

# Investing in renewables – More than a matter of money

Ingo Kastner & Paul C. Stern



## Research focus

Understanding & promoting major energy investment in households (e.g., investments in solar energy)

- These behaviors have a substantial impact on individual energy consumption while there is a research shortage in this area in behavioral science

### I. Review study

- Collecting available empirical research on energy investments
- Identifying important factors influencing these investment decisions

### II. Experimental study

### III. Combining social-psychological theories to build a conceptual framework

- Providing more detailed information of how these factors are associated.

# Literature review

## - Overview -



- We found 26 empirical studies focusing on energy investment decisions in households
  - Time frame: 30 years
  - All were conducted in Western Countries
- These studies involved fundamental differences in:
  - Methods (e.g., measurements, analyses, target groups)
  - Theoretical perspectives & concepts => different kinds of factors were measured
  - ...
- We identified six factor categories that were frequently measured.

# Literature review

## - Frequently analysed factors & influences -

- 1) Expected individual benefits
  - mostly financial, security or comfort related expectations
- 2) Expected ecological benefits
- 3) Policy Measures
  - mostly financial incentives in terms of grants
- 4) Social influences
- 5) Personal traits, value orientations, attitudes etc.
- 6) Demography.

# Literature review

## - decision-relevant factors -

- Expected individual benefits (in 48,9% of the measurements within the studies) & financial incentives (54,0%) were found to have a strong influence on the investment decisions
- Income also had a stable positive influence across the studies

***Money & (expected) individual benefits play an important role when it comes to energy investments.***

# Literature review

## - decision-relevant factors -

- Expected ecological benefits were found to be even more decision-relevant (56,5%) while
- social influences were rather unimportant (28,3%)
- these results may have been biased by measurement problems
  - direct questioning is the most common method => this may cause social desirable answers
  - decision makers did not have to decide between different consequences
- Personal traits, value orientations and attitudes were also found to be rather irrelevant for investment decisions (28,1%)
  - prior studies indicate that these factors may not work directly but in in combination with other factors (e.g., certain policy measures)

- *Indirect & competitive approaches may provide a more reliable picture of the relevance and of decision factors*
- *Interactions between factors should also be considered.*

# Discrete Choice Analysis

## - Procedure -

- Experimental study on energy investment decisions (investments in solar thermal energy) with (n=345) home owners living in existing building
- *Decision consequences* were varied within a discrete choice experiment (17 trials)
- The participants had to decide between investment consequences (**competitive approach**):
  - financial consequences
  - ecological consequences (CO<sub>2</sub> saving potentials)
  - security-related consequences (guarantee extend)
  - social influences (recommendations by different sources)
- The decision makers' value orientations were measured afterwards
- The data analyses accounted for main effects and **interactions** between decision consequences and value orientations.

# Discrete Choice Analysis

## - Results -



- In the competitive analyses financial factors were most important, followed by social influences (trustworthy recommendations by others)
- no significant effects were found for security-related expectations and ecological benefits when decision makers had to choose between different consequences
- In addition, several interactions were found between these decision consequences and the decisions makers' value orientations, e.g.,
  - Financial and security factors are more important for conservative and hedonistic persons while
  - Pro-environmental/ prosocial decision makers are more sensitive towards social influences and ecological consequences.



# Integrating theories

## - Method -

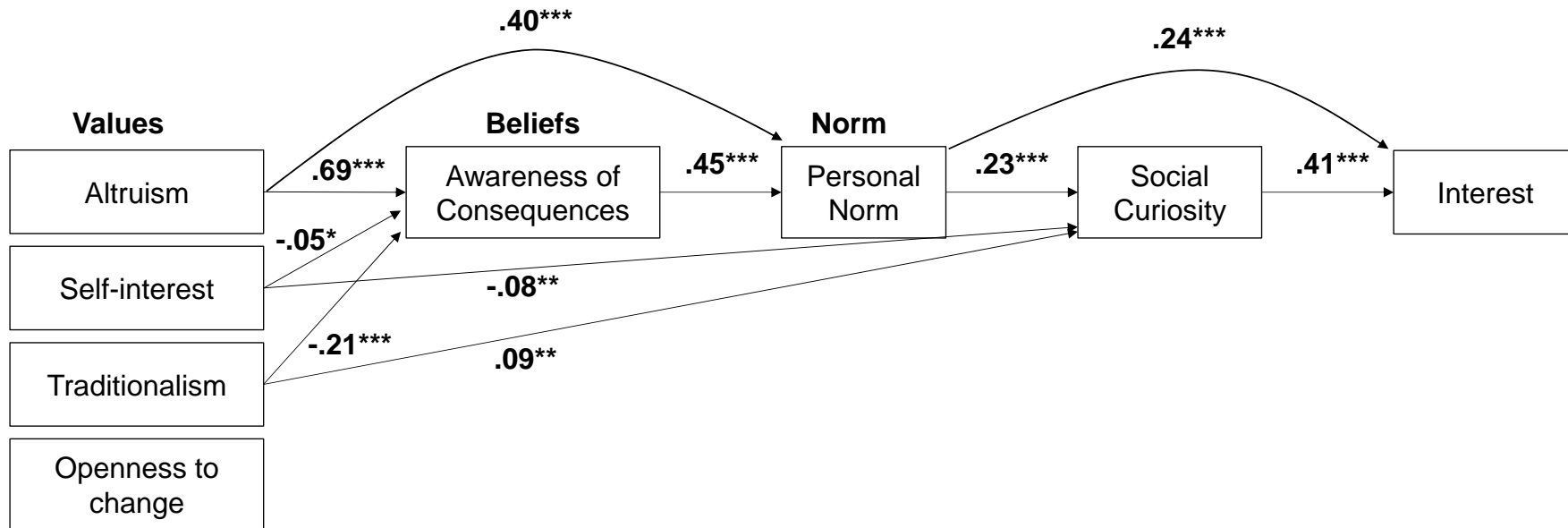
- Analysis of PV adoption in the US
- Focus on 4 states presenting different physical and policy contexts (Calif., Ariz., New Jersey, New York)
- Three surveys: General population in the 4 states; households who have contacted a PV provider but have not adopted; adopter households
- Today it will be focused on the general population survey.

# Integrating theories

## - Method -

- Survey included measures of variables derived from three theories
  - Value-Belief-Norm (VBN) Theory (Stern et al., 1999)
  - Diffusion of Innovation Theory
  - Theory of Planned Behavior (TPB)
- Survey also included a large number of items hypothesized or expected to affect adoption by researchers or practitioners
- Potential predictors of interest were analyzed inductively (factor analysis) to identify reliable and conceptually coherent measures
- The factor analysis identified additional concepts with reliable measurement and influence on the dependent variable.

# Values-Belief-Norm theory



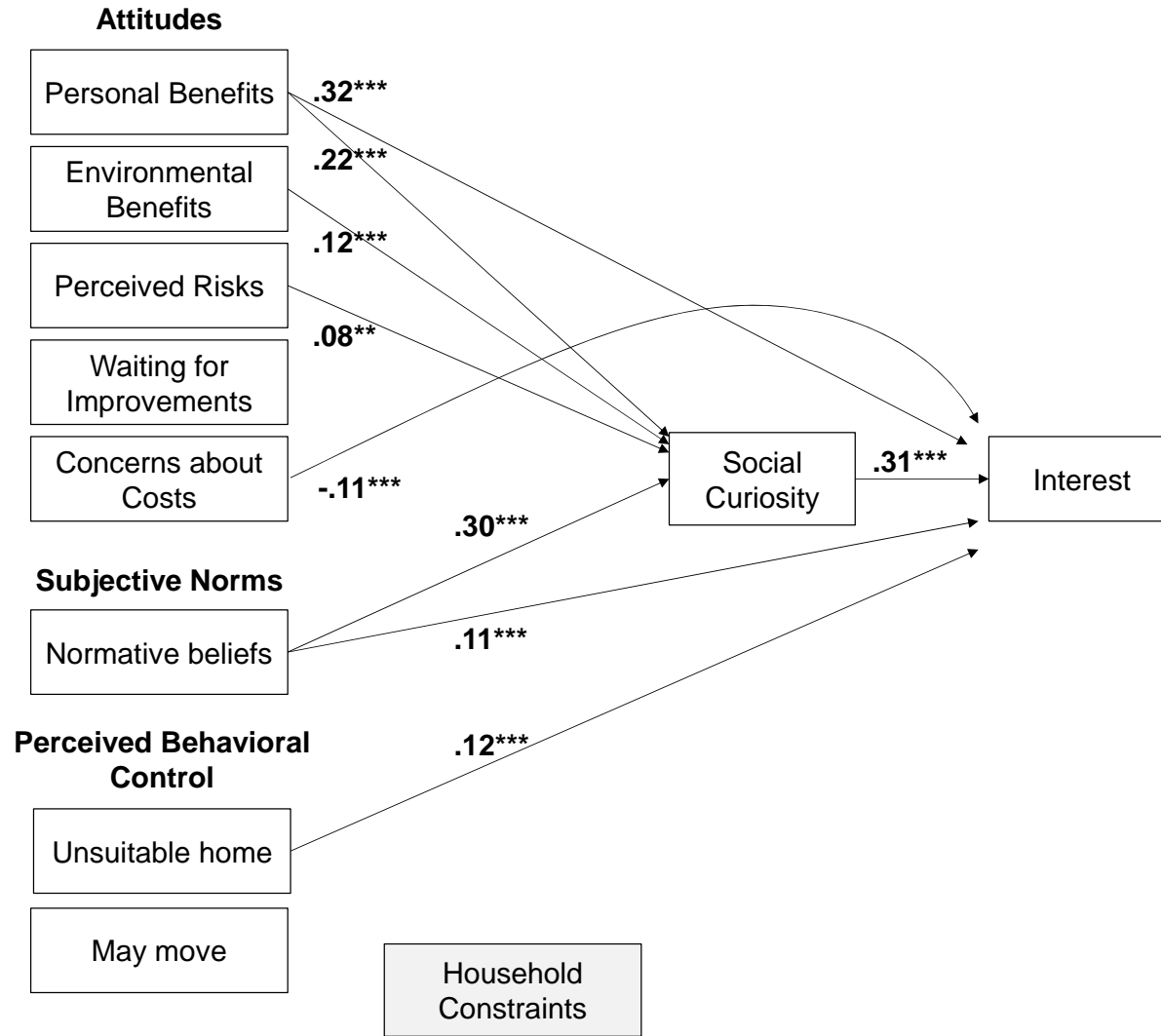
Household Constraints

(Significant paths not shown)

$R^2 = .36$   
 $R^2_{Adj} = .35$

VBN explains 11% of variance after controlling for household constraints (excluding SC)

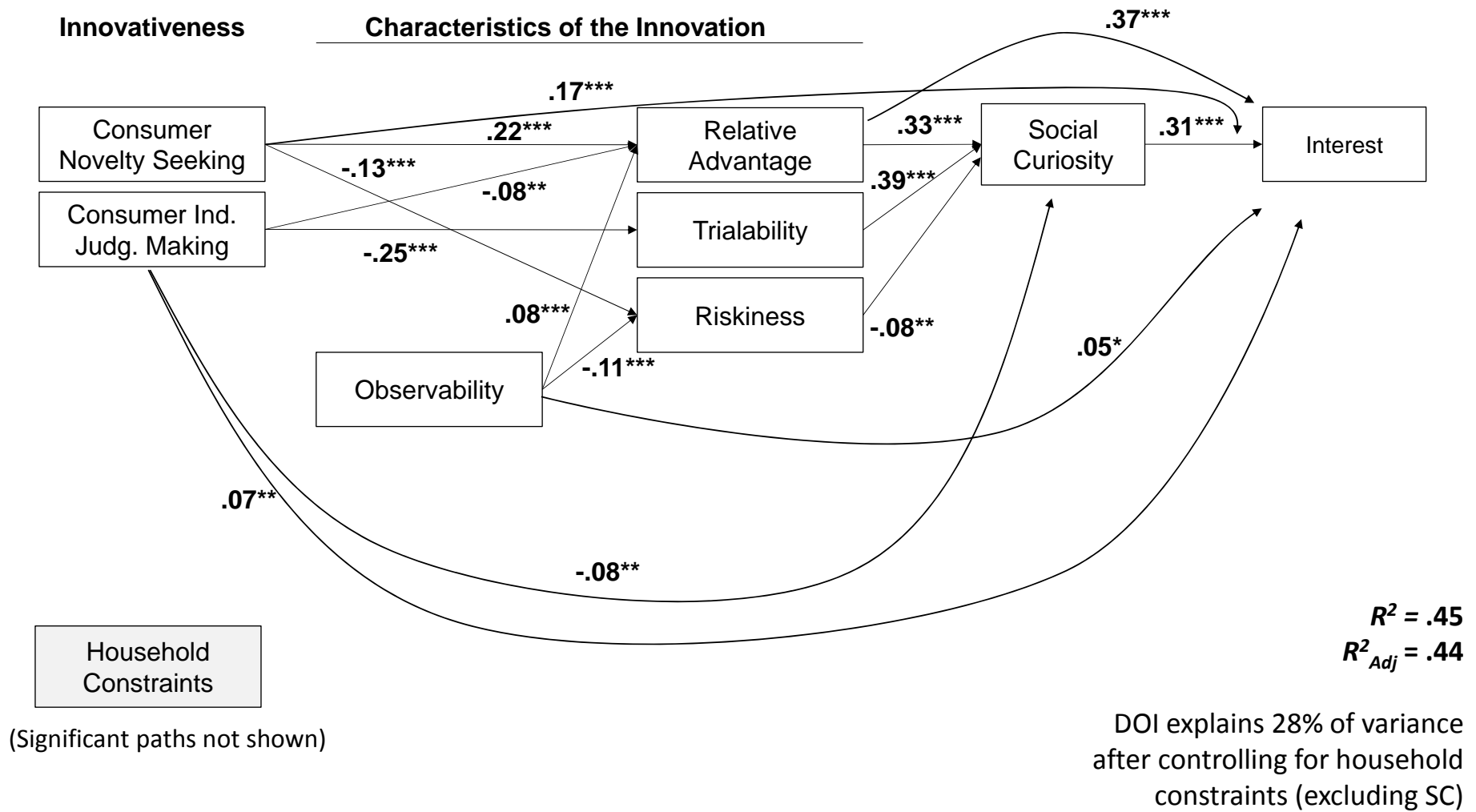
# Theory of Planned Behavior



$R^2 = .45$   
 $R^2_{Adj} = .44$

TPB explains 27% of variance after controlling for household constraints (excluding SC)

# Diffusion of Innovations



# Integrating theories

## - Results -

- All three theories offer statistically significant explanatory power, sometimes quite strong
- TPB and DOI appear to offer stronger explanatory power than VBN, *but*
- When all predictors are taken into account, each theory adds some unique predictive value

## Overall conclusions & possible implications

- *Financial incentives* are only one important element policy measures should involve
- *Personal traits, values and attitudes* suggest market segments to address with targeted approaches:
  - value orientations, innovativeness
  - Independent judgment (CIJM, trialability, distrust of industry, social curiosity [trust in friends and neighbors over industry])
  - Susceptibility to social influence (social curiosity, social support)
- *Beliefs and expectations* that impede interest may be subject to influence with marketing strategies about about:
  - Personal benefits
  - Expense concerns
  - Unsuitability of home
  - Social support/ recommendations.

# Thank you for your attention

## Selected References

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