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Value of co-benefits from energy efficient ventilation — Insights from a contingent valuation on Swiss home owners

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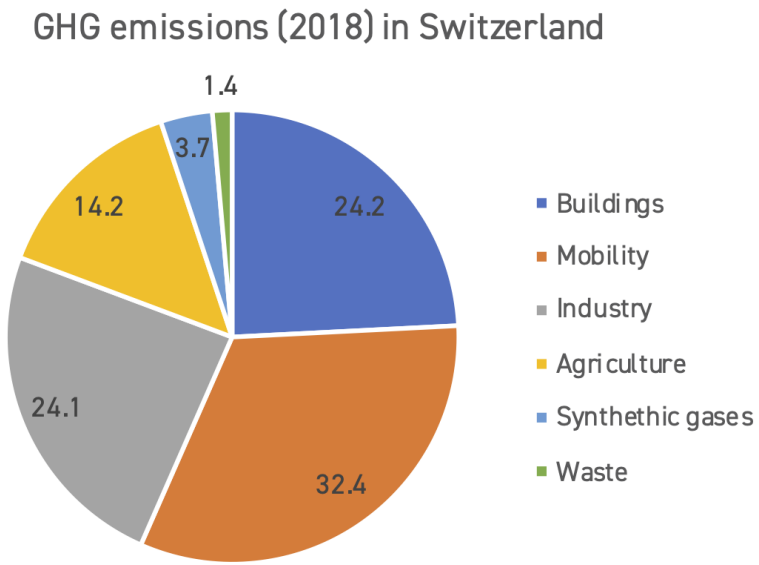
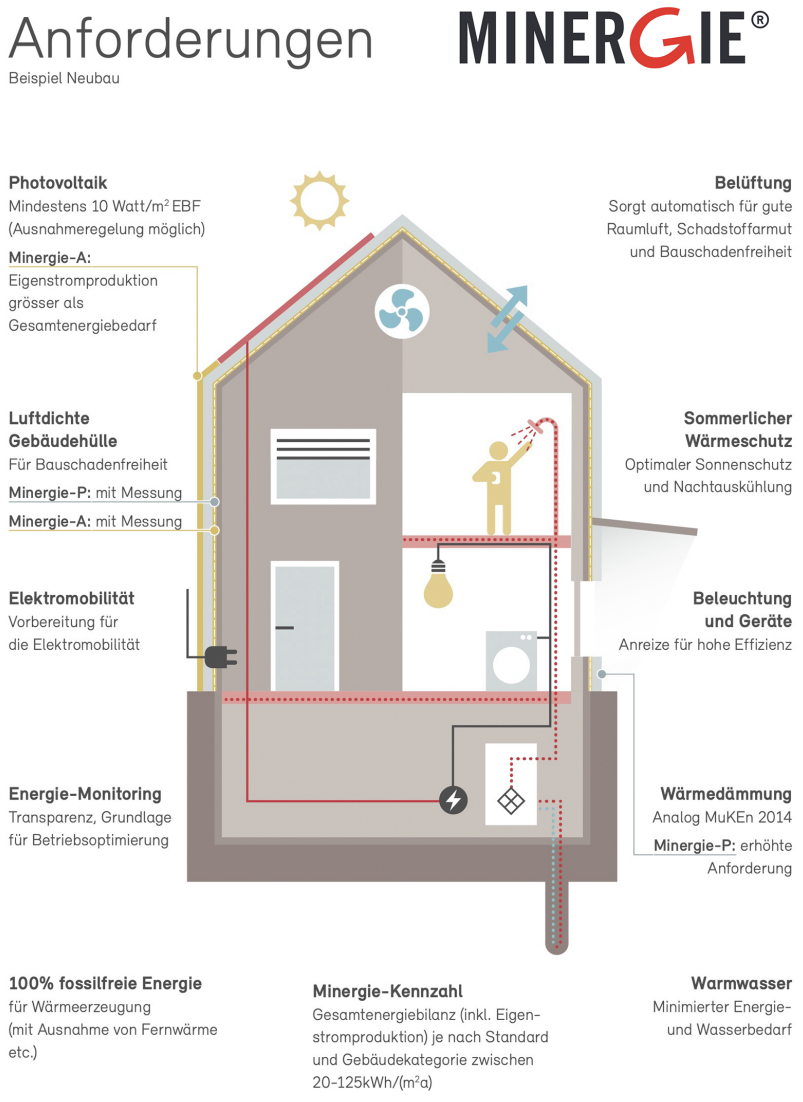
Introduction (1/4)



- The building sector contributes $\frac{1}{4}$ to Swiss GHG emission
- Decarbonising the building sector is crucial for the net zero target
- Swiss long-term climate goals: CO_2-emissions from buildings (compared to the 1990 level) should be reduced by 65% in 2030.

Introduction (2/4)

- **Energy efficient renovations** are promoted via subsidies, information programs and energy efficiency labels
- Construction of **new energy efficient buildings** is regulated via severe energy efficiency building codes, promotion via information campaigns, and subsidies to construction of *Minergie* buildings



Introduction (3/4)

- Compared to conventional new buildings, construction of Minergie buildings is characterised by **higher initial costs** by 5 to 10% (Salvi et al., 2008).
- Investment analysis: consider differences in initial costs and differences in benefits —i.e. not only energy savings but indoor air quality, noise reduction, and thermal comfort as well.
- Monetising energy savings over the life of the building is fairly straightforward.
- However, estimation of the **value of indoor air quality, noise reduction, and thermal comfort** is an issue that has occupied less attention from academia and practitioners.
- Main goal of this paper: estimate the value of co-benefits provided by energy efficient ventilation (EEV) embedded in a Minergie house.

Introduction (4/4)

- Challenge: estimating the value of co-benefits of energy saving investments where most people *have not experienced* those co-benefits.
- Economic theory: an **experience good** is a good difficult to appraise in advanced. Such appraisal is only feasible after experience has been gained through use of such a good.
- Kahneman and Thaler (2006): disparity between ‘’decision utility” and ‘’experience utility”.
- Thus, estimation of co-benefits provided by EEV need to be based on preferences of people that have experienced such co-benefits:
  - Monthly **willingness to accept (WTA)** compensation to hold off using EEV embedded in Minergie houses
  - However, possible overestimation of WTA: we have also implemented a **willingness to pay (WTP)** protocol on owners of conventional (non-Minergie) houses.

Contribution

- Scarce literature on the value of co-benefits of energy efficient residential housing:
  - does not analyse experience as a factor: Spetic et al. (2005); Banfi et al. (2008); Chau et al. (2010)
  - investigate the factor ‘’experience”: He et al. (2019); Golbazi et al. (2020)
- Further contribution: we think because of the experience dimension of the good considered in this study, the WTA approach — not used so far in studies on co-benefits of energy efficient homes — can provide new insights.
- Further contribution: we provide an empirical analysis that based on a sample of people with and without experience in living in an energy-saving single-family house.

Contingent valuation method

- Contingent valuation (CV) is a survey-based method for estimating the value of a **non-market** good/service as if it was traded in a market.
- A CV survey may ask how much money people would be willing to pay (or willing to accept) to maintain the existence of (or be compensated for the loss of) an environmental feature, such as biodiversity.
- Typical examples: Valuation of a national park, a specific landscape, preventing oil spills (e.g. Exxon Valdez)... $\rightarrow$ These examples are public goods.
- Here: We deal with a **private good** for which no market is in place.
- Elicitation: We use a **single-bounded dichotomous choice question** ("take-it-or-leave-it question")
- CV studies report information about the broad shape of the WTP/WTA distribution and also information on how that distribution varies with respondent characteristics.
- Usual advantages and disadvantages...

Contingent valuation questions

We spend a lot of time in our house, especially at night. Good indoor air quality therefore contributes significantly to our well-being and health. A so-called comfort ventilation system offers an advanced alternative to classic window ventilation: even with closed windows, the exhaled air is removed as needed and replaced by fresh outside air filtered from fine dust and preheated via a heat exchanger. This ensures **good air quality, thermal comfort** and **reduced noise pollution**. In addition, the supplied air is filtered from pollen, thus relieving allergy sufferers. The ventilation is also **energy-saving**. Waste heat is recovered from the polluted air, which would otherwise escape unused through the window.

WTA: In the case that your ventilation system gets broken, would you be willing to accept monthly [40/80/120/160/200/240] CHF for 3 months to wait for reparation?

- Yes
- No

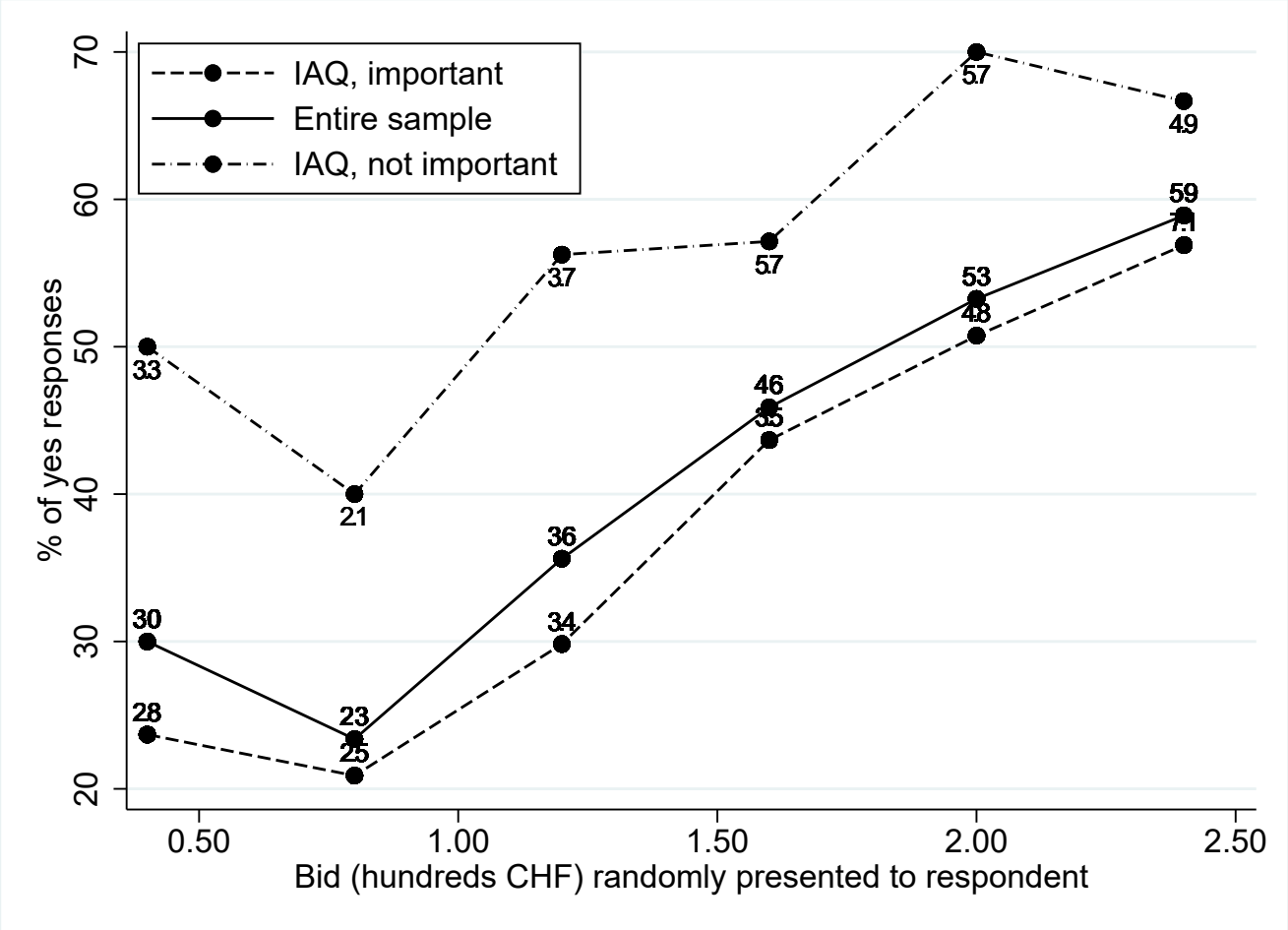
WTP: Would you be willing to pay monthly [40/80/120/160/200/240] CHF for 20 years for a comfort ventilation, as described above?

- Yes
- No

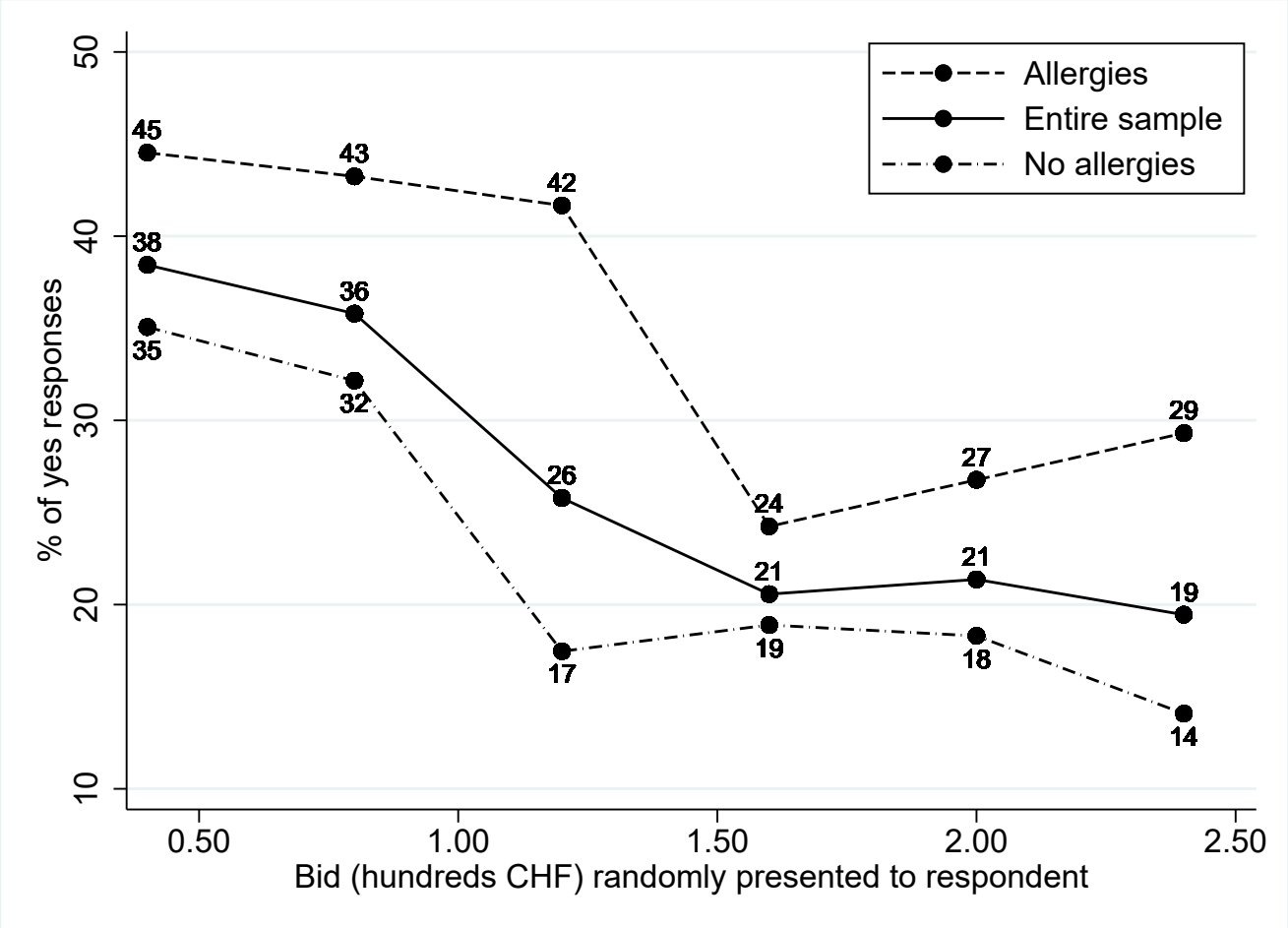
Data – Household Survey

- Household survey implemented in 2020 in the Canton of Zurich (CH) with the cooperation of the cantonal Statistical Office.
- The invitation sample into two groups:
  1. **2,071** letters were sent to all Minergie certified single-family homes in the Canton of Zurich
  2. **14,629** letters were sent to a stratified sample of single family homes
     - Only single-family homes,
     - Year of construction prior to 1990,
     - 50% with renovation permits during the last 5 years,
     - large buckets for age and household size.
- Response rate of around 17%
- Concerning the representaveness:
  - Respondents in our sample are on average older, earn a higher income and occupy larger dwellings than the average person in the canton of Zurich.
  - However, this is expected, as we sampled only owners of single-family homes.

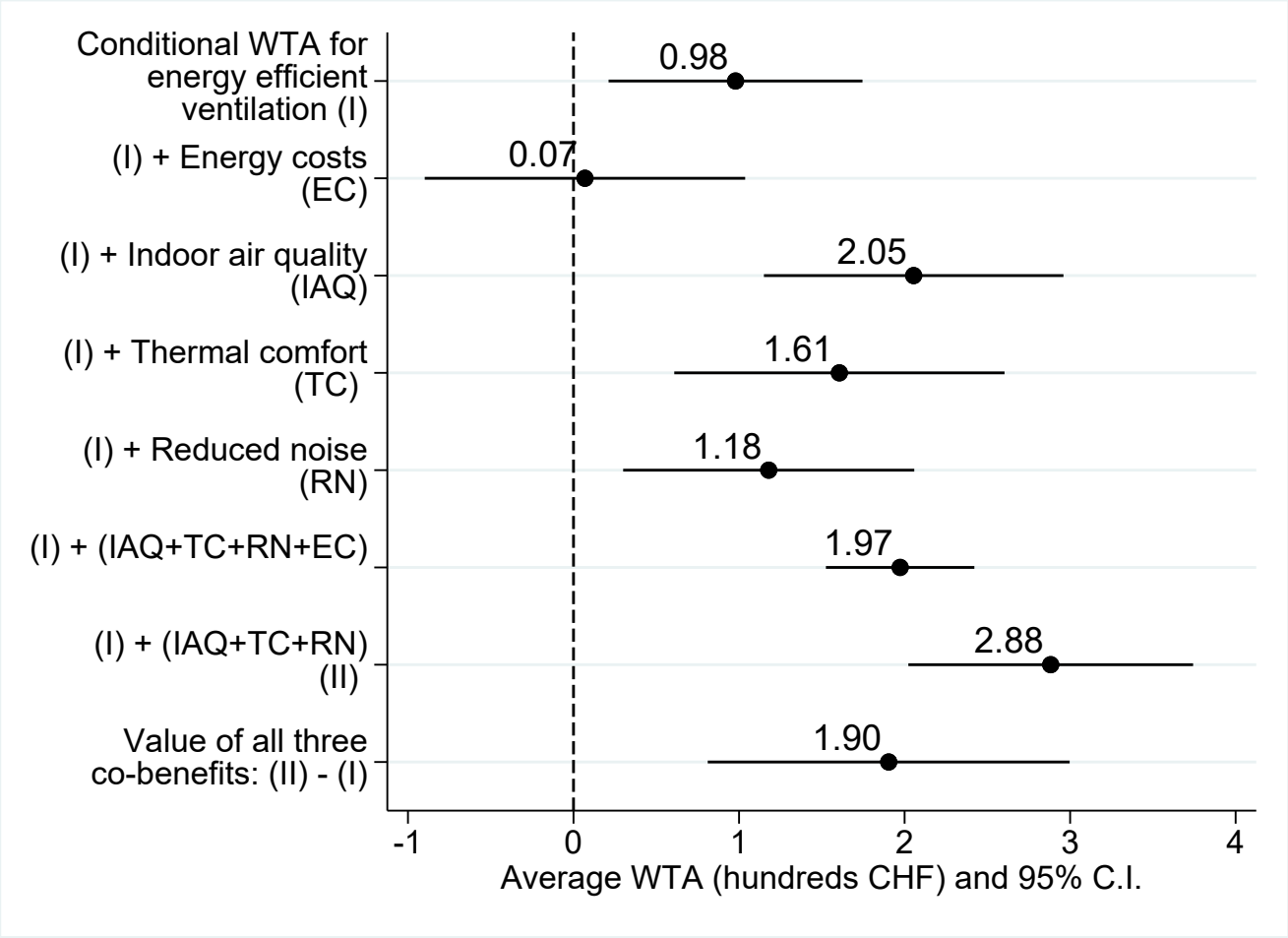
Unconditional WTA responses —entire sample (n=485)



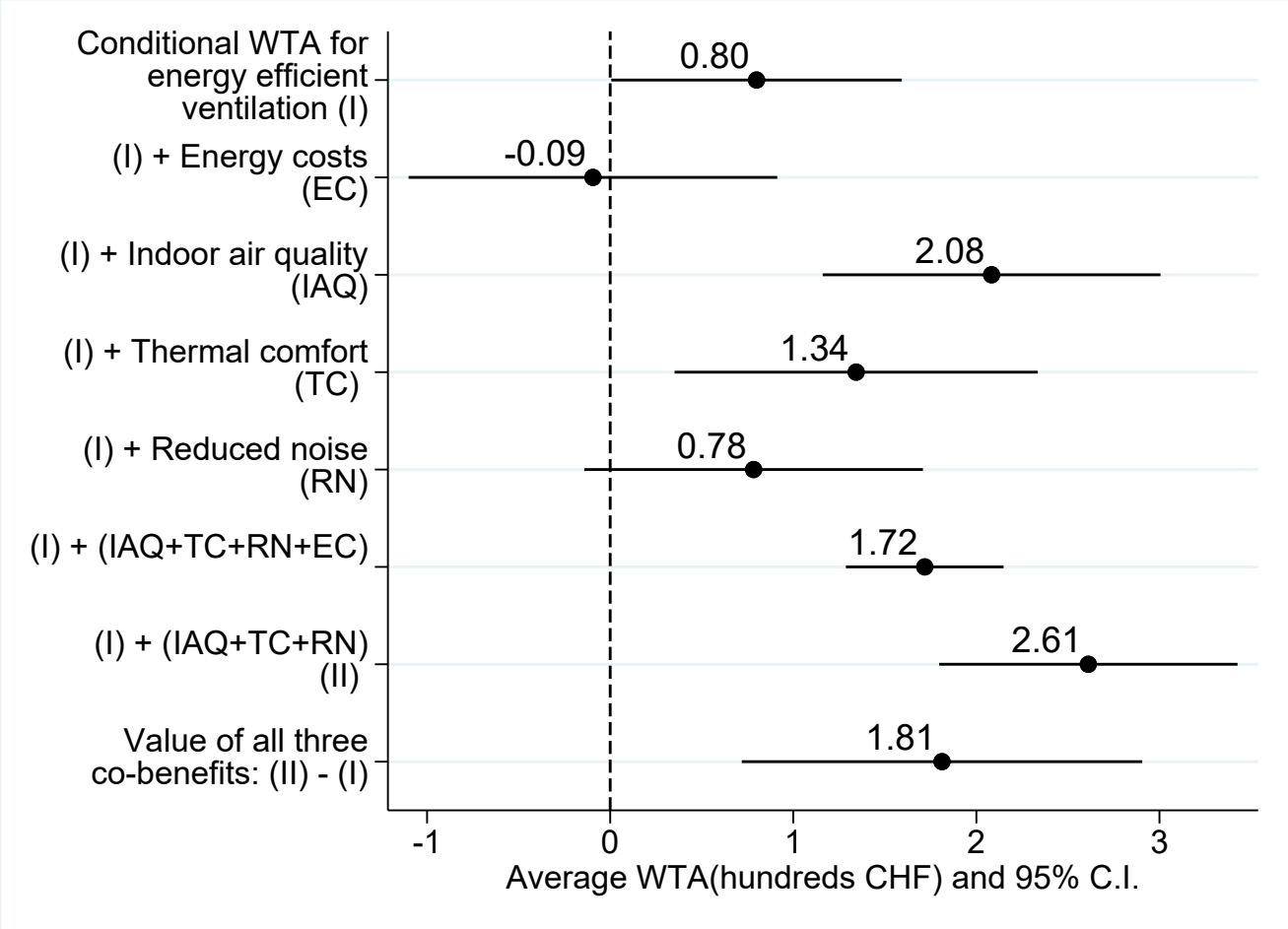
Unconditional WTP responses —entire sample (n=2,042)



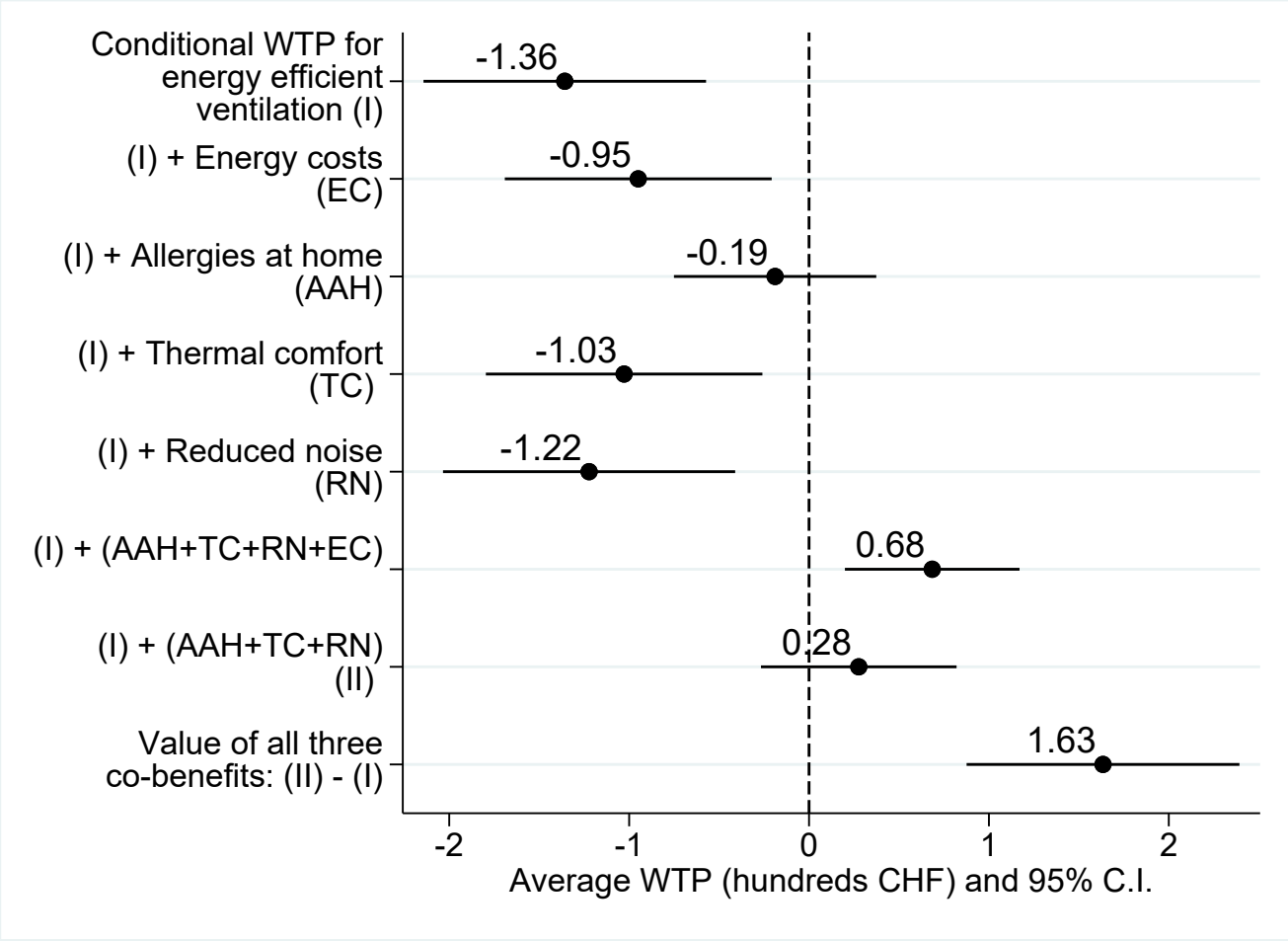
WTA estimates —entire sample (n=485)



WTA estimates —sample excluding protest zeros (n=444)



WTP estimates —entire sample (n=2,042)



Conclusions

- Average monthly WTA is estimated at CHF 181 —value attached to all three co-benefits by experienced homeowners, with IAQ dominating most of it.
- Average monthly WTP is estimated at CHF 163 —value attached by in-experienced homeowners.
- Implications: Value of co-benefits might help that households/companies take a more informed investment decision (energy efficient vs conventional home).
  - Real estate companies: if co-benefits are well advertised they can ask more for the house or the rent.
  - Policymaker: they can organise public information campaign to promote the adoption of EEV promoting the co-benefits
- Back-of-the-envelope calculation of the costs:
  - An EEV system costs CHF 18,000–20'000 for a SFH house.
  - Assuming a lifespan of 20 years and maintenance cost of 150 CHF/a, we calculate costs of 88–96 CHF/month.
- **Other ideas to compare the WTA/WTP values with?**

QUESTIONS?

Thank you for your attention...

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