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Future Orientation and Energy Saving

Subjective Discount Rates and Consideration of Future Consequences as Predictors of Environmentally Responsible Behavior

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Für den Inhalt und die Schlussfolgerungen ist ausschliesslich die Autorin dieses Berichts verantwortlich. An Kapitel 2 waren zusätzlich Andreas Diekmann und Reto Meyer beteiligt.

Summary

Many decisions relevant to environmental conservation involve a trade-off between short- and long-term benefits. For example, avoiding leaving electrical devices on stand-by or lowering thermostat settings in winter results in lower energy costs and helps protect the environment in the long run, although in the short term it leads to a loss of comfort. This temporal dimension is particularly relevant for long-term investments. For example, an investment in an energy-efficient heat pump is in the long term beneficial to society as a whole as it reduces resource consumption compared to conventional oil-fired heating. At the same time, it comes with short-term opportunity costs as the investment decision itself is likely to require more time and to come with higher investment costs than if an oil-based heating system were simply replaced.

Although this temporal dimension of pro-environmental behavior is often acknowledged, there is still much room for exploration. Therefore, this project focuses on the role of future orientation as a predictor of environmentally friendly behavior. Future orientation describes the extent to which someone is oriented towards the future and thus to what extent future outcomes are valued in the face of more immediate benefits. Future-oriented persons typically plan their actions, set goals that can only be achieved in the long run, and consider long-term consequences of their behavior.

In the field of economics, the subjective discount rate is a typical measure that taps into this very idea while psychological studies generally rely on multi-item scales that capture a person's self-perception. This project follows both approaches: Chapter 2 presents results based on subjective discount rates whereas Chapter 3 introduces the Consideration of Future Consequences scale (CFC; Strathman, Gleicher, Boninger, & Edwards, 1994) as a predictor of pro-environmental behavior. Both the CFC scale and subjective discount rates capture a sense of either caring for future or present outcomes.

Chapter 1: Method

The analyses in this report are based on two surveys: the "Swiss Environmental Survey 2007" and a follow-up survey conducted as part of this project in 2010/2011. Chapter 2 on subjective

discount rates is based on both data sets, whereas Chapter 3 on the psychological measure of future orientation is restricted to the more recent data set.

The "Swiss Environmental Survey 2007" is a representative general population study based on an extensive telephone interview (CATI, n = 3369) and a follow-up postal paper-and-pencil questionnaire (n = 2789). Both were conducted in German, French, and Italian and addressed to the residential population of Switzerland aged 18 or above with a registered telephone line.

Between November 2010 and March 2011, as many of the respondents of the "Swiss Environmental Survey 2007" as possible were contacted for another follow-up survey, once again conducted in three languages by means of a paper-and-pencil questionnaire. This resulted in a sample of 1945 respondents.

Chapter 2: Subjective Discount Rates

Chapter 2 is concerned with a particular set of pro-environmental behavior: energy-saving behavior that (on average) results in lower overall costs for the household in question. The starting point is that even behaviors that would pay off in the long term are not always carried out. This may, for example, be the case for investments in energy-efficient heating systems or for avoiding stand-by on the television set. Therefore, on the aggregate level a large potential for energy saving is lost.

Subjective discount rates present one possible explanation for such a lack of foresight. A high discount rate implies that someone is devaluing future rewards rapidly and thus is present-oriented. In contrast, a low discount rate signifies a higher valuation of future utility and therefore a higher degree of future orientation. Hence, persons with lower discount rates are expected to accept additional costs upfront more readily than those with higher discount rates. Consequently, they should be more likely to carry out those energy-saving behaviors that result in lower costs in the long term.

Based on data from the "Swiss Environmental Survey 2007" and the follow-up study in 2010/2011, our analyses address four topics for which the main results are as follows:

(1) **High absolute level of subjective discount rates in the Swiss population**

The average subjective discount rate is well above market interest rates. More than half of the respondents have a discount rate of 20% and above. Even though such findings are common, this has serious consequences as it implies that future benefits are devalued very strongly.

(2) **Subjective discount rates are related to high income and high levels of education**
As expected, more educated persons and those with higher incomes make more patient choices. In addition, females rather than males choose smaller sooner payments. The relationship between age and discount rates appears curvilinear.

(3) **Subjective discount rates are moderately reliable but not necessarily stable**
Our analyses indicate a certain reliability and a moderate stability of discount rates. Yet a look at results from psychological studies on the stability of personality measures casts doubt on whether there is enough evidence to conclude that discount rates are stable. Hence, the results on the stability of discount rates remain ambiguous.

(4) **Subjective discount rates do not predict energy saving behavior**
Contrary to expectations and despite our focus on economically efficient behavior, we do not find consistent effects of subjective discount rates on energy-saving behavior. Only five out of 34 expected effects are confirmed (15%).

In sum, our study confirms the expected findings on discount rates with regard to their absolute level and group differences in the population. However, the results only indicate a moderate stability and disconfirm our expectation that subjective discount rates would predict energy saving behavior. Thus, the results on the stability of discount rates and their predictive power for behavior are ambiguous at best. In fact, they challenge the classic economic assumption that the subjective discount rate represents a stable individual difference variable that predicts behavior across different situations.

Chapter 3: Consideration of Future Consequences

The third chapter analyzes the relationship between environmentally friendly behavior and future orientation as measured by the Consideration of Future Consequences scale (CFC; Strathman et al., 1994) and is based on the 2010/2011 data. CFC captures the extent to which a person is driven by short-term rewards or orients him or herself towards long-term goals. While previous studies have repeatedly shown that CFC may be related to pro-environmental behavior, there is considerable debate about whether the scale captures concern with future consequences only, or with both future *and* immediate consequences. This would not only have implications for research but also for practical interventions: For example, if a particular behavior is mainly driven by a concern with immediate benefits, pointing to long-term outcomes may be in vain.

While the core interest of the present chapter is on the relationship between CFC and behavior, the above issue is addressed by preliminary factor analyses. These support differentiation into two subscales: one reflecting concern for immediate benefits and one conveying a concern for future outcomes. To explore whether this distinction is useful in the prediction of environmentally friendly behavior, all analyses with regard to behavior were conducted twice – once with a one-factorial scale and once with both subscales as independent variables.

In conclusion, the results suggest that consideration of future (and immediate) consequences is systematically related to pro-environmental behavior. A non-negligible part of this relationship is mediated by environmental concern. Even though the results based on the full scale and on the two subscales do not differ systematically, the distinction of two subscales still reveals that not all behaviors are equally related to both of them. There is some indication that curtailment behavior could be more closely associated with consideration of immediate consequences, whereas efficiency-enhancing behavior may be related to concern with future outcomes (if related to either one of the scales).

From a practical point of view, the observation that most efficiency-enhancing behaviors are neither related to concern with future nor immediate consequences is dissatisfying as particularly efficiency-increasing behaviors have a large potential for energy-saving and are far-reaching. Nonetheless, the general result that both consideration with future and with immediate consequences are relevant to behavior merits further attention. Further research is needed to analyze what type of behavior is more closely related to concern with future and with immediate consequences respectively.

Overall Conclusion

Pro-environmental behavior very frequently involves a trade-off between short- and long-term benefits. Therefore, the present project focuses on the role of future orientation as a predictor of environmentally friendly behavior. It does so by following two research traditions: First, the relationship between energy saving and a behavioral measure from economic research – the subjective discount rate – is analyzed. Second, the psychological multi-item "Consideration of Future Consequences" (CFC) scale is introduced as a predictor of pro-environmental behavior. Theoretically, subjective discount rates and the psychological scale both capture a preoccupation with future and present outcomes of behavior and therefore can be considered as two sides of the same coin. For this reason, it was hypothesized that both would be valid predictors of pro-environmental behavior.

Overall, the results on the CFC scale are in line with expectations: The scale is shown to be a reliable instrument irrespective of whether it is considered as one- or as two-dimensional. In addition, it is clearly related to environmentally friendly behavior. This relationship was partially mediated by environmental concern.

With regard to temporal discounting, the results reveal high average subjective discount rates for the Swiss population that are well above market interest rates. As expected, more educated persons and those with higher incomes generally have lower discount rates. Yet, our analyses attest discount rates (at best) a moderate stability. Moreover, we do not find any systematic effects of discount rates on behavior – despite the fact that the measures were state-of-the-art, showed a moderate stability and given the analyses were restricted to behaviors that should result in lower financial overall costs for most respondents.

Hence, the question remains as to why the behavioral measures (discount rates) were not related to pro-environmental behavior while the psychological multi-item scale (CFC) was. It is frequently assumed that behavioral measures are superior to attitude measures. They are believed to tap more directly into a person's actual preferences than attitudinal items. Thus, the respondents should be less likely to (consciously) portray themselves according to their self-perceptions. However, with regard to the prediction of behavior our results clearly contradict the notion that behavioral measures are generally superior to attitude scales: The CFC scale was related to behavior, whereas subjective discount rates were not. This strongly suggests future research should be more critical regarding measures of subjective discounting and that it may be advisable to consider using attitudinal instruments instead.

Zusammenfassung

Viele Entscheidungen, die für die Umwelt relevant sind, bedingen ein Abwägen zwischen kurzfristigen und langfristigen Vorteilen. Wer zum Beispiel elektrische Geräte nicht im Standby-Modus belässt oder im Winter etwas weniger heizt, hat zwar geringere Energiekosten zu tragen und hilft, die Umwelt zu schützen, doch kurzfristig können solche Verhaltensweisen zu Komforteinbussen führen. Diese zeitliche Dimension ist insbesondere bei langfristigen Investitionen bedeutsam. Eine Investition in eine energieeffiziente Wärmepumpe ist beispielsweise für die Gesellschaft insgesamt von Vorteil, da sie im Vergleich zu einer konventionellen Ölheizung einen geringeren Ressourcenverbrauch aufweist. Gleichzeitig aber verursacht eine solche Investition kurzfristig Opportunitätskosten, da die Entscheidung selbst mutmasslich mehr Zeit erfordert und höhere Investitionskosten bedingt, als wenn lediglich eine Ölheizung ersetzt würde.

Obschon diese Zeitdimension des Umweltverhaltens gemeinhin anerkannt ist, besteht nach wie vor Forschungsbedarf. Das vorliegende Projekt befasst sich mit der Bedeutung der Zukunftsorientierung als Prädiktor für Umweltverhalten. Die Zukunftsorientierung beschreibt das Ausmass, in welchem sich eine Person an der Zukunft orientiert, und damit auch, wie sehr sie zukünftige Handlungsergebnisse im Vergleich zu kurzfristigerem Nutzen wertschätzt. Zukunftsorientierte Person planen typischerweise ihre Handlungen, setzen sich längerfristige Ziele und berücksichtigen langfristige Folgen ihres Verhaltens.

In der ökonomischen Forschung wird in der Regel die subjektive Diskontrate verwendet, um eine derartige Orientierung zu erfassen. Psychologische Studien dagegen verwenden meist Skalen, die mittels einer grossen Zahl an Items das Selbstbild einer Person erfassen. Das vorliegende Projekt verfolgt beide Ansätze: Kapitel 2 stellt Ergebnisse vor, die unter Berücksichtigung der subjektiven Diskontrate entstanden sind, während Kapitel 3 die "Consideration of Future Consequences"-Skala (CFC; Strathman et al., 1994) als Prädiktor für Umweltverhalten verwendet. Sowohl die CFC-Skala als auch die subjektive Diskontrate erfassen, inwieweit sich eine Person an gegenwärtigen oder zukünftigen Handlungsfolgen orientiert.

Kapitel 1: Methode

Die Analysen in diesem Bericht beruhen auf zwei Studien: dem "Schweizer Umweltsurvey 2007" und einer Folgeuntersuchung, welche im Rahmen dieses Projektes im Zeitraum 2010-2011 durchgeführt wurde. Kapitel 2 zur subjektiven Diskontrate basiert auf beiden Datensätzen, während Kapitel 3 zur "Consideration of Future Consequences"-Skala ausschliesslich den letzteren Datensatz verwendet.

Der "Schweizer Umweltsurvey 2007" ist eine repräsentative Studie in der allgemeinen Bevölkerung bestehend aus einem umfangreichen Telefoninterview (CATI, n = 3369) und einer anschliessenden schriftlichen, postalischen Umfrage (n = 2789). Beide Befragungen wurden auf Deutsch, Französisch und Italienisch durchgeführt. Befragt wurde die Wohnbevölkerung ab 18 Jahren, welche über einen eingetragenen Telefonanschluss verfügt.

Zwischen November 2010 und März 2011 wurden möglichst viele der Teilnehmenden des "Schweizer Umweltsurveys 2007" erneut kontaktiert und um ihre Teilnahme an einer Nachfolgestudie gebeten. Auch diese wurde als dreisprachige, postalische Umfrage durchgeführt. Dies führte zu einer Stichprobe von 1945 Personen.

Kapitel 2: Subjektive Diskontrate

Kapitel 2 befasst sich mit einem speziellen Typ des Umweltverhaltens: Energiesparverhalten, welches (im Durchschnitt) zu geringeren Gesamtkosten für den betreffenden Haushalt führt. Der Ausgangspunkt ist, dass oft nicht einmal jene Verhaltensweisen ausgeführt werden, welche sich langfristig auszahlen würden. Beispiele sind unterlassene Investitionen in energieeffiziente Heizungssysteme oder wenn der Standby-Betrieb eines Fernsehgeräts nicht vermieden wird. Auf diese Weise bleibt gesamtgesellschaftlich ein grosses Energiesparpotential ungenutzt.

Die subjektive Diskontrate stellt eine mögliche Erklärung für einen solchen Mangel an Voraussicht dar. Eine hohe Diskontrate bedeutet, dass eine Person zukünftige Belohnungen stark abwertet und damit gegenwartsorientiert ist. Im Gegensatz dazu besagt eine tiefe Diskontrate, dass zukünftiger Nutzen hoch gewichtet wird und entsprechend eine stärker ausgeprägte Zukunftsorientierung vorliegt. Daher wird erwartet, dass Personen mit einer tieferen Diskontrate eher bereit sind, anfänglich zusätzliche Kosten auf sich zu nehmen, als Personen mit einer höheren Diskontrate. Dies bedeutet, dass sie eher bereit sein sollten, jenes Energiesparverhalten zu zeigen, welches langfristig in Kosteneinsparungen resultiert.

Basierend auf den Daten des "Schweizer Umweltsurveys 2007" und der Nachbefragung in 2010/2011 wurden vier Themen behandelt. Dies führt zu folgenden Hauptergebnissen:

(1) **Hohe subjektive Diskontraten in der Schweizer Bevölkerung**
Die subjektive Diskontrate liegt im Schnitt deutlich über den aktuellen Marktzinssätzen. Mehr als die Hälfte der Antwortenden weist eine Diskontrate von 20% oder höher auf. Obwohl dieser Befund mit früheren Studien vergleichbar ist, hat dies ernstzunehmende Folgen, da es bedeutet, dass zukünftiger Nutzen stark abgewertet wird.

(2) **Die subjektive Diskontrate ist mit hoher Bildung und hohem Einkommen korreliert**
Wie erwartet haben sich gebildetere Personen und jene mit höheren Einkommen als geduldiger erwiesen. Des Weiteren entscheiden sich Frauen eher als Männer für geringere, jedoch frühere Auszahlungen. Die Beziehung zwischen dem Alter und der Diskontrate scheint kurvilinear.

(3) **Die subjektive Diskontrate ist moderat reliabel, aber nicht zwingend stabil**
Unsere Analysen attestieren der subjektiven Diskontrate eine gewisse Reliabilität und eine moderate Stabilität. Ein Blick auf die Ergebnisse psychologischer Studien zur Stabilität von Persönlichkeitsmerkmalen wirft jedoch Zweifel auf, ob die Befunde hinreichend sind, um auf Stabilität zu schliessen. Daher sind die diesbezüglichen Ergebnisse nicht schlüssig.

(4) **Kein Zusammenhang zwischen der subjektiven Diskontrate und Energiesparen**
Entgegen den Erwartungen und trotz der Einschränkung auf ökonomisch effizientes Verhalten finden wir keine konsistenten Effekte der subjektiven Diskontrate auf das Energiesparen. Nur fünf der erwarteten 34 Effekte konnten bestätigt werden (15%).

Zusammenfassend lässt sich festhalten, dass unsere Studie die erwarteten Ergebnisse bezüglich des absoluten Niveaus der subjektiven Diskontrate und zu Unterschieden in der Bevölkerung bestätigt. Jedoch erweist sich die Diskontrate lediglich als moderat stabil und die Hypothese, dass die Diskontrate als Prädiktor für Energiesparen fungiert, wurde nicht bestätigt. Damit sind die Ergebnisse zur Stabilität und zum Einfluss auf das Verhalten bestenfalls als unklar zu bezeichnen. Sie lassen Zweifel an der klassischen ökonomischen Annahme aufkommen, dass die subjektive Diskontrate ein stabiles Persönlichkeitsmerkmal darstellt, das das Verhalten in den unterschiedlichsten Situationen beeinflusst.

Kapitel 3: Consideration of Future Consequences

Das dritte Kapitel untersucht den Zusammenhang zwischen Umweltverhalten und Zukunftsorientierung, wie sie die "Consideration of Future Consequences"-Skala erfasst (CFC; Strathman et al., 1994). Dazu werden die Daten der Umfrage 2010/2011 verwendet. CFC erfasst das Ausmass, in dem eine Person durch kurzfristige Belohnungen angetrieben ist oder aber sich an

langfristigen Zielen orientiert. Frühere Studien haben wiederholt gezeigt, dass Umweltverhalten mit CFC im Zusammenhang stehen könnte. Nach wie vor ist aber unklar, ob die Skala ausschliesslich eine Ausrichtung an zukünftigen Handlungsfolgen oder auch eine Orientierung an sofortigen Konsequenzen erfasst. Dies hätte nicht nur Folgen für die Forschung, sondern auch für praktische Interventionen: Ist ein Verhalten beispielsweise hauptsächlich durch eine Orientierung an unmittelbarem Nutzen beeinflusst, so wäre es möglicherweise fruchtlos, auf langfristige Folgen hinzuweisen.

Während das zentrale Anliegen dieses Kapitels die Analyse des Zusammenhangs zwischen CFC und Verhalten ist, wird das obige Problem durch vorgängige Faktoranalysen angegangen. Diese sprechen für eine Unterscheidung von zwei Subskalen: eine, die eine Orientierung an unmittelbaren Handlungsfolgen erfasst, und eine, welche eine Ausrichtung an künftigem Nutzen ausdrückt. Um zu prüfen, ob sich diese Unterscheidung bezüglich Verhalten als relevant erweist, wurden alle folgenden Analysen doppelt ausgeführt – einmal mit einer einfaktoriellen Skala und einmal mit den beiden Subskalen als unabhängige Variablen.

Zusammenfassend bestätigen die Ergebnisse, dass eine Ausrichtung an zukünftigen (und auch an sofortigen) Handlungsfolgen in einem systematischen Zusammenhang mit Umweltverhalten steht. Ein nicht vernachlässigbarer Teil dieses Zusammenhangs wird durch das Umweltbewusstsein vermittelt. Die Analyseergebnisse mit der Gesamtskala unterscheiden sich nicht systematisch von jenen, die beide Subskalen berücksichtigen. Dennoch zeigt sich aber, dass nicht alle Verhaltensweisen gleichermassen mit beiden Subskalen zusammenhängen. Möglicherweise steht alltägliches (Routine-)Verhalten in einem engeren Zusammenhang mit einer Orientierung an sofortigen Konsequenzen, während umfassendere Energiesparinvestitionen tendenziell eher mit einer Ausrichtung an künftigen Handlungsfolgen zusammenhängen (sofern überhaupt ein Zusammenhang zu einer der Subskalen besteht).

Aus praktischer Sicht ist unbefriedigend, dass die meisten der untersuchten Energiesparinvestitionen weder mit einer Orientierung an gegenwärtigen noch an zukünftigen Handlungsfolgen zusammenhängen. Gerade diese Verhaltensweisen hätten weitreichende Folgen und damit ein grosses Potential, Energie zu sparen. Nichtsdestotrotz verdient das Ergebnis Beachtung, dass sowohl die Zukunfts- als auch die Gegenwartsorientierung generell in einem Zusammenhang mit dem Verhalten stehen. Welcher Typ des Verhaltens mit welcher Orientierung zusammenhängt, muss zukünftige Forschung zeigen.

Schlussbemerkungen

Umweltschonendes Verhalten bedingt oftmals ein Abwägen zwischen kurz- und langfristigem Nutzen. Daher befasst sich das vorliegende Projekt mit der Bedeutung der Zukunftsorientierung für das Umweltverhalten. Dabei werden die Ansätze zweier unterschiedlicher Forschungstraditionen berücksichtigt: Einerseits wird der Zusammenhang zwischen Energiesparen und der subjektiven Diskontrate, einem verhaltensorientierten Mass der ökonomischen Forschung, untersucht. Andererseits wird die psychologische Multi-Item-Skala "Consideration of Future Consequences" (CFC) als Prädiktor für Umweltverhalten verwendet. Aus theoretischer Sicht erfassen beide Instrumente eine Fokussiertheit auf zukünftige respektive gegenwärtige Folgen von Verhalten und können daher als zwei Seiten derselben Medaille erachtet werden. Daher wurde erwartet, dass sich beide Masse als valide Prädiktoren des Umweltverhaltens erweisen würden.

Im Grossen und Ganzen bestätigen die Ergebnisse zur CFC-Skala die Erwartungen: Die Skala hat sich als reliables Instrument erwiesen und zwar unabhängig davon, ob sie als ein- oder zweidimensional erachtet wurde. Des Weiteren steht sie in einem deutlichen Zusammenhang mit Umweltverhalten. Das Umweltbewusstsein mediiert diese Beziehung teilweise.

Die Analysen zur Diskontierung zeigen hohe durchschnittliche Diskontraten für die Schweizer Bevölkerung, die deutlich über den Marktzinssätzen liegen. Wie erwartet wurde für gebildetere Personen und solche mit höherem Einkommen eine tiefere Diskontrate gefunden. Die Stabilität der Diskontrate ist allerdings (bestenfalls) als moderat zu bezeichnen. Zudem wurden keine systematischen Effekte auf das Verhalten gefunden – obschon die Operationalisierung dem Stand der Forschung entspricht, eine moderate Stabilität festgestellt wurde und die Analyse auf ökonomisch effiziente Verhaltensweisen beschränkt war.

So bleibt die Frage, warum die verhaltensorientierten Masse (Diskontrate) nicht mit dem Verhalten zusammenhängen, während die psychologische Multi-Item-Skala (CFC) eben dies tat. Oft wird davon ausgegangen, dass die verhaltensorientierten Masse den Einstellungsskalen überlegen sind. Es wird vermutet, dass sie die wahren Präferenzen unmittelbarer erfassen als Einstellungsfragen dies tun. Entsprechend sollte es weniger wahrscheinlich sein, dass sich Befragte (bewusst) entsprechend ihrem Selbstbild darstellen. Mit Bezug auf das Verhalten widersprechen die vorliegenden Ergebnisse der Annahme jedoch deutlich, dass verhaltensorientierte Masse Einstellungsskalen generell überlegen sind: Die CFC-Skala weist einen Bezug zum Verhalten auf, während die subjektive Diskontrate ebendies nicht tut. Dies legt nahe, dass zukünftige Forschung der subjektiven Diskontrate gegenüber kritischer sein sollte und es ratsam sein könnte, stattdessen Einstellungsinstrumente zu verwenden.

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Chapter 1

Brief Description of Data Collection

This chapter briefly describes the survey conducted as part of this project. All analyses in this report are based on this study and (in case of Chapter 2) its precursor, the "Swiss Environmental Survey 2007". As the former study was designed as a second wave to the latter, the next section quickly describes the earlier survey before turning to the more recent study. As this chapter is very brief, additional information including documentation and questionnaires of both studies can be found online.[1]

The Precursor of the Present Study

The "Swiss Environmental Survey 2007" is a large, representative general population study (n = 3369) conducted at the Chair of Sociology of ETH Zurich (Diekmann & Meyer, 2008).[2] It covered a broad range of environmentally relevant topics, including many behaviors, preferences and attitudes. The data collection was based on a two-stage random sample taken from the resident population of Switzerland with a registered telephone line. In a first step, households were selected randomly from regional strata and notified by mail. The households were then contacted by telephone. In the second step of the sampling procedure, one respondent within each household was selected at random from all its members aged 18 or older and able to respond in German, French, or Italian. The telephone interviews were conducted between November 2006 and March 2007 and lasted on average 37 minutes (CATI).

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[1] For further information see http://www.socio.ethz.ch/research/umweltsurvey/nachbefragung2011 for the more recent study and http://www.socio.ethz.ch/research/umweltsurvey/umweltsurvey2007 for the "Swiss Environmental Survey 2007" (22.10.2013).

[2] The "Swiss Environmental Survey 2007" was funded by the Swiss National Science Foundation (project number 100012-107835), the Swiss Federal Office for the Environment, the cantons of Basel-Stadt (environment and energy office) and Zurich (waste, water, energy and air office), the central Swiss cantons (environment offices) and the environment and health protection offices of the city of Zurich. The Swiss Federal Statistical Office provided financial and methodological support but did neither influence methods nor results.

The resulting response rate was 52% (RR2, Research, AAPOR). A written follow-up questionnaire was completed by a total of 83% of those already interviewed (2789 persons). Up to two reminders were used.

Sample and Procedure[3]

The present study was designed as a follow-up survey to the "Swiss Environmental Survey 2007". Accordingly, as many of the original participants as possible were contacted once again between November 2010 and March 2011. As roughly four years had passed since the last interview, not all addresses could be retrieved. In addition, some respondents had previously declined to participate any further. Altogether, 2517 respondents from the original telephone interview were able to be contacted again for this sequel study. The survey was once again conducted by means of a postal paper-and-pencil questionnaire in German, French, and Italian. The procedure was fairly similar to the previous survey: again, a pre-notification letter as well as up to two reminders were sent. With the questionnaire, a pre-paid return envelope and an incentive (a set of stamps with a value of CHF 6.-) were sent to the respondents. A reprint of the questionnaire was sent with the first reminder.

Altogether 1945 persons participated – equaling 58% of those answering the telephone interview, or 77% of those reached. The resulting sample consists of 52.9% females. The average age is 52.6 years in 2011 (ranging from 21 to 97) and the median level of education is 12 years.

To examine the data set's representativeness of the Swiss population, the relative proportions of the two sexes and three age classes were compared to official statistics. In order to do so, data of the "Statistik der Bevölkerung und der Haushalte (STATPOP)" for the year 2010 was used (Swiss Federal Statistical Office, 2011). The analyses reveal that compared to the general population, women are slightly overrepresented (52.9% vs. 50.7%). In addition, the age structure differs from the general population: Our data includes fewer young adults (18-39 years; 20.8% as opposed to 35.7% in the general population) whereas the middle aged (40-59 years; 45.8% vs. 36.4%) and the older age group (60 years and above; 33.5% vs. 27.9%) are both overrepresented. This deviation was already present in the first wave in 2007 but has increased as the sample has aged by four years in the meantime.

[3] The figures in this section were computed using a design weight for strata and household size.

Materials

In order to avoid a disproportionate number of people with an above-average interest in the environment taking part, the study was not announced as an environmental survey but as a study on "living in Switzerland" ("Leben und Wohnen in der Schweiz"). A subsequent statistical test revealed no significant differences in environmental concern between those who participated in the follow-up survey and those who did not (for details see Diekmann & Bruderer Enzler, 2012).

Pretests

The questionnaire for this study was developed based on literature, a brief survey with students and three pretests:

First, a brief online survey with 1483 students at the Swiss Federal Institute of Technology in Zurich was conducted in 2009. This survey was mainly designed to pretest different measures of future orientation. Second, a qualitative pretest was conducted with 20 persons, both laypersons and researchers, differing in age, gender, level of education and living circumstances. The questionnaire was improved successively based on the feedback received by these persons.

Third, a quantitative pretest was conducted in February 2010 with a sample of 400 Swiss-German households. Fourth, another quantitative pretest was carried out in May 2010. It was addressed to 900 households – 300 from each the German-speaking, the French-speaking and the Italian-speaking areas of Switzerland. For this purpose, the questionnaire was translated into French and Italian by professional translators and double-checked by the project team as well as two experienced translators. In order to ensure comparability, previous translations were adopted if available. The samples for both quantitative pretests were randomly drawn from a telephone directory ("Twixtel 41"). The resulting response rates were 31.7% (n = 120) and 27.2% (n = 234) for the first and second quantitative pretest respectively.

Data entry was conducted manually by the project team. During this process, every questionnaire was examined individually in order to uncover possible difficulties. Based on these considerations and complemented by quantitative analyses, the questionnaire was finalized.

Questionnaire

The focus of the resulting questionnaire was on energy-saving behavior within one's home, future orientation and environmental concern. Behavior was assessed by a variety of items concerned with curtailment behavior (such as switching off the lights upon leaving a room or avoiding leaving the television set on stand-by mode) and efficiency-enhancing behavior (such as insulating the building shell or installing solar panels). Environmental concern was measured by the scale put forth by Diekmann and Preisendörfer (2001) while future orientation was captured by a shortened version of the "Consideration of Future Consequences" scale (Strathman et al., 1994) and several measures of subjective discount rates.

Chapter 2

Subjective Discount Rates in the General Population and their Predictive Power for Energy Saving Behavior[4]

Abstract: Why do people sometimes refrain from saving energy even if it would pay off in monetary terms? Subjective discount rates present one possible explanation for this lack of foresight, but little is known about their level and reliability in the general population. With regard to behavior, persons with lower discount rates are expected to accept additional costs upfront more readily than those with higher discount rates. Based on a representative nation-wide study, the "Swiss Environmental Survey 2007", and a follow-up survey, our analyses reveal that on average subjective discount rates are well above market interest rates and moderately stable over a time interval of four years. Income and education are negatively correlated with discount rates. Contrary to expectations, we did not find convincing support for an impact of discount rates on energy saving behavior.

Introduction

Many decisions relevant to environmental conservation involve a trade-off between short- and long-term benefits. For example, when buying a washing machine, less expensive but less energy-efficient devices have to be compared to options with higher purchase prices and lower operating costs. In some of these situations, investments in energy efficiency would result in lower life-cycle costs. But even in such cases, the corresponding option is not always chosen. Hence, more money than necessary is spent on certain goods and services, and on the aggregate level a large potential for energy saving is lost. This lack of investments corresponds to the so-called "energy efficiency gap" (Howarth, 2004).

[4] This chapter was co-authored by Andreas Diekmann and Reto Meyer. A slightly modified version of this chapter will appear in *Energy Policy*.

This paper focuses on one possible explanation for such a lack of foresight: subjective discount rates.[5] They capture the extent to which a person is present- or future-oriented. Daly and Farley (2011, p. 190) describe discounting as follows: "When evaluating present and future values, intertemporal discounting is the process of systematically weighting future costs and benefits as less valuable than present ones. […] The farther off in time that a cost or benefit occurs, the more we discount its present value." A high discount rate implies that someone is devaluing future rewards rapidly and thus is present-oriented. In contrast, a low discount rate signifies a higher valuation of future utility and therefore a higher degree of future orientation.

Environmentally responsible behavior that pays off financially often only does so in the long run. It therefore requires behaving in a future-oriented manner by delaying utility. For example, the purchase of a fuel-efficient car may initially be more expensive than a less energy-efficient vehicle, but it is profitable in the long term and at the same time causes a lower environmental burden. In such situations, persons with lower discount rates should more readily accept additional costs up front than those with higher discount rates since they put greater value on future utility.

While these theoretical considerations might be compelling, little is known about the level of subjective discount rates and their reliability (and hence temporal stability) in the general population. Most previous studies have been conducted with relatively small (student) samples and report average discount rates that are considerably higher than market interest rates (see Frederick, Loewenstein, & O'Donoghue, 2002). Furthermore, there are only a few studies analyzing subjective discount rates as predictors of actual behavior. So far the results have been heterogeneous.

The aim of this paper is fourfold: First, it reports subjective discount rates for a representative population sample in Switzerland. Second, a brief analysis of the reliability of discount rates is conducted. This is noteworthy not only because of the sample properties but also since the measurements were conducted four years apart. Third, the effects of different socio-demographic variables on subjective discount rates are analyzed by means of multivariate methods. Fourth, discount rates are used to predict self-reported behavior. This paper thus presents one of the rare examples that analyzes a representative general population sample and links discount rates to energy saving behavior.

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[5] An overview of alternative explanations is found in Howarth (2004). These include structural aspects (for example, a user/investor dilemma), hidden costs, uncertainty and computational limitations (see also DEFRA, 2010; Diekmann, 2001; Hassett & Metcalf, 1993; Jakob, 2006; Ott et al., 2005).

Estimation of Subjective Discount Rates in the General Population

So far, only a few studies have reported discount rates for representative population samples. For example, Harrison, Lau, and Williams (2002) have reported a mean of 28% for a Danish sample and Epper, Fehr-Duda, and Schubert (2011) a median of 47% based on an online survey in the German-speaking area of Switzerland.

For student samples, a broad range of average discount rates has been reported. For example, in their classic study Benzion, Rapoport, and Yagil (1989) report mean discount rates of 11–46% (average 21%) depending on framing, amounts and delays involved. There is no clear expectation as to whether the average discount rate of a student or a population sample should be higher. On the one hand, students are more educated than the average population and therefore presumably more adept in handling compound interest computations. On the other hand, they might also be more impulsive and hence more tempted to choose earlier payments rather than more delayed ones (see the next section for a discussion of the effects of education and age on discount rates).

When interpreting subjective discount rates reported by such studies, it should be kept in mind that the way in which discount rates are typically measured already implies there should be positive discounting and hence may bias discount rates upwards (Frederick et al., 2002): Most studies – including the ones cited above – use choice tasks to capture subjective discount rates (Frederick et al., 2002). Usually, respondents are given a choice between a smaller sooner reward (SSR) and a larger later reward (LLR) – for example, a payment of $100 in one year versus a payment of $125 in two years. In the above example, someone preferring the earlier payment is said to have an annual discount rate of at least 25%. As such a measurement simply yields a lower or upper bound on the discount rate, many studies use series of choice tasks varying the delay as well as the amounts of the reward involved. By doing so, the possible range of each person's discount rate can be narrowed down (for example, Kirby, Petry, & Bickel, 1999). The absolute level of discount rates found in such experiments depends on several factors (for comprehensive reviews see Frederick et al., 2002; Manzini & Mariotti, 2007). For example, lower discount rates are reported when higher amounts of a reward are involved (see Kirby, 1997; Percoco & Nijkamp, 2009). This "magnitude effect" is plausible if the respondents do not only consider the relative but also the absolute height of the amounts involved and behave accordingly (Loewenstein & Prelec, 1991).

A related phenomenon is increasing patience with delay (hyperbolic discounting). For example, a decision between a cookie tomorrow and two cookies the day after tomorrow is perceived differently from a decision between a cookie in 60 days and two cookies in 61 days. In both situations, the same additional waiting period (one day) is required to receive a larger

instead of a smaller reward. However, the situations differ with regard to when this additional waiting period begins (in one or in 60 days). Hyperbolic discounting conveys that respondents are more likely to wait for LLRs in the second type of decision. The closer to the present the additional waiting period starts, the higher the discount rates are (Benzion et al., 1989; Thaler, 1981).

So far there is no conclusive evidence on whether discount rates are affected by whether hypothetical rewards, real rewards or rewards depending on a lottery are used (Coller & Williams, 1999; Frederick et al., 2002). It could either be argued that the possibility of actually receiving a reward increases its salience (see for example research on psychological distance; Trope & Liberman, 2010) and hence may lead to more impulsive choices, or it could be assumed that incentivized choices should yield lower discount rates as respondents might be more thoughtful when facing real rewards (see Camerer & Hogarth, 1999).

Apart from the methodological factors discussed so far, there are other possible confounding factors such as transaction costs, risk preferences and trust in the paying institution. To reduce these, studies with incentivized choices often use delayed rewards only (see Frederick et al., 2002; Harrison, Lau, Rutström, & Williams, 2005).

In our surveys, the subjective discount rate was measured twice in each wave. All measures are based on choice tasks, some of which were incentivized while some also included a front-end delay. This allows comparing them and testing for possible influences of the magnitude of the rewards, the delays involved and the presence of a lottery. However, one of the main goals of this paper is to estimate the average discount rate for a general population sample, in this case the Swiss population.

Reliability of Subjective Discount Rates

Only a few studies have investigated the reliability or stability of discount rates. Typically, two measurements were conducted with a brief period between them, such as one week or three months, and the findings are based on non-representative and rather small (student) samples.

Table 2.1 gives an overview of correlations between discount rates over time reported by previous studies. Most of them report moderate to high correlations, although the results vary both between and within the studies.

Table 2.1. Overview of previous studies reporting correlations between discount rates over time

Study	Sample size	Period between measurements	Correlations*
Beck and Triplett (2009)	224	6 weeks	0.64 – 0.70
Johnson, Bickel, and Baker (2007)	3 x 30	1 week	0.45 – 1.00
Kirby (2009)	≈100	5, 52, and 57 weeks	0.57 – 0.75
Kirby et al. (2002)	≈154	≈ 3, 6, 9 and 12 months	non-significant up to 0.33
Meier and Sprenger (2010)	250	12 months	0.40
Ohmura, Takahashi, Kitamura, and Wehr (2006)	22	3 months	non-significant up to 0.76
Simpson and Vuchinich (2000)	15	1 week	0.74 – 0.91
Takahashi, Furukawa, Miyakawa, Maesato, and Higuchi (2007)	33	2 months	0.37
Weatherly, Derenne, and Terrell (2011)	115	3 months	0.33 – 0.73

* Ranges of correlations are reported for discount rates mentioned for different delays and goods.
Note: A recent online survey in the German-speaking area of Switzerland by Epper et al. (2011, general public, period of 8 months) finds no significant change if the respondents were paid independently of their answers (n = 192) and a significant decrease if the payments depended on the respondents' choices (n = 140). However, the study does not report correlations.

Unfortunately, none of these correlation studies is based on a representative population sample. The present paper will, however, report the test-retest reliability of discount rates over a period of four years as well as the parallel form reliability for a representative Swiss population sample.

Socio-Demographic Determinants of Subjective Discount Rates

Although several socio-demographic variables have been shown to co-vary with subjective discount rates, the evidence regarding the causes of individual differences in discount rates is still very limited (see Kirby et al., 2002). Stable effects have mainly been found for education and income. Most studies report a negative relationship – thus, higher income and higher education both accompany lower discount rates (for example Burks, Carpenter, Götte, & Rustichini, 2011; de Wit, Flory, Acheson, McCloskey, & Manuck, 2007; Green, Myerson, Lichtman, Rosen, & Fry, 1996; Harrison et al., 2002; Hausman, 1979; Reimers, Maylor, Stewart, & Chater, 2009). For gender and age the existing studies report diverging results. Many studies do not find any relationship between discount rates and gender (for example Anderson & Stafford, 2009; Coller & Williams, 1999; M. Daly, Delaney, & Harmon, 2008; de Wit et al., 2007; Harrison et al., 2002). A few point to females being more present-oriented (Cairns & Pool,

2000; Read & Read, 2004; Reimers et al., 2009) and others on the delay of gratification generally conclude females were slightly more future-oriented (Silverman, 2003).

Studies on the effect of age are mainly based on cross-sectional data (see Borghans, Duckworth, Heckman, & ter Weel, 2008; Frederick et al., 2002; Khwaja, Silverman, & Sloan, 2007). To our knowledge, there are no panel studies over substantial periods. Different theoretical positions either suggest a decline (Rogers, 1994), a steady increase (Trostel & Taylor, 2001) or a curvilinear relationship (u-shaped; Sozou & Seymour, 2003) over adulthood. Each of these positions comes with limited empirical support only (for example Cairns & Pool, 2000; Harrison et al., 2002; Kirby et al., 2002; Read & Read, 2004; Reimers et al., 2009).

Our analyses focus on the four predictors discussed above – education, income, gender and age – as they are believed to be relevant for many other individual differences, and attempt to shed further light on their role in discounting.

Subjective Discount Rates as a Predictor of Behavior

So far, discounting and pro-environmental behavior have not been linked very often. A number of mainly older studies from the US infer (aggregate market) discount rates from actual energy-saving behavior (e.g. Gately, 1980; Hausman, 1979; Liebermann & Ungar, 1983; A. Meier & Witthier, 1983; Ruderman, Levine, & McMahon, 1987). Their results vary greatly both between and within product types (partially due to model specifications). For example, annual discount rates of 10–32% were found for thermal insulations, 2–36% for space heating, 3–29% for air conditioning systems and 34–300% for refrigerators (Train, 1985, p. 1246ff). Most of these discount rates are considerably higher than market interest rates. This implies that consumers spend more money on certain goods and services than necessary. But as these studies inferred discount rates from behavior, the latter determines the former and not the other way round. One cannot conclude from these studies that the subjective discount rate – being an independent construct – has a causal impact on the purchasing behavior.

Many of the more recent studies, in contrast, use discount rates as *predictors* of behavior and thus measure individual discount rates independently from behavior. Most of these studies focus on financial savings and debts, substance abuse, sexual intercourse and other health-related behaviors such as nutrition and exercise (e.g. Burks et al., 2011; Chabris, Laibson, Morris, Schuldt, & Taubinsky, 2008; Chapman, 1998; Khwaja et al., 2007; Kirby et al., 1999; Nyhus, 2002; Reimers et al., 2009; Sutter, Kocher, Rützler, & Trautmann, 2010). The results so far have been ambiguous.

Only very few studies have linked discount rates to environmental behavior. To our knowledge, these are the studies by Fehr and Leibbrandt (2008) and Liebermann and Ungar

(1997, 2002). Fehr and Leibbrandt (2008) analyze the impact of discount rates on fishing in rural Brazil. For the particular behaviors in question, the individual rational solution is to free-ride and thus not to behave environmentally friendly. Nonetheless, one of two measures of discount rates – a choice task involving mineral water – had a significant impact: in comparison to respondents with high discount rates, those with low discount rates do their everyday fishing in a more future-oriented, environmentally conscious manner. An analogous measure using a monetary reward did not predict behavior.

Both studies by Liebermann and Ungar (1997, 2002) first measured discount rates and then presented the respondents with a questionnaire including an item on the purchase of an air-conditioning system. This task required a choice between a more energy-efficient while initially more expensive device and a less energy-efficient system with a lower purchase price. The earlier study implied an annual threshold discount rate of roughly 7%, the later a rate of 10%. In both studies, persons with discount rates below this cut-off value were expected to choose the more energy-efficient device whereas respondents with discount rates above this threshold were expected to do the opposite. Behavior in line with these expectations was labeled as "efficient" (Liebermann & Ungar, 2002, p. 732). Roughly 41% of the participants in 1997 and 71% in 2002 made efficient choices in terms of their discount rates. However, note that this is a weak test for the hypothesis of an impact of subjective discount rates on behavior because both studies rely on hypothetical choices.

Given these inconsistent results, the question of the relevance of discounting for behavioral outcomes needs further investigation. Our study contributes by applying discount rates as a predictor of various energy-saving behaviors. From this, the question arises as to which behaviors are expected to be influenced by discount rates. Generally, discount rates convey a sense of future orientation and self-control; more narrowly, they imply financial optimization. This supplies us with a criterion for when to expect a relationship: where energy-saving behavior is most cost-effective in the long run.

Method and Descriptive Analyses

Participants and Procedure

All analyses are based on data from the "Swiss Environmental Survey 2007"[6], a representative general population study (n = 3369), and a follow-up survey conducted around four years later

[6] The "Swiss Environmental Survey 2007" was funded by the Swiss National Science Foundation (project number 100012-107835), the Swiss Federal Office for the Environment, the cantons of Basel City (environment and energy office) and Zurich (waste, water, energy and air office), the central Swiss cantons

(n = 1945). The data collection for the "Swiss Environmental Survey 2007" was based on a two-stage random sample taken from the adult population of Switzerland with a registered telephone extension. In a first step, households were selected randomly from regional strata and notified by mail. The study was described as an investigation into living conditions in Switzerland and not as an environmental study in order to avoid a disproportionate number of people with an above-average interest in the environment taking part. The households were then contacted by telephone. In the second step of the sampling procedure, one respondent within each household was selected at random from all its members aged 18 or older and being able to respond in German, French or Italian. Foreigners belonging to the resident population were included provided they could complete the survey in one of the three languages mentioned. The telephone interviews were conducted between November 2006 and March 2007. On average they lasted 37 minutes. The resulting response rate was 52% (RR2, Research, AAPOR). A written follow-up questionnaire was completed by a total of 83% of those already interviewed (2789 persons). Up to two reminders were used.

Between November 2010 and March 2011, as many of the respondents of the "Swiss Environmental Survey 2007" as possible were contacted for another follow-up survey conducted by means of a postal paper-and-pencil questionnaire. The procedure was fairly similar to the previous survey: again, a pre-notification letter as well as up to two reminders were sent. The study was once more not labeled as related to environmental protection but was announced as survey on "living in Switzerland" ("Leben und Wohnen in der Schweiz").

2517 respondents from the original telephone interview in 2006/2007 were able to be contacted again for this sequel study as not all addresses could be recovered and some respondents had previously indicated they were not willing to participate any further. Altogether 1945 persons participated – equaling 58% of those answering the telephone interview or 77% of those reached.

The resulting sample consists of 56% females in 2007 and 55% in 2011, whose mean age was 50 (in 2007, ranging from 18 to 94) and 54 years (in 2011, ranging from 21 to 97), respectively. For both surveys, the median level of education is 12 years. Further information on the sample as well as on procedures and materials can be found in the project documentation (Diekmann & Bruderer Enzler, 2012; Diekmann & Meyer, 2008).[7]

(environment offices) and the environment and health protection offices of the city of Zurich. The Swiss Federal Statistical Office provided financial and methodological support but did neither influence methods nor results.

[7] To test for an environment-related self-selection bias, for both written surveys, the index's measures of environmental concern during the oral interview in 2006/2007 were compared between the participants and non-participants. In both cases, no significant differences were observed.

Measurement of Subjective Discount Rates

The "Swiss Environmental Survey 2007" as well as the follow-up survey each comprises two main measures of subjective discount rates (see Table A2.1 the appendix for the exact wording). One of the measures in the Environmental Survey 2007 is a hypothetical choice task in which half of the respondents chose between receiving CHF 500 "now" and CHF 600 in one year's time. The other half chose between CHF 500 in one year's time and CHF 600 in two years' time. CHF 500 equaled roughly USD 440 in 2007 and USD 495 in 2011. Both versions of the item allow distinguishing between a group of respondents with a discount rate of at least 20% and a group with a discount rate of 20% at most. In the follow-up study in 2011 the exact same items were used with the same persons while for about a fifth of the respondents, these items were combined with a lottery where three persons would be drawn at random to receive the payment they opted for. Table 2.2 gives an overview of these binary choice tasks.

In addition, a serial choice task was implemented in both surveys. In 2007, this was done in the oral interview. The respondents were to choose between CHF 1000 immediately and CHF 2000 in one year's time. If a respondent decided to wait, the later amount was lowered step by step until either the respondent chose the SSR of CHF 1000 or the LLR reached CHF 1010. The steps of the LLR were CHF 2000, 1500, 1300, 1200, 1150, 1100, 1050, 1030, 1020 and 1010 (see Table 2.3 in the next section). Each respondent was presented with ten decisions at most. After the completion of all interviews, three persons were drawn randomly to receive a payment amounting to one of their decisions. From these items, relatively precise individual threshold discount rates were inferred without having to ask the respondents to name any amounts themselves.

In the 2011 study, a related serial choice task was implemented. Again it involved a lottery in which three participants were to receive a payment in the amount of one of their decisions. As the survey was conducted in written form, the number of decisions was reduced to four and – for the sake of credibility – a front-end delay of a year was introduced so that the payments were due either one or two years from the time the survey was mailed to the respondents. The decisions were as follows: CHF 1000 in one year versus CHF 2000, 1500, 1200 or 1100 in two years.

Results on Subjective Discount Rates in the General Population

Table 2.2 shows the answers obtained by the different versions of the singular choice task:

Table 2.2. Singular choice task: item versions and responses in 2007 and 2011

Item version				Number of respondents choosing	
Delay SSR	Delay LLR	Lottery	Survey	SSR	LLR
now	1 year	no	2007	781 (57.7%)	572 (42.3%)
now	1 year	no	2011	417 (55.2%)	338 (44.8%)
now	1 year	yes	2011	125 (61.0%)	80 (39.0%)
1 year	2 years	no	2007	769 (58.0%)	557 (42.0%)
1 year	2 years	no	2011	399 (53.6%)	345 (46.4%)
1 year	2 years	yes	2011	135 (61.4%)	85 (38.6%)

Comparing the responses to the different item versions, two findings are noteworthy (both confirmed by bivariate and multivariate analyses). First, in presence of a lottery, the respondents seem less patient (binominal test on the 2011 data: $z = 2.470$; $p < .05$). Second, contrary to expectations, the answers do not differ depending on the delays involved (binominal test: $z = .205$; $p > .05$). Assuming a hyperbolic discounting function, a larger proportion of respondents would have been expected to wait when both payments were delayed. Yet the postponement by one year might have been too little considering the amounts of money involved and that a general population sample was investigated. Overall, more than half of the respondents opt for the SSR (55-61%, depending on which item is considered) – thus indicating a discount rate of 20% and above.

Tables 2.3 and 2.4 give an overview of the distributions and mean values of our serial choice tasks. In addition, Table 2.3 gives an overview of the items involved and the discount rates inferred from them. As the 2007 serial choice task was administered orally and ended as soon as the SSR was chosen, no observations were dropped. In case of the written 2011 task, incomplete or contradictory observations were excluded from all analyses (including descriptive statistics).

Table 2.3. Serial choice tasks 2007 (n = 3159) and 2011 (n = 1596): steps and discount rates inferred

Survey	SSR [CHF]	LLR [CHF]	Range of discount rate implied if SSR is chosen here for the first time	Category midpoints (discount rate used in later analyses)	Number of respon-dents	% of valid responses
2007	1000	2000	≥100%	100%	1654	52.4
	1000	1500	50% – 99.9%	75%	275	8.7
	1000	1300	30% – 49.9%	40%	249	7.9
	1000	1200	20% – 29.9%	25%	163	5.2
	1000	1150	15% – 19.9%	17.5%	163	5.2
	1000	1100	10% – 14.9%	12.5%	92	2.9
	1000	1050	5% – 9.9%	7.5%	163	5.2
	1000	1030	3% – 4.9%	4%	60	1.9
	1000	1020	2% – 2.9%	2.5%	39	1.2
	1000	1010	1% – 1.9%;	1.5%	33	1.0
			if LLR is chosen: ≤1%	0.5%	268	8.5
2011	1000	2000	≥100%	100%	277	17.4
	1000	1500	50% – 99.9%	75%	173	10.8
	1000	1200	20% – 49.9%	35%	497	31.1
	1000	1100	10% – 19.9%	15%	230	14.4
			if LLR is chosen: ≤10%	5%	419	26.3

Table 2.4. Mean discount rates inferred from serial choice tasks (arithmetic mean)

	Including all valid responses			Excluding extreme values ≥100%		
Survey	Number of respondents	Mean discount rate	95% CI	Number of respondents	Mean discount rate	95% CI
2007	3159	65.1%	63.73% - 66.57%	1505	26.8%	25.52% - 28.18%
2011	1596	39.9%	38.17% - 41.54%	1319	27.2%	26.01% - 28.44%

Including all valid responses, the sample mean of the annual discount rate is 65% in 2007 and 40% in 2011 (serial choice tasks, see Table 2.4). In the 2007 data, more than half of the respondents have a very high discount rate (over 100%) while only 18% of the respondents express a discount rate of up to 10% – roughly in the range of market interest rates. Looking at the 2011 data, the results are different. Namely, only 17% of the responses imply a discount rate of 100% or above and 26% of the respondents answer in a manner that indicates a discount rate of up to 10% (see Table 2.3). Meanwhile, by recomputing the two average discount rates excluding values of 100% and above, the mean discount rate in 2007 (26.8%) gets very similar to the one reported for 2011 (27.2%, see Table 2.4).[8]

[8] These differences in absolute levels might be due to several reasons. Since, in 2011, there was a mode

Although a comparison of the results obtained by the four measures in our surveys reveals substantial differences, the proportions of the sample with a discount rate of 20% and above are roughly comparable as long as extreme values of the serial choice task in 2007 are excluded: 58% for the singular choice tasks in 2007, 56% in 2011; and 74% in the serial choice task in 2007 including all valid responses and 46% if extreme values are excluded. In 2011 the proportions are 59% and 51%, respectively. This implies a subjective discount rate of at least 20% for more than half of our sample.[9]

Figure 2.1 plots the estimated present value of CHF 10,000 in 10 years based on an assumed market interest rate of 4% in comparison to the different mean discount rates derived from the serial choice tasks (see Table 2.4). It illustrates that – irrespective of which measure is considered – the mean discount rate is well above market interest rates.

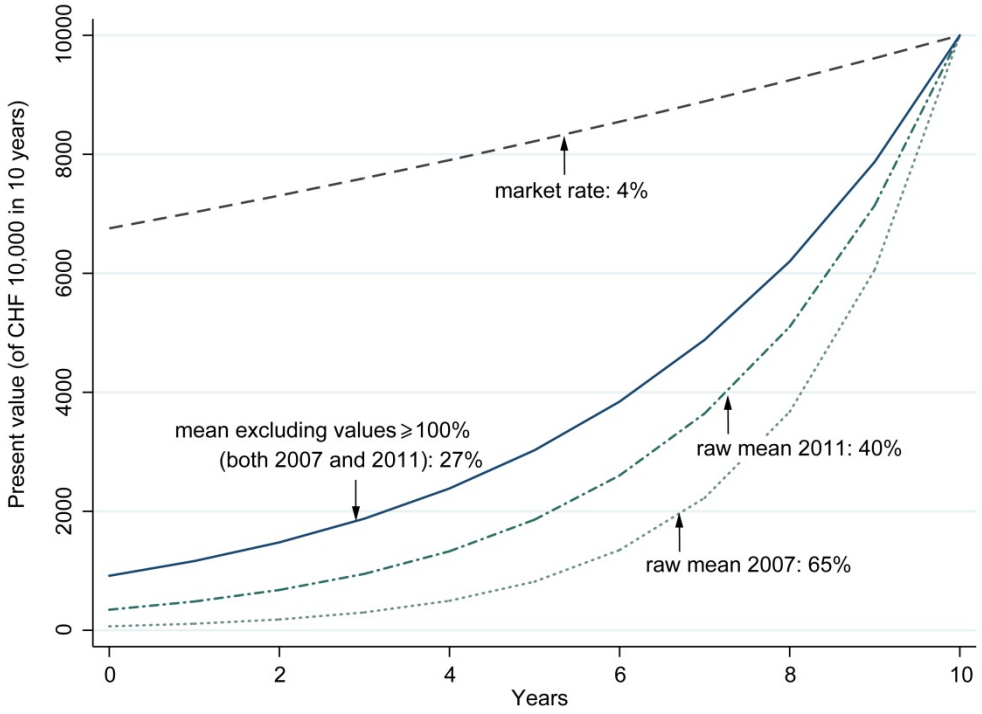

Figure 2.1. Estimates of the present value of CHF 10,000 in ten years applying different discount rates

switch from oral to written (self-administered), there were fewer steps involved, a front-end delay was added and, more importantly, the respondents could see right from the start where the first question led – they could see they were to answer four similar items with a progressively lowered LLR. In addition, in the 2011 questionnaire, this item series was placed right after the singular choice task that implied a discount rate of 20%. This might have functioned as an anchor (Frederick et al., 2002). Thus the importance of the difference in absolute levels should not be overestimated.

[9] By comparing the third item of the serial choice task (CHF 1000 in one year versus CHF 1200 in two years) and one version of the singular choice task (CHF 500 in one year versus CHF 600 in two years, with lottery), we can test for a magnitude effect in our 2011 data. If there was a magnitude effect, the discount rate inferred from the latter item should be higher than the one inferred from the former. This is not the case (Wilcoxon signed-rank test: $z = -1.1835$, $p > .05$, $n = 192$).

Results on the Reliability of Subjective Discount Rates

A look at Table 2.5 reveals moderate to high correlations between the four measures of discount rates. This can be interpreted as evidence for parallel form reliability as well as test-retest reliability. The correlations between the different measures implemented in the same survey are relatively high (parallel form reliabilities of .61 and .58 in 2007 and 2011, respectively). The test-retest reliabilities are considerably lower with a value of .38 for the singular choice task (all versions pooled), a value of .30 for the serial choice task and values of .28 and .34 for pairs of different measures (i.e. the singular choice task from one wave correlated with the serial choice task from the other wave).

Table 2.5. Bivariate correlations between the measures of discount rates (all versions of the singular choice task pooled within each survey)

	Serial choice task 2007	Singular choice task 2011	Serial choice task 2011
Singular choice task 2007	*0.613**** (2579)	0.384*** (1727)	0.339*** (1438)
Serial choice task 2007		0.284*** (1856)	0.296*** (1542)
Singular choice task 2011			*0.576**** (1591)

* p < .05, ** p < .01, *** p < .001, number of respondents in parentheses
Notes: Values for parallel form reliability are printed in italics. The remaining values denote test-retest reliabilities.

As roughly four-fifths of our sample (1380 respondents) answered exactly the same singular choice task in 2007 and in 2011, these items allow us to gain more precise information on the test-retest reliability of discount rates over this four year period. A first analysis reveals a bivariate correlation of .44 ($p < .001$, $n = 694$) between the two waves for the item version requesting a choice between CHF 500 now and CHF 600 in 1 year. For the version requesting a choice between CHF 500 in one year versus CHF 600 in two years, the correlation is .36 ($p < .001$, $n = 686$). The proportion of respondents changing their minds does not differ significantly between these two item versions (binominal test: $z = 1.672$; $p > .05$, $n = 1380$). A crosstabulation of the pooled responses reveals that in 2011, approximately 70% of the respondents chose the same option as they had previously, while roughly 30% answered differently (see Table 2.6).[10]

[10] Multivariate models predicting changes in subjective discount rates did not lead to any insights that are not already accounted for by the models in the next section. Meier and Sprenger (2010), in the same vein, did not find any robust effects of the standard socio-demographic variables or of change in them either.

Table 2.6. Crosstabulation of responses to singular choice task in 2007 and 2011

		2011 (without lottery)	
		SSR	LLR
2007	SSR	545 (39.5%)	213 (15.4%)
	LLR	197 (14.3%)	425 (30.8%)

Results of Multivariate Analyses

Socio-Demographic Determinants of Subjective Discount Rates

To analyze the effects of different socio-demographic variables on subjective discount rates, OLS regression models were run for the serial choice tasks and logistic models were estimated for the singular choice tasks. For these analyses, the different versions of the singular choice tasks were pooled. To control for the effect of the lottery in the 2011 data, a dummy was included. Further information on the predictor variables can be found in Table A2.2 in the appendix. Table 2.7 shows the results of these analyses.

The overall explanatory power of the four models is rather low (as the R^2 values indicate). However, there are robust effects for several of the explanatory variables. Across both data sets we find that being more educated and male goes with lower discount rates. Participants with higher incomes reveal lower subjective discount rates. This effect is found in two of the above four models. And in only two of the models, economically active persons report lower discount rates than inactive ones (recipients of retirement or disability pensions, students, unemployed, etc.).

Whereas we do not find a consistent effect of age if it is incorporated as a linear term only (see Table A2.3), there is some evidence for a non-linear relationship if age is introduced in a quadratic fashion, albeit significant only for the serial choice tasks. According to these models, discount rates are lowest for middle-aged persons (at roughly 49 years and 37 years for the serial choice task in 2007 and 2011, respectively).

Persons in a steady relationship might have lower discount rates than single persons (including widowed persons), whereas respondents with children appear to have higher discount rates; but these effects are not significant in all models. There is also some indication that persons living in the French- or Italian-speaking area have higher discount rates than those in the German language area.

Table 2.7. OLS and logistic models to explain subjective discount rates

	Singular CT 2007	Serial CT 2007	Singular CT 2011	Serial CT 2011
Gender (1 = female)	0.35**	0.06**	0.42**	0.06**
	(3.73)	(3.77)	(3.58)	(3.24)
Age (divided by 10)	-0.24	-0.11**	-0.12	-0.10*
	(-1.40)	(-4.02)	(-0.52)	(-2.39)
Age (divided by 10, squared)	0.02	0.01**	0.02	0.01**
	(1.47)	(4.26)	(0.81)	(3.32)
Personal income (per month, in thsd)	-0.03	-0.01*	-0.06**	-0.00
	(-1.59)	(-2.20)	(-2.61)	(-1.09)
Years of education	-0.09**	-0.02**	-0.07**	-0.01**
	(-5.04)	(-6.02)	(-3.38)	(-3.90)
Language area (reference: German-speaking area)				
French-speaking area	0.34**	-0.01	0.52**	0.06**
	(2.89)	(-0.47)	(3.48)	(2.60)
Italian-speaking area	0.23	0.03	0.86**	0.18**
	(1.25)	(1.06)	(3.48)	(4.12)
Economically active	-0.28*	-0.04*	-0.15	-0.03
	(-2.26)	(-2.01)	(-0.97)	(-1.02)
Steady relationship	-0.12	-0.04**	-0.25+	-0.02
	(-1.23)	(-2.67)	(-1.95)	(-1.06)
Has children	0.18+	0.05*	0.27*	0.02
	(1.77)	(2.55)	(2.13)	(0.83)
Lottery			0.31*	
			(2.48)	
Constant	2.00**	1.13**	1.30*	0.69**
	(4.55)	(16.84)	(2.05)	(6.74)
Pseudo R^2 (McFadden)	0.042		0.062	
Adjusted R^2		0.068		0.126
Number of observations	2473	2892	1687	1407

t-/z-statistics in brackets; + p<.10, * p<.05, ** p<.01
Notes: "CT" is the abbreviation of "choice task".
All models were estimated with robust standard errors.
All variables in a model are taken from the same survey, either in 2007 or 2011.
For the serial choice tasks, ordered logistic regression models did not yield substantially different insights.
Using the equivalent income instead of the personal income does not lead to an improvement of the models (R^2-change < .01).

Subjective Discount Rates as Predictor of Behavior

Based on literature and expert opinions, energy saving behaviors were selected that are expected to result in lower overall financial costs than their conventional counterparts in most cases, given market interest rates. This includes routine behaviors such as switching off the lights upon leaving a room, avoiding leaving the television set on stand-by mode or frequent tire pressure checks on cars. Some behaviors are only relevant during winter: opening windows for brief periods only, reacting in an environmentally friendly manner when feeling cold at home and turning down the radiators when being away for more than four hours. In addition, several smaller and larger investment decisions are analyzed: the use of energy-saving light bulbs and hypothetical choices on lamps and refrigerators, the thermal insulation of the

building, the quality of windows and the resulting annual heating costs (as a proxy for investments made and energy-saving routines carried out). Table 2.8 gives an overview of the descriptive properties of these variables.

Table 2.8. Outcome variables

Variable	Year	N	M	SD	Min	Max
Always turning off the lights when leaving a room (in the case of standard light bulbs; 1=yes, 0=no)	2007	2773	0.38		0	1
	2011	1809	0.35		0	1
Use of energy-saving light bulbs (in some or all cases; single person households only; 1=yes, 0=no)	2007	1044	0.60		0	1
	2011	520	0.82		0	1
Hypothetical choice of energy-efficient refrigerator (1=yes, 0=no)	2007	2538	0.94		0	1
Hypothetical choice of energy-efficient light bulb (1=yes, 0=no)	2011	1755	0.84		0	1
Opening windows for brief periods in winter (4-point scale; 4 = best value)	2011	1838	3.39	0.80	1	4
Avoid leaving TV in stand-by mode (only persons using a TV; 1=yes, 0=no)	2007	2511	0.68		0	1
	2011	1789	0.67		0	1
Yearly number of manual tire pressure checks on car (logarithmized; only persons holding a driver's license and owning cars without automatic control system)	2007	1052	1.14	0.68	-0.69	3.00
Environmentally friendly reaction when feeling cold at home in winter (1=yes, 0=no)	2007	3169	0.57		0	1
Turning radiators down when away for more than four hours (if technically possible and not regulated automatically; 1=yes, 0=no)	2007	1257	0.36		0	1
	2011	895	0.31		0	1
Thermal insulation (1=yes, 0=no)	2007	2223	0.73		0	1
Thermal insulation of outer walls (1=yes, 0=no)	2011	1524	0.77		0	1
Thermal insulation of roof or attic floor (1=yes, 0=no)	2011	1468	0.84		0	1
Thermal insulation of basement (or basement ceiling or lowermost floor of living spaces; 1=yes, 0=no)	2011	1316	0.69		0	1
High quality windows (with multiple glazing, seals and no drought when shut; 1=yes, 0=no)	2011	1865	0.60		0	1
Annual heating costs (in CHF, logarithmized)	2011	1196	7.22	0.68	3.40	8.99

Table A2.2 in the appendix gives on overview of the control variables in the analyses to follow. As a measure for environmental concern the nine five-point items suggested by Diekmann and Preisendörfer (2001) were used (for an English translation, see Diekmann & Preisendörfer, 2003). While the items cover three theoretical dimensions – affective, cognitive and conative – a factor analysis with subsequent Varimax rotation gives a one-dimensional solution for 2007 (as put forth by Diekmann & Preisendörfer, 2001) and a two-factor solution for 2011. As the latter option is theoretically inconclusive, the former is chosen for both years. The

corresponding reliabilities are .75 (2007) and .82 (2011; Cronbach's alpha). All nine items were summed up and divided by the number of items. While the resulting scale theoretically ranges from 1 to 5, its mean is 3.69 (2007) and 3.63 (2011), respectively.

Together with gender, age, education and dummies for the different language areas, income and environmental concern build up a basic set of control variables that is used in all of the models to follow. The models relating to properties of the building (thermal insulation, quality of windows, annual heating costs) share a set of additional control variables, namely the type of building and the period in which the house was built. In addition, for the model concerning the type of windows, the age of the windows themselves is included. In the model for heating costs, additional control variables are the size of heated living space, the type of heating, the thermal insulation of the building and the quality of the windows.

Depending on the operationalization of the behavior in question, OLS or logistic regression models were estimated. For each of the behavioral outcomes, separate models were run for each of the measures of discount rates. This results in two or four analyses – each including one of the measures for discounting – depending on whether the outcome was measured in 2007, in 2011 or in both years. Table 2.9 gives an overview of our results with regard to the effects of discount rates. While the second column indicates what sign was expected theoretically, the following columns reveal the sign and significance level of our results for each of the measures of discount rates. The underlying multivariate models can be found in the appendix (Tables A2.4 to A2.7). As several of the behaviors do not apply to all respondents, the analyses are carried out including relevant subgroups only (see Table 2.9). For example, in the case of the thermal insulation only home owners are analyzed.

Table 2.9. Expected effects and observed effects of discount rates on various energy saving behaviors (reading help: a negative sign indicates that more of the behavior in question goes with a lower discount rate)

Behavior	Expec-ted sign	Observed sign			
		Serial CT 2007	Singular CT 2007	Serial CT 2011	Singular CT 2011
Turning off the lights when leaving a room (in case of standard light bulbs)	–	+*	+	+	–
Use of energy-saving light bulbs (single person households)	–	–	–	–	–
Hypothetical choice of energy-efficient refrigerator (2007) / light bulb (2011) [a]	–	–**	–**	–	–*
Opening windows for brief periods in winter	–	n/a	n/a	–+	–**
Avoid leaving TV on stand-by mode (only persons using a TV)	–	–+	–**	–*	–+
Yearly number of manual tire pressure controls on car (without automatic control system; car owners only; logarithmized)	–	+*	–	n/a	n/a
When feeling cold at home in winter: environmentally friendly reaction	–	–*	–**	n/a	n/a
When away for more than four hours: turning radiators down (if technically possible and not regulated automatically)	–	+	+	+	–
Thermal insulation [b, c]	–	+	+	n/a	n/a
Thermal insulation of outer walls [b, c]	–	n/a	n/a	+	+
Thermal insulation of roof or attic floor [b, c]	–	n/a	n/a	–	+
Thermal insulation of basement (or basement ceiling or lowermost floor of living space) [b, c]	–	n/a	n/a	+	+
High quality windows [b, d]	–	n/a	n/a	+	–
Annual heating costs (logarithmized) [e]	+	n/a	n/a	+	+

** p < .01, * p < .05, + p < .10

Notes: "CT" is the abbreviation of "choice task".

"n/a" indicates that the respective outcome variable was not available in the data set in question.

Control variables: gender, age, income, education, language area, environmental concern.

All variables in a model are taken from the same survey, either in 2007 or 2011.

[a] As these items are hypothetical they are not considered in the conclusion below.

[b] 2007: owner households only; 2011: respondent or their partner is owner.

[c] Additional control variables: age of building, type of building.

[d] Additional control variables: age of building, type of building, age of windows.

[e] Additional control variables: age of building, type of building, heated living area, heating system, thermal insulation, quality of windows, owner household.

Table 2.9 clearly reveals the heterogeneity of our results with regard to the effect of discount rates on behavior. For example, while people with low discount rates tend to avoid leaving their television set on stand-by mode, there is no consistent effect on switching off the lights upon leaving a room or – in case of home owners – on applying thermal insulation to one's house. Overall, only 17 out of 34 hypotheses show the expected sign (hypothetical choice tasks excluded). Five of these effects are significant at the 5% level. The remaining tests show the opposite of the sign expected, with two of them being statistically significant. If a Bonferroni correction is applied to the overall model F tests to adjust for the fact that our models are not fully independent from one another (but at the same time differ with regard to whose behavior is considered), the results remain unchanged.

Given the low number of significant results, the question arises whether the effects found are due to chance. In this case, the results would reflect a series of alpha errors (erroneous rejections of the null hypotheses). In fact, 14.7% of the above equations show statistically significant effects in the expected direction.

Discussion

Our study pursued four main aims, two of which led to results in accordance with expectations: With regard to our aim to report population values for the subjective discount rate, we were able to demonstrate that in a large, nation-wide survey they are on average very high and well above market interest rates. Based on the serial choice tasks, the mean discount rate of the Swiss population is approximately 27% if extreme values of 100% and higher are excluded (both in 2007 and 2011) and 65% (2007) or 40% (2011) if all cases are considered.

According to both the singular and the serial choice tasks, more than half of the respondents have a discount rate of 20% and above (singular choice tasks: 58% in 2007 and 56% in 2011; serial choice tasks with / without extreme values: 74% / 46% in 2007 and 59% / 51% in 2011). Such high figures are a common finding in both experimental and field studies, with students or with general population samples (see Epper et al., 2011; Frederick et al., 2002; Harrison et al., 2002; Train, 1985).[11] Nonetheless, this has serious consequences as it implies that future benefits are devalued very strongly. This means future benefits that come with a particular option need to be high compared to more immediate payoffs by other options for an average decision-maker to choose accordingly.

[11] Note, however, that subjective discount rates do not reflect pure time preferences but are also influenced by other factors such as transaction costs or risk preferences (see below). These confounds may bias upward estimates of time preferences.

Another aim of this study was to analyze the determinants of subjective discount rates in a general population sample. The respective analyses confirmed the expected effects of education and income: more educated persons and those with higher incomes make more patient choices. In addition, our data indicates that females rather than males choose smaller sooner payments. The relationship between age and discount rates appears curvilinear with its minimum at roughly 49 years and 37 years for the serial choice task in 2007 and 2011, respectively. The remaining variables in our models indicate lower discount rates for those who are economically active, are in a steady relationship, do not have children and live in the German-speaking area of Switzerland.

With regard to the remaining two aims of this paper – concerning the reliability (and hence stability) of discount rates and their predictive power for energy-saving behavior – the results are ambiguous at best and the conclusions are sobering. They challenge the classic economic assumption that the subjective discount rate represents a trait, a stable individual difference variable that "applies to all acts of consumption" (Frederick et al., 2002, p. 394). These two properties – stability and relevance to a wide range of behaviors – are essential to the psychological understanding of traits (cf. Frederick et al., 2002; Roberts, 2009). The next few paragraphs therefore focus on these two aspects.

Our analyses indicate a certain reliability and a moderate stability of discount rates. This conclusion is based on several observations. First, the bivariate correlations between the two measures used in 2007 and in 2011, respectively, amount to roughly .6 (parallel form reliability). Second, in the singular choice tasks, roughly 70% of the respondents choose the same option both in 2007 and in 2011. The resulting correlation between the two points in time is around .4 (test-retest reliability). The test-retest reliabilities between different pairs of measures are around .3.

Thus, the correlations across time (test-retest reliability) are considerably lower than between different items measured at the same time (parallel form reliability). This might be taken as a hint that discount rates might not be stable over time. In addition, a look into psychological studies on personality measures reveals that one would generally expect higher correlations over an interval of four years in order to assume stability. For example, in an older but frequently cited overview, Costa and McCrae (1994) report that many studies based on adults find test-retest correlations in the range of .6 to .8 for the Big Five dimensions. A slightly more recent meta-analysis limited to 152 studies with retest intervals of at least one year reports average test-retest correlations of roughly .5 (Roberts & DelVecchio, 2000).

While clearly lower and limited to four years as opposed to many personality studies with retest intervals as large as 10, 20 or even 40 years, our correlations are roughly

comparable to the one-year stability of discount rates reported by S. Meier and Sprenger (2010, a value of .4). They suggest this low value may be unproblematic considering they were using a one-item measure of discount rates as opposed to psychological scales that typically comprise a large number of items – future studies using more precise techniques to measure discount rates may find higher test-retest reliabilities. Hence, the overall conclusion with regard to the stability of discount rates remains ambiguous.

Contrary to expectations we did not find convincing evidence for the hypothesis that subjective discount rates have an impact on the degree of energy saving behavior. A lot of research has investigated discount rates in the past decades, yet most of it has been focused on the development of adequate measures, the exploration of methodological aspects and the discounting function itself. While it frequently has been assumed that discount rates are a relevant predictor of various behaviors, only a small portion of all research has actually investigated this link. The results of these studies are heterogeneous in most behavioral domains (see for example Chapman, 1998; Nyhus & Webley, 2006). We, too, do not find consistent effects of discount rates on behavior, despite our focus on economically efficient behavior. Only five out of 34 expected effects are confirmed (15%).

This weakness may be due to the typical measurement technique of discount rates. When asking subjects to compare SSR and LLR, the outcome does not only depend on time preferences. There are several confounding factors such as the uncertainty whether they would receive the LLR, possible transaction costs or risk preferences (Epper et al., 2011; Frederick et al., 2002). Hence, the discount rate is a multidimensional construct which might partly explain the poor predictive performance of the measure.

In addition, our study may be limited by the methodology used as, for instance, we rely on self-reported behavior. But despite all possible deficiencies, our results clearly indicate that subjective discount rates may not be a valid predictor of behavior after all – even given that the behavior pays off financially in the long run.

This finding puts into question a second property of subjective discount rates as individual difference variables: their ability to predict behavior across different situations. This is in line with Frederick et al. (2002, p. 392) who conclude their comprehensive review of time discounting and time preferences by noting: "[…] in our view the cumulative evidence raises serious doubts about whether there is, in fact, such a construct – a stable factor that operates identically on, and applies equally to, all sources of utility."

One possible albeit confining answer is to investigate whether discount rates are domain-specific. This might help explaining why the studies that inferred discount rates from actual purchases of energy-using devices have reported a wide range of discount rates (for

overviews see DEFRA, 2010; Train, 1985). If discount rates are domain-specific (as for example suggested by Tsukayama & Duckworth, 2010; Weatherly, Terrell, & Derenne, 2010), they need to be measured specifically tailored to the behavioral domain at hand. In our case, this raises two problems: first, there is the question of practicability. As energy saving behavior does not fall within one single domain (for example, mobility, diet, household finances), there should be separate measures for each domain involved. Second, when assessing discount rates specifically by domain (and hence following the correspondence principle, see, for example, Ajzen (1991)), framing effects may occur and lead to an overestimation of the relevance of the predictor in question. Studies using broader, more general measures, however, unavoidably report lower effects on specific behaviors and therefore are less prone to overestimation. In this light, domain- or even behavior-specific measures are problematic while the use of general measures appears more favorable.

In sum, our study confirms some of the expected findings on discount rates with regard to their absolute level and group differences in the population while calling into question the assumption that discount rates are stable over longer periods and that they are valid predictors of energy saving behavior. This points to a very fundamental theoretical issue: Do discount rates reflect an individual difference variable at all? Frederick et al. (2002, p. 392) argue this may not be the case – however theoretically compelling the idea might be. What adds weight to our results is that our data is based on a representative general population sample and covers a time interval roughly four times larger than that of any of the previous studies on the stability of subjective discount rates known to us.

Given these results, it may be advisable to instead examine related concepts such as future orientation, self-control or impulsivity (for similar reasoning, see Duckworth, Tsukayama, & Kirby, 2013; Frederick et al., 2002; Nyhus & Webley, 2006). There already are a number of psychological studies on the impact of future orientation – as measured by the Zimbardo Time Perspective Inventory (Zimbardo & Boyd, 1999), the Consideration of Future Consequences scale (Strathman et al., 1994) or its revised version (Joireman, Shaffer, Balliet, & Strathman, 2012) – on pro-environmental behavior. In a recent meta-analysis of 13 studies, Milfont, Wilson, and Diniz (2012) report an average correlation of $r = .26$, $p < .001$. This suggests that future orientation is positively associated with pro-environmental behavior (see also Bruderer Enzler, 2014).

Yet for the moment, the following question remains: If subjective discount rates do not account for environmental decisions in households, why do several studies report surprisingly high aggregate discount rates for purchases of energy consuming appliances? For example, Ruderman et al. (1987) report aggregate market discount rates for various appliances in the

range of 16 to 243 percent. Our study suggests that instead of subjective discount rates other factors may have contributed to the seemingly high market discount rate.[12] For example, it has frequently been argued that consumers may have insufficient information on energy prices and savings from more efficient appliances. Moreover, in Switzerland landlords usually purchase larger household devices while tenants pay the utility bill. This so-called investor-user dilemma decreases the incentive to invest in energy-saving equipment and is, in international comparison, even more pronounced in Switzerland because of the large proportion of tenants (two thirds according to the Swiss Federal Office for Housing, 2005). Energy efficiency labels, as they are now common with many appliances, the creation of further incentives and regulations for home owners and the adoption of third-party contracting may be helpful to promote energy-efficient investments in households. As far as our empirical findings are concerned subjective discount rates do not contribute to an explanation of energy-saving investments.

[12] See Ruderman et al. (1987) for a list of explanations of the high aggregate market discount rate.

Chapter 3

Consideration of Future Consequences as a Predictor of Environmentally Responsible Behavior

Evidence from a General Population Study[13]

Abstract. The present study analyzes the relationship between Consideration of Future Consequences (CFC; Strathman, Gleicher, Boninger, & Edwards, 1994) and environmentally friendly behavior in a large general population survey (n = 1945). CFC captures the extent to which a person is driven by short-term rewards or orients him or herself towards long-term goals. As there is considerable debate about whether the scale captures concern with future consequences only, or with both future *and* immediate consequences, preliminary factor analyses were conducted. These support differentiation into two subscales: one reflecting concern for immediate benefits (CFC-Immediate) and one conveying a concern for future outcomes (CFC-Future). The results with regard to behavior, however, do not differ systematically between CFC-Immediate and CFC-Future. Overall, the results reveal that CFC is a significant predictor of pro-environmental behavior and that this relationship was (partially) mediated by environmental concern.

Introduction

Many behaviors relevant to the environment involve a conflict between short-term and long-term benefits (e.g. Dawes, 1980). For example, in the long run avoiding leaving electrical devices on stand-by or lowering thermostat settings in winter results in lower energy costs and helps protect the environment, although in the short term it leads to a loss of comfort. This temporal dimension is particularly relevant for long-term investments. For example, an investment in an energy-efficient heat pump is in the long term beneficial to society as a whole

[13] A slightly modified version of this chapter will appear in *Environment and Behavior*.

as it reduces resource consumption compared to conventional oil-fired heating. At the same time, it comes with short-term opportunity costs as the investment decision itself is likely to require more time and effort than if an oil-based heating system were simply replaced.

Although this temporal dimension of pro-environmental behavior is often acknowledged, there is still much room for exploration (see for example Hendrickx, Poortinga, & Kooij, 2001). One possible approach is to introduce future orientation as a predictor of behavior. Future orientation describes the extent to which someone is oriented towards the future in their thinking (Hoornaert, 1973). Thus, future-oriented persons typically plan their future actions, set goals that can only be achieved in the long run, and generally consider the long-term consequences of their behavior (Lasane & O'Donnell, 2005; Zimbardo & Boyd, 1999). One of the most commonly used measures for future orientation is the Consideration of Future Consequences (CFC) scale developed by Strathman et al. (1994). They define CFC as "the extent to which individuals consider the potential distant outcomes of their current behaviors and the extent to which they are influenced by these potential outcomes. It involves the intrapersonal struggle between present behavior with one set of immediate outcomes and one set of future outcomes" (p. 743). In this sense, CFC captures the extent to which a person is driven by short-term rewards or orients him or herself towards long-term goals.

Since these propensities are particularly important with regard to behavior with far-reaching consequences, CFC has been investigated frequently in other subject areas such as healthcare, financial planning, or education (recent examples are Adams, 2012; Appleby et al., 2005; Beenstock, Adams, & White, 2011; Daugherty & Brase, 2010; Joireman, Kees, & Sprott, 2010; Martin, Delaney, & Harmon, 2010). These studies generally point to the relevance of future orientation for behavior. In the field of environmental research, too, a number of studies indicate that there is a link between future orientation and pro-environmental behavior, as will be shown below (for a review, see Milfont et al., 2012).

The aim of this article is to investigate the relationship between future orientation – as measured by the CFC scale – and pro-environmental behavior. However, recent studies suggest the CFC scale may in fact be better conceptualized as two-dimensional (see for example Joireman, Balliet, Sprott, Spangenberg, & Schultz, 2008; Petrocelli, 2003). This implies that it not only captures a preoccupation with future consequences but also a concern with immediate outcomes of behavior. This in turn has implications for practical interventions since future and present orientation may differentially affect behavior (e.g. Keough, Zimbardo, & Boyd, 1999). Therefore, a preliminary analysis of the reliability and structure of the CFC scale is conducted to examine whether it is advisable to treat CFC as capturing both concern with future and immediate consequences. Thereafter, the core section of this paper addresses the

relationship of CFC and environmentally responsible behavior. By doing so, the paper also examines whether this relationship may be mediated by environmental concern.

What distinguishes this paper from previous work is that, first of all, most studies are either limited to investigating the structure of the CFC scale or its application as a predictor of behavior (as has also been noted by Joireman et al., 2012). The two aims are seldom combined; the only exception in the field of pro-environmental behavior is the original paper by Strathman et al. (1994). In the present study, factor analyses are run to determine the structure of the construct and for all further analyses a one-factor and a two-factor solution are compared. Second, only few studies in the field of environmental research have examined indirect effects of CFC on behavior. Third, the study is based on a large general population sample whereas the majority of the studies mentioned so far have been conducted with relatively small student samples.

The Relationship between CFC and Pro-Environmental Behavior

A recent meta-analysis by Milfont et al. (2012) summarizes most of the studies on the relationship between CFC and environmentally friendly behavior. It covers studies on various behaviors such as inquiring about how to reduce fire risk (Cvetkovich & Winter, 2008), recycling (Ebreo & Vining, 2001; Lindsay & Strathman, 1997), preference for commuting by public transport (Collins & Chambers, 2005; Joireman, Van Lange, & Van Vugt, 2004), political participation (Joireman, Lasane, Bennett, Richards, & Solaimani, 2001), or measures for environmentally friendly behavior in general (Brun, 2001; Corral-Verdugo et al., 2009; Strathman et al., 1994). A literature search revealed three additional studies: Hanss (2012) on sustainable consumption, Kortenkamp and Moore (2006) on giving up extra course credit for the environment and Joireman, Posey, Truelove, and Parks (2009) on harvesting in a hypothetical common pool resource dilemma.

Most of these studies find some link between CFC and pro-environmental behavior. This is also supported by Milfont et al. (2012, p. 5) who conclude there is a "medium correlation" between future orientation and environmentally friendly behavior. Nine of the 13 studies covered by this meta-analysis were based on the CFC scale, for which the correlations did not differ significantly from those for the other measures used in the analysis – hence CFC may be an important predictor of pro-environmental behavior.

Some of the studies mentioned so far suggest that the influence of CFC on behavior may be more complex than a simple direct relationship (for an elaboration see Joireman, Strathman, & Balliet, 2006); either it may moderate the impact of other variables such as environmental concern (Kortenkamp & Moore, 2006) or the perceived environmental impact

of the behavior in question (Joireman et al., 2004), or it might be mediated by other variables. For example, Hanss (2012) shows that self-efficacy mediates the relationship between CFC and the purchase of eco-friendly groceries; Joireman et al. (2001) conclude that the perceived consequences of behavior act as a mediator in the relationship of CFC and political activities and Joireman et al. (2004) report that the perceived environmental impact of cars partially mediates the relationship of CFC with stated preferences for public transport.

The present study tests whether CFC relates to both environmental concern and environmental behavior, and whether environmental concern mediates the link between CFC and environmental behavior. From a theoretical point of view, it is plausible that more future-oriented persons will develop a more pronounced environmental concern and that this in turn influences their behavior. The rationale behind this is that environmental concern implies a wish to maintain a high environmental quality for the future. Therefore, the present study examines this reasoning by running mediation analyses for environmental concern.

Another key difference between the studies is whether the CFC scale is treated as capturing concern with future consequences only, or with both future *and* immediate consequences. In the first case, a low orientation towards future outcomes is conceptually the same as a high orientation towards immediate consequences. The two orientations are opposites on one dimension. Therefore, if such a scale predicts behavior, it is neither desired nor possible to determine whether it does so out of concern for immediate or delayed consequences. In the latter case, however, the items reflecting concern for immediate benefits and those conveying a concern for future outcomes are separated from one another. This not only allows a person to score high on both temporal constructs but also allows determining whether a particular behavior is more strongly driven by a concern for its immediate or its future consequences (for similar reasoning see Hoornaert, 1973; Joireman et al., 2012; Keough et al., 1999; Khachatryan, Joireman, & Casavant, 2011; Zimbardo & Boyd, 1999).

In the field of environmental research, the studies by Brun (2001) and Khachatryan et al. (2011) have examined consideration of future and of immediate consequences separately.[14] In the stated preference survey by Khachatryan et al. both temporal orientations have an impact on fuel choice. The study by Brun, in contrast, concludes that a focus on future consequences was more closely related to behavior than consideration of immediate outcomes. A few studies from other behavioral areas also use the subscales as separate predictors: One of them concludes behavior was more strongly related to concern with future consequences (Joireman et al., 2012, on intentions to exercise and to eat healthily). Two other studies report the

[14] Khachatryan et al. (2011) use a 14-item version of the CFC scale recently put forth by Joireman et al. (2012) while Brun (2001) uses a version with 15 items.

opposite result, meaning consideration of immediate consequences was relevant while concern with future outcomes was not (Joireman et al., 2008, on the effect of ego-depletion on temporal discounting; Joireman et al., 2010, on compulsive buying tendencies and credit card debt). Yet another study does not lead to a clear conclusion regarding behavior (Rappange, Brouwer, & Van Exel, 2009, on health related behavior). In a related study using another measure of temporal orientations (namely the Zimbardo Time Perspective Inventory), Keough et al. (1999) conclude that present time perspective is more closely related to alcohol, drug and tobacco use than future orientation. Overall, these results underpin the notion that there may be differences depending on the kind of behavior involved. A closer look at the studies indicating that only consideration with immediate consequences is relevant reveals that they focus on behavior that is typically associated with impulsivity or sensation seeking, not with future-mindedness.

Yet, these studies do not provide a theoretical rationale for why a particular behavior should be influenced by consideration of future or of immediate consequences alone, nor do they allow distinguishing empirically between two "categories" of behavior. In this context, the distinction between curtailment and efficiency-increasing behavior may be helpful (see for example Gardner & Stern, 1996). Curtailment behaviors reduce resource consumption typically through repeated inconvenient or sacrificial actions. Maintaining such behaviors often requires particular self-imposed constraints, habits or lifestyles. Given the above results one may hypothesize that curtailment behavior might be prone to temptation and possible short-term benefits, hence affected by consideration of immediate consequences. For example, switching off the lights, reducing meat consumption or adjusting thermostat settings upon departure may be more closely related to a preoccupation with one’s short-term well-being than to strategic considerations regarding a lower energy bill in the future.

Efficiency-increasing behavior, in contrast, refers to adopting more energy-efficient equipment (Gardner & Stern, 1996). These behaviors only have to be carried out infrequently and have a long-term impact on resource consumption. They generally require a considerable amount of planning and only (if at all) result in personal benefits after a certain period of time. Therefore, this type behavior may primarily be influenced by a preoccupation with future consequences. For example, installing solar panels probably is more strongly influenced by expected future benefits – such as lower energy costs or social prestige – than by immediate consequences which would be the costs or effort involved in implementing the endeavor.

If concern with immediate and concern with future consequences affect different kinds of behavior, this bears strong implications for practical interventions: different approaches are recommendable depending on whether a behavior is more strongly influenced by immediate

consequences (such as investment costs, inconvenience, or transaction costs) or by delayed consequences (such as lower energy bills). For example, if a particular behavior is driven by convenience, pointing to possible financial benefits may not be effective at all.

Therefore, the present study analyzes the relationship of a one-dimensional scale (CFC-Total) as well as of the two subscales (CFC-Future, CFC-Immediate) with environmentally friendly behavior. This allows for comparing the predictive power of the different scales. The outcome variables are 17 self-reported pro-environmental behaviors.

Method and Descriptive Results

Participants and Procedure

All analyses are based on data from a follow-up survey (conducted in 2010/2011, n = 1945) to a representative general population study, the "Swiss Environmental Survey 2007". The data collection for the "Swiss Environmental Survey 2007" (n = 3369) was based on a two-stage random sample taken from the adult population of Switzerland with a registered telephone extension. In a first step, households were selected randomly from regional strata and notified by mail. The study was described as an investigation into living conditions in Switzerland and not as an environmental study in order to avoid a disproportionate number of people with an above-average interest in the environment taking part. The households were then contacted by telephone. In the second step, one respondent within each household was selected at random from all its members aged 18 or older and being able to respond in German, French or Italian. Foreigners belonging to the resident population were included provided they could complete the survey in one of the three languages mentioned. The telephone interviews were conducted between November 2006 and March 2007. The resulting response rate was 52% (RR2, Research, AAPOR). A written follow-up questionnaire was completed by a total of 83% of those already interviewed. Up to two reminders were used.

Between November 2010 and March 2011, as many of the respondents of the "Swiss Environmental Survey 2007" as possible were contacted for another follow-up survey conducted by means of a postal paper-and-pencil questionnaire. The procedure was fairly similar to the previous survey: again, a pre-notification letter and up to two reminders were sent. Once more, the study was not labeled as related to environmental protection but was announced as a survey on "living in Switzerland" ("Leben und Wohnen in der Schweiz").

For this sequel study, 2517 respondents from the original telephone interview in 2006/2007 could be contacted again as not all addresses could be recovered and some

respondents had previously indicated they were not willing to participate any further. In total, 1945 persons participated – equaling 58% of those answering the telephone interview or 77% of those reached. The resulting sample consists of 56% females, whose mean age was 54 years (in 2011, ranging from 21 to 97). The median level of education was 12 years. Further information on the sample as well as on procedures and materials can be found in the project documentation (Diekmann & Bruderer Enzler, 2012; Diekmann & Meyer, 2008).[15]

Measures and Descriptive Results

The CFC Scale and its Factorial Structure

In its original version, the CFC scale (Strathman et al., 1994) consists of 12 items with a Likert scale ranging from "extremely uncharacteristic" (1) to "extremely characteristic" (5). Five items reflect a concern for future consequences, for example: "I am willing to sacrifice my immediate happiness or well-being in order to achieve future outcomes." The remaining seven items focus on immediate consequences and are thus negatively worded, for example: "I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time." Strathman et al. (1994) suggest reverse-scoring the items if applicable and computing a sum scale ranging from 12 to 60 (or 1 to 5 if average scores are reported). Higher values indicate a higher concern for future outcomes.

As our sample consisted of German-, French- and Italian-speaking persons, a thorough search was conducted to locate any previous translations. Based on the German version by Seidl (2009), we developed our own by slightly simplifying the wording of some of the items (since readability may be a weak point of this instrument as Crockett, Weinman, Hankins, and Marteau (2009) have pointed out). The original ordering of the items was kept (see Table 3.1). A qualitative pretest and an online survey were conducted.[16] In the latter survey, items cfc08 and cfc12 showed considerably more missing values than the other items (13% and 15% respectively versus roughly 3% for the other items). Therefore, we decided to drop these two items from the questionnaire. With the help of two professional translators for each language, the shortened German scale was translated into French and Italian as no previous translations

[15] To test for an environment-related self-selection bias, for both written surveys, the index's measures of environmental concern during the oral interview in 2006/2007 were compared between the participants and non-participants. In both cases, no significant differences were observed.

[16] The online survey was conducted with 1483 students at the Swiss Federal Institute of Technology in Zurich in 2009. 498 of them completed the translated 12-item CFC scale.

were available. Table 3.1 contains the item wording (in English)[17] as well as the descriptive results of the individual items and the scales resulting from the analyses below.

Table 3.1. CFC: item wording and descriptive statistics

Variable	Temporal focus [a]	Item text	N	M	SD	Min	Max
cfc01	Future	I consider how things might be in the future.	1896	3.93	.910	1	5
cfc02	Future	Often I engage in a particular behavior in order to achieve outcomes that may only result many years from now.	1865	3.00	1.11	1	5
cfc03	Immediate	I mainly act to satisfy my immediate concerns, figuring the future will take care of itself.	1907	2.56	1.03	1	5
cfc04	Immediate	My behavior is only influenced by the immediate (i.e. a matter of days or weeks) outcomes of my actions.	1885	2.27	1.05	1	5
cfc05	Immediate	My convenience is a big factor in the decisions I make or the actions I take.	1911	2.67	1.07	1	5
cfc06	Future	I am willing to sacrifice now in order to achieve future outcomes.	1900	3.54	.967	1	5
cfc07	Future	I think it is important to take warnings about negative outcomes seriously even if the negative outcome will not occur for many years.	1901	3.70	.973	1	5
cfc08[b]	Future	I think it is more important to perform a behavior with important distant consequences than a behavior with less important immediate consequences.			n/a		
cfc09	Immediate	I generally ignore warnings about possible future problems because I think the problems will be resolved before they reach crisis level.	1903	2.33	.995	1	5
cfc10	Immediate	I think that sacrificing now is usually unnecessary since problematic future outcomes can be dealt with at a later time.	1900	2.06	.945	1	5
cfc11	Immediate	I only act to satisfy immediate concerns, figuring that I will take care of future problems that may occur at a later date.	1909	2.04	.972	1	5
cfc12[b]	Immediate	Since my day-to-day work has specific outcomes, it is more important to me than behavior that has distant outcomes.			n/a		
CFC-Total		Average score of items 01, 02, 03, 04, 06, 07, 09, 10 and 11	1778	3.68	.620	1	5
CFC-Future		Average score of items 01, 02, 06 and 07	1778	3.56	.710	1	5
CFC-Immediate		Average score of items 03, 04, 09, 10 and 11	1778	2.22	.712	1	5

[a] This column indicates the temporal focus of the items.
[b] Item omitted due to results of preliminary online survey.

[17] Translations are available from author upon request.

At this time, there is a substantial discussion about the factorial structure of the scale and which items it should include. Recently, a number of studies suggest that the instrument might be two-dimensional with one factor used to capture the preoccupation with future outcomes and one covering concern with immediate outcomes (Adams, 2012; Joireman et al., 2008; Rappange et al., 2009; Toepoel, 2010). However, Crockett et al. (2009) and Hevey et al. (2010) suspect this may be a methodological artifact of the item wording. Petrocelli (2003) suggests we may restrict ourselves to eight items (a one-factor solution) while Brun (2001) adds three and Joireman et al. (2012) add two items, both resulting in two factors. In addition, several studies mention considerable cross-loadings (Petrocelli, 2003; Toepoel, 2010). With these issues in mind, a scale analysis is conducted.

To begin with, the suitability of the data for an exploratory factor analysis was examined: Bartlett's Test of Sphericity was significant ($\chi^2(45) = 4457.58$, $p < .001$) and the Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was .851, which is "meritorious" according to Kaiser (1974, p. 35). Both tests confirm the suitability of the data. A subsequent principal components analysis suggests three factors with eigenvalues greater than 1.0, accounting for 60.2% of total variance. Direct Oblimin rotation was applied as previous research suggests possible subscales may be correlated (e.g. Joireman et al., 2012). As the rotated factor loadings in Table 3.2 (left section) reveal, three out of 10 items show substantial cross-loadings. In addition, the eigenvalue of factor three is only slightly above the threshold (1.02) and the resulting factorial structure is difficult to interpret theoretically. Therefore, this solution is not to be recommended.

Table 3.2. Rotated factor loadings if all 10 items are included (left) and without item cfc05 (right)

Item	Temporal focus [a]	All 10 items			Without item cfc05	
		Factor 1	Factor 2	Factor 3	Factor 1	Factor 2
cfc01	Future	.068	**.758**	-.140	-.053	**.692**
cfc02	Future	.064	**.828**	-.062	.004	**.776**
cfc03	Immediate	.131	**-.359**	**.564**	**.643**	-.136
cfc04	Immediate	.105	-.257	**.665**	**.731**	.016
cfc05	Immediate	.059	.143	**.698**		
cfc06	Future	-.239	**.606**	.167	.069	**.773**
cfc07	Future	**-.610**	**.362**	**.330**	-.104	**.609**
cfc09	Immediate	**.826**	.097	.032	**.655**	-.017
cfc10	Immediate	**.759**	.061	.192	**.792**	.057
cfc11	Immediate	**.517**	-.098	**.400**	**.782**	-.004
Explained variance (before rotation)		37.4 %	12.6%	10.2%	40.5%	12.8%

Notes: Direct Oblimin rotation was applied (but Varimax rotation led to the same conclusions). Factor loadings > .300 are marked **bold**.

[a] This column indicates the temporal focus of the items.

As a next step, a reliability analysis was conducted including all 10 items. While the reliability itself was acceptable (Cronbach's alpha α = .804), a low item discrimination value was found for item cfc05 (.248 compared to values between .436 and .597 for the other items). This item had also been a source of confusion in a qualitative pretest run earlier. Therefore, the factor analysis was repeated without item cfc05. The results indicated a theoretically sound two-factor solution accounting for 53.23% of total variance. Two eigenvalues were greater than 1.0. The rotated factor loadings are shown in the right section of Table 3.2. This second analysis clearly separates the items concerned with immediate results (Factor 1) from those focusing on future consequences (Factor 2). As expected, the two factors are negatively correlated (r = -.482). There are no notable cross-loadings. Hence – given that item cfc05 is removed – a two-factor solution is advisable.[18]

Thus, average scores were computed for these two factors (hereinafter referred to as CFC-Immediate and CFC-Future). In addition, a scale comprising both subscales was created (CFC-Total). The reliabilities of the resulting scales are satisfactory: α = .814 for the CFC-Total scale, α = .779 for the CFC-Immediate scale and α = .699 for the CFC-Future scale (Cronbach's alpha, n = 1778, all item discrimination values > .4). The mean values for CFC-Future and CFC-Immediate indicate a relatively high degree of future orientation (3.56) and a lesser degree of present orientation (2.22) respectively (see Table 3.1).

To briefly examine the instrument's validity, bivariate correlations to conscientiousness and subjective discount rates are examined below. Both the CFC scales and subjective discount rates capture a sense of either caring for future or present outcomes and are thus conceptually related (for empirical results see Charlton, Gossett, & Charlton, 2011; M. Daly et al., 2008; Daugherty & Brase, 2010; Joireman et al., 2008; Joireman, Sprott, & Spangenberg, 2005; Rappange et al., 2009). Conscientiousness typically involves the ability to delay gratification, to

[18] A confirmatory factor analysis using the structural equation module of Stata 12 indicated that a one-factorial structure (nine items) does not fit the data very well, regardless of whether error correlations between all CFC-Immediate items to adjust for method effects are implemented as suggested by Hevey et al. (2010; fit: $\chi^2(17) = 211.44$, p = .000, Root Mean Square Error Approximation RMSEA = .080 with a lower limit LL = .071 and an upper limit UL = .090, pclose = .000, Comparative Fit Index CFI = .954, Bayesian Information Criterion BIC = 40819.74) or not ($\chi^2(27) = 773.19$, p < .000, RMSEA = .125, LL = .117, UL = .132, pclose = .000, CFI = .823, BIC = 41306.66). The model suggested by the results of the exploratory factor analysis with two correlated factors showed a similar fit ($\chi^2(26) = 424.90$, p = .000, RMSEA = .093, LL = .085, UL = .101, pclose = .000, CFI = .905, BIC = 40965.86). In order to achieve a reasonable fit, five correlated error terms were estimated (between the error terms of items 03 and 04, 07 and 09, 09 and 10, 06 and 07, 10 and 11, respectively; resulting fit: $\chi^2(21) = 124.10$, p = .000, RMSEA = .053, LL = .044, UL = .062, pclose = .303, CFI = .976, BIC = 40702.46). The two factors were moderately correlated (ϕ = -.28, p < .001). The final model shows the best fit, as indicated by a chi-square difference test with regard to the two-factorial model without error correlations ($\chi^2(5) = 300.81$, p < .001) and a comparison of BIC values with regard to both one-factorial solutions. Thus the confirmatory factor analyses support a two-factorial solution. But it should be noted that the introduction of error correlations was empirically driven (based on modification indices).

plan ahead and to control impulses (John, Naumann, & Soto, 2008) and therefore is inherently linked to future orientation (for empirical results see Daugherty & Brase, 2010; Rappange et al., 2009; Strathman et al., 1994).

There were two measures for subjective discount rates. The first is a hypothetical choice task in which half of the respondents chose between receiving CHF 500 "now" and CHF 600 in one year's time. The other half chose between CHF 500 in one year's time and CHF 600 in two years' time. CHF 500 equaled roughly USD 495 in 2011. For about a fifth of the respondents, these items were combined with a lottery where three persons would be drawn at random to receive the payment they opted for. For the purpose of the current analyses, these item versions were pooled. This resulted in 55.9% of the respondents opting for the smaller sooner payment, thus revealing a subjective discount rate of 20% and above. The second measure for subjective discount rates is a serial choice task with four decisions. The respondents were asked to choose between receiving CHF 1000 in one year and a larger amount – CHF 2000, CHF 1500, CHF 1200 or CHF 1100 – in two years' time. The participants were informed that three persons would be drawn at random to receive one of the payments they opted for. This resulted in an average subjective discount rate of 39.9%.

Conscientiousness was measured by three items of the Big Five inventory "BFI-S" (Gerlitz & Schupp, 2005), which is a short version of the inventory presented by Benet-Martinez and John (1998). French and Italian translations were adopted from Plaisant, Courtois, Réveillère, Mendelsohn, and John (2010) and John (1991) respectively. The reliability of the subscale for conscientiousness was α = .51.[19] The items were reverse-scored if needed and an average score was computed.

As expected, the three CFC scales were correlated among one another and to subjective discount rates and conscientiousness (see Table 3.3).

Table3.3. Bivariate correlations of the CFC scales and temporal discounting variables

	N	CFC-Total	CFC-Future	CFC-Immediate
CFC-Future	1778	.837***		
CFC-Immediate	1778	-.900***	-.515***	
Subjective discount rate (serial choice task)	1485	-.271***	-.242***	.231***
High subjective discount rate (singular choice task)	1764	-.217***	-.194***	.186***
Conscientiousness	1598	.123***	.087***	-.124***

*** p < .001

[19] Rather low reliabilities are not unusual for scales with few items. Gerlitz and Schupp (2005) who developed this inventory report a reliability of α = .67. In a large sample of roughly 20,000 respondents, Dehne and Schupp (2007) find a reliability of α = .62.

Additional Measures and Descriptive Results

The hypothesized mediator, environmental concern, was measured by the nine German five-point items suggested by Diekmann and Preisendörfer (2001). As this scale was a replication, French and Italian translations were adopted from the "Swiss Environmental Survey 2007" (for an English translation, see Diekmann and Preisendörfer (2003)). While the items cover three theoretical dimensions – affective, cognitive and conative – a factor analysis with subsequent Varimax rotation produced a two-factor solution. As this is theoretically inconclusive, a one-dimensional solution was chosen instead (as put forth by Diekmann & Preisendörfer, 2001). The corresponding reliability was α = .82 (Cronbach's alpha). The items were reverse-scored if applicable and an average score was computed.

To analyze the relationship of the CFC scales to environmentally friendly behavior, 17 behaviors were selected. These include routine behaviors such as switching off the lights upon leaving a room or avoiding leaving the television on stand-by. Some behaviors are only relevant during winter: opening windows for brief periods only, the setting of the room temperature and turning down the radiators when being away for more than four hours. In addition, several smaller and larger investment decisions are analyzed: the use of energy-saving light bulbs, the type of heating system, the installation of solar panels, the thermal insulation of the building, the quality of windows and the resulting annual heating costs (as a proxy for investments made and energy-saving routines carried out). Other behaviors in the analyses are the use of recycled toilet paper, meat consumption, recycling of energy-saving bulbs or whether a tumble dryer is used. Table 3.4 gives an overview of the descriptive properties of these variables.

Table 3.4. Outcome variables

Variable	N	M	SD	Min	Max
Always turning off the lights when leaving a room (in the case of standard light bulbs; 1 = yes, 0 = no)	1809	0.35		0	1
Use of energy-saving light bulbs (in some or all cases; single person households only; 1 = yes, 0 = no)	520	0.82		0	1
Recycling of energy-saving bulbs (only persons ever having disposed of an energy-saving bulb; 1 = yes, 0 = no)	1391	0.80		0	1
Avoid leaving TV on stand-by (only persons using a TV; 1 = yes, 0 = no)	1789	0.67		0	1
Use of tumble dryer (yes = 1, no = 0)	1875	0.59		0	1
Days a week with meat consumption	1933	3.63	1.79	0	7
Use of recycled toilet paper (1 = yes, 0 = no)	1772	0.59		0	1
Opening windows for brief periods in winter (4-point scale; 4 = best value)	1838	3.39	0.80	1	4
Turning radiators down when away for more than four hours (if technically possible and not regulated automatically; 1 = yes, 0 = no)	895	0.31		0	1
Room temperature in winter (in °C)	1911	21.04	1.40	15	28
Solar panels (1 = yes, 0 = no; respondent or partner is home owner)	833	0.07		0	1
Heat pump or wood-based heating system (as opposed to any other system; 1 = yes, 0 = no; respondent or partner is home owner)	829	0.31		0	1
Thermal insulation of outer walls (1 = yes, 0 = no; respondent or partner is home owner)	755	0.81		0	1
Thermal insulation of roof or attic floor (1 = yes, 0 = no; respondent or partner is home owner)	762	0.89		0	1
Thermal insulation of basement (or basement ceiling or lowermost floor of living spaces; 1=yes, 0=no; respondent or partner is home owner)	684	0.76		0	1
High-quality windows (with multiple glazing, seals and no draught when shut; 1 = yes, 0 = no; respondent or partner is home owner)	813	0.69		0	1
Annual heating costs (in CHF, logarithmized)	1196	7.22	0.68	3.40	8.99

Table A3.1 in the appendix gives an overview of the control variables in the multivariate regression analyses to follow. All analyses share a basic set of control variables: environmental concern, gender, age, education, income and dummy variables for the different language areas. To estimate the use of a tumble dryer, the number of persons in the household and the presence of children were added as further covariates. The models relating to properties of the building (solar panels, heating system, thermal insulation, quality of windows, and annual heating costs) share a set of additional control variables, namely the type of building and the period in which the house was built. In addition, for the model concerning the type of windows, the age of the windows themselves is included. Moreover, for the model predicting the type of heating system, the age of the heating system is accounted for. In the model for heating costs, additional control variables are the size of the heated living space, the type of heating system, the thermal insulation of the building and the quality of the windows. As

several of the behaviors do not apply to all respondents, the analyses are carried out including relevant subgroups only (see Table 3.4). For example, in the case of the thermal insulation only home owners are analyzed.

Multivariate Results on the Relationship between CFC and Pro-Environmental Behavior

To analyze the role of CFC with regard to pro-environmental behavior, stepwise ordinary least squares (OLS) or logistic regression models were estimated (depending on the operationalization of the behavior in question). Since we are interested in both the effects of the CFC-Total scale and the two subscales CFC-Future and CFC-Immediate, all analyses to follow will be conducted twice – once with CFC-Total and once using the two subscales.

To examine whether environmental concern mediates the relationship between the CFC scales and behavior, mediation analyses were conducted. Following the causal steps approach by Baron and Kenny (1986), such analyses require four steps: First, a regression on the behavior in question is run without the mediator variable. Ideally, the CFC scales have an effect on the outcome. Second, the mediator (environmental concern) is regressed on the CFC scales in order to confirm that these variables are related. This is the case in all analyses. Third, a regression on behavior with both the CFC scales and environmental concern is estimated. The mediator is expected to show a significant effect. All models in which this is not the case are to be excluded from Step 4. Fourth, the effects of the CFC scales from the models in Step 1 are compared to those in the models from Step 3. According to Baron and Kenny (1986), there is complete mediation if the effects of the CFC scales on behavior drop to nonsignificance and partial mediation if the effects are closer to zero in the presence of the environmental concern than before its inclusion.

While the causal steps strategy is the most commonly used approach to test hypotheses about mediation, more recent papers criticize its comparatively low power (for a simulation study see MacKinnon, Lockwood, Hoffman, West, & Sheets, 2002) and increasingly advocate the use of bootstrapping instead (see Hayes, 2009; Kenny, 2012; MacKinnon, Lockwood, & Williams, 2004; Preacher & Hayes, 2008; Zhao, Lynch, & Chen, 2010). Therefore, in addition to the causal steps approach, the indirect effects were estimated by the user-written Stata command "binary_mediation" (Ender, 2011), which allows for dichotomous dependent variables and estimates indirect effects using the product of coefficients approach. To determine the significance of these indirect effects, bias-corrected confidence intervals (CI) were determined by bootstrapping (1000 iterations). If the CI does not include zero, the

indirect effect differs significantly from zero ($p < .05$, Preacher & Hayes, 2008; Zhao et al., 2010). Zhao et al. (2010) recommend this as the *sole* criterion to determine whether there is mediation.

Table 3.5 gives an overview of the results with regard to the relationship between the CFC scales and behavior. While the second and third columns indicate what signs were expected theoretically, subsequent columns summarize the effects found for either CFC-Total or CFC-Future and CFC-Immediate. Note that the effects for CFC-Future are controlled for CFC-Immediate and vice versa as they are based on models with both subscales as predictors simultaneously. The columns labeled "Causal steps" display the results of the mediation analyses according to the Baron and Kenny approach. Detailed results of the underlying analyses are to be found in the appendix (Tables A3.2 to A3.18). The sections labeled "Bootstrapping" present standardized estimates of the indirect effects and the corresponding 95% CIs (bias-corrected).[20]

[20] In order to adjust for the fact that our models are not fully independent from one another but at the same time differ with regard to whose behavior is considered, a Bonferroni correction was applied to the overall model F tests. As a consequence, the models for solar panels lose significance (CFC-Total without environmental concern: $\chi^2 = 20.20$, df = 10, p = .027; with environmental concern: $\chi^2 = 26.09$, df = 11, p = .006; CFC-Future and CFC-Immediate without environmental concern: $\chi^2 = 21.44$, df = 11, p = .029; with environmental concern: $\chi^2 = 26.46$, df = 12, p = .009). The other models remain unchanged.

Table 3.5. Effects of the CFC scales on pro-environmental behavior: Expected signs of the effects, unstandardized direct effects without (Step 1) and with environmental concern as a control variable (Step 3) and estimates of standardized indirect effects and corresponding bias-corrected 95% CIs

	Expected signs		Observed effects: CFC-Total				Observed effects: CFC-Future[a]				Observed effects: CFC-Immediate[a]			
			Causal steps[b]		Bootstrapping[c]		Causal steps[b]		Bootstrapping[c]		Causal steps[b]		Bootstrapping[c]	
	CFC-Total / -Future	CFC-Immediate	Step 1	Step 3	Indirect effect	CI: LL UL	Step 1	Step 3	Indirect effect	CI: LL UL	Step 1	Step 3	Indirect effect	CI: LL UL
Turning off the lights when leaving a room (logistic regression)	+	-	**.210***	.112	.033†	.010 .060	-.034	-.101	.025†	.007 .045	**-.237***	-.200	-.015†	-.031 -.005
Use of energy-saving light bulbs (logistic regression)[d]	+	-	.403	.510	-.041	-.120 .017	.179	.245	-.030	-.089 .014	-.223	-.266	.019	-.007 .069
Recycling of energy-saving light bulbs (logistic regression)	+	-	*.525***	*.411***	.038†	.009 .074	.182	.105	.029†	.006 .055	*-.340**	*-.299**	-.017†	-.038 -.002
Avoid leaving TV on stand-by (logistic regression)	+	-	*.490***	*.382***	.037†	.011 .066	**.226***	.153	.029†	.011 .052	*-.265**	*-.228**	-.015†	-.032 -.005
Use of tumble dryer (logistic regression)[e]	-	+	**-.215***	-.084	-.045†	-.073 -.022	.016	.108	-.035†	-.057 -.015	**.227***	.181	.019†	.009 .034
Days a week with meat consumption (OLS regression)	-	+	**-.184***	-.021	-.056†	-.079 -.036	*-.259***	*-.155**	-.041†	-.060 -.025	-.067	-.122	.021†	.011 .035
Use of recycled toilet paper (logistic regression)	+	-	**.191***	-.003	.065†	.041 .092	.146	.025	.047†	.029 .072	-.048	.026	-.028†	-.048 -.015
Opening windows for brief periods in winter (logistic regression)	+	-	.148**	.141**	.005	-.016 .027	.017	.011	.005	-.011 .023	-.129**	-.126**	-.003	-.012 .006
Turning radiators down when away for more than 4 hours (logistic regression)	+	-	.299*	.243	.019	-.027 .059	.323*	.295*	.011	-.014 .040	.018	.042	-.009	-.033 .013
Room temperature in winter (in °C) (OLS regression)	-	+	*-.331***	*-.265***	-.030†	-.054 -.011	**-.140***	-.096	-.023†	-.042 -.008	*.191***	*.167***	.012†	.004 .024
Solar panels (logistic regression)[f]	+	-	.598	.233	.103†	.036 .176	**.556***	.336	.072†	.025 .133	-.056	.082	-.045†	-.095 -.014
Heat pump or wood-based heating system (logistic regression)[g]	+	-	.238	.172	.020	-.015 .062	.402*	.367*	.013	-.015 .046	.153	.176	-.008	-.030 .008
Thermal insulation of outer walls (logistic regression)[f]	+	-	.027	-.013	.015	-.038 .067	.019	-.005	.011	-.023 .058	-.009	.008	-.006	-.032 .014
Thermal insulation of roof or attic floor (logistic regression)[f]	+	-	.397	.328	.024	-.028 .083	.248	.208	.017	-.022 .066	-.155	-.126	-.011	-.051 .010
Thermal insulation of basement (logistic regression)[f]	+	-	-.143	-.237	.031	-.012 .078	-.052	-.117	.026	-.011 .067	.091	.121	-.010	-.034 .003
High-quality windows (logistic regression)[h]	+	-	-.008	.003	-.004	-.048 .035	-.229	-.227	-.001	-.032 .031	-.202	-.204	.000	-.020 .022
Annual heating costs (logarithmized) (OLS regression)[i]	-	+	.008	.038	-.028†	-.062 -.002	-.029	-.006	-.025†	-.054 -.002	-.035	-.041	.006	-.001 .022

** p < .01, * p < .05, † 95% CI does not include zero

Notes:

[a] The effects for CFC-Future are controlled for CFC-Immediate and vice versa as they are based on models with both subscales as predictors simultaneously.

[b] The columns labeled "Causal steps" represent the results according to Baron and Kenny (1986): Step 1 presents results from models without environmental concern and Step 3 summarizes effects from models with environmental concern. The underlying models can be found in the appendix. Numbers in *italics* indicate partial mediation (lowering of effects) and **bold** numbers complete mediation (effects drop to nonsignificance).

[c] The columns labeled "Bootstrapping" present the results from the product of coefficients approach with bootstrapping to obtain CIs (LL is the abbreviation of "lower limit" and UL of "upper limit"). All CIs (95%) from bootstrapping are bias-corrected. The coefficients are standardized.

[d] The regression models on the use of energy-saving light bulbs are not significant (see Table A3.3 in the appendix).

[e] Additional control variables: children in household, number of persons in household.

[f] Additional control variables: age of building, type of building.

[g] Additional control variables: age of building, type of building, age of heating system.

[h] Additional control variables: age of building, type of building, age of windows.

[i] Additional control variables: age of building, type of building, heated living area, heating system, thermal insulation, quality of windows, owner household.

As Table 3.5 shows, all significant effects are in the expected direction. In 12 out of 17 cases the CFC scales have a significant direct or indirect effect on environmentally friendly behavior. This clearly indicates that the CFC scales are relevant to pro-environmental behavior. With the exception of using energy-saving light bulbs (for which the regression model itself was not significant)[21], the behaviors that were not related to the CFC scales represent investments into the building envelope (i.e. thermal insulation and high-quality windows).

The number of behaviors on which there is a significant effect is roughly equal for both CFC-Total and the two subscales (11 and 12 behaviors, respectively). It was presumed that CFC-Immediate would be more closely related to curtailment activities while CFC-Future was expected to be more closely linked to efficiency-increasing behaviors. However, the present analyses only partially support this assumption: While both subscales predict some of the curtailment behaviors (always controlling for the effect of the other subscale; upper section of Table 3.5), their number is – in line with expectations – higher for CFC-Immediate than for CFC-Future. In addition, CFC-Future is related to two out of seven efficiency-enhancing behaviors (lower section of Table 3.5), whereas CFC-Immediate is not correlated to any of them at all.

As expected, the results support the hypothesis that environmental concern acts as a mediator between the CFC scales and behavior. However, the causal steps procedure by Baron and Kenny and the more powerful bootstrapping approach differ in the amount of evidence they offer. Following the causal steps approach, with regard to CFC-Total, there is complete

[21] This might be caused by recent regulations that limit the choice of light bulbs available to Swiss consumers (stepwise regulation between 2009 and 2012; Swiss Federal Office of Energy, 2009) and by a subsequent rather heated public discourse.

mediation in four and partial mediation in three of the models. For two behaviors, there is a significant direct effect of CFC-Total but no mediation by environmental concern (as the effect of the latter was not significant in the first place). Bootstrapping indicates there may be indirect effects in two additional cases in which the Baron and Kenny approach has not led to any significant results regarding direct or indirect effects.

According to the Baron and Kenny procedure, CFC-Future has a significant effect on behavior (while controlling for CFC-Immediate) in six of the cases; its effect is completely mediated in three and partially in one of the analyses. Very similarly, CFC-Immediate is significantly related (after controlling for CFC-Future) in six of the cases, while its effect is completely mediated in two and partially mediated in three cases. Bootstrapping once again detects more indirect effects: For CFC-Future, bootstrapping leads to five additional indirect effects, in all of which the causal steps approach found no evidence of any effect at all. For CFC-Immediate, this is the case in regard to three behaviors.

Discussion

The goal of this study was to analyze the link between the Consideration of Future Consequences scale by Strathman et al. (1994) and environmentally friendly behavior. Prior to doing so, a detailed scale analysis was conducted as more recent research suggests the scale may be two-dimensional (for example Adams, 2012). In the present study, factor and scale analyses led to a two-factor structure with one factor comprising four items concerned with future consequences of behavior (CFC-Future) and one factor based on five items focusing on present benefits (CFC-Immediate). Confirmatory factor analyses confirmed that the two-factor solution fits the data slightly better than a one-factor scale (CFC-Total). The reliabilities of CFC-Total, CFC-Future and CFC-Immediate were satisfactory. As expected, the scales were correlated among one another as well as to subjective discount rates and conscientiousness.

All analyses with regard to environmentally friendly behavior were conducted twice – once with CFC-Total and once with both CFC-Future and CFC-Immediate as independent variables. This allowed for a comparison of the two solutions in the context of behavior. Including CFC-Future and CFC-Immediate in the same model in turn allows us to determine whether a particular behavior is rather driven by concerns for future or for immediate consequences or by both equally.

Overall, the results of this study suggest that consideration of future and of immediate consequences are valid predictors of pro-environmental behavior. For 12 out of 17 behaviors, there is a significant (indirect) relationship to at least one of the CFC scales: 11 behaviors were

related to CFC-Total, 11 to CFC-Future and 9 to CFC-Immediate. This relationship proved to be (partially) mediated by environmental concern as was indicated by both the causal steps approach (Baron & Kenny, 1986) and by a bootstrapping procedure (Ender, 2011; Zhao et al., 2010).

Yet the number of behaviors linked to either the CFC-Total or the CFC-Future and CFC-Immediate scales does not indicate substantial overall differences between the one- and the two-factorial solution. But as was hypothesized earlier in this paper, a particular pattern was expected with regard to the type of behavior related to CFC-Future and CFC-Immediate, respectively. It was assumed that concern with immediate consequences may be more relevant for behaviors that need continuous upkeep (curtailment behavior, such as switching off the lights, avoiding using stand-by or adjusting the room temperature) and that a preoccupation with future outcomes supports long-term investments (efficiency-increasing behavior, such as retrofitting a building). However, this pattern was only partially supported by the empirical results. While CFC-Immediate indeed was linked to curtailment behavior only, CFC-Future predicted merely two of the efficiency-enhancing behaviors and in addition was clearly related to several of the curtailment behaviors.

Thus the results indicate that, for most efficiency-increasing behaviors, neither concern with future nor with present outcomes is a significant predictor. From a practical point of view, this is dissatisfying as particularly efficiency-increasing behaviors have a large potential for energy-saving (Gardner & Stern, 1996; Jakob, 2006, 2007) and are far-reaching; the estimated lifetime of wall insulations for example is 40 years (Jakob, 2006). Post hoc, it seems reasonable to refer to a line of research that suggests personal variables such as attitudes and norms primarily influence behavior in low-cost situations (for example Best & Kneip, 2011; Black, Stern, & Elworth, 1985; Diekmann & Preisendörfer, 1998; Diekmann & Preisendörfer, 2003; Guagnano, Stern, & Dietz, 1995). In these situations, behaving according to one's attitudes or norms causes little in the way of extra costs compared to alternative behaviors. In this context, costs are not limited to financial aspects but are more broadly understood (covering time, effort, discomfort, etc.). Based on the assumption that the extra costs of environmentally friendly investments are larger than in the case of curtailment behavior, one would expect a stronger influence of any attitude or personality measure in the latter case. While this line of reasoning is worth considering, it would have to be tested in further studies.

In a related paper, we analyzed the relationship between subjective discount rates and pro-environmental behavior and did not find any systematic effects – despite the fact that the measures for subjective discounting were state-of-the-art and showed a satisfactory reliability (Bruderer Enzler, Diekmann, & Meyer, 2014). Theoretically, subjective discount rates and future

orientation both capture a preoccupation with future outcomes and therefore can be considered as two sides of the same coin. Hence, the question remains to be answered as to why the economic measures (discount rates) were not related to pro-environmental behavior while the psychological scale (CFC) was.

A limitation of the present study is its correlational nature which does not allow inferring causality between the variables of interest. For this purpose, future research may consider experimental or longitudinal designs. In addition, the present study relies on self-reported behavior. Observational data or – for example – data from registers of buildings and dwellings may prove helpful. It also should be kept in mind that the CFC scales in the present study are based on nine of the original 12 items. This may have affected the results and it limits comparisons to other studies, although, as far as this study is concerned, this reduction was unproblematic as it resulted in reliable scales.

In conclusion, despite all limitations, the present study suggests that consideration of future (and immediate) consequences is systematically related to pro-environmental behavior. A non-negligible part of this relationship is mediated by environmental concern. Even though a comparison of the results with respect to CFC-Total and the two subscales does not indicate any systematic, substantial differences regarding the number of behaviors the two solutions predict, the distinction of two subscales still revealed that not all behaviors are equally related to both of them. There was some indication that curtailment behavior could be more closely associated with CFC-Immediate whereas efficiency-enhancing behavior may be related to CFC-Future (if to any of the scales).

This distinction of CFC-Future and CFC-Immediate was also supported by factor analyses and by the fact that in Step 2 of the mediation analyses, CFC-Future was generally more closely related to environmental concern than CFC-Immediate while the latter still made a secondary contribution. This is meaningful as splitting the scale may allow distinguishing between two drivers of behavior: consideration of future or of immediate consequences. As the present results do not fully meet our expectations, further research is needed to analyze what type of behavior is more closely related to concern with future or with immediate consequences. A meaningful pattern would bear implications for practical interventions, particularly where concern with immediate consequences is the primary driver of behavior.

References

Adams, J. (2012). Consideration of immediate and future consequences, smoking status, and body mass index. *Health Psychology, 31*(2), 260-263

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

Anderson, L., & Stafford, S. (2009). Individual Decision-Making Experiments with Risk and Intertemporal Choice. *Journal of Risk and Uncertainty, 38*, 51-72.

Appleby, P. R., Marks, G., Ayala, A., Miller, L. C., Murphy, S., & Mansergh, G. (2005). Consideration of Future Consequences and Unprotected Anal Intercourse Among Men Who Have Sex with Men. *Journal of Homosexuality, 50*(1), 119-133.

Baron, R. M., & Kenny, D. A. (1986). The Moderator-Mediator Variable Distinction in Social Psychological Research: Conceptual, Strategic, and Statistical Considerations. *Journal of Personality and Social Psychology, 51*(6), 1173-1182.

Beck, R., & Triplett, M. (2009). Test-Retest Reliability of a Group-Administered Paper-Pencil Measure of Delay Discounting. *Experimental and Clinical Psychopharmacology, 17*(5), 345-355.

Beenstock, J., Adams, J., & White, M. (2011). The association between time perspective and alcohol consumption in university students: cross-sectional study. *European Journal of Public Health, 21*(4), 438-443.

Benet-Martinez, V., & John, O. P. (1998). Los Cinco Grandes across cultures and ethnic groups: Multitrait method analyses of the Big Five in Spanish and English. *Journal of Personality and Social Psychology, 75*, 729-750.

Benzion, U., Rapoport, A., & Yagil, J. (1989). Discount Rates Inferred from Decisions: An Experimental Study. *Management Science, 35*(3), 270-284.

Best, H., & Kneip, T. (2011). The impact of attitudes and behavioral costs on environmental behavior: A natural experiment on household waste recycling. *Social Science Research, 40*(3), 917-930.

Black, J. S., Stern, P. C., & Elworth, J. T. (1985). Personal and Contextual Influences on Household Energy Adaptations. *Journal of Applied Psychology, 70*(1), 3-21.

Borghans, L., Duckworth, A., Heckman, J., & ter Weel, B. (2008). The Economics and Psychology of Personality Traits. *The Journal of Human Resources, XLIII*(4), 972-1059.

Bruderer Enzler, H. (2014). Consideration of Future Consequences as a Predictor of Environmentally Responsible Behavior. Evidence from a General Population Study. *To appear in Environment and Behavior*.

Bruderer Enzler, H., Diekmann, A., & Meyer, R. (2014). Subjective discount rates in the general population and their predictive power for energy saving behavior. *To appear in Energy Policy*.

Brun, W. (2001). Predicting environment-friendly behaviour in adolescence. *Nordisk Psykologi, 53*, 303-324.

Burks, S., Carpenter, J., Götte, L., & Rustichini, A. (2011). *Which Measures of Time Preference Best Predict Outcomes? Evidence from a Large-Scale Field Experiment*. IZA Discussion Paper. Institute for the Study of Labor (IZA).

Cairns, J., & Pool, M., van der. (2000). Valuing future private and social benefits: The discounted utility model versus hyperbolic discounting models. *Journal of Economic Psychology, 21*, 191-205.

Camerer, C. F., & Hogarth, R. M. (1999). The Effects of Financial Incentives in Experiments: A Review and Capital-Labor-Production Framework. *Journal of Risk and Uncertainty, 19*(1), 7-42.

Chabris, C., Laibson, D., Morris, C., Schuldt, J., & Taubinsky, D. (2008). Individual laboratory-measured discount rates predict field behavior. *Journal of Risk and Uncertainty, 37*, 237-269.

Chapman, G. (1998). Sooner or Later. The Psychology of Intertemporal Choice. *The Psychology of Learning and Motivation, 38*, 83-113.

Charlton, S. R., Gossett, B. D., & Charlton, V. A. (2011). Beyond the Shadow of a Trait: Understanding Discounting through Item-Level Analysis of Personality Scales. *Psychological Record, 61*(4), 583-598.

Coller, M., & Williams, M. (1999). Eliciting Individual Discount Rates. *Experimental Economics, 2*(2), 107-127.

Collins, C., & Chambers, S. (2005). Psychological and Situational Influences on Commuter-Transport-Mode Choice. *Environment and Behavior, 37*(5), 640-661.

Corral-Verdugo, V., Bonnes, M., Tapia-Fonllem, C., Fraijo-Sing, B., Frías-Armenta, M., & Carrus, G. (2009). Correlates of pro-sustainability orientation: The affinity towards diversity. *Journal of Environmental Psychology, 29*(1), 34-43.

Costa, P. T., & McCrae, R. R. (1994). Stability and Change in Personality from Adolescence through Adulthood. In C. F. Halverson, G. A. Kohnstamm & R. P. Martin (Eds.), *The Developing Structure of Temperatment and Personality from Infancy to Adulthood* (pp. 139-150). Hilllsdale, New Jersey: Lawrence Erlbaum.

Crockett, R. A., Weinman, J., Hankins, M., & Marteau, T. (2009). Time Orientation and Health-Related Behaviour. Measurement in General Population Samples. *Psychology and Health, 24*(3), 333-350.

Cvetkovich, G., & Winter, P. (2008). *The Experience of Community Residents in a Fire-Prone Ecosystem: A Case Study on the San Bernardino National Forest*. Research Paper PSW-RP-257. US Department of Agriculture, Forest Service, Pacific Southwest Research Station. Albany. Retrieved from http://www.fs.fed.us/psw/publications/documents/psw_rp257/psw_rp257.pdf

Daly, H. E., & Farley, J. (2011). *Ecological economics. Principles and applications* (2nd ed.). Washington, D.C.: Island Press.

Daly, M., Delaney, L., & Harmon, C. (2008). *Psychological and Biological Foundations of Time Preference: Evidence from a Day Reconstruction Study with Biological Tracking*. IZA Discussion Paper. Institute for the Study of Labor (IZA).

Daugherty, J. R., & Brase, G. L. (2010). Taking time to be healthy: Predicting health behaviors with delay discounting and time perspective. *Personality and Individual Differences, 48*(2), 202-207.

Dawes, R. M. (1980). Social Dilemmas. *Annual Review of Psychology, 31*, 169-193.

de Wit, H., Flory, J., Acheson, A., McCloskey, M., & Manuck, S. (2007). IQ and Nonplanning Impulsivity are Independently Associated With Delay Discounting in Middle-Aged Adults. *Personality and Individual Differences, 42*, 111-121.

DEFRA. (2010). *Behavioural Economics and Energy Using Products. Scoping Research on Discounting Behaviour and Consumer Reference Points*. Research Report for the Department for Environment, Food and Rural Affairs, GHK Consulting and CeDEx, University of Nottingham and Durham Business School.

Dehne, M., & Schupp, J. (2007). *Persönlichkeitsmerkmale im Sozio-oekonomischen Panel (SOEP) - Konzept, Umsetzung und empirische Eigenschaften*. Research Notes 2007/26. Deutsches Institut für Wirtschaftsforschung DIW. Berlin. Retrieved from http://www.diw.de/documents/publikationen/73/diw_01.c.76533.de/rn26.pdf

Diekmann, A. (2001). Umweltbewusstsein und Oekonomie des Energiesparens. In R. Stockmann & J. Urban (Eds.), *Umweltberatung und Nachhaltigkeit*. Berlin: Erich Schmidt Verlag.

Diekmann, A., & Bruderer Enzler, H. (2012). Dokumentation Projekt "Zeitpräferenzen und Energiesparen". Eine Nachbefragung zum Schweizer Umweltsurvey 2007. Zürich: Professur für Soziologie, ETH Zürich.

Diekmann, A., & Meyer, R. (2008). Schweizer Umweltsurvey 2007. Dokumentation und Codebuch. Zürich: Professur für Soziologie, ETH Zürich.

Diekmann, A., & Preisendörfer, P. (1998). Environmental behavior - Discrepancies between aspirations and reality. *Rationality and Society, 10*(1), 79-102.

Diekmann, A., & Preisendörfer, P. (2001). *Umweltsoziologie*. Reinbek bei Hamburg: Rowohlt.

Diekmann, A., & Preisendörfer, P. (2003). Green and Greenback. The Behavioral Effects of Environmental Attitudes in Low-Cost and High-Cost Situations. *Rationality and Society, 15*.

Duckworth, A., Tsukayama, E., & Kirby, T. A. (2013). Is it really self-control? Examining the predictive power of the delay of gratification test. *Personality and Social Psychology Bulletin, 39*(7), 843-855.

Ebreo, A., & Vining, J. (2001). How Similar are Recycling and Waste Reduction? Future Orientation and Reasons for Reducing Waste as Predictors of Self-Reported Behavior. *Environment and Behavior, 33*(3), 424-448.

Ender, P. B. (2011). Stata binary_mediation command to estimate indirect effects with a binary dependent variable and / or mediator variable Retrieved 18012013, from http://www.ats.ucla.edu/stat/stata/ado/analysis

Epper, T., Fehr-Duda, H., & Schubert, R. (2011). Energy-Using Durables: The Role of Time Discounting in Investment Decisions. *Publication No. 290417, Swiss Federal Office of Energy*.

Fehr, E., & Leibbrandt, A. (2008). *Cooperativeness and Impatience in the Tragedy of the Commons*. Working Paper. Institute of Empirical Research in Economics, University of Zurich.

Frederick, S., Loewenstein, G., & O'Donoghue, T. (2002). Time Discounting and Time Preferences: A Critical Review. *Journal of Economic Literature, 40*(2), 351-401.

Gardner, J., & Stern, P. C. (1996). *Environmental Problems and Human Behavior*. Boston: Allyn and Bacon.

Gately, D. (1980). Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables: Comment. *The Bell Journal of Economics, 11*(1), 373-374.

Gerlitz, J.-Y., & Schupp, J. (2005). *Zur Erhebung der Big-Five-basierten Persönlichkeitsmerkmale im SOEP. Dokumentation der Instrumententwicklung BFI-S auf Basis des SOEP-Pretests 2005*. Research Notes 2005/4. Deutsches Institut für Wirtschaftsforschung DIW. Berlin. Retrieved from www.diw.de/documents/publikationen/73/43490/rn4.pdf

Green, L., Myerson, J., Lichtman, D., Rosen, S., & Fry, A. (1996). Temporal Discounting in Choice Between Delayed Rewards: The Role of Age and Income. [doi:]. *Psychology and Aging, 11*(1), 79-84.

Guagnano, G. A., Stern, P. C., & Dietz, T. (1995). Influences on Attitude-Behavior Relationships. A Natural Experiment With Curbside Recycling. *Environment and Behavior, 27*(5), 699-718.

Hanss, D. (2012). Explaining sustainable consumption. Findings from cross-sectional and intervention approaches. Doctoral dissertation. Bergen: University of Bergen. Retrieved from http://www.dicelab.org/images/pdfFiles/thesis_hanss_2012.pdf.

Harrison, G. W., Lau, M. I., Rutström, E. E., & Williams, M. B. (2005). Eliciting Risk and Time Preferences Using Field Experiments: Some Methodological Issues. In J. Carpenter, G. W. Harrison & J. A. List (Eds.), *Field Experiments in Economics* (Vol. 10). Greenwich, CT: JAI Press.

Harrison, G. W., Lau, M. I., & Williams, M. (2002). Estimating Individual Discount Rates in Denmark: A Field Experiment. *The American Economic Review, 92*(5), 1606-1617.

Hassett, K., & Metcalf, G. (1993). Energy Conservation Investment: Do Consumers Discount the Future Correctly? *Energy Policy, 21*, 710-716.

Hausman, J. A. (1979). Individual Discount Rates and the Purchase and Utilization of Energy-Using Durables. *The Bell Journal of Economics, 10*(1), 33-54.

Hayes, A. F. (2009). Beyond Baron and Kenny: Statistical Mediation Analysis in the New Millennium. *Communication Monographs, 76*(4), 408-420.

Hendrickx, L., Poortinga, W., & Kooij, R. v. d. (2001). Temporal factors in resource dilemmas. *Acta Psychologica, 108*(2), 137-154.

Hevey, D., Pertl, M., Thomas, K., Maher, L., Craig, A., & Chuinneagain, S. N. (2010). Consideration of future consequences scale: Confirmatory Factor Analysis. *Personality and Individual Differences, 48*(5), 654-657.

Hoornaert, J. (1973). Time Perspective Theoretical and Methodological Considerations. *Psychologica Belgica, 13*(3), 265-294.

Howarth, R. (2004). Discount Rates and Energy Efficiency Gap. In R. Ayres, R. Costanza, J. Goldemberg, M. Ilic, E. Jochem, R. Kaufmann, A. Lovins, M. Munasinghe, R. Pachauri, C. Pardo, P. Peterson, L. Schipper, M. Slade, V. Smil & E. Worrell (Eds.), *Encyclopedia of Energy* (Vol. 1, pp. 817-822). Amsterdam: Elsevier.

Jakob, M. (2006). Marginal Costs and Co-Benefits of Energy Efficiency Investments: The Case of the Swiss Residential Sector. *Energy Policy, 34*, 172-187.

Jakob, M. (2007). *The drivers of and the barriers to energy efficiency in renovation decisions of single-family home-owners*. CEPE Working Paper No 56. ETH Zurich. Zurich.

John, O. P. (1991). Big Five Inventory (BFI). Traduzzione Italiana autorizzata a cura di Deborah Donati & Alessandro Ubbiali Retrieved 20.3.2010, from http://www.ocf.berkeley.edu/~johnlab/pdfs/BFI-Italian.pdf

John, O. P., Naumann, L. P., & Soto, C. J. (2008). Paradigm Shift to the Integrative Big Five Trait Taxonomy. History, Measurement, and Conceptual Issues. In O. P. John, R. W. Robins & L. A. Pervin (Eds.), *Handbook of Personality: Theory and Research* (3 ed., pp. 114-158). New York: Guilford Press.

Johnson, M., Bickel, W., & Baker, F. (2007). Moderate Drug Use and Delay Discounting: A Comparison of Heavy, Light, and Never Smokers. *Experimental and Clinical Psychopharmacology, 15*(2), 187-194.

Joireman, J., Balliet, D., Sprott, D., Spangenberg, E., & Schultz, J. (2008). Consideration of future consequences, ego-depletion, and self-control: Support for distinguishing between CFC-Immediate and CFC-Future sub-scales. *Personality and Individual Differences, 45*(1), 15-21.

Joireman, J., Kees, J., & Sprott, D. (2010). Concern with Immediate Consequences Magnifies the Impact of Compulsive Buying Tendencies on College Students' Credit Card Debt. *Journal of Consumer Affairs, 44*(1), 155-178.

Joireman, J., Lasane, T. P., Bennett, J., Richards, D., & Solaimani, S. (2001). Integrating Social Value Orientation and the Consideration of Future Consequences Within the Extended Norm Activation Model of Proenvironmental Behaviour. *British Journal of Social Psychology, 40*, 133-155.

Joireman, J., Posey, D. C., Truelove, H. B., & Parks, C. D. (2009). The environmentalist who cried drought: Reactions to repeated warnings about depleting resources under conditions of uncertainty. *Journal of Environmental Psychology, 29*(2), 181-192.

Joireman, J., Shaffer, M. J., Balliet, D., & Strathman, A. (2012). Promotion Orientation Explains Why Future-Oriented People Exercise and Eat Healthy: Evidence From the Two-Factor Consideration of Future Consequences-14 Scale. *Personality and Social Psychology Bulletin, 38*(10), 1272-1287.

Joireman, J., Sprott, D. E., & Spangenberg, E. R. (2005). Fiscal responsibility and the consideration of future consequences. *Personality and Individual Differences, 39*(6), 1159-1168.

Joireman, J., Strathman, A., & Balliet, D. (2006). Considering Future Consequences. An Integrative Model. In L. J. Sanna & E. C. Chang (Eds.), *Judgment over Time. The Interplay of Thoughts, Feelings, and Behaviors* (pp. 82-99). Oxford: Oxford University Press.

Joireman, J., Van Lange, P., & Van Vugt, M. (2004). Who Cares About the Environmental Impact of Cars? Those With an Eye Toward the Future. *Environment and Behavior, 36*(2), 187-296.

Kaiser, H. (1974). An index of factorial simplicity. *Psychometrika, 39*(1), 31-36.

Kenny, D. A. (2012). Mediation. Retrieved 18.01.2013, from http://davidakenny.net/cm/mediate.htm

Keough, K. A., Zimbardo, P. G., & Boyd, J. N. (1999). Who's smoking, drinking, and using drugs? Time perspective as a predictor of substance use. *Basic and Applied Social Psychology, 21*(2), 149-164.

Khachatryan, H., Joireman, J., & Casavant, K. (2011). *Investigating Consumer Preferences for Biofuels: The Effects of the Consideration of Future Consequences*. FPTI Working Paper #3. Freight Policy Transportation Institute, Washington State University. Pullman. Retrieved from http://www.fpti.wsu.edu/research/Documents/Reports/Working%20Paper%203_investigating%20preferences%20for%20biofuels.pdf

Khwaja, A., Silverman, D., & Sloan, F. (2007). Time Preference, Time Discounting, and Smoking Decisions. *Journal of Health Economics, 26*(927-979).

Kirby, K. N. (1997). Bidding on the Future: Evidence Against Normative Discounting of Delayed Rewards. *Journal of Experimental Psychology: General, 126*(1), 54-70.

Kirby, K. N. (2009). One-year temporal stability of delay-discount rates. *Psychonomic Bulletin & Review, 16*(3), 457-462.

Kirby, K. N., Godoy, R., Reyes-Garcia, V., Byron, E., Apaza, L., Leonard, W., . . . Wilkie, D. (2002). Correlates of delay-discount rates: Evidence from Tsimane' Amerindians of the Bolivian rain forest. *Journal of Economic Psychology, 23*, 291-316.

Kirby, K. N., Petry, N., & Bickel, W. (1999). Heroin Addicts Have Higher Discount Rates for Delayed Rewards Than Non-Drug-Using Controls. *Journal of Experimental Psychology: General, 128*(1), 78-87.

Kortenkamp, K. V., & Moore, C. F. (2006). Time, uncertainty, and individual differences in decisions to cooperate in resource dilemmas. *Personality and Social Psychology Bulletin, 32*(5), 603-615.

Lasane, T. P., & O'Donnell, D. A. (2005). Time Orientation Measurement. A Conceptual Approach. In A. Strathman & J. Joireman (Eds.), *Understanding Behavior in the Context of Time. Theory, Research, and Application* (pp. 11-30). Mahwah, New Jersey: Lawrence Erlbaum.

Liebermann, Y., & Ungar, M. (1983). Effects of Inflation on Consumer Choice. *Journal of Business Research, 11*(379-388).

Liebermann, Y., & Ungar, M. (1997). Life Cycle Cost: An Individual Consumer's Perspective. *Managerial and Decision Economics, 18*, 227-234.

Liebermann, Y., & Ungar, M. (2002). Efficiency of Consumer Intertemporal Choice under Life Cycle Cost Conditions. *Journal of Economic Psychology, 23*, 729-748.

Lindsay, J., & Strathman, A. (1997). Predictors of Recycling Behavior: An Application of a Modified Health Belief Model *Journal of Applied Social Psychology, 27*(20), 1799-1823.

Loewenstein, G., & Prelec, D. (1991). Decision Making over Time and under Uncertainty: A Common Approach. *Management Science, 37*(7), 770-786.

MacKinnon, D. P., Lockwood, C. M., Hoffman, J. M., West, S. G., & Sheets, V. (2002). A comparison of methods to test mediation and other intervening variable effects. *Psychological Methods, 7*(1), 83-104.

MacKinnon, D. P., Lockwood, C. M., & Williams, J. (2004). Confidence Limits for the Indirect Effect: Distribution of the Product and Resampling Methods. *Multivariate Behavioral Research, 39*(1), 99-128.

Manzini, P., & Mariotti, M. (2007). *Choice over Time*. Working Paper. Queen Mary, University of London, School of Economics and Finance.

Martin, R., Delaney, L., & Harmon, C. (2010). *Micro-Level Determinants of Lecture Attendance and Additional Study-Hours*. IZA Discussion Paper. Institute for the Study of Labor (IZA).

Meier, A., & Witthier, J. (1983). Consumer Discount Rates Implied by Purchases of Energy-Efficient Refrigerators. *Energy, 8*(12), 957-962.

Meier, S., & Sprenger, C. (2010). *Stability of Time Preferences*. IZA Discussion Paper. Institute for the Study of Labor (IZA).

Milfont, T. L., Wilson, J., & Diniz, P. (2012). Time Perspective and Environmental Engagement: A Meta-Analysis. *International Journal of Psychology*, 1-12.

Nyhus, E. K. (2002). *Psychological Determinants of Household Saving Behaviour. Dissertation*: Department of Strategy Management, Norwegian School of Economics and Business Administration.

Nyhus, E. K., & Webley, P. (2006). Discounting, Self-control, and Saving. In M. Altman (Ed.), *Handbook of Contemporary Behavioral Economics. Foundations and Developments* (pp. 297-325). Armonk, New York: M. E. Sharpe.

Ohmura, Y., Takahashi, T., Kitamura, N., & Wehr, P. (2006). Three-Month Stability of Delay and Probability Discounting Measures. *Experimental and Clinical Psychopharmacology, 14*(3), 318-328.

Ott, W., Jakob, M., Baur, M., Kaufmann, Y., Ott, A., & Binz, A. (2005). Mobilisierung der energetischen Erneuerungspotenziale im Wohnbaubestand (Mobilisation of the energy efficiency potentials of the residential building stock). Bern: Swiss Federal Office of Energy (SFOE).

Percoco, M., & Nijkamp, P. (2009). Estimating Individual Rates of Discount: a Meta-Analysis. *Applied Economic Letters, 16*, 1235-1239.

Petrocelli, J. V. (2003). Factor validation of the Consideration of Future Consequences Scale: Evidence for a short version. *Journal of Social Psychology, 143*(4), 405-413.

Plaisant, O., Courtois, R., Réveillère, C., Mendelsohn, G. A., & John, O. P. (2010). Validation par analyse factorielle du Big Five Inventory français (BFI-Fr). Analyse convergente avec le NEO-PI-R. *Annales Médico-psychologiques, revue psychiatrique, 168*(2), 97-106.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. *Behavior Research Methods, 40*(3), 879-891.

Rappange, D. R., Brouwer, W. B. F., & Van Exel, N. J. A. (2009). Back to the Consideration of Future Consequences Scale: Time to Reconsider? *Journal of Social Psychology, 149*(5), 562-584.

Read, D., & Read, N. (2004). Time Discounting over the Lifespan. *Organizational Behavior and Human Decision Processes, 94*, 22-32.

Reimers, S., Maylor, E. A., Stewart, N., & Chater, N. (2009). Associations between a one-shot delay discounting measure and age, income, education and real-world impulsive behavior. *Personality and Individual Differences, 47*(8), 973-978.

Roberts, B. W. (2009). Back to the future: Personality and Assessment and personality development. *Journal of Research in Personality, 43*(2), 137-145.

Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126*(1), 3-25.

Rogers, A. (1994). Evolution of Time Preference by Natural Selection. *The American Economic Review, 84*(3), 460-481.

Ruderman, H., Levine, M. D., & McMahon, J. E. (1987). The Behavior of the Market of Energy Efficiency in the Residential Applicances Including Heating and Cooling Equipment. *The Energy Journal, 9*(1), 101-124.

Seidl, R. (2009). *Eine Multi-Agentensimulation der Wahrnehmung wasserbezogener Klimarisiken*. Marburg: metropolis.

Silverman, I. (2003). Gender Differences in Delay of Gratification. *Sex Roles, 49*(9/10), 451-463.

Simpson, C., & Vuchinich, R. (2000). Reliability of a Measure of Temporal Discounting. *The Psychological Record, 50*, 3-16.

Sozou, P. D., & Seymour, R. M. (2003). Augmented discounting: interaction between ageing and time–preference behaviour. *Proceedings of the Royal Society of London. Series B: Biological Sciences, 270*(1519), 1047-1053.

Strathman, A., Gleicher, F., Boninger, D. S., & Edwards, C. S. (1994). The Consideration of Future Consequences: Weighting Immediate and Distant Outcomes of Behavior. *Journal of Personality and Social Psychology, 66*(4), 742-752.

Sutter, M., Kocher, M., Rützler, D., & Trautmann, S. (2010). *Impatience and Uncertainty: Experimental Decisions Predict Adolescents' Field Behavior*. IZA Discussion Paper. Institute for the Study of Labor (IZA).

Swiss Federal Office for Housing. (2005). Briefing Wohneigentum. Wie viele Haushalte haben in der Schweiz Wohneigentum und warum sind es nicht mehr? Bern: Swiss Federal Office for Housing.

Swiss Federal Office of Energy. (2009). *Haushaltslampen: Effizienzvorschriften 2009 bis 2012 [Household lamps: Energy-efficiency regulation 2009 - 2012]*. Bern: Swiss Federal Office of Energy.

Swiss Federal Statistical Office. (2011). Statistik der Bevölkerung und der Haushalte 2010 (STATPOP). Neuchâtel: BFS.

Takahashi, T., Furukawa, A., Miyakawa, T., Maesato, H., & Higuchi, S. (2007). Two-month stability of hyperbolic discount rates for delayed monetary gains in abstinent inpatient alcoholics. *Neuroendocrinology Letters, 28*(2), 131-136.

Thaler, R. H. (1981). Some Empirical Evidece on Dynamic Inconsistency. *Economics Letters, 8*, 201-207.

Toepoel, V. (2010). Is consideration of future consequences a changeable construct? *Personality and Individual Differences, 48*(8), 951-956.

Train, K. (1985). Discount Rates In Consumers' Energy-Related Decisions: A Review of the Literature. *Energy, 10*(12), 1243-1253.

Trope, Y., & Liberman, N. (2010). Construal-level theory of psychological distance. *Psychological Review, 117*(2), 440-463.

Trostel, P. A., & Taylor, G. A. (2001). A Theory of Time Preference. *Economic Inquiry, 39*(3), 379-395.

Tsukayama, E., & Duckworth, A. (2010). Domain-specific Temporal Discounting and Temptation. *Judgment and Decision Making, 5*(2), 72-82.

Weatherly, J. N., Derenne, A., & Terrell, H. K. (2011). Testing the reliability of delay discounting of ten commodities using the fill-in-the-blank method. *The Psychological Record, 61*, 113-126.

Weatherly, J. N., Terrell, H. K., & Derenne, A. (2010). Delay Discounting of Different Commodities. *The Journal of General Psychology, 137*(3), 273 - 286.

Zhao, X. S., Lynch, J. G., & Chen, Q. M. (2010). Reconsidering Baron and Kenny: Myths and Truths about Mediation Analysis. *Journal of Consumer Research, 37*(2), 197-206.

Zimbardo, P. G., & Boyd, J. N. (1999). Putting Time in Perspective: A Valid, Reliable Individual-Differences Metric. *Journal of Personality and Social Psychology, 77*(6), 1271-1288.

Appendices

Appendix Chapter 2

Table A2.1. Wording of selected items

Singular choice tasks in 2007 and 2011 without lottery

Given we would offer you some money which of the following payments would you prefer: CHF 500 now or CHF 600 in one year?

Given we would offer you some money which of the following payments would you prefer: CHF 500 in one year or CHF 600 in two years?

Singular choice tasks in 2011 with lottery

With a little luck, you can win CHF 500 or CHF 600. Would you prefer to win CHF 500 now or CHF 600 in one year?

With a little luck, you can win CHF 500 or CHF 600. Would you prefer to win CHF 500 in one year or CHF 600 in two years?

Serial choice task in 2007

You have a choice between two amounts, a lower one now or a higher one in one year's time. The lower amount now is CHF 1000. And the higher one in a year's time is CHF 2000. Which of these two amounts would you choose? [CHF 1000 remains constant. If the respondent chooses the smaller sooner payment, the serial choice task is discontinued. If the respondent decides to wait for the larger amount, this amount will be lowered until the respondent chooses the smaller sooner reward or CHF 1010 is reached. The following smaller sooner rewards are possible: CHF 2000, CHF 1500, CHF 1300, CHF 1200, CHF 1150, CHF 1100, CHF 1050, CHF 1030, CHF 1020, CHF 1010.]

Serial choice task in 2011

With a little luck, you can win between CHF 1000 and CHF 2000. Among all respondents three winners will be drawn randomly. […] Please answer for each of the following four decisions which option you would prefer to win [...]:

Decision 1: CHF 1000 in one year or CHF 2000 in two years
Decision 2: CHF 1000 in one year or CHF 1500 in two years
Decision 3: CHF 1000 in one year or CHF 1200 in two years
Decision 4: CHF 1000 in one year or CHF 1100 in two years

Choice task on refrigerator (2007)

Given you were to choose between buying a refrigerator X and Y. Both are of the same overall size, have a freezing compartment of the same size and are generally of the same quality. But they differ in their purchase prices and power consumption. Which of the following two refrigerators would you buy?

- *Refrigerator X with a purchase price of CHF 350 and electricity costs of CHF 90 a year*
- *Refrigerator Y with a purchase price of CHF 500 and electricity costs of CHF 60 a year*

Choice task on light bulb (2011, presented in table form)

Given you would buy one of the following light bulbs today, which model would you rather choose? Both bulbs have the same light intensity, the same socket, the same looks and their light is equally warm.

- *Light bulb X: energy efficiency grade D, energy use of 28 Watt, light intensity of 400 lumens, life-time of 2000 hours and a purchase price of CHF 3.50*
- *Light bulb Y: energy efficiency grade A, energy use of 7 Watt, light intensity of 400 lumens, life-time of 6000 hours and a purchase price of CHF 13.50*

Table A2.2. Variables and descriptive findings of the independent variables

Variable	Year	N	M	SD	Min	Max	Description
Gender (1 = female)	2007	3369	0.56		0	1	1 = female, 0 = male
	2011	1945	0.55		0	1	
Age (divided by 10)	2007	3369	5.00	1.71	1.8	9.4	Age in years, divided by 10
	2011	1945	5.41	1.59	2.1	9.7	
Personal income (per month, in thsd)	2007	3042	4.72	4.37	0	100.00	In CHF (2007: if possible based on open question, otherwise based on categories. 2011: based on categories)
	2011	1867	5.08	2.83	1	11	
Equivalence income (per month, in thsd)	2007	2908	5.26	4.00	0.7	83.42	Household income divided by square root of number of persons living in the household (2007: if possible based on open question, otherwise based on categories. 2011: based on categories)
	2011	1870	5.16	2.14	0.58	13	
Years of education	2007	3363	12.99	2.85	9	19	Highest degree completed (categories) converted into years of education according to recommendations by the Swiss Federal Statistical Office
	2011	1932	13.51	2.73	9	19	
French-speaking area	2007	3369	0.16		0	1	Persons living in the French (1=yes, 0=no) as opposed to the German- and Italian-speaking areas of Switzerland
	2011	1844	0.15		0	1	
Italian-speaking area	2007	3369	0.07		0	1	Persons living in the Italian (1=yes, 0=no) as opposed to the German- and French-speaking areas of Switzerland
	2011	1844	0.06		0	1	
Economically active	2007	3364	0.65		0	1	Currently economically active (1=yes, 0=no)
	2011	1934	0.62		0	1	
Steady relationship	2007	3365	0.68		0	1	Steady relationship (1=yes, 0=no) as opposed to single
	2011	1932	0.74		0	1	
Has children	2007	3365	0.63		0	1	Has children of any age (1=yes, 0=no)
	2011	1890	0.71		0	1	
Environmental concern	2007	3134	3.69	0.66	1.11	5	Additive index of nine five-point items divided by the number of items
	2011	1729	3.63	0.64	1.33	5	
Residential property	2007	2761	0.45		0	1	Person living in residential property (1=yes, 0=no) as opposed to rental homes
	2011	1776	0.50		0	1	
Single family home	2007	3368	0.39		0	1	Persons living in a detached, semi-detached or row house (1=yes, 0=no) as opposed to a multiple family home
	2011	1899	0.42		0	1	
House built in 1970–1989	2007	2678	0.30		0	1	Persons living in a house built in 1970–1989 (1=yes, 0=no) as opposed to earlier or later
	2011	1840	0.29		0	1	
House built in 1990 or later	2007	2678	0.21		0	1	Persons living in a house built in 1990 or later (1=yes, 0=no) as opposed to earlier
	2011	1840	0.25		0	1	
Heated living space	2011	1744	11.66	5.61	1	55	In 10 m^2
Heat pump or wood-based heating system	2011	1873	0.21		0	1	Heat pump or wood-based heating system (1=yes, 0=no) as opposed to any other system
Age of windows	2011	1744	16.69	15.03	0	170	In years

Table A2.3. OLS and logistic regression models to explain subjective discount rates: models without age squared

	Singular CT 2007	Serial CT 2007	Singular CT 2011	Serial CT 2011
Gender (1 = female)	0.34**	0.06**	0.41**	0.06**
	(3.62)	(3.47)	(3.53)	(2.99)
Age (divided by 10)	0.00	0.00	0.06	0.04**
	(0.13)	(0.15)	(1.34)	(5.51)
Personal income (per month, in thsd)	-0.03+	-0.01*	-0.06**	-0.01
	(-1.66)	(-2.35)	(-2.71)	(-1.51)
Years of education	-0.09**	-0.02**	-0.07**	-0.01**
	(-5.07)	(-6.41)	(-3.34)	(-3.73)
Reference category: German-speaking area				
French-speaking area	0.34**	-0.01	0.51**	0.06*
	(2.83)	(-0.60)	(3.45)	(2.52)
Italian-speaking area	0.22	0.03	0.85**	0.17**
	(1.17)	(0.87)	(3.44)	(3.93)
Economically active	-0.34**	-0.07**	-0.19	-0.06**
	(-2.95)	(-3.55)	(-1.33)	(-2.59)
Steady relationship	-0.13	-0.05**	-0.27*	-0.03
	(-1.37)	(-3.14)	(-2.08)	(-1.53)
Has children	0.15	0.03+	0.26*	0.01
	(1.51)	(1.71)	(2.06)	(0.35)
Lottery			0.31*	
			(2.48)	
Constant	1.56**	0.96**	0.93*	0.41**
	(5.00)	(18.73)	(2.11)	(5.94)
Pseudo R^2 (McFadden)	0.042		0.062	
Adjusted R^2		0.063		0.118
Number of observations	2473	2892	1687	1407

t-/z-statistics in brackets; + p<.10, * p<.05, ** p<.01

Notes: All variables in a model are taken from the same survey, either the 2007 or 2011 data.

All models were estimated with robust standard errors. "CT" is the abbreviation of "choice task".

Wald (OLS models) and likelihood-ratio tests (logistic models) comparing the models in this table to those in Table 1.7 were significant for the serial choice tasks (singular choice task 2007: $\chi^2(1) = 2.21$, $p > .05$; serial choice task 2007: $F(1, 2881) = 18.19$, $p < .01$; singular choice task 2011: $\chi^2(1) = .64$, $p > .05$; serial choice task 2011: $F(1, 1396) = 11.00$, $p < .01$).

Table A2.4. OLS and logistic regression models predicting various behaviors

	Turning off the lights when leaving a room				Use of energy-saving lamps				Choice task on refrigerator		Choice task on bulb		Opening windows for brief periods	
	2007	2007	2011	2011	2007	2007	2011*	2011*	2007	2007	2011	2011	2011	2011
Discount rate (serial choice task)	0.24* (2.12)		0.06 (0.32)		-0.11 (-0.59)		-0.76 (-1.78)		-0.66** (-2.59)		-0.07 (-0.30)		-0.13+ (-1.83)	
High discount rate (singular choice task)		0.09 (0.94)		-0.11 (-0.91)		-0.08 (-0.50)		-0.84 (-2.74)		-0.98** (-4.51)		-0.38* (-2.46)		-0.12** (-2.73)
Gender (1 = female)	-0.15 (-1.64)	-0.15 (-1.63)	-0.16 (-1.26)	-0.09 (-0.79)	-0.21 (-1.31)	-0.21 (-1.21)	-0.29 (-0.89)	-0.29 (-0.96)	0.43* (2.11)	0.38+ (1.93)	0.19 (1.13)	0.13 (0.87)	0.07 (1.49)	0.08+ (1.79)
Age (divided by 10)	0.12** (4.14)	0.12** (4.14)	0.09* (2.10)	0.11** (2.90)	0.04 (0.93)	0.02 (0.31)	-0.03 (-0.36)	-0.04 (-0.42)	0.26** (3.77)	0.26** (3.90)	-0.02 (-0.28)	-0.03 (-0.67)	0.01 (0.72)	-0.00 (-0.11)
Equivalence income (per month, in thsd)	-0.01 (-0.44)	-0.01 (-0.59)	0.02 (0.48)	-0.00 (-0.05)	-0.04** (-2.60)	-0.05** (-2.78)	-0.13 (-2.02)	-0.14 (-2.34)	0.02 (0.66)	0.02 (0.57)	0.15** (3.46)	0.14** (3.57)	-0.00 (-0.17)	-0.00 (-0.22)
Years of education	-0.00 (-0.19)	0.00 (0.15)	-0.08** (-3.03)	-0.06* (-2.53)	0.09** (3.13)	0.10** (3.20)	0.08 (1.15)	0.11 (1.61)	0.05 (1.22)	0.05 (1.08)	0.01 (0.27)	0.01 (0.42)	0.02* (2.22)	0.03** (2.99)
Reference category: German-speaking area														
French-speaking area	0.34** (2.77)	0.33** (2.74)	0.72** (4.19)	0.69** (4.47)	0.29 (1.32)	0.35 (1.51)	1.12 (1.66)	1.29 (2.23)	-0.24 (-0.95)	-0.30 (-1.28)	-0.02 (-0.08)	0.07 (0.31)	-0.22** (-3.14)	-0.21** (-3.13)
Italian-speaking area	1.34** (6.78)	1.34** (6.99)	1.17** (4.50)	1.08** (4.67)	-0.39 (-1.11)	-0.46 (-1.24)	-0.71 (-0.98)	-0.02 (-0.03)	-0.13 (-0.31)	-0.01 (-0.03)	0.44 (1.14)	0.06 (0.21)	-0.19 (-1.64)	-0.25* (-2.22)
Environmental concern (scaled 1 – 5)	0.22** (3.12)	0.23** (3.24)	0.28** (2.76)	0.28** (3.12)	0.21+ (1.89)	0.24* (2.00)	0.09 (0.39)	0.07 (0.32)	0.56** (3.96)	0.50** (3.50)	0.35** (2.70)	0.39** (3.38)	0.07* (1.99)	0.05 (1.60)
Constant	-2.03** (-5.09)	-2.05** (-5.18)	-1.22* (-2.17)	-1.47** (-2.80)	-1.36* (-2.05)	-1.47* (-2.06)	1.40 (1.05)	1.36 (1.09)	-1.01 (-1.22)	-0.46 (-0.55)	-0.41 (-0.53)	-0.32 (-0.46)	2.94** (15.06)	2.95** (15.63)
Pseudo R^2 (McFadden)	0.030	0.030	0.040	0.038	0.022	0.026	0.050	0.058	0.054	0.068	0.023	0.029		
Adjusted R^2													0.019	0.024
Number of obs.	2259	2268	1229	1447	801	703	323	398	2088	2097	1220	1436	1238	1470

z-/t-statistics in brackets, + p<.10, * p<.05, ** p<.01.

Notes: All models were estimated with robust standard errors.

* Model on the use of energy-saving lamps for the 2011 data not significant (serial choice task: $\chi^2 = 11.32$, df = 8, p = .184; singular choice task: $\chi^2 = 14.23$, df = 8, p = .076).

Table A2.5. OLS and logistic regression models predicting various behaviors

	Avoid leaving TV on standby mode				Yearly number of tire pressure controls (log.)		Environmentally friendly reaction when feeling cold		Turning radiators down when away for more than four hours			
	2007	2007	2011	2011	2007	2007	2007	2007	2007	2007	2011	2011
Discount rate (serial choice task)	-0.23+ (-1.89)		-0.46* (-2.32)		0.11* (2.04)		-0.24* (-2.30)		0.26 (1.50)		0.14 (0.49)	
High discount rate (singular choice task)		-0.28** (-2.79)		-0.21+ (-1.73)		-0.01 (-0.25)		-0.26** (-2.85)		0.02 (0.16)		-0.07 (-0.41)
Gender (1 = female)	0.16 (1.62)	0.17+ (1.76)	0.00 (0.03)	0.05 (0.44)	-0.37** (-7.98)	-0.36** (-7.73)	0.23** (2.70)	0.22* (2.36)	-0.07 (-0.47)	-0.08 (-0.53)	0.25 (1.35)	0.29 (1.63)
Age (divided by 10)	0.16** (5.19)	0.16** (5.29)	0.16** (3.68)	0.16** (3.91)	0.07** (4.11)	0.07** (4.10)	0.00 (0.18)	0.01 (0.47)	0.26** (5.95)	0.27** (6.05)	0.16** (2.61)	0.17** (3.15)
Equivalence income (per month, in thsd)	-0.04* (-2.12)	-0.04* (-2.08)	-0.09** (-2.68)	-0.06* (-2.18)	-0.00 (-0.23)	-0.00 (-0.46)	0.02 (1.44)	0.01 (1.06)	-0.03 (-0.86)	-0.03 (-0.85)	-0.14** (-2.77)	-0.14** (-2.81)
Years of education	0.06** (2.87)	0.05* (2.33)	0.03 (1.02)	0.04 (1.39)	-0.02+ (-1.83)	-0.02+ (-1.78)	0.04* (2.54)	0.04* (2.34)	0.02 (0.56)	0.02 (0.66)	0.08* (2.10)	0.08* (2.20)
Reference category: German-speaking area												
French-speaking area	0.42** (3.00)	0.48** (3.43)	0.42* (2.18)	0.39* (2.24)	-0.02 (-0.33)	-0.04 (-0.76)	-0.09 (-0.77)	-0.04 (-0.35)	0.42* (2.19)	0.45* (2.43)	0.73** (2.68)	0.77** (3.15)
Italian-speaking area	0.02 (0.09)	0.12 (0.59)	0.13 (0.45)	0.18 (0.73)	0.08 (0.78)	0.04 (0.45)	-0.50** (-2.85)	-0.32+ (-1.69)	0.75* (2.40)	0.73* (2.41)	0.68+ (1.82)	0.88* (2.54)
Environmental concern (scaled 1 – 5)	0.35** (4.56)	0.33** (4.31)	0.31** (3.08)	0.40** (4.36)	0.02 (0.58)	0.01 (0.23)	0.32** (4.91)	0.28** (4.08)	0.19+ (1.66)	0.17 (1.56)	0.22 (1.55)	0.22 (1.61)
Constant	-1.89** (-4.35)	-1.70** (-3.94)	-1.07+ (-1.82)	-1.67** (-3.07)	1.10** (5.74)	1.22** (6.39)	-1.41** (-3.89)	-1.30** (-3.27)	-2.83** (-4.48)	-2.69** (-4.36)	-3.12** (-3.77)	-3.14** (-3.94)
Pseudo R^2 (McFadden)	0.032	0.032	0.025	0.028			0.018	0.015	0.046	0.043	0.041	0.046
Adjusted R^2					0.094	0.092						
Number of observations	2034	2044	1203	1430	873	886	2491	2153	1027	1037	630	715

z-/t-statistics in brackets, + p<.10, * p<.05, ** p<.01.

Notes: All models were estimated with robust standard errors.

Table A2.6. Logistic regression models predicting thermal insulation

	Insulation of building		Insulation of outer walls		Insulation of "roof"		Insulation of "basement"	
	2007	2007	2011	2011	2011	2011	2011	2011
Discount rate (serial choice task)	0.04 (0.16)		0.12 (0.31)		-0.01 (-0.03)		0.07 (0.19)	
High discount rate (singular choice task)		0.04 (0.20)		0.12 (0.47)		0.38 (1.25)		0.25 (1.11)
Gender (1 = female)	-0.01 (-0.06)	-0.04 (-0.21)	-0.14 (-0.49)	-0.00 (-0.02)	-0.41 (-1.29)	-0.39 (-1.36)	0.07 (0.27)	0.04 (0.16)
Age (divided by 10)	-0.06 (-0.88)	-0.02 (-0.36)	-0.24* (-2.28)	-0.18+ (-1.88)	-0.09 (-0.67)	-0.02 (-0.17)	0.06 (0.56)	0.02 (0.27)
Equivalence income (per month, in thsd)	0.05 (1.40)	0.03 (1.07)	-0.03 (-0.39)	0.01 (0.22)	0.12 (1.42)	0.14+ (1.76)	0.12* (2.11)	0.13* (2.27)
Years of education	-0.02 (-0.38)	-0.01 (-0.36)	-0.14* (-2.51)	-0.12* (-2.40)	-0.10 (-1.55)	-0.05 (-0.89)	-0.11* (-2.37)	-0.12** (-2.75)
Reference category: German-speaking area								
French-speaking area	0.11 (0.38)	0.01 (0.04)	-0.04 (-0.10)	-0.06 (-0.17)	0.26 (0.45)	0.32 (0.64)	0.08 (0.19)	0.20 (0.54)
Italian-speaking area	-0.32 (-0.89)	-0.48 (-1.37)	-1.13* (-2.13)	-0.87+ (-1.94)	-0.40 (-0.75)	-0.25 (-0.52)	0.12 (0.26)	-0.03 (-0.06)
Environmental concern (scaled 1–5)	-0.09 (-0.61)	-0.10 (-0.69)	0.22 (1.10)	0.10 (0.53)	0.39 (1.58)	0.29 (1.29)	0.26 (1.43)	0.17 (1.06)
Single family home	0.06 (0.25)	0.18 (0.78)	0.18 (0.58)	0.03 (0.11)	0.61+ (1.77)	0.45 (1.40)	0.38 (1.40)	0.29 (1.20)
Reference: house built prior to 1970								
House built in 1970–1989	2.72** (9.68)	2.67** (9.82)	1.93** (6.51)	1.83** (6.89)	1.16** (3.18)	1.01** (3.16)	0.90** (3.51)	0.81** (3.41)
House built in 1990 or later	3.92** (8.36)	3.80** (8.84)	5.24** (5.03)	4.50** (5.95)	3.82** (3.69)	2.80** (4.51)	2.64** (6.71)	2.30** (6.68)
Constant	0.62 (0.72)	0.49 (0.57)	2.68* (2.33)	2.36* (2.19)	1.04 (0.63)	0.18 (0.12)	-0.31 (-0.28)	0.28 (0.29)
Pseudo R^2 (McFadden)	0.305	0.295	0.312	0.281	0.177	0.140	0.153	0.136
Number of observations	932	940	547	636	548	641	501	579

z-statistics in brackets, + p<.10, * p<.05, ** p<.01.

Notes: All models were estimated with robust standard errors.

Table A2.7. OLS and logistic regression models predicting the quality of windows and annual heating costs

	High quality windows		Annual heating costs (log.)	
	2011	2011	2011	2011
Discount rate (serial choice task)	0.31 (0.87)		0.05 (0.76)	
High discount rate (singular choice task)		-0.08 (-0.41)		0.02 (0.33)
Gender (1 = female)	-0.50* (-2.16)	-0.35+ (-1.67)	-0.01 (-0.25)	0.01 (0.28)
Age (divided by 10)	0.22* (2.11)	0.23** (2.58)	0.05* (2.32)	0.05* (2.53)
Equivalence income (per month, in thsd)	0.10+ (1.86)	0.11* (2.13)	-0.02 (-1.12)	-0.02 (-1.41)
Years of education	-0.04 (-0.82)	-0.03 (-0.68)	0.02* (2.44)	0.02* (2.11)
Reference category: German-speaking area				
French-speaking area	-1.12** (-3.64)	-0.87** (-3.01)	0.21** (2.81)	0.21** (3.08)
Italian-speaking area	-0.70+ (-1.73)	-0.35 (-0.91)	0.31** (3.38)	0.31** (3.59)
Environmental concern (scaled 1–5)	-0.04 (-0.23)	-0.00 (-0.01)	-0.05 (-1.35)	-0.06+ (-1.73)
Single family home	0.38+ (1.67)	0.18 (0.87)	0.10+ (1.72)	0.06 (1.16)
Owners			0.19** (2.98)	0.16** (2.65)
Reference category: house built prior to 1970				
House built in 1970–1989	0.14 (0.56)	0.30 (1.24)	-0.07 (-1.32)	-0.07 (-1.29)
House built in 1990 or later	0.76** (2.69)	0.77** (3.01)	-0.26** (-3.14)	-0.28** (-3.49)
Age of windows (years)	-0.08** (-5.24)	-0.08** (-6.12)		
Heated living space (square meters)			0.04** (7.20)	0.04** (7.84)
Heat pump or wood-based heating system			-0.43** (-6.68)	-0.40** (-6.65)
High window quality			-0.04 (-0.84)	-0.05 (-0.92)
All 3 parts of the building insulated			-0.14* (-2.33)	-0.12* (-2.31)
Constant	1.04 (0.95)	0.76 (0.77)	6.50** (28.47)	6.63** (30.58)
Pseudo R^2 (McFadden)	0.187	0.188		
Adjusted R^2			0.318	0.306
Number of observations	575	670	484	553

z-/t-statistics in brackets, + p<.10, * p<.05, ** p<.01.
Notes: All models were estimated with robust standard errors.

Appendix Chapter 3

Table A3.1. Variables and descriptive findings of the independent variables

Variable	N	M	SD	Min	Max	Notes/Explanations
Subjective discount rate (serial choice task)	1596	0.40	0.34	0.05	1	Subjective discount rate inferred from four binary choice tasks
High subjective discount rate (singular choice task)	1924	0.56		0	1	Subjective discount rate higher than 20% = 1, subjective discount rate lower than 20% = 0
Conscientiousness	1881	5.79	0.87	2	7	Subscale of Big Five inventory (average score, scaled 1–7)
Gender (1 = female)	1945	0.55		0	1	1 = female, 0 = male
Age (divided by 10)	1945	5.41	1.59	2.1	9.7	Age in years, divided by 10
Personal income (per month, in thsd)	1867	5.08	2.83	1	11	In CHF (based on categories)
Equivalence income (per month, in thsd)	1870	5.16	2.14	0.58	13	Household income divided by square root of number of persons living in the household (based on categories)
Years of education	1932	13.51	2.73	9	19	Highest degree completed (categories) converted into years of education according to recommendations by the Swiss Federal Statistical Office
Children in household	1943	0.17		0	1	1 = yes, 0 = no
Number of persons in household	1943	2.37	1.27	1	8	Including children
French-speaking area	1844	0.15		0	1	Persons living in the French- (1 = yes, 0 = no) as opposed to the German- and Italian-speaking areas of Switzerland
Italian-speaking area	1844	0.06		0	1	Persons living in the Italian- (1 = yes, 0 = no) as opposed to the German- and French-speaking areas of Switzerland
Environmental concern	1729	3.63	0.64	1.33	5	Based on nine items (average score, scaled 1–5)
Residential property	1776	0.50		0	1	Person living in residential property (1=yes, 0=no) as opposed to rental homes
Single family home	1899	0.42		0	1	Persons living in a detached, semi-detached or row house (1 = yes, 0 = no) as opposed to a multiple family home
Age of heating system	1561	18.61	17.02	0	173	In years
House built in 1970–1989	1840	0.29		0	1	Persons living in a house built in 1970–1989 (1 = yes, 0 = no) as opposed to earlier or later
House built in 1990 or later	1840	0.25		0	1	Persons living in a house built in 1990 or later (1 = yes, 0 = no) as opposed to earlier
Heated living space	1744	11.66	5.61	1	55	In 10 m^2
Age of windows	1744	16.69	15.03	0	170	In years

Table A3.2. Turning off the lights when leaving a room: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Turning off the lights when leaving a room				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.21*		0.11		0.38**	
	(1.97)		(1.00)		(12.01)	
CFC-Future		-0.03		-0.10		0.24**
		(-0.34)		(-0.96)		(7.88)
CFC-Immediate		-0.24*		-0.20+		-0.15**
		(-2.35)		(-1.95)		(-4.96)
Environmental concern			0.26**	0.28**		
			(2.66)	(2.80)		
Gender (1 = female)	-0.06	-0.08	-0.12	-0.14	0.20**	0.21**
	(-0.54)	(-0.67)	(-0.97)	(-1.14)	(6.20)	(6.48)
Age (divided by 10)	0.12**	0.12**	0.11**	0.11**	0.02+	0.02+
	(2.88)	(2.85)	(2.74)	(2.71)	(1.84)	(1.91)
Equiv. income	-0.01	-0.01	-0.00	-0.00	-0.04**	-0.04**
(per month, in thsd)	(-0.35)	(-0.39)	(-0.05)	(-0.09)	(-4.25)	(-4.16)
Years of education	-0.06*	-0.06*	-0.06*	-0.06*	0.00	0.00
	(-2.28)	(-2.31)	(-2.29)	(-2.34)	(0.10)	(0.15)
Reference category: German-speaking area						
French-speaking area	0.71**	0.73**	0.67**	0.70**	0.14**	0.13**
	(4.43)	(4.57)	(4.22)	(4.38)	(3.11)	(2.79)
Italian-speaking area	1.02**	1.01**	0.99**	0.98**	0.15*	0.15*
	(4.20)	(4.18)	(4.05)	(4.02)	(2.25)	(2.35)
Constant	-1.36*	0.09	-1.94**	-0.75	2.16**	3.02**
	(-2.52)	(0.13)	(-3.30)	(-1.01)	(14.35)	(15.90)
Number of observations	1367	1367	1367	1367	1367	1367
Pseudo R^2 (McFadden)	0.030	0.031	0.034	0.035		
Adjusted R^2					0.160	0.164

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.3. Use of energy-saving bulbs: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Use of energy-saving bulbs				Environmental concern	
	Step 1 [a]	Step 1 [a]	Step 3 [a]	Step 3 [a]	Step 2	Step 2
CFC-Total	0.40		0.51+		0.37**	
	(1.62)		(1.95)		(5.93)	
CFC-Future		0.18		0.25		0.22**
		(0.88)		(1.13)		(3.92)
CFC-Immediate		-0.22		-0.27		-0.15*
		(-0.96)		(-1.15)		(-2.48)
Environmental concern			-0.33	-0.33		
			(-1.31)	(-1.31)		
Gender (1 = female)	-0.39	-0.39	-0.36	-0.36	0.16*	0.17*
	(-1.27)	(-1.26)	(-1.17)	(-1.15)	(2.17)	(2.34)
Age (divided by 10)	-0.03	-0.03	-0.02	-0.02	0.03	0.03
	(-0.30)	(-0.30)	(-0.17)	(-0.17)	(1.60)	(1.60)
Equiv. income	-0.12*	-0.12*	-0.14*	-0.14*	-0.04**	-0.04**
(per month, in thsd)	(-2.00)	(-2.00)	(-2.21)	(-2.21)	(-2.75)	(-2.73)
Years of education	0.08	0.08	0.09	0.09	0.02	0.02
	(1.17)	(1.17)	(1.27)	(1.27)	(1.33)	(1.35)
Reference category: German-speaking area						
French-speaking area	0.99+	0.99+	1.02+	1.02+	0.06	0.05
	(1.71)	(1.68)	(1.77)	(1.74)	(0.53)	(0.41)
Italian-speaking area	-0.19	-0.19	-0.09	-0.09	0.32*	0.33*
	(-0.31)	(-0.31)	(-0.14)	(-0.14)	(2.30)	(2.32)
Constant	-0.03	1.31	0.66	2.26	2.00**	2.89**
	(-0.02)	(0.84)	(0.46)	(1.33)	(6.59)	(7.39)
Number of observations	364	364	364	364	364	364
Pseudo R^2 (McFadden)	0.038	0.038	0.043	0.043		
Adjusted R^2					0.145	0.147

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Notes: All models were estimated with robust standard errors and restricted to single person households.

[a] The four models regressing behavior on the CFC scales are not significant (CFC-Total without environmental concern: $\chi^2 = 9.19$, df = 7, p = .239; with environmental concern: $\chi^2 = 10.58$, df = 8, p = .227; CFC-Future and CFC-Immediate without environmental concern: $\chi^2 = 9.49$, df = 8, p = .303; with environmental concern: $\chi^2 = 10.81$, df = 9, p = .289).

Table A3.4. Recycling of energy-saving bulbs: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Recycling of energy-saving bulbs				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.52**		0.41**		0.39**	
	(3.93)		(2.79)		(10.88)	
CFC-Future		0.18		0.10		0.24**
		(1.40)		(0.78)		(7.07)
CFC-Immediate		-0.34*		-0.30*		-0.15**
		(-2.37)		(-2.02)		(-4.42)
Environmental concern			0.30*	0.31*		
			(2.22)	(2.27)		
Gender (1 = female)	0.17	0.16	0.11	0.10	0.17**	0.18**
	(1.05)	(1.01)	(0.64)	(0.58)	(4.73)	(5.00)
Age (divided by 10)	0.38**	0.38**	0.38**	0.38**	0.01	0.01
	(6.26)	(6.25)	(6.21)	(6.21)	(0.63)	(0.65)
Equiv. income	-0.07	-0.07	-0.06	-0.06	-0.04**	-0.03**
(per month, in thsd)	(-1.59)	(-1.61)	(-1.33)	(-1.36)	(-3.65)	(-3.44)
Years of education	-0.01	-0.01	-0.01	-0.01	-0.00	-0.00
	(-0.34)	(-0.35)	(-0.29)	(-0.29)	(-0.15)	(-0.15)
Reference category: German-speaking area						
French-speaking area	-0.21	-0.20	-0.28	-0.26	0.22**	0.21**
	(-0.93)	(-0.88)	(-1.22)	(-1.15)	(4.31)	(3.96)
Italian-speaking area	-0.09	-0.10	-0.15	-0.16	0.18*	0.19*
	(-0.26)	(-0.28)	(-0.45)	(-0.48)	(2.47)	(2.56)
Constant	-2.03**	0.02	-2.72**	-0.93	2.22**	3.08**
	(-2.81)	(0.02)	(-3.51)	(-0.86)	(12.86)	(13.66)
Number of observations	1059	1059	1059	1059	1059	1059
Pseudo R^2 (McFadden)	0.051	0.051	0.056	0.057		
Adjusted R^2					0.167	0.171

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.5. Avoid leaving TV on stand-by: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Avoid leaving TV on stand-by				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.49**		0.38**		0.38**	
	(4.70)		(3.42)		(12.36)	
CFC-Future		0.23*		0.15		0.25**
		(2.26)		(1.48)		(8.28)
CFC-Immediate		-0.26*		-0.23*		-0.13**
		(-2.53)		(-2.12)		(-4.55)
Environmental concern			0.30**	0.30**		
			(2.90)	(2.91)		
Gender (1 = female)	0.15	0.15	0.10	0.09	0.18**	0.19**
	(1.24)	(1.25)	(0.78)	(0.76)	(5.62)	(5.95)
Age (divided by 10)	0.16**	0.16**	0.16**	0.16**	0.01	0.01
	(3.88)	(3.88)	(3.78)	(3.78)	(1.17)	(1.21)
Equiv. income	-0.08*	-0.08*	-0.07*	-0.07*	-0.04**	-0.03**
(per month, in thsd)	(-2.57)	(-2.56)	(-2.24)	(-2.24)	(-4.09)	(-3.94)
Years of education	0.02	0.02	0.02	0.02	-0.01	-0.01
	(0.58)	(0.58)	(0.65)	(0.65)	(-0.75)	(-0.71)
Reference category: German-speaking area						
French-speaking area	0.43*	0.42*	0.37*	0.38*	0.18**	0.17**
	(2.39)	(2.37)	(2.10)	(2.11)	(4.05)	(3.66)
Italian-speaking area	0.21	0.22	0.16	0.16	0.16*	0.17**
	(0.80)	(0.80)	(0.61)	(0.60)	(2.54)	(2.70)
Constant	-1.88**	-0.29	-2.58**	-1.21	2.26**	3.05**
	(-3.43)	(-0.42)	(-4.28)	(-1.58)	(15.05)	(15.76)
Number of observations	1347	1347	1347	1347	1347	1347
Pseudo R^2 (McFadden)	0.028	0.028	0.034	0.034		
Adjusted R^2					0.164	0.170

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.6. Use of tumble dryer: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

		Use of tumble dryer			Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	-0.22*		-0.08		0.38**	
	(-2.27)		(-0.83)		(12.62)	
CFC-Future		0.02		0.11		0.25**
		(0.17)		(1.10)		(8.44)
CFC-Immediate		0.23*		0.18+		-0.14**
		(2.36)		(1.86)		(-4.69)
Environmental concern			-0.35**	-0.37**		
			(-3.62)	(-3.76)		
Gender (1 = female)	-0.10	-0.08	-0.03	-0.01	0.20**	0.21**
	(-0.84)	(-0.71)	(-0.25)	(-0.05)	(6.12)	(6.49)
Age (divided by 10)	-0.09*	-0.09*	-0.08+	-0.08+	0.00	0.00
	(-1.99)	(-1.98)	(-1.95)	(-1.94)	(0.29)	(0.34)
Equiv. income	0.16**	0.16**	0.15**	0.15**	-0.04**	-0.04**
(per month, in thsd)	(5.18)	(5.22)	(4.72)	(4.77)	(-4.64)	(-4.48)
Years of education	-0.06*	-0.06*	-0.06*	-0.06*	-0.00	-0.00
	(-2.52)	(-2.51)	(-2.55)	(-2.54)	(-0.06)	(-0.03)
Reference category: German-speaking area						
French-speaking area	0.11	0.08	0.17	0.14	0.16**	0.14**
	(0.68)	(0.52)	(1.02)	(0.84)	(3.57)	(3.19)
Italian-speaking area	-0.50*	-0.49*	-0.45+	-0.44+	0.14*	0.15*
	(-2.05)	(-1.99)	(-1.85)	(-1.77)	(2.30)	(2.42)
Children in household	0.41*	0.41*	0.40*	0.41*	-0.04	-0.04
	(2.17)	(2.17)	(2.15)	(2.15)	(-0.83)	(-0.82)
Number of persons in	0.15*	0.15*	0.14*	0.14*	-0.02	-0.01
household	(2.53)	(2.54)	(2.47)	(2.48)	(-0.97)	(-0.93)
Constant	1.22*	-0.16	2.04**	0.98	2.32**	3.12**
	(2.24)	(-0.23)	(3.42)	(1.31)	(14.05)	(15.23)
Number of observations	1417	1417	1417	1417	1417	1417
Pseudo R^2 (McFadden)	0.037	0.038	0.044	0.046		
Adjusted R^2					0.168	0.174

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.7. Days a week with meat consumption: Mediation analysis following the causal steps approach (OLS regression analysis)

	Days a week with meat consumption				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	-0.18*		-0.02		0.38**	
	(-2.41)		(-0.26)		(12.74)	
CFC-Future		-0.26**		-0.15*		0.25**
		(-3.50)		(-2.05)		(8.64)
CFC-Immediate		-0.07		-0.12		-0.13**
		(-0.89)		(-1.58)		(-4.64)
Environmental concern			-0.43**	-0.42**		
			(-5.55)	(-5.34)		
Gender (1 = female)	-0.91**	-0.93**	-0.82**	-0.85**	0.19**	0.20**
	(-9.97)	(-10.20)	(-9.03)	(-9.22)	(6.17)	(6.55)
Age (divided by 10)	-0.05	-0.05	-0.04	-0.04	0.02	0.02
	(-1.53)	(-1.55)	(-1.32)	(-1.34)	(1.40)	(1.43)
Equiv. income	0.03	0.02	0.01	0.01	-0.04**	-0.04**
(per month, in thsd)	(1.13)	(1.02)	(0.45)	(0.39)	(-4.45)	(-4.29)
Years of education	-0.05**	-0.05**	-0.05**	-0.05**	-0.00	-0.00
	(-2.94)	(-2.97)	(-2.99)	(-3.02)	(-0.17)	(-0.13)
Reference category: German-speaking area						
French-speaking area	-0.09	-0.05	-0.02	0.01	0.16**	0.14**
	(-0.69)	(-0.40)	(-0.18)	(0.04)	(3.61)	(3.20)
Italian-speaking area	-1.11**	-1.14**	-1.04**	-1.06**	0.16**	0.17**
	(-6.99)	(-7.15)	(-6.69)	(-6.83)	(2.63)	(2.78)
Constant	5.70**	6.12**	6.65**	7.37**	2.22**	3.00**
	(13.95)	(12.05)	(15.40)	(13.00)	(15.29)	(16.06)
Number of observations	1458	1458	1458	1458	1458	1458
Adjusted R^2	0.088	0.092	0.108	0.110	0.163	0.170

t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.8. Use of recycled toilet paper: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Use of recycled toilet paper				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.19*		-0.00		0.38**	
	(1.97)		(-0.03)		(12.12)	
CFC-Future		0.15		0.02		0.24**
		(1.53)		(0.25)		(7.82)
CFC-Immediate		-0.05		0.03		-0.14**
		(-0.48)		(0.25)		(-4.84)
Environmental concern			0.53**	0.52**		
			(5.33)	(5.29)		
Gender (1 = female)	-0.01	-0.00	-0.12	-0.11	0.19**	0.20**
	(-0.11)	(-0.04)	(-0.98)	(-0.94)	(5.68)	(5.98)
Age (divided by 10)	0.08*	0.08*	0.07+	0.07+	0.02	0.02
	(2.00)	(2.00)	(1.82)	(1.82)	(1.33)	(1.31)
Equiv. income	-0.12**	-0.12**	-0.10**	-0.10**	-0.04**	-0.03**
(per month, in thsd)	(-4.02)	(-3.98)	(-3.48)	(-3.47)	(-4.00)	(-3.85)
Years of education	0.10**	0.10**	0.10**	0.10**	0.00	0.00
	(4.05)	(4.05)	(4.15)	(4.15)	(0.27)	(0.31)
Reference category: German-speaking area						
French-speaking area	-0.13	-0.15	-0.23	-0.24	0.18**	0.16**
	(-0.83)	(-0.91)	(-1.43)	(-1.46)	(3.91)	(3.53)
Italian-speaking area	-0.42+	-0.41+	-0.52*	-0.51*	0.17**	0.17**
	(-1.73)	(-1.71)	(-2.13)	(-2.12)	(2.61)	(2.70)
Constant	-1.46**	-1.18+	-2.64**	-2.79**	2.17**	3.02**
	(-2.78)	(-1.77)	(-4.60)	(-3.81)	(14.15)	(15.32)
Number of observations	1336	1336	1336	1336	1336	1336
Pseudo R^2 (McFadden)	0.020	0.020	0.036	0.036		
Adjusted R^2					0.161	0.166

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.9. Opening windows for brief periods: Mediation analysis following the causal steps approach (OLS regression analysis)

	Opening windows for brief periods				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.15**		0.14**		0.38**	
	(4.00)		(3.52)		(12.39)	
CFC-Future		0.02		0.01		0.25**
		(0.47)		(0.30)		(8.56)
CFC-Immediate		-0.13**		-0.13**		-0.13**
		(-3.20)		(-3.10)		(-4.59)
Environmental concern			0.02	0.02		
			(0.49)	(0.63)		
Gender (1 = female)	0.05	0.04	0.04	0.03	0.19**	0.20**
	(1.05)	(0.90)	(0.95)	(0.77)	(5.90)	(6.29)
Age (divided by 10)	-0.00	-0.00	-0.00	-0.00	0.01	0.01
	(-0.00)	(-0.02)	(-0.02)	(-0.04)	(0.99)	(1.04)
Equiv. income	-0.00	-0.00	-0.00	-0.00	-0.04**	-0.04**
(per month, in thsd)	(-0.35)	(-0.41)	(-0.29)	(-0.33)	(-4.64)	(-4.49)
Years of education	0.02+	0.02+	0.02+	0.02+	0.00	0.00
	(1.85)	(1.83)	(1.85)	(1.83)	(0.17)	(0.22)
Reference category: German-speaking area						
French-speaking area	-0.19**	-0.18**	-0.19**	-0.18**	0.16**	0.14**
	(-2.82)	(-2.64)	(-2.82)	(-2.66)	(3.58)	(3.17)
Italian-speaking area	-0.29*	-0.30*	-0.30*	-0.30*	0.17**	0.18**
	(-2.45)	(-2.50)	(-2.48)	(-2.53)	(2.82)	(2.92)
Constant	2.68**	3.46**	2.64**	3.39**	2.21**	3.00**
	(13.10)	(13.72)	(12.28)	(12.67)	(14.93)	(15.76)
Number of observations	1388	1388	1388	1388	1388	1388
Adjusted R^2	0.026	0.027	0.025	0.026	0.167	0.174

t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.10. Turning radiators down when away for more than four hours: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Turning radiators down when away for more than four hours				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.30*		0.24		0.42**	
	(2.01)		(1.48)		(9.66)	
CFC-Future		0.32*		0.29*		0.22**
		(2.24)		(1.98)		(5.36)
CFC-Immediate		0.02		0.04		-0.20**
		(0.12)		(0.27)		(-4.52)
Environmental concern			0.13	0.13		
			(0.89)	(0.82)		
Gender (1 = female)	0.32+	0.34+	0.30+	0.33+	0.15**	0.16**
	(1.82)	(1.93)	(1.69)	(1.80)	(3.36)	(3.44)
Age (divided by 10)	0.22**	0.23**	0.22**	0.22**	0.01	0.01
	(3.66)	(3.76)	(3.63)	(3.73)	(0.83)	(0.94)
Equiv. income	-0.13**	-0.13**	-0.13**	-0.13**	-0.04**	-0.04**
(per month, in thsd)	(-2.75)	(-2.78)	(-2.60)	(-2.65)	(-3.51)	(-3.53)
Years of education	0.06+	0.06+	0.06+	0.06+	0.00	0.00
	(1.69)	(1.76)	(1.66)	(1.74)	(0.34)	(0.40)
Reference category: German-speaking area						
French-speaking area	0.75**	0.72**	0.72**	0.69**	0.21**	0.20**
	(3.02)	(2.87)	(2.89)	(2.76)	(3.43)	(3.31)
Italian-speaking area	0.77*	0.79*	0.75*	0.77*	0.15	0.15
	(2.08)	(2.12)	(2.05)	(2.09)	(1.43)	(1.46)
Constant	-3.48**	-3.65**	-3.77**	-4.06**	2.10**	3.28**
	(-4.13)	(-3.42)	(-4.23)	(-3.46)	(10.37)	(11.97)
Number of observations	674	674	674	674	674	674
Pseudo R^2 (McFadden)	0.048	0.050	0.049	0.051		
Adjusted R^2					0.188	0.188

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.11. Room temperature in winter (in °C): Mediation analysis following the causal steps approach (OLS regression analysis)

	Room temperature in winter (in °C)				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	-0.33**		-0.26**		0.38**	
	(-5.51)		(-4.17)		(12.66)	
CFC-Future		-0.14*		-0.10		0.25**
		(-2.37)		(-1.59)		(8.50)
CFC-Immediate		0.19**		0.17**		-0.13**
		(3.13)		(2.70)		(-4.66)
Environmental concern			-0.18**	-0.18**		
			(-2.86)	(-2.88)		
Gender (1 = female)	0.05	0.05	0.09	0.09	0.20**	0.21**
	(0.74)	(0.75)	(1.22)	(1.25)	(6.32)	(6.68)
Age (divided by 10)	-0.02	-0.02	-0.02	-0.02	0.01	0.01
	(-0.78)	(-0.78)	(-0.69)	(-0.68)	(1.25)	(1.29)
Equiv. income	0.09**	0.09**	0.08**	0.08**	-0.04**	-0.04**
(per month, in thsd)	(4.91)	(4.91)	(4.48)	(4.49)	(-4.67)	(-4.51)
Years of education	-0.04*	-0.04*	-0.04*	-0.04*	-0.00	-0.00
	(-2.44)	(-2.43)	(-2.46)	(-2.46)	(-0.22)	(-0.18)
Reference category: German-speaking area						
French-speaking area	-0.45**	-0.45**	-0.42**	-0.43**	0.16**	0.14**
	(-4.60)	(-4.58)	(-4.31)	(-4.32)	(3.56)	(3.19)
Italian-speaking area	-0.49**	-0.48**	-0.46**	-0.45**	0.16**	0.17**
	(-3.41)	(-3.41)	(-3.20)	(-3.18)	(2.63)	(2.78)
Constant	22.49**	21.35**	22.89**	21.89**	2.24**	3.03**
	(68.27)	(51.82)	(63.34)	(47.99)	(15.23)	(16.14)
Number of observations	1437	1437	1437	1437	1437	1437
Adjusted R^2	0.057	0.057	0.062	0.062	0.166	0.172

t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.

Table A3.12. Solar panels: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Solar panels				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.60+		0.23		0.38**	
	(1.75)		(0.71)		(8.59)	
CFC-Future		0.56*		0.34		0.24**
		(2.14)		(1.40)		(5.04)
CFC-Immediate		-0.06		0.08		-0.15**
		(-0.20)		(0.29)		(-3.43)
Environmental concern			0.89**	0.87**		
			(2.86)	(2.83)		
Gender (1 = female)	0.16	0.18	0.02	0.03	0.22**	0.22**
	(0.52)	(0.56)	(0.05)	(0.10)	(4.75)	(4.92)
Age (divided by 10)	-0.10	-0.10	-0.14	-0.14	0.02	0.02
	(-0.65)	(-0.70)	(-0.93)	(-0.98)	(0.94)	(0.87)
Equiv. income	-0.04	-0.03	-0.02	-0.01	-0.02+	-0.02
(per month, in thsd)	(-0.55)	(-0.47)	(-0.23)	(-0.14)	(-1.77)	(-1.64)
Years of education	0.08	0.08	0.09	0.09	-0.00	-0.00
	(1.22)	(1.17)	(1.36)	(1.30)	(-0.33)	(-0.40)
Reference category: German-speaking area						
French-speaking area	-0.18	-0.22	-0.40	-0.43	0.26**	0.24**
	(-0.39)	(-0.47)	(-0.84)	(-0.89)	(3.79)	(3.55)
Italian-speaking area	0.67	0.70	0.53	0.57	0.23**	0.23**
	(1.35)	(1.42)	(1.10)	(1.18)	(2.85)	(2.90)
Single family home	0.79+	0.80+	0.84*	0.86*	0.00	0.01
(vs. apartment building)	(1.87)	(1.90)	(2.02)	(2.04)	(0.08)	(0.13)
Reference: house built prior to 1970						
House built in 1970–1989	0.32	0.32	0.39	0.38	-0.06	-0.06
	(0.84)	(0.83)	(1.01)	(0.99)	(-1.09)	(-1.07)
House built in 1990 or later	-0.24	-0.22	-0.25	-0.24	-0.00	0.00
	(-0.62)	(-0.55)	(-0.64)	(-0.61)	(-0.03)	(0.06)
Constant	-6.11**	-5.77**	-7.97**	-8.41**	2.06**	2.95**
	(-3.02)	(-3.12)	(-3.73)	(-3.90)	(8.41)	(10.07)
Number of observations	670	670	670	670	670	670
Pseudo R^2 (McFadden)	0.053	0.056	0.081	0.084		
Adjusted R^2					0.165	0.168

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors and restricted to home owners (respondent or their partner is owner).

Table A3.13. Heat pump or wood-based heating system: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Heat pump or wood-based heating system				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.24		0.17		0.39**	
	(1.51)		(1.01)		(8.35)	
CFC-Future		0.40*		0.37*		0.24**
		(2.41)		(2.12)		(4.98)
CFC-Immediate		0.15		0.18		-0.15**
		(0.91)		(1.04)		(-3.20)
Environmental concern			0.16	0.14		
			(1.09)	(0.94)		
Gender (1 = female)	0.01	0.03	-0.03	-0.00	0.21**	0.22**
	(0.03)	(0.14)	(-0.16)	(-0.02)	(4.55)	(4.73)
Age (divided by 10)	-0.24**	-0.25**	-0.25**	-0.25**	0.01	0.01
	(-2.89)	(-2.95)	(-2.92)	(-2.98)	(0.65)	(0.61)
Equiv. income	-0.15**	-0.14**	-0.14**	-0.14**	-0.02+	-0.02
(per month, in thsd)	(-2.86)	(-2.70)	(-2.78)	(-2.63)	(-1.66)	(-1.54)
Years of education	-0.02	-0.02	-0.02	-0.02	-0.00	-0.01
	(-0.52)	(-0.58)	(-0.49)	(-0.56)	(-0.45)	(-0.54)
Reference category: German-speaking area						
French-speaking area	-0.04	-0.10	-0.08	-0.13	0.24**	0.22**
	(-0.14)	(-0.35)	(-0.27)	(-0.46)	(3.32)	(3.11)
Italian-speaking area	0.24	0.29	0.20	0.25	0.22**	0.23**
	(0.69)	(0.82)	(0.58)	(0.71)	(2.69)	(2.77)
Single family home	0.75**	0.76**	0.75**	0.76**	0.02	0.02
(vs. apartment building)	(3.47)	(3.50)	(3.46)	(3.50)	(0.34)	(0.38)
Reference: house built prior to 1970						
House built in 1970–1989	0.14	0.14	0.15	0.15	-0.07	-0.07
	(0.58)	(0.59)	(0.63)	(0.63)	(-1.19)	(-1.16)
House built in 1990 or later	0.61**	0.63**	0.62**	0.63**	-0.04	-0.04
	(2.62)	(2.69)	(2.66)	(2.72)	(-0.70)	(-0.65)
Age of heating system in years	-0.01	-0.01	-0.01	-0.01	-0.00	-0.00
	(-1.06)	(-1.15)	(-1.04)	(-1.13)	(-0.59)	(-0.72)
Constant	0.02	-0.86	-0.32	-1.29	2.11**	3.00**
	(0.02)	(-0.71)	(-0.31)	(-1.02)	(8.33)	(9.92)
Number of observations	640	640	640	640	640	640
Pseudo R^2 (McFadden)	0.080	0.086	0.082	0.087		
Adjusted R^2					0.162	0.166

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors and restricted to home owners (respondent or their partner is owner).

Table A3.14. Insulation of outer walls: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Insulation of outer walls				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.03		-0.01		0.39**	
	(0.11)		(-0.05)		(8.04)	
CFC-Future		0.02		-0.00		0.24**
		(0.08)		(-0.02)		(4.68)
CFC-Immediate		-0.01		0.01		-0.15**
		(-0.04)		(0.04)		(-3.24)
Environmental concern			0.12	0.12		
			(0.59)	(0.58)		
Gender (1 = female)	0.02	0.02	-0.00	-0.00	0.21**	0.22**
	(0.07)	(0.07)	(-0.01)	(-0.01)	(4.30)	(4.47)
Age (divided by 10)	-0.12	-0.12	-0.12	-0.12	0.01	0.01
	(-1.20)	(-1.21)	(-1.21)	(-1.22)	(0.40)	(0.36)
Equiv. income	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02
(per month, in thsd)	(-0.13)	(-0.13)	(-0.10)	(-0.10)	(-1.42)	(-1.32)
Years of education	-0.11*	-0.11*	-0.11*	-0.11*	-0.00	-0.00
	(-2.22)	(-2.21)	(-2.20)	(-2.18)	(-0.27)	(-0.35)
Reference category: German-speaking area						
French-speaking area	0.06	0.06	0.03	0.03	0.24**	0.23**
	(0.15)	(0.15)	(0.08)	(0.08)	(3.10)	(2.90)
Italian-speaking area	-0.86+	-0.86+	-0.89+	-0.89+	0.21**	0.22**
	(-1.90)	(-1.90)	(-1.92)	(-1.91)	(2.60)	(2.63)
Single family home	0.00	0.00	0.00	0.00	0.01	0.01
(vs. apartment building)	(0.01)	(0.01)	(0.01)	(0.01)	(0.14)	(0.18)
Reference: house built prior to 1970						
House built in 1970–1989	1.82**	1.82**	1.83**	1.83**	-0.05	-0.05
	(6.76)	(6.75)	(6.74)	(6.74)	(-0.73)	(-0.71)
House built in 1990 or later	4.51**	4.51**	4.51**	4.51**	0.01	0.02
	(5.98)	(5.96)	(5.97)	(5.95)	(0.21)	(0.32)
Constant	2.40*	2.45+	2.14+	2.09	2.06**	2.97**
	(2.01)	(1.71)	(1.74)	(1.41)	(7.87)	(9.33)
Number of observations	611	611	611	611	611	611
Pseudo R^2 (McFadden)	0.280	0.280	0.281	0.281		
Adjusted R^2					0.159	0.162

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors and restricted to home owners (respondent or their partner is owner).

Table A3.15. Insulation of roof/attic floor: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Insulation of roof/attic floor				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.40		0.33		0.38**	
	(1.37)		(1.11)		(7.88)	
CFC-Future		0.25		0.21		0.23**
		(1.09)		(0.91)		(4.76)
CFC-Immediate		-0.15		-0.13		-0.15**
		(-0.64)		(-0.52)		(-3.33)
Environmental concern			0.21	0.20		
			(0.90)	(0.88)		
Gender (1 = female)	-0.40	-0.39	-0.43	-0.43	0.22**	0.22**
	(-1.40)	(-1.38)	(-1.51)	(-1.49)	(4.55)	(4.69)
Age (divided by 10)	0.04	0.04	0.04	0.04	0.01	0.01
	(0.39)	(0.36)	(0.37)	(0.35)	(0.52)	(0.47)
Equiv. income	0.08	0.09	0.09	0.09	-0.02	-0.01
(per month, in thsd)	(1.04)	(1.06)	(1.07)	(1.08)	(-1.17)	(-1.06)
Years of education	-0.07	-0.07	-0.07	-0.07	-0.00	-0.00
	(-1.14)	(-1.17)	(-1.09)	(-1.11)	(-0.37)	(-0.43)
Reference category: German-speaking area						
French-speaking area	0.39	0.37	0.34	0.32	0.23**	0.22**
	(0.78)	(0.75)	(0.67)	(0.64)	(2.99)	(2.80)
Italian-speaking area	-0.13	-0.12	-0.17	-0.17	0.22**	0.22**
	(-0.25)	(-0.25)	(-0.35)	(-0.34)	(2.61)	(2.63)
Single family home	0.36	0.36	0.35	0.35	0.01	0.01
(vs. apartment building)	(1.11)	(1.12)	(1.09)	(1.10)	(0.21)	(0.26)
Reference: house built prior to 1970						
House built in 1970–1989	0.99**	1.00**	1.02**	1.02**	-0.08	-0.08
	(3.17)	(3.17)	(3.18)	(3.17)	(-1.35)	(-1.34)
House built in 1990 or later	2.82**	2.83**	2.82**	2.83**	0.00	0.01
	(4.53)	(4.52)	(4.54)	(4.53)	(0.06)	(0.14)
Constant	0.11	1.06	-0.36	0.42	2.08**	2.99**
	(0.07)	(0.64)	(-0.21)	(0.22)	(8.01)	(9.73)
Number of observations	618	618	618	618	618	618
Pseudo R^2 (McFadden)	0.134	0.134	0.136	0.136		
Adjusted R^2					0.154	0.157

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors and restricted to home owners (respondent or their partner is owner).

Table A3.16. Insulation of basement/basement ceiling: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

	Insulation of basement/basement ceiling				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	-0.14		-0.24		0.39**	
	(-0.76)		(-1.19)		(7.83)	
CFC-Future		-0.05		-0.12		0.28**
		(-0.29)		(-0.63)		(5.53)
CFC-Immediate		0.09		0.12		-0.11*
		(0.49)		(0.64)		(-2.36)
Environmental concern			0.25	0.25		
			(1.45)	(1.46)		
Gender (1 = female)	0.09	0.09	0.04	0.04	0.21**	0.22**
	(0.40)	(0.40)	(0.20)	(0.19)	(4.18)	(4.43)
Age (divided by 10)	0.06	0.06	0.05	0.05	0.01	0.01
	(0.63)	(0.62)	(0.59)	(0.59)	(0.37)	(0.28)
Equiv. income	0.10+	0.10+	0.10+	0.10+	-0.03+	-0.03+
(per month, in thsd)	(1.74)	(1.74)	(1.87)	(1.86)	(-1.93)	(-1.78)
Years of education	-0.12**	-0.12**	-0.12*	-0.12*	-0.00	-0.00
	(-2.58)	(-2.59)	(-2.57)	(-2.56)	(-0.04)	(-0.13)
Reference category: German-speaking area						
French-speaking area	0.27	0.27	0.22	0.22	0.22*	0.20*
	(0.72)	(0.72)	(0.57)	(0.58)	(2.48)	(2.21)
Italian-speaking area	0.04	0.04	-0.01	-0.01	0.21*	0.22*
	(0.09)	(0.09)	(-0.03)	(-0.03)	(2.34)	(2.37)
Single family home	0.26	0.26	0.26	0.26	0.01	0.01
(vs. apartment building)	(1.08)	(1.08)	(1.09)	(1.08)	(0.16)	(0.22)
Reference: house built prior to 1970						
House built in 1970–1989	0.72**	0.72**	0.73**	0.73**	-0.01	-0.01
	(3.07)	(3.07)	(3.08)	(3.07)	(-0.22)	(-0.21)
House built in 1990 or later	2.28**	2.28**	2.28**	2.28**	0.03	0.04
	(6.60)	(6.60)	(6.62)	(6.61)	(0.40)	(0.52)
Constant	1.46	0.92	0.94	0.21	2.04**	2.72**
	(1.42)	(0.75)	(0.86)	(0.15)	(7.43)	(8.32)
Number of observations	563	563	563	563	563	563
Pseudo R^2 (McFadden)	0.127	0.127	0.130	0.130		
Adjusted R^2					0.159	0.168

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors and restricted to home owners (respondent or their partner is owner).

Table A3.17. High-quality windows: Mediation analysis following the causal steps approach (logistic and OLS regression analysis)

		High-quality windows			Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	-0.01		0.00		0.39**	
	(-0.05)		(0.02)		(8.62)	
CFC-Future		-0.23		-0.23		0.24**
		(-1.41)		(-1.37)		(5.04)
CFC-Immediate		-0.20		-0.20		-0.15**
		(-1.18)		(-1.17)		(-3.49)
Environmental concern			-0.03	-0.01		
			(-0.18)	(-0.05)		
Gender (1 = female)	-0.33	-0.34+	-0.33	-0.34	0.21**	0.22**
	(-1.61)	(-1.67)	(-1.56)	(-1.63)	(4.49)	(4.63)
Age (divided by 10)	0.28**	0.29**	0.28**	0.29**	0.02	0.02
	(2.97)	(3.02)	(2.98)	(3.03)	(0.99)	(0.94)
Equiv. income	0.10+	0.09+	0.10+	0.09+	-0.03*	-0.02+
(per month, in thsd)	(1.91)	(1.79)	(1.90)	(1.78)	(-2.01)	(-1.87)
Years of education	-0.02	-0.01	-0.02	-0.01	-0.01	-0.01
	(-0.38)	(-0.31)	(-0.39)	(-0.31)	(-0.62)	(-0.70)
Reference category: German-speaking area						
French-speaking area	-0.91**	-0.87**	-0.90**	-0.87**	0.26**	0.25**
	(-3.09)	(-2.93)	(-3.05)	(-2.91)	(3.68)	(3.49)
Italian-speaking area	-0.47	-0.50	-0.46	-0.50	0.22**	0.23**
	(-1.23)	(-1.30)	(-1.21)	(-1.30)	(2.74)	(2.80)
Single family home	0.19	0.18	0.19	0.18	0.00	0.00
(vs. apartment building)	(0.87)	(0.83)	(0.86)	(0.83)	(0.00)	(0.06)
Reference: house built prior to 1970						
House built in 1970–1989	0.39	0.39	0.39	0.39	-0.07	-0.07
	(1.56)	(1.55)	(1.54)	(1.54)	(-1.20)	(-1.18)
House built in 1990 or later	0.84**	0.83**	0.84**	0.83**	-0.02	-0.01
	(3.23)	(3.19)	(3.23)	(3.19)	(-0.28)	(-0.18)
Age of windows	-0.08**	-0.08**	-0.08**	-0.08**	-0.00	-0.00
	(-5.89)	(-5.88)	(-5.90)	(-5.88)	(-0.78)	(-0.79)
Constant	0.37	1.57	0.43	1.60	2.10**	3.04**
	(0.36)	(1.32)	(0.39)	(1.23)	(8.47)	(10.24)
Number of observations	645	645	645	645	645	645
Pseudo R^2 (McFadden)	0.193	0.196	0.193	0.196		
Adjusted R^2					0.168	0.171

z-/t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors and restricted to home owners (respondent or their partner is owner).

Table A3.18. Annual heating costs (log.): Mediation analysis following the causal steps approach (OLS regression analysis)

	Annual heating costs (log.)				Environmental concern	
	Step 1	Step 1	Step 3	Step 3	Step 2	Step 2
CFC-Total	0.01		0.04		0.39**	
	(0.22)		(0.91)		(7.80)	
CFC-Future		-0.03		-0.01		0.32**
		(-0.78)		(-0.16)		(6.37)
CFC-Immediate		-0.04		-0.04		-0.08
		(-0.89)		(-1.02)		(-1.58)
Environmental concern			-0.08*	-0.07+		
			(-1.98)	(-1.88)		
Gender (1 = female)	0.00	-0.00	0.02	0.02	0.23**	0.24**
	(0.04)	(-0.02)	(0.39)	(0.33)	(4.28)	(4.52)
Age (divided by 10)	0.05**	0.05**	0.05**	0.05**	0.01	0.01
	(2.64)	(2.61)	(2.66)	(2.64)	(0.25)	(0.33)
Equiv. income	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
(per month, in thsd)	(-1.29)	(-1.33)	(-1.40)	(-1.42)	(-1.45)	(-1.31)
Years of education	0.02+	0.02+	0.02+	0.02+	0.00	0.00
	(1.77)	(1.79)	(1.78)	(1.79)	(0.09)	(0.04)
Reference category: German-speaking area						
French-speaking area	0.20**	0.20**	0.21**	0.22**	0.21*	0.17*
	(2.88)	(2.99)	(3.04)	(3.10)	(2.39)	(2.04)
Italian-speaking area	0.27**	0.27**	0.29**	0.29**	0.21*	0.20+
	(3.10)	(3.13)	(3.28)	(3.30)	(2.07)	(1.95)
Single family home	0.08	0.08	0.09	0.09	0.04	0.05
(vs. apartment building)	(1.41)	(1.39)	(1.47)	(1.46)	(0.69)	(0.78)
Reference: house built prior to 1970						
House built in 1970–1989	-0.08	-0.07	-0.08	-0.08	-0.10	-0.10
	(-1.38)	(-1.37)	(-1.51)	(-1.50)	(-1.48)	(-1.53)
House built in 1990 or later	-0.29**	-0.29**	-0.29**	-0.29**	0.01	0.03
	(-3.52)	(-3.55)	(-3.52)	(-3.52)	(0.13)	(0.34)
Residential property	0.14*	0.14*	0.13*	0.13*	-0.07	-0.07
	(2.19)	(2.19)	(2.11)	(2.11)	(-1.02)	(-0.99)
Heated living space (in 10m2)	0.04**	0.04**	0.04**	0.04**	-0.01	-0.01
	(7.61)	(7.67)	(7.63)	(7.67)	(-1.46)	(-1.54)
Heat pump or wood-based	-0.39**	-0.39**	-0.39**	-0.39**	0.00	-0.01
heating system	(-6.43)	(-6.30)	(-6.37)	(-6.27)	(0.03)	(-0.23)
All three parts of the building	-0.12*	-0.12*	-0.12*	-0.12*	-0.03	-0.04
(fully) insulated	(-2.19)	(-2.16)	(-2.24)	(-2.22)	(-0.46)	(-0.57)
High-quality windows	-0.06	-0.07	-0.07	-0.07	-0.05	-0.04
	(-1.27)	(-1.31)	(-1.35)	(-1.37)	(-0.78)	(-0.67)
Constant	6.42**	6.64**	6.60**	6.83**	2.27**	2.72**
	(26.85)	(23.66)	(27.82)	(23.46)	(8.41)	(8.23)
Number of observations	538	538	538	538	538	538
Adjusted R^2	0.291	0.291	0.295	0.294	0.168	0.187

t-statistics in brackets. + p<0.10, * p<0.05, ** p<0.01

Note: All models were estimated with robust standard errors.