

Incentivizing load shifts from residential customers

Are gamification and normative feedback based approaches more effective than time-based tariffs?

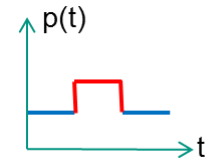
by Anne Schäffer, Patrick Jochem, Sven Feurer

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Agenda

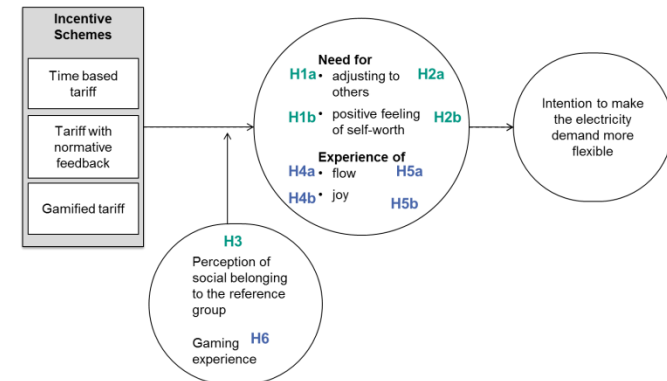
- Introduction:
incentives for residential customers to provide load flexibilities



- Research questions



- Method:
Hypothesis model and
online survey of residential customers



- Results from hypothesis model

- Conclusions and answers to our research questions

1. Need for flexibilities in the electricity system

Current challenges

- Increase in curtailment of electricity generation from wind and photovoltaics in Germany
- Negative prices at wholesale markets
- High costs for storage
- Limited flexibilities of supply and demand

(e.g. IEA 2015)

Demand Response

Idea:

- Active involvement of users
- Shifting, reducing, increasing energy demand according to the current energy situation

Problem:

- Current price spreads on the electricity markets are too small

→ **Are there other more effective incentives?**

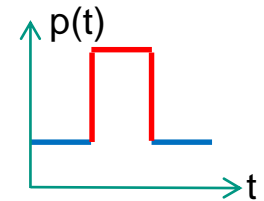
(see Konrad/Scheer 2014, Schnabel 2014, Lijesen 2007, Layer et al. 2017)

1. Analyzed incentives for load flexibility

Time based tariff (Critical Peak Pricing)

- Pure financial incentive (time-dependent electricity price)
- Critical peak pricing (CPP) from 0.27 to 0.90 €/kwh between 6 and 9 p.m.

(cf. Faruqui et al. 2010, Newsham/ Bowker 2010)



Tariff with normative feedback

- Comparison with what is “normal” and socially accepted
- “Moral compass” as motivator for providing flexibility
- „What did you do in comparison to others during the last requested load shift“

(cf. Anderson/ Lee 2016, Schultz 1999)



Tariff with game elements

- Using play instinct to influence load pattern
- “Earning of coins to improve a virtual house and impress neighbours”

(cf. Deterding et al. 2011, Blohm/Leimeister 2013, Gamma 2016, Lossin et al., 2016a, b)



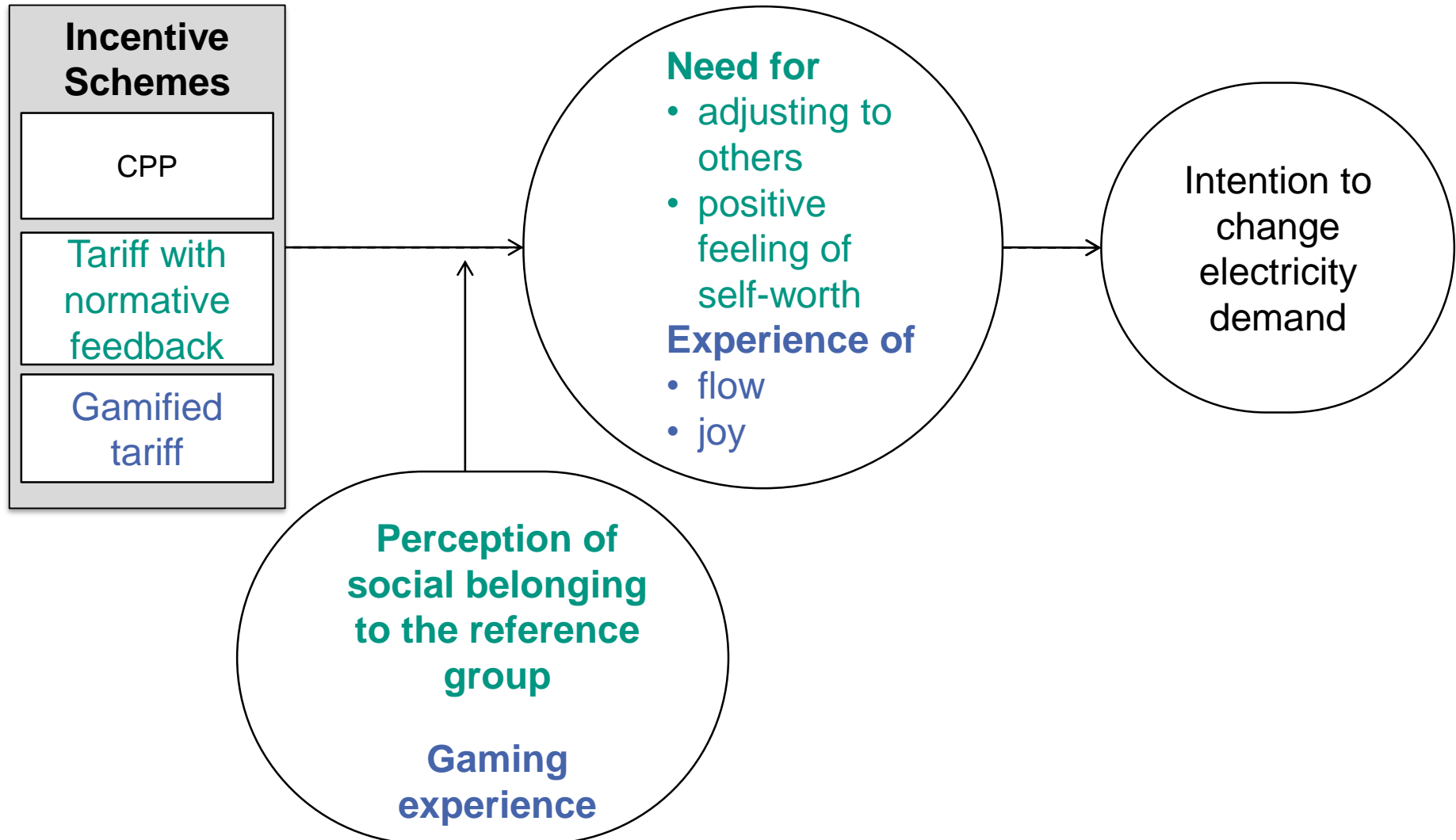
2. Research questions

What motivates users to change their electricity demand?

Is a tariff with normative feedback and a gamified tariff more effective than a time based tariff when aiming for a flexible energy demand?

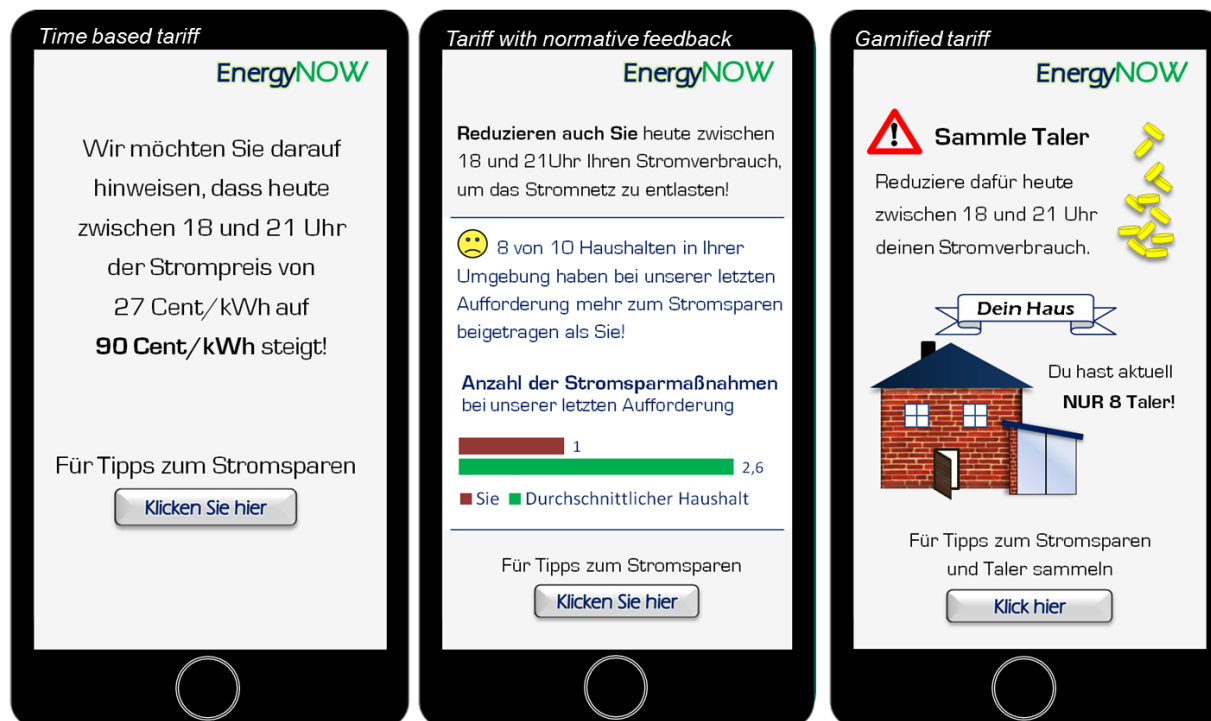
Which incentive scheme is most suitable under which conditions?

3. Hypothesis model

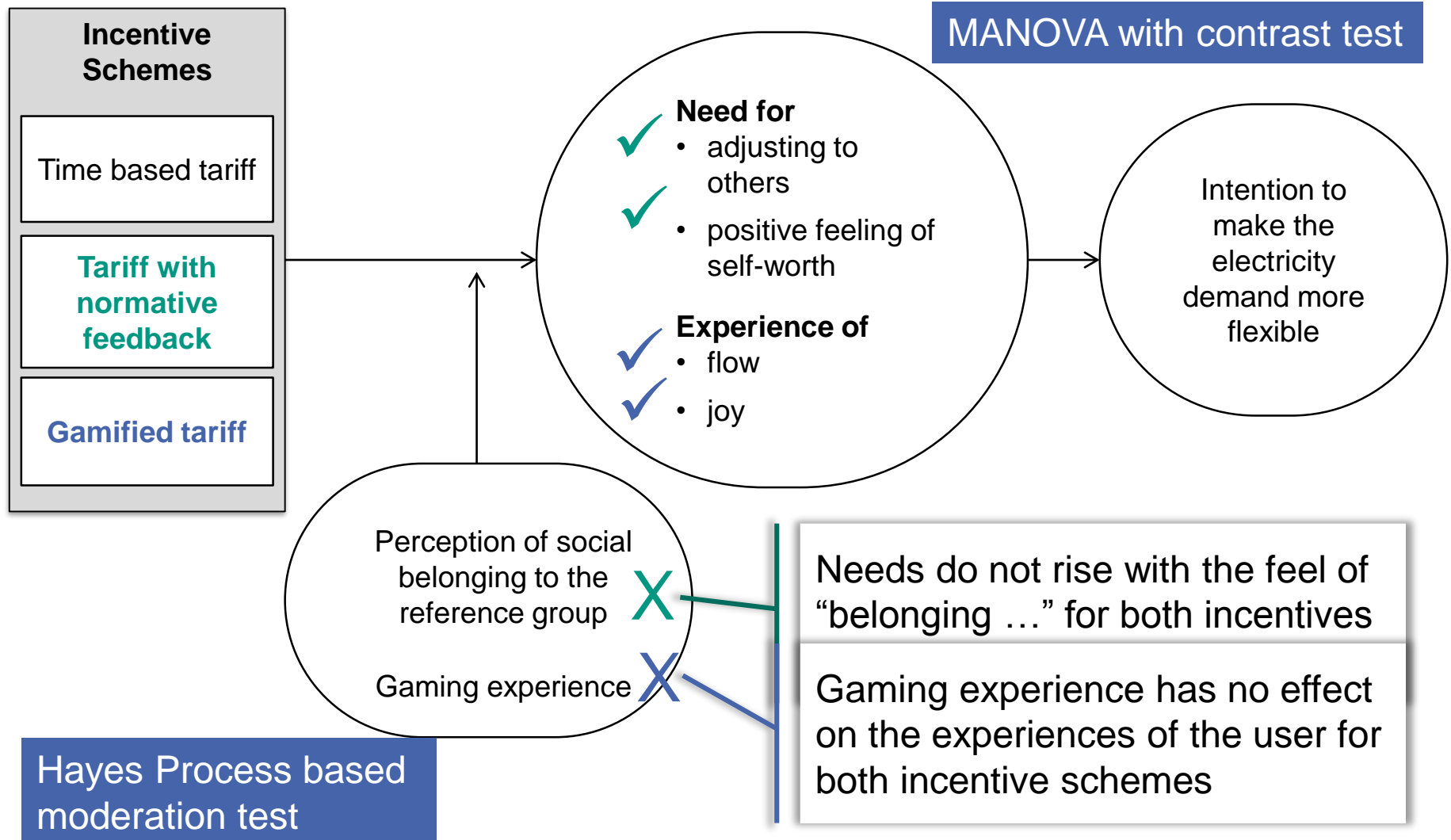


4. Online survey

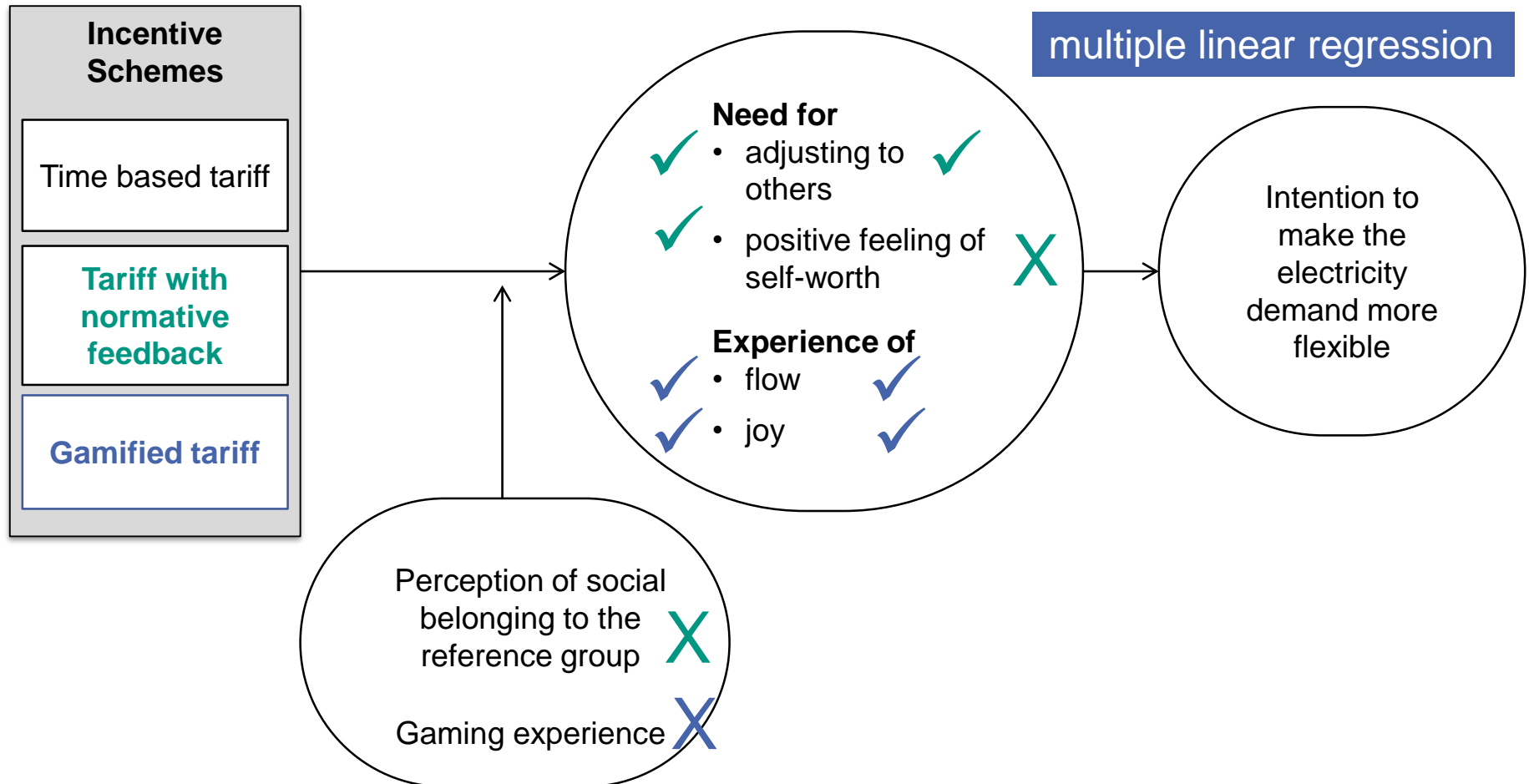
- Online survey in Germany with 396 respondents (panel provider)
- Sample representative in age, gender, and level of education (age: 20-70 years)
- One-factorial between subjects design
- 3 scenarios, one for each incentive scheme



5. Results: Hypothesis model



5. Results: Hypothesis model



6. Conclusion / Answers to research questions

RQ1: What motivates users to change their electricity demand?

All tariffs perform equally. Our study could not confirm the hypothesis that tariffs with normative feedback or game elements are more effective than CPP tariff when aiming for a flexible energy demand.

Are there focus groups for tariffs?

- CPP seem to be more attractive for lower income levels
- normative feedback is more effective for high-income levels
- women indicated a higher sensitivity for tariffs with game elements.

- Overall the willingness to reduce demand seems to be less attractive than shifting load.
- Residential customers seem to know few on electricity demand of their appliances. → There is a need for further field studies!

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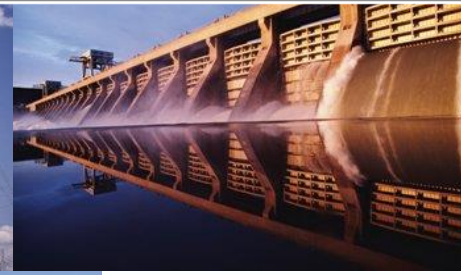
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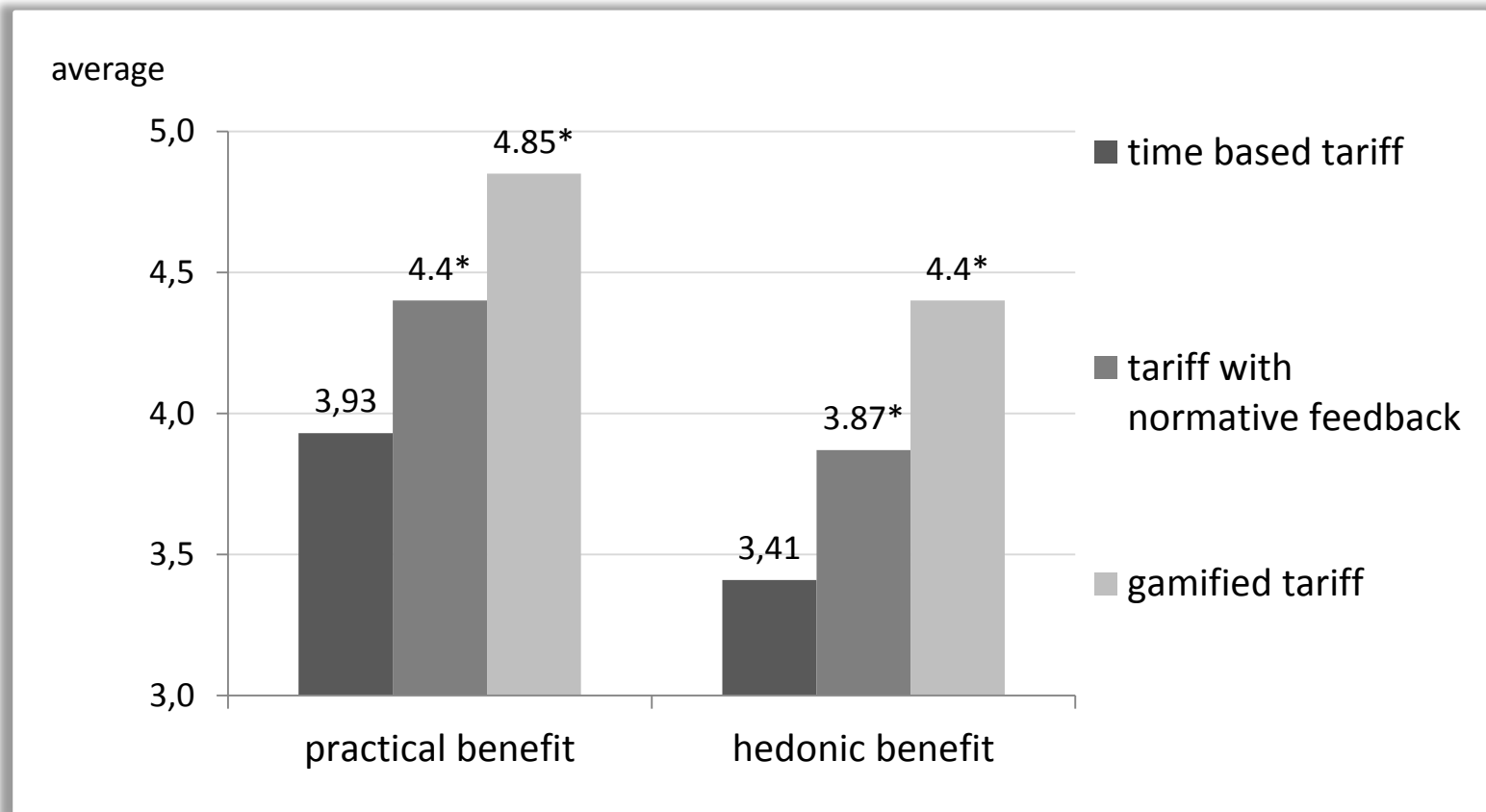


Thank you for your attention!
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5. Results of the online survey

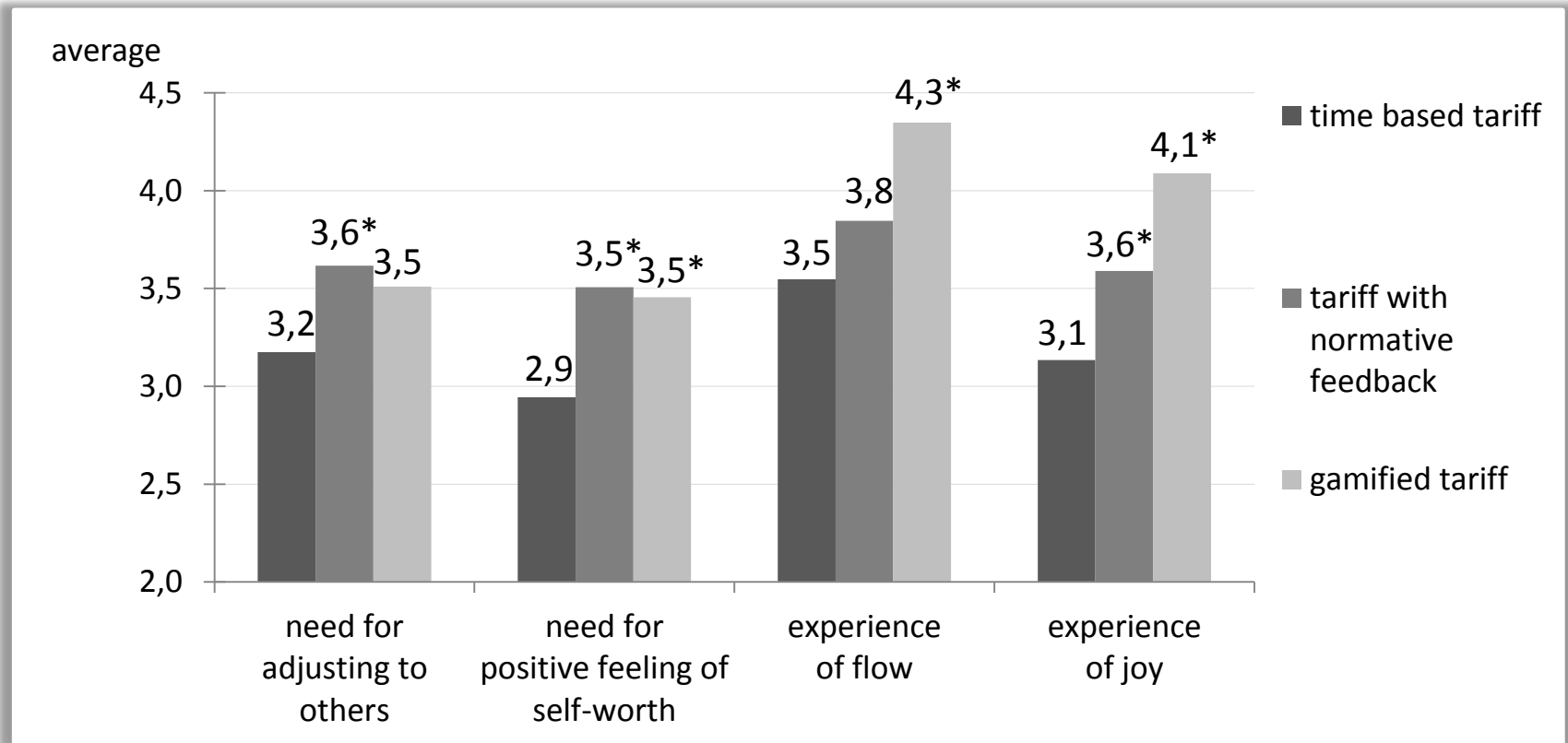
- Perceived benefits of the electricity tariff depends on the incentive scheme



* Significant difference from the time based tariff

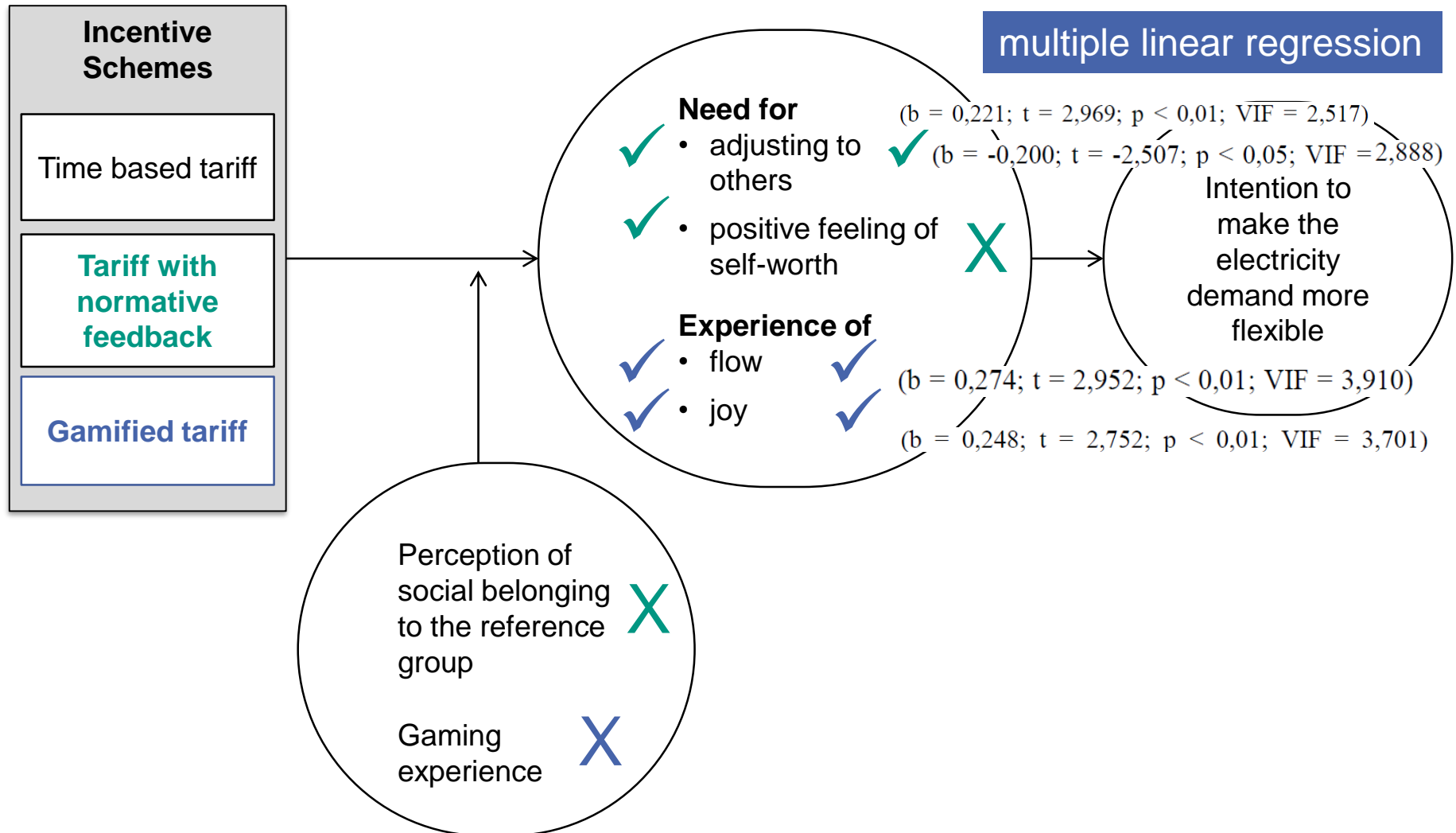
5. Results of the online survey

- Effects of the incentive schemes on the needs and experiences of the user
- Normative feedback and gamification address the user at a more emotional level than time based tariffs



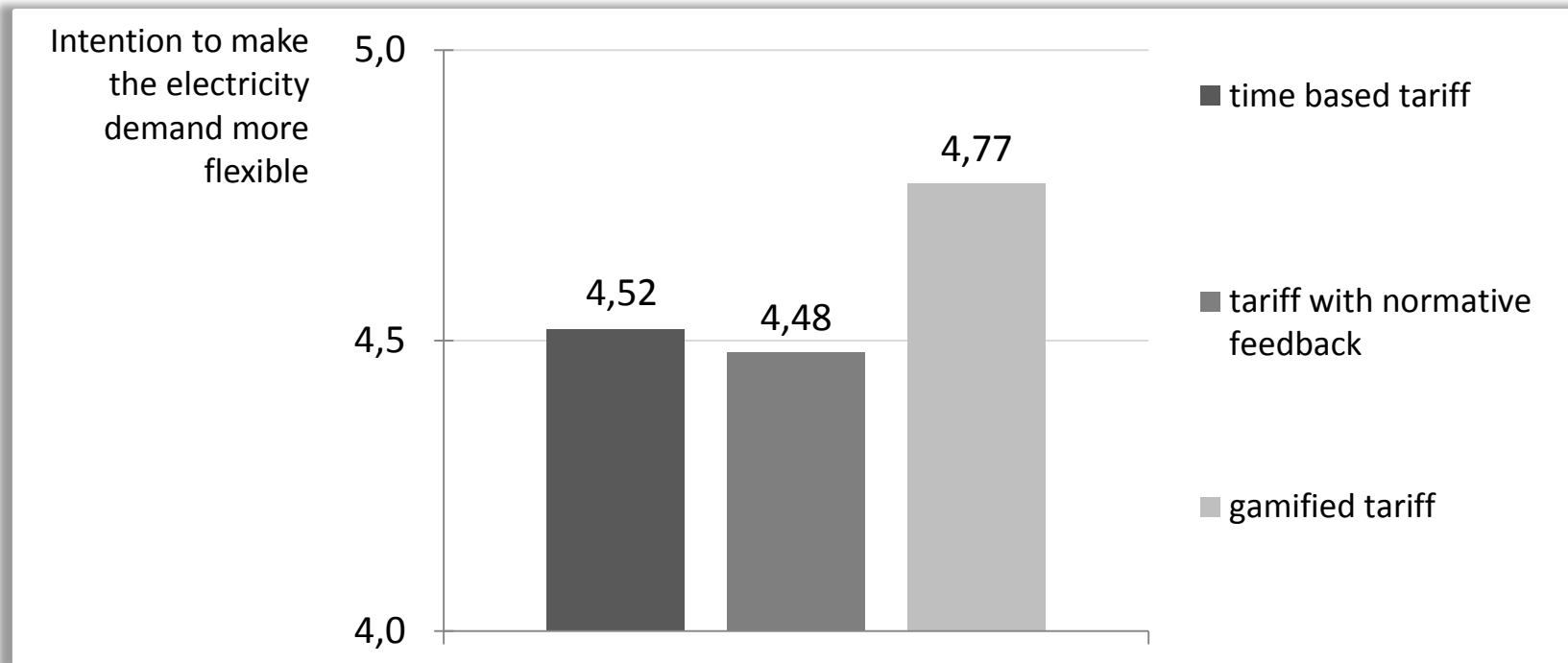
* Significant difference from the time based tariff

5. Results: Hypothesis model



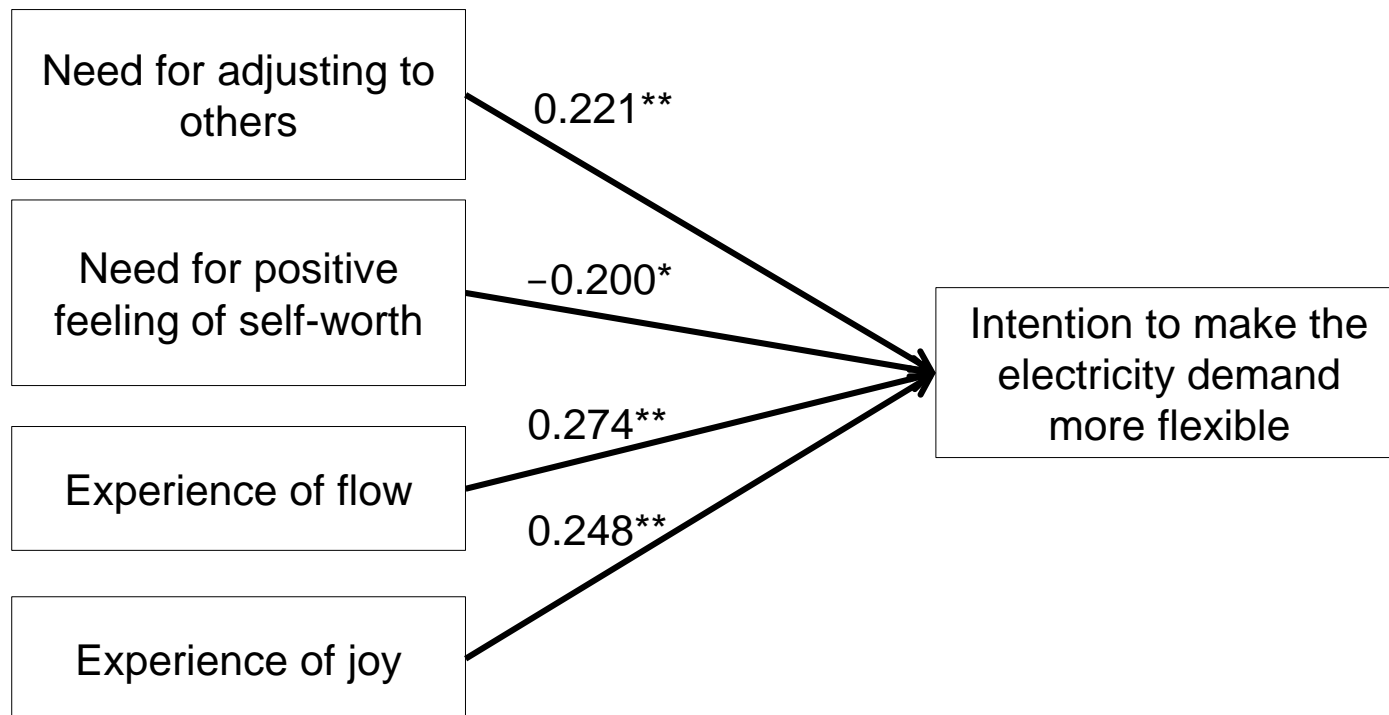
5. Results: different incentive?

- There is no significant difference between the incentives:



5. Results of the online survey

- Effects of the needs and experiences of the user on his/her intention to make the demand more flexible.
- Regression analysis does not explain any causal relation
- → More studies needed to explain the relation



* $p < 0.05$; ** $p < 0.01$

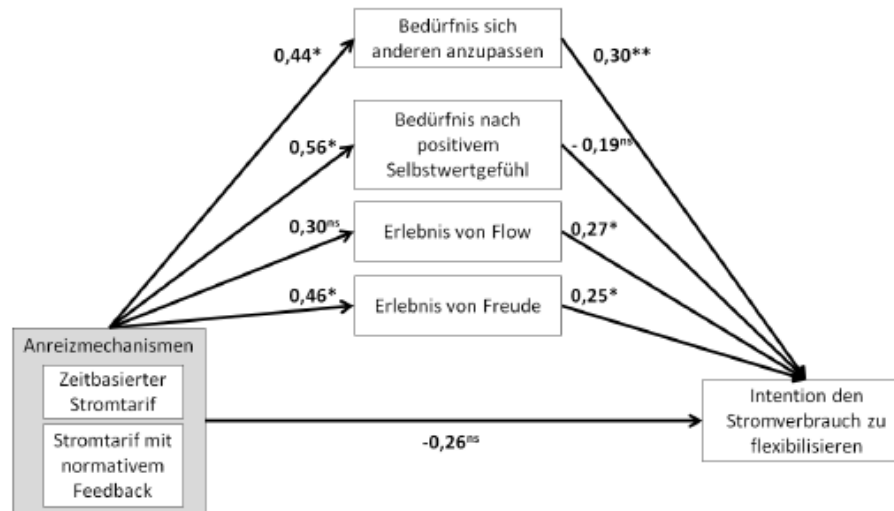


Abbildung 11: Analyse des Mediationeffekts bei paarweisem Vergleich des zeitbasierten Stromtarifs und des Stromtarifs mit normativem Feedback; * $p < 0,05$; ** $p < 0,005$.

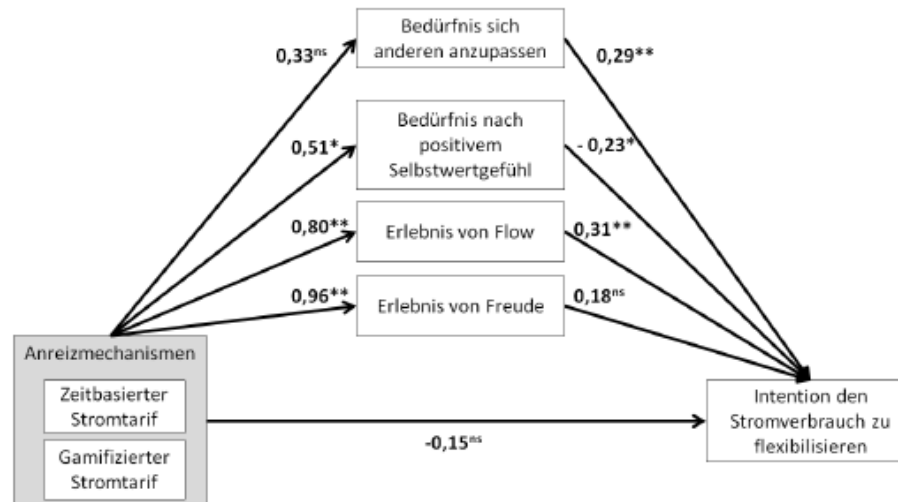


Abbildung 12: Analyse des Mediationeffekts bei paarweisem Vergleich des zeitbasierten Stromtarifs und des gamifizierten Stromtarifs; * $p < 0,05$; ** $p < 0,005$.