*, 31-43.

Leventoğlu, B. (2017). Bargaining with habit formation. *Economic Theory*, 64(3), 477-508.

Löfgren, Å. (2003). Habit formation in environmental quality : Dynamic optimal environmental taxation. Working papers in economics / Department of Economics, School of Economics and Commercial Law, Göteborg University (Print), 92.

Löfgren, Å., & Nordblom, K. (2006). The importance of habit formation for environmental taxation. (Working papers in economics / Department of Economics, School of Economics and Commercial Law, Göteborg University (Print), 204.

Miafodzyeva, S., Brandt, N., & Andersson, M. (2013). Recycling behaviour of householders living in multicultural urban area: A case study of Järva, Stockholm, Sweden. *Waste Management & Research*, 31(5), 447-457.

Statistics Sweden (2021). *Invandring till Sverige*. Retrieved May 19, 2021, <u>https://www.scb.se/hitta-statistik/sverige-i-siffror/manniskorna-i-sverige/invandring-till-sverige/</u>

Videras, J., Owen, A. L., Conover, E., & Wu, S. (2012). The Influence of Social Relationships on Pro-environment Behaviors. *Journal of Environmental Economics and Management* 63(1), 35-50.

#### Hi!

We are two master students at University of Gothenburg researching how students in Sweden sort and dispose of packaging waste. We greatly appreciate you taking this survey. It should take less than 5 minutes.

The survey requires that you are currently living in Sweden.

We ask you to kindly answer as correctly and truthfully as you can.

All responses are anonymous. (Original survey link: https://forms.gle/M3Jce9ZhXNcPCfK78)

#### 1) Do you want to proceed?

(Tick 'Yes' to proceed)

First, we would like some basic information about your studies.

#### 2) Gender

Male / Female / Other

3) Age

#### 4) At what level are you currently studying?

Bachelor / Master / PhD / Other / I'm not a student

#### 5) Field of study

Business, Economics & Law Computer Science, IT and Engineering Social Science Natural and Life Sciences Health and Medical Care Arts and Humanities Other

#### 6) In which term did you begin your study program?

Terms: Spring/Autumn Year: Earlier than 2017 – 2021

#### 7) Are you an international student?

Yes / No

#### 8) What type of accommodation do you live in?

Student corridor, shared kitchen

Shared apartment with other student(s)

Shared apartment with non-student(s)

With my parents

Own room/apartment with kitchen Other: \_\_\_\_\_

9) Did you live somewhere other than your country of nationality before starting this study program (for Swedish respondents) / Did you live somewhere other than your country of nationality before coming to Sweden? (for international respondents)

10) When did you arrive in Sweden? (internationals only)

Options: Year, Month

11) Country of nationality (internationals only)

12) For how long did you live in your previous country of residence (If response is "Yes" to Question 9)

13—17) Please select between 0% to 100% how much of each category of packaging waste you usually sort

0% / 25% / 50% / 75% / 100% for paper, plastic, glass, metal and *pant* each.

18-22) Now please recall how much of each category of packaging waste you used to sort BEFORE the beginning of this study program (Swedish respondents) / ~ in your previous country of residence (for international respondents)

0% / 25% / 50% / 75% / 100% for paper, plastic, glass, metal and *pant* each.

#### 23-31) Please select the extent to which you agree to the following statements.

1= strongly disagree, 7 = strongly agree

Questions on perceived behavioral control It requires too much time to sort packaging waste The process of sorting and recycling takes too much effort I do not have enough information about how to sort and recycle

Questions on attitude I find the process of sorting and recycling distasteful Recycling is good for the environment I feel like a good person when I recycle

Questions on subjective norm

Proper sorting and recycling of materials are part of the Swedish norm Swedish authorities expect me to properly sort and recycle packaging waste People I personally know in Sweden generally consider recycling to be important

32—40) Now imagine you were shown the same statements as in the previous section BEFORE coming to Sweden. We ask you to respond to these statements as you would in your PREVIOUS COUNTRY OF RESIDENCE. (for internationals) // Now imagine you were shown the same statements as in the previous section BEFORE the beginning of your current study program. We ask you to respond to these statements as you would during that time. (For Swedish respondents)

```
1= strongly disagree, 7 = strongly agree
```

Questions on perceived behavioral control It requires too much time to sort packaging waste The process of sorting and recycling takes too much effort I do not have enough information about how to sort and recycle

Questions on attitude I find the process of sorting and recycling distasteful Recycling is good for the environment I feel like a good person when I recycle

Questions on subjective norm

Proper sorting and recycling of materials are part of the Swedish norm Swedish authorities expect me to properly sort and recycle packaging waste People I personally know in Sweden generally consider recycling to be important

#### 41) Where did you find out about this survey?

Email / Facebook / Other

Matrix of correlat	tions																
Variables	(1)	(2)	(3)	(4)	(5)	(9)	(2)	(8)	(6)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
(1) recnow	1.000																
(2) att1	0.319	1.000															
(3) att2	0.011	0.182	1.000														
(4) att3	0.056	0.073	0.326	1.000													
(5) norml	0.156	0.088	0.180	0.182	1.000												
(6) norm2	0.139	0.078	0.175	0.211	0.521	1.000											
(7) norm3	0.097	0.013	0.236	0.168	0.528	0.386	1.000										
(8) recpast	0.614	0.224	-0.007	-0.069	0.056	0.044	0.014	1.000									
(9) att1past	-0.308	-0.720	-0.169	0.026	-0.093	-0.062	0.022	-0.350	1.000								
(10) att2past	0.055	0.198	0.584	0.400	0.194	0.137	0.120	0.094	-0.249	1.000							
(11) att3past	-0.009	0.014	0.339	0.789	0.141	0.286	0.157	-0.047	0.014	0.412	1.000						
(12) norm1past	0.218	0.073	0.104	0.040	0.409	0.225	0.263	0.529	-0.214	0.234	0.042	1.000					
(13) norm2past	0.182	0.064	0.056	0.050	0.337	0.526	0.233	0.439	-0.165	0.180	0.132	0.732	1.000				
(14) norm3past	0.225	0.075	0.145	0.037	0.303	0.164	0.493	0.446	-0.218	0.213	0.034	0.687	0.605	1.000			
(15) pbc1 past	-0.367	-0.408	-0.087	-0.028	-0.053	-0.061	-0.044	-0.444	0.560	-0.196	-0.045	-0.259	-0.235	-0.291	1.000		
(16) pbc2past	-0.364	-0.372	-0.073	-0.033	-0.091	-0.060	-0.072	-0.480	0.580	-0.202	-0.034	-0.281	-0.219	-0.329	0.861	1.000	
(17) pbc3past	-0.178	-0.247	-0.003	0.080	-0.076	-0.006	-0.004	-0.451	0.400	-0.122	0.023	-0.405	-0.352	-0.387	0.428	0.444	1.000

### Appendix 2: Additional tables

Table A1: Coefficient table for OLS regressions

Variables	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7
Subjective norm	$2.202^{*}$	1.104	1.180	4.175**	4.027**	4.469**	5.968**
	(0.964)	(0.734)	(0.736)	(1.358)	(1.363)	(1.387)	(1.972)
Attitude	1.527	1.675	2.129*	1.845	2.259	0.398	-1.003
	(1.247)	(0.929)	(0.970)	(1.228)	(1.282)	(1.997)	(2.367)
Perceived behavioral control	-5.767***	-1.369*	-1.413*	-5.259***	-5.240***	-0.995	-3.908**
	(0.828)	(0.667)	(0.670)	(0.843)	(0.847)	(1.237)	(1.428)
International (dummy variable)		29.12***	26.79***	-31.72**	-33.86***	1.062	-39.62**
		(4.576)	(4.760)	(9.594)	(9.660)	(8.781)	(15.02)
Past recycling level		0.695***	0.687***			0.452***	
		(0.0445)	(0.0448)			(0.0971)	
Past subjective norm				-2.498	-2.302		-2.744
				(1.418)	(1.424)		(2.476)
International × Past recycling level		-0.339***	-0.308***			-0.0115	
		(0.0673)	(0.0687)			(0.117)	
International × Past subjective norm				4.907**	5.169**		5.397
				(1.868)	(1.879)		(2.795)
Female (dummy variable)			-1.992		-1.500	-3.162	-1.690
			(1.584)		(2.092)	(3.074)	(3.625)
Level of education			-0.441		0.349	0	0
			(1.069)		(1.407)	(.)	(.)
Age			1.247		2.260	1.535	0.901
			(1.475)		(1.939)	(3.880)	(4.503)
Age-squared			-0.0167		-0.0326	-0.0226	-0.0205
			(0.0261)		(0.0343)	(0.0678)	(0.0788)
Constant	73.06***	13.94	-7.006	74.37***	36.47	1.225	74.64
	(9.118)	(7.603)	(21.95)	(9.496)	(29.06)	(57.89)	(68.19)
N	375	375	375	375	375	154	154
R <sup>2</sup>	0.166	0.542	0.549	0.205	0.218	0.459	0.260

Standard errors in parentheses \* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001

Table A2: Results of OLS regression. Column 6 and 7 are restricted to respondents who are studying a masters program at the time of taking the survey