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Reverse auctions for government subsidies promoting household energy transitions: challenges and opportunities

April 17, 2024

Picture: https://www.pinterest.com.au/pin/why-did-the-chicken-cross-the-road--270990102566507334/

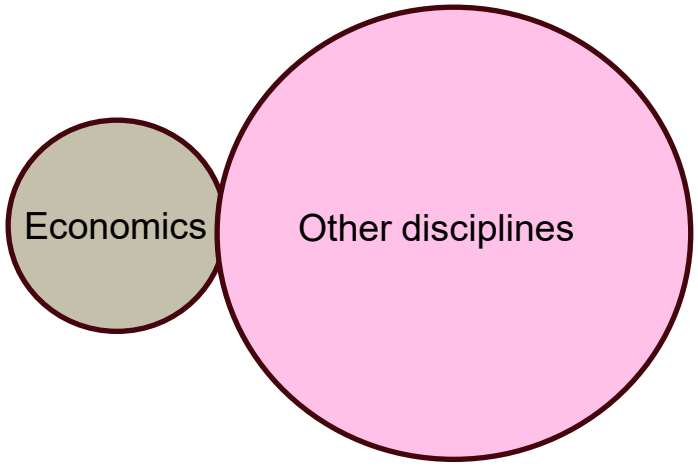
- Why did the chicken cross the road?

- Why did the chicken cross the road?
  - It was cheaper on the other side

Specialization in economics

- Why did the chicken cross the road?
  - It was cheaper on the other side
- Specialization in economics
  - markets and prices
  - "*Economics can only contribute to policy issues in a positive way. Economists, as scientists, should not make normative judgements*" (Sloman, John, Dean Garratt, and Jon Guest, 2018. Economics. 10th ed. Pearson.)

Chicken and Venn issue



Specialization in economics; not much overlap

- Can there be more overlap between economics and other disciplines in policy formulation?

Picture: https://pixabay.com/photos/birds-chick-ornithology-species-5014150/

Combining 3 fields

- 1. Utility-scale energy auctions
- 2. Social safety net schemes
- 3. Participation by individuals or households in auctions for housing or consumer goods

1. Utility scale and off-grid energy auctions

- Energy auctions have been increasingly common for utility scale energy generation
  - "Auctions have become the main instrument of choice to support renewable electricity around the world" (del Rio and Kiefer, 2021)
  - Auctions have also started to be used in low and middle-income countries for off-(main)grid (mini grid and solar home systems)
    - Still at an aggregated level where a developer is investing for many households, rather than auctions involving a single household

2. Social safety net schemes

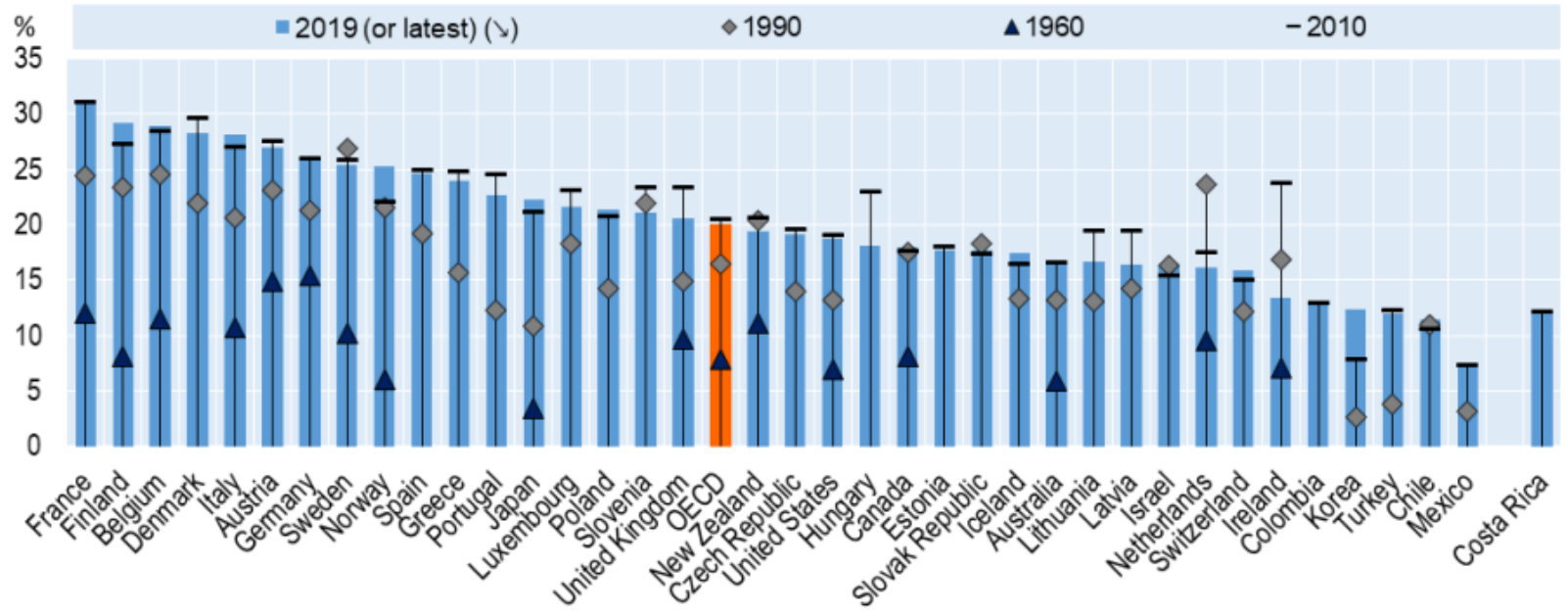
- Large categories of public social expenditure include pensions and health
  - But energy-related payments have also been high in some countries over the past decade
  - For pensions and health, there is a mix of public and private financing
    - E.g age pension (public) and superannuation (private) in Australia
- Social spending is roughly $15 trillion per year across OECD countries

2. Social safety net schemes

PUBLIC SOCIAL SPENDING IN OECD COUNTRIES: 20% OF GDP

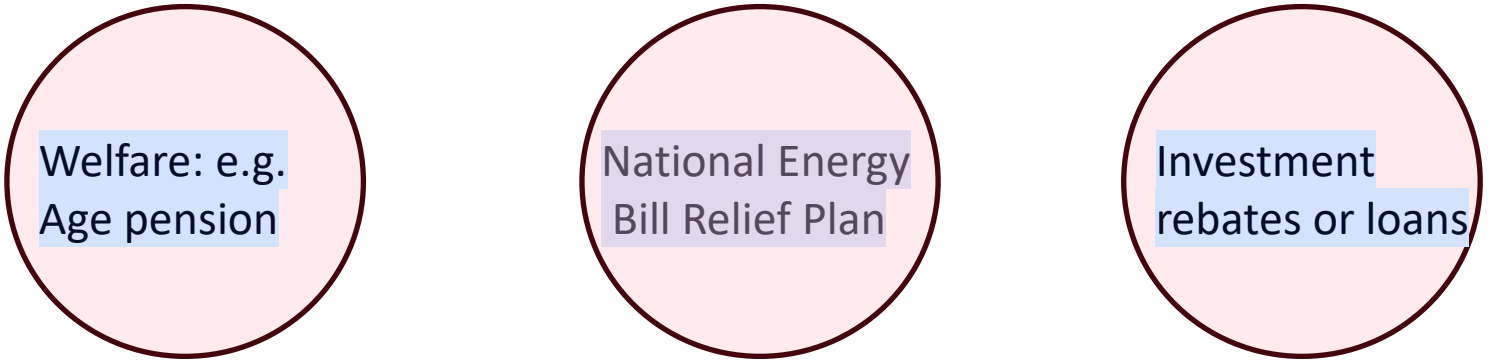
Figure 1. Public social spending is worth 20% of GDP on average across the OECD

Public social expenditure as a percentage of GDP, 1960, 1990 and 2019 (or latest year available)

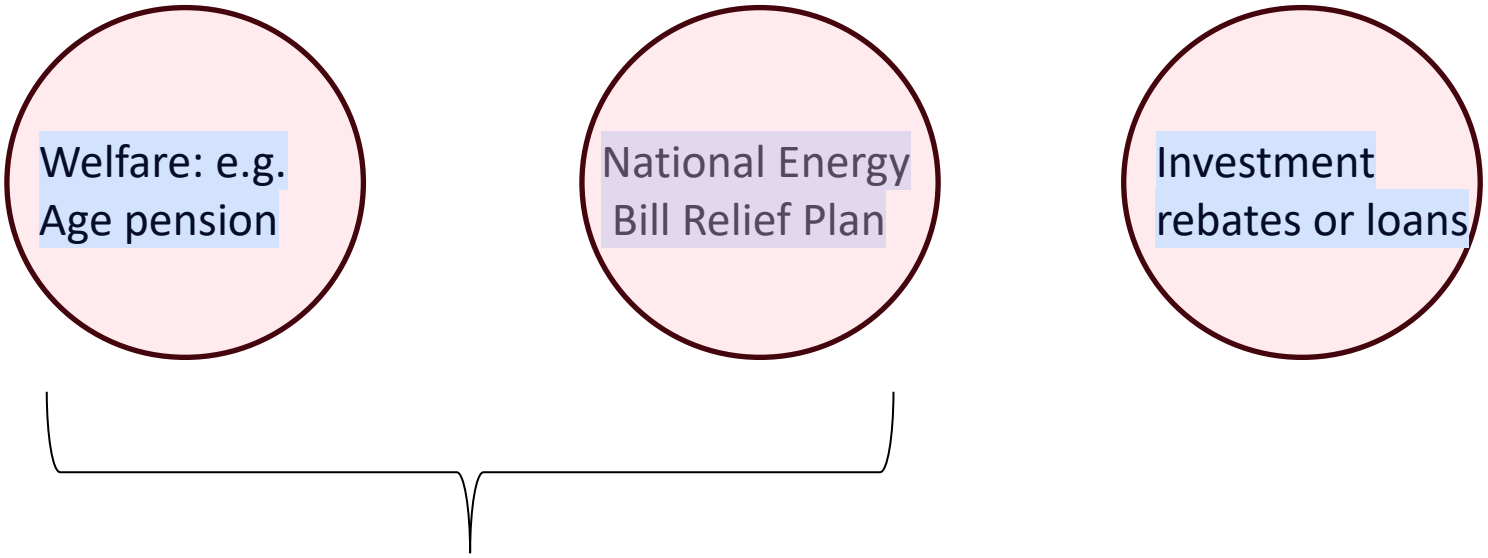


https://www.oecd.org/els/soc/OECD2020-Social-Expenditure-SOCX-Update.pdf

Integrating schemes



Integrating schemes

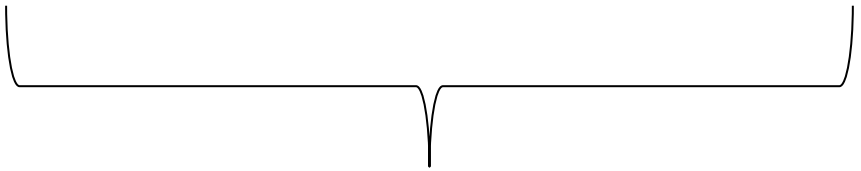


Integrating schemes

Welfare: e.g. Age pension

National Energy Bill Relief Plan

Investment rebates or loans



Integrating schemes

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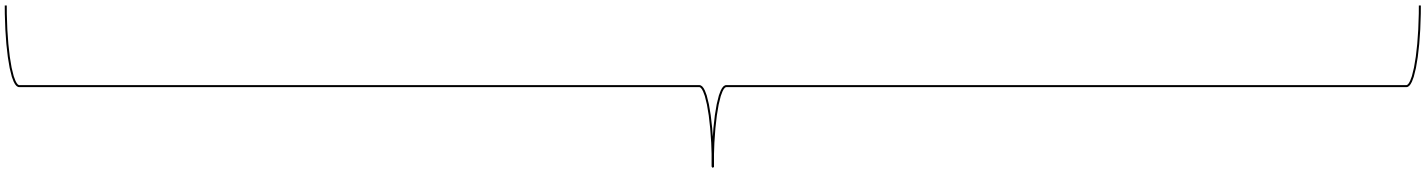


Integration principles

- Design principles:
  - Aim for a higher amount of social benefits from social spending
    - E.g. solar panels provide emissions reduction benefits (in addition to reducing energy bills)
  - Aim to enhance both equity and efficiency
    - there may not always be trade-offs

Natural Bridges

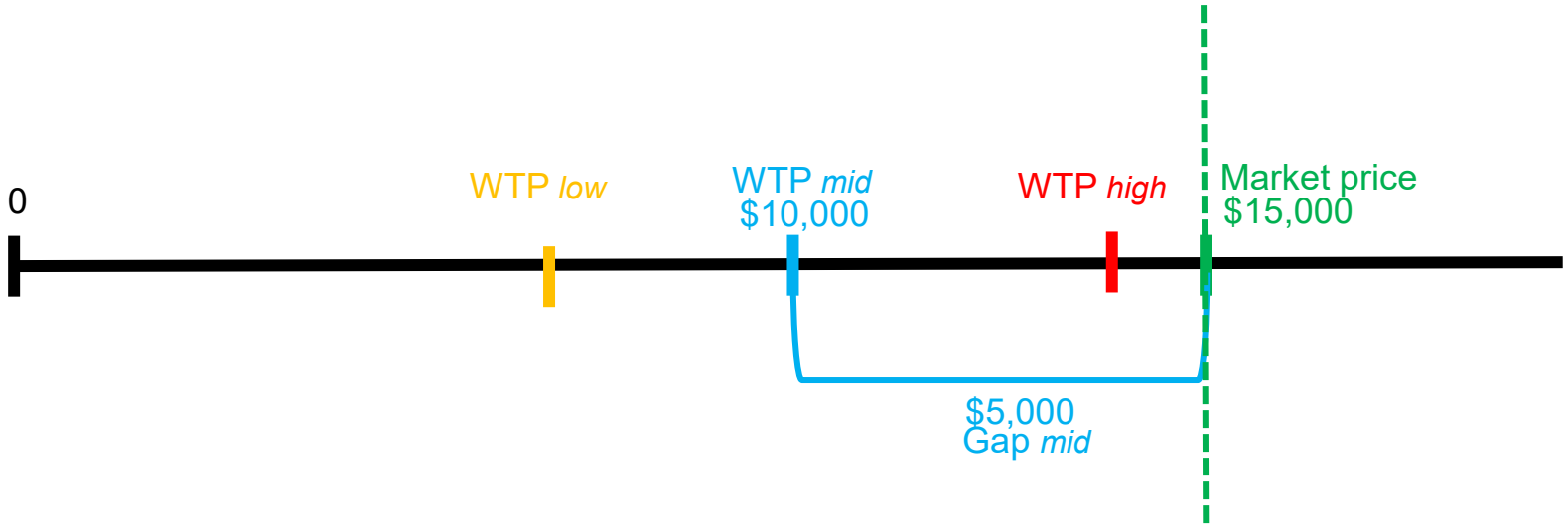
NATIONAL MONUMENT UTAH

https://www.nps.gov/nabr/index.htm

Bridging the gap

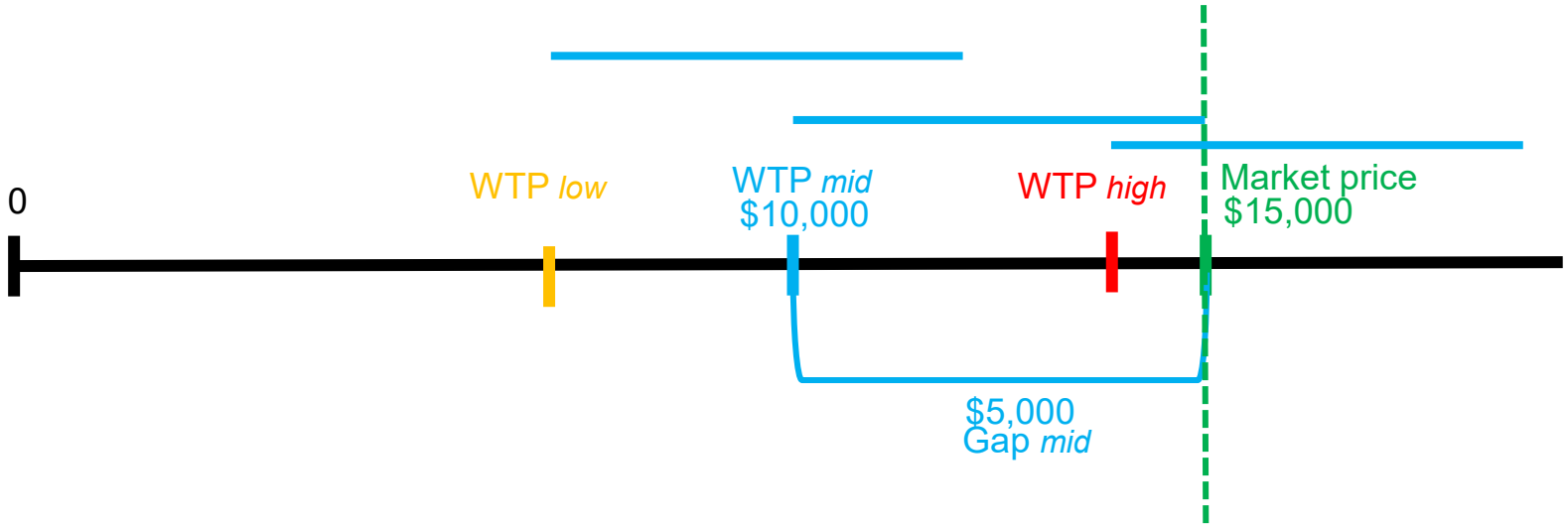
HTTPS://GREATOCEANROADMELBOURNETOURS.COM.AU/ATTRACTIONS/LONDON-BRIDGE/

"Natural Bridges" for "welfare payments"



WTP = willingness (and ability) to pay

"Natural Bridges" for "welfare payments"



= $5,000 subsidy

Government roles

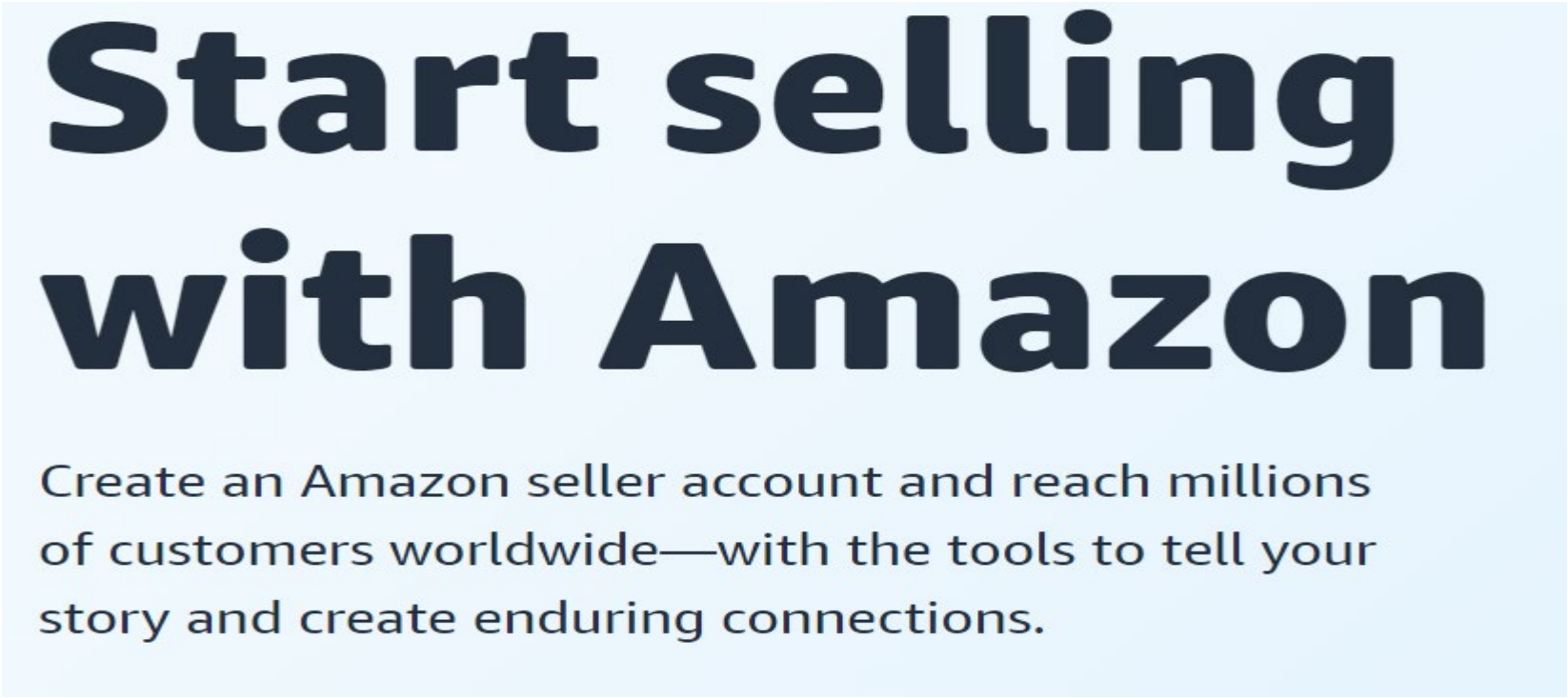
- Governments can take an increased role as co-investors with household investment, in pursuit of social benefits
  - Precise payments to bridge the gap between what consumers can/will pay and what the market price is

Perspectives on government role

- A key challenge for governments is information elicitation
  - However, governments can and do access a lot of relevant information: income, land values, household surveys, academic research
- Governments versus markets seems to be a common perspective (substitutes)
- Alternatives include:
  - Governments and markets (complements); and/or
  - Governments creating markets

3. Auctions for many items

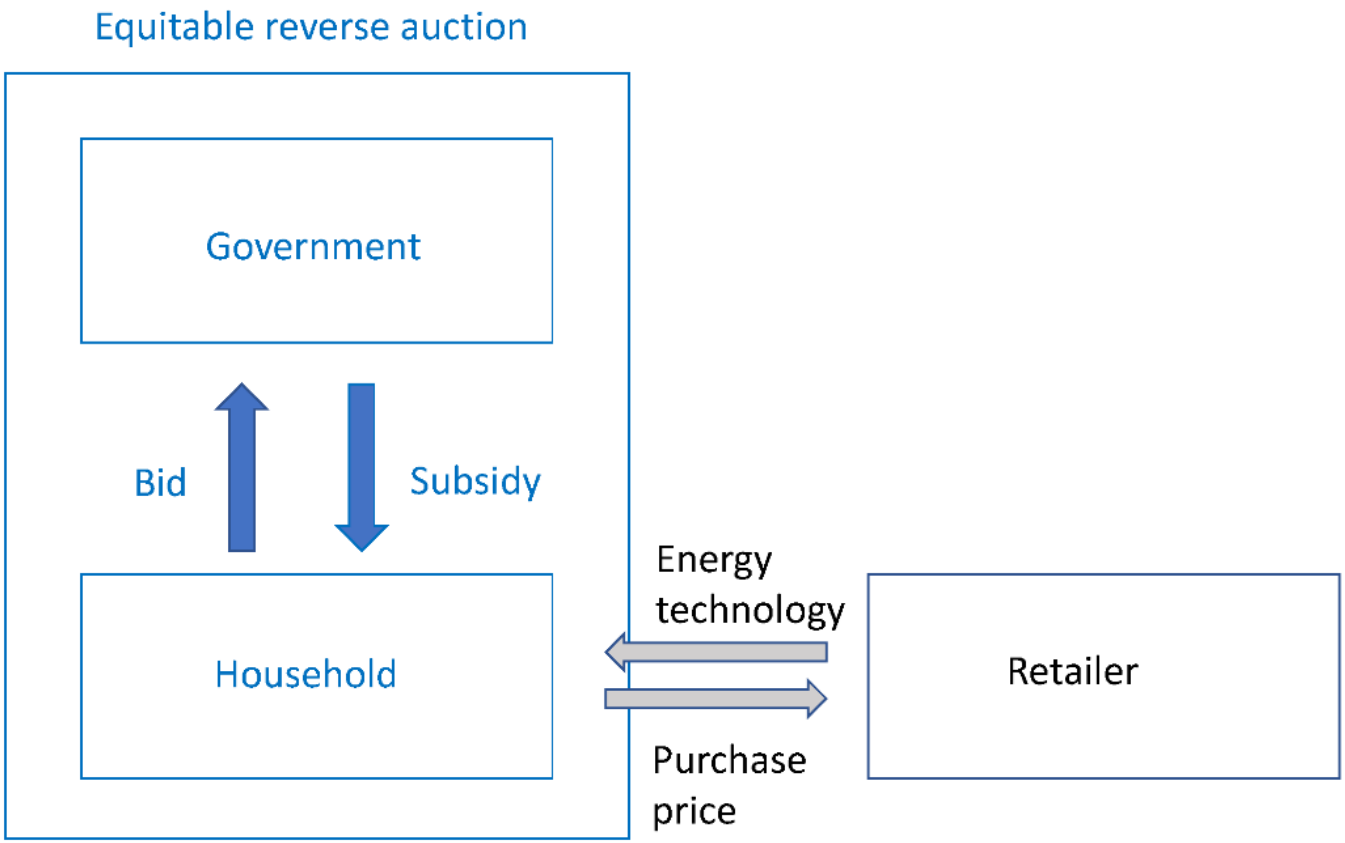
UBIQUITOUS



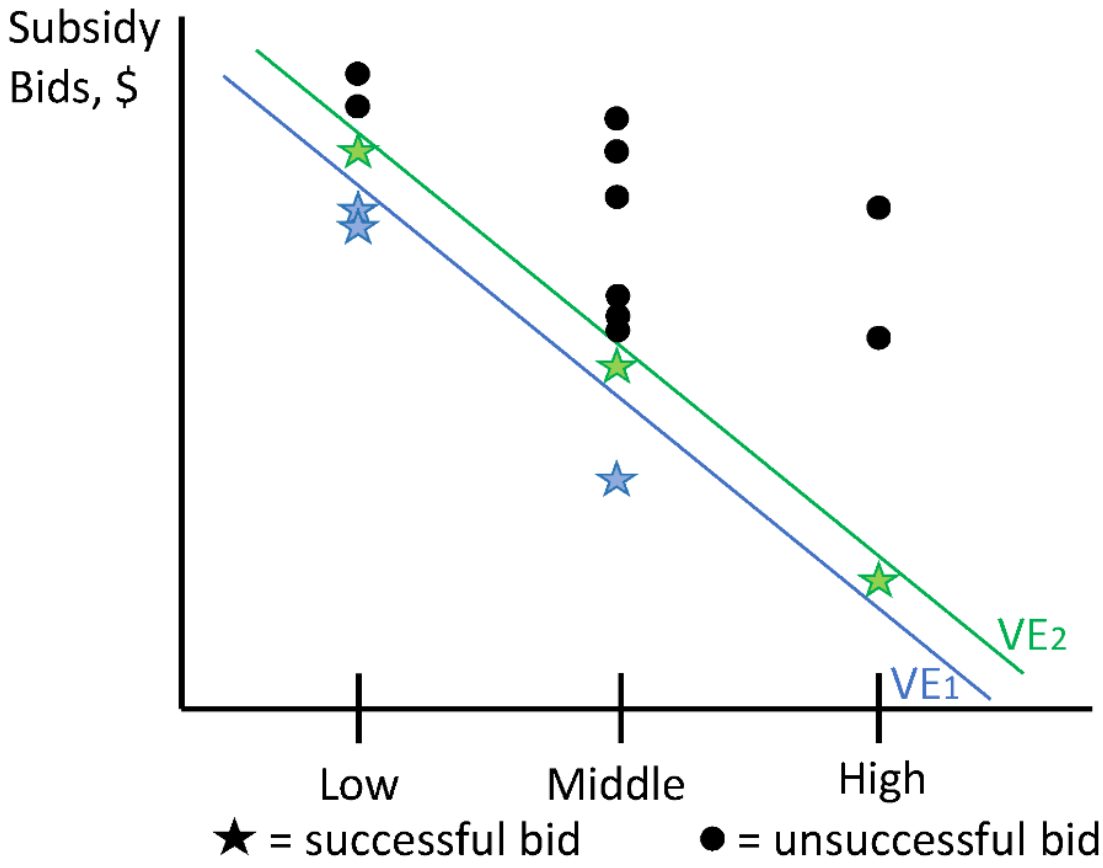
Equitable reverse auctions

- Equitable reverse auctions are a way to get benefits from reverse auctions, as a complement for welfare schemes, for the household sector
  - Cost-effective
  - Equitable
- 10.1016/j.enpol.2023.113548

Equitable reverse auctions



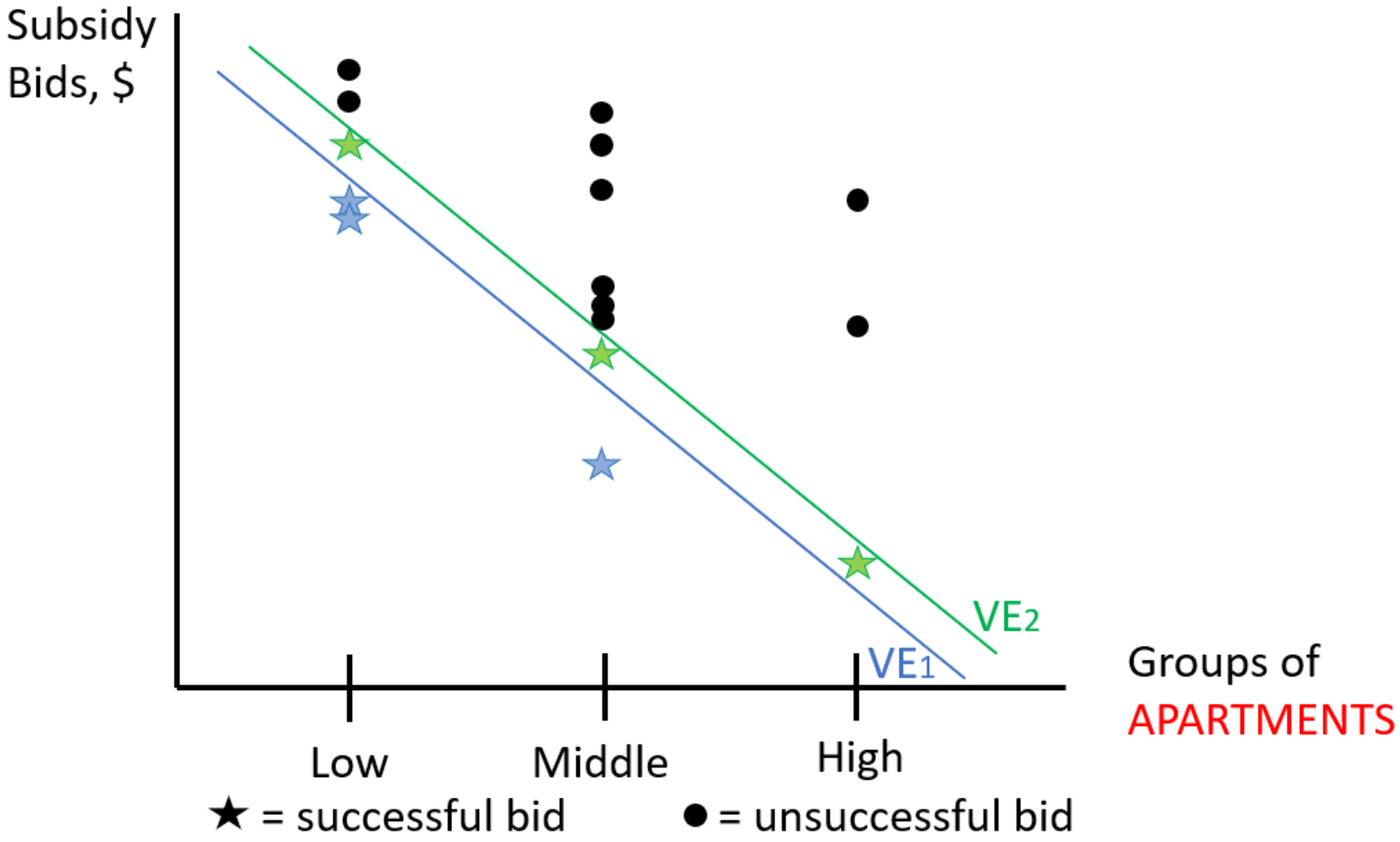
Sub-auctions by socio-economic group



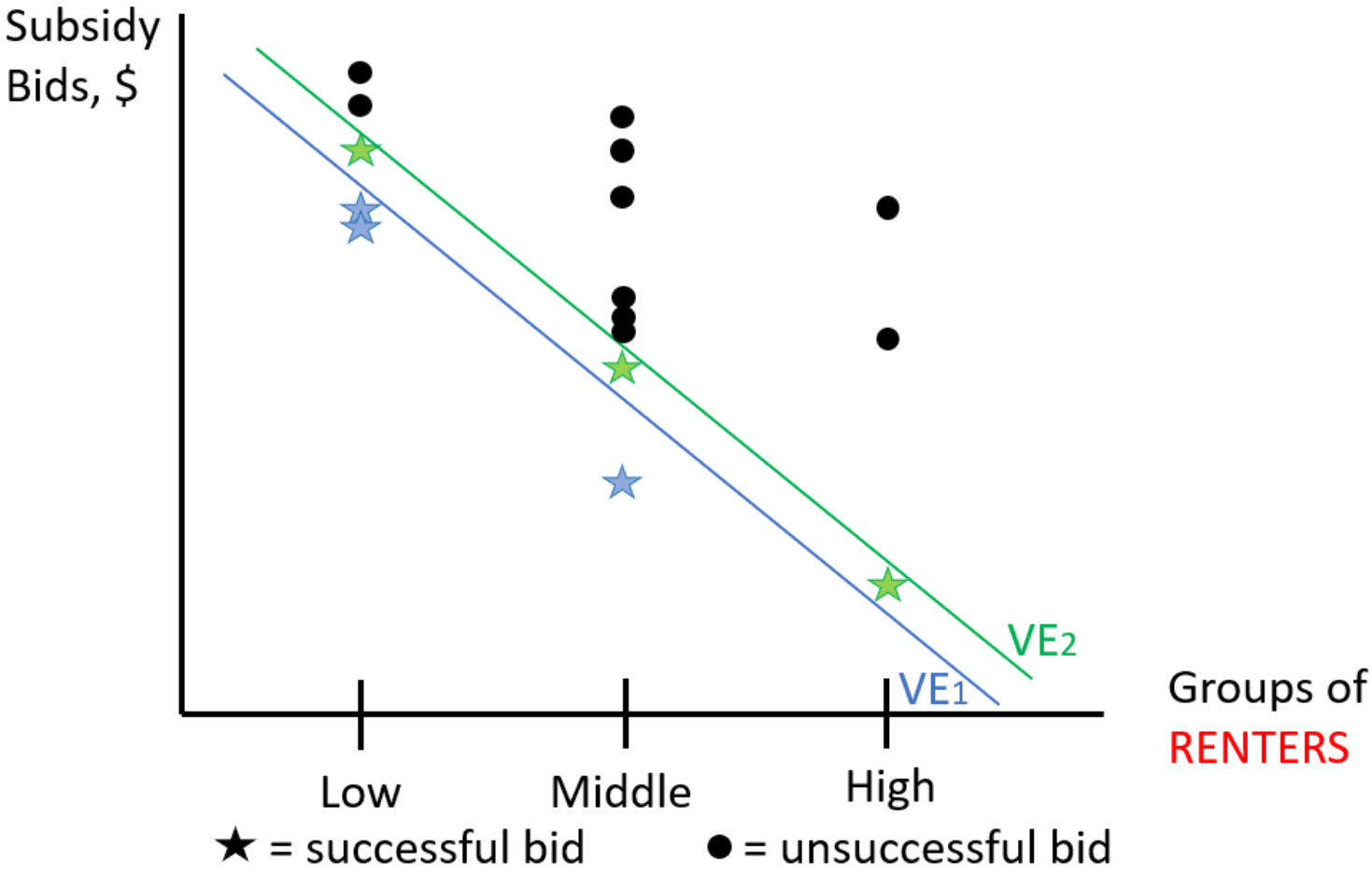
VE = Vertical equity

Socio-economic groups

Sub-auctions for apartments



Sub-auctions among renters



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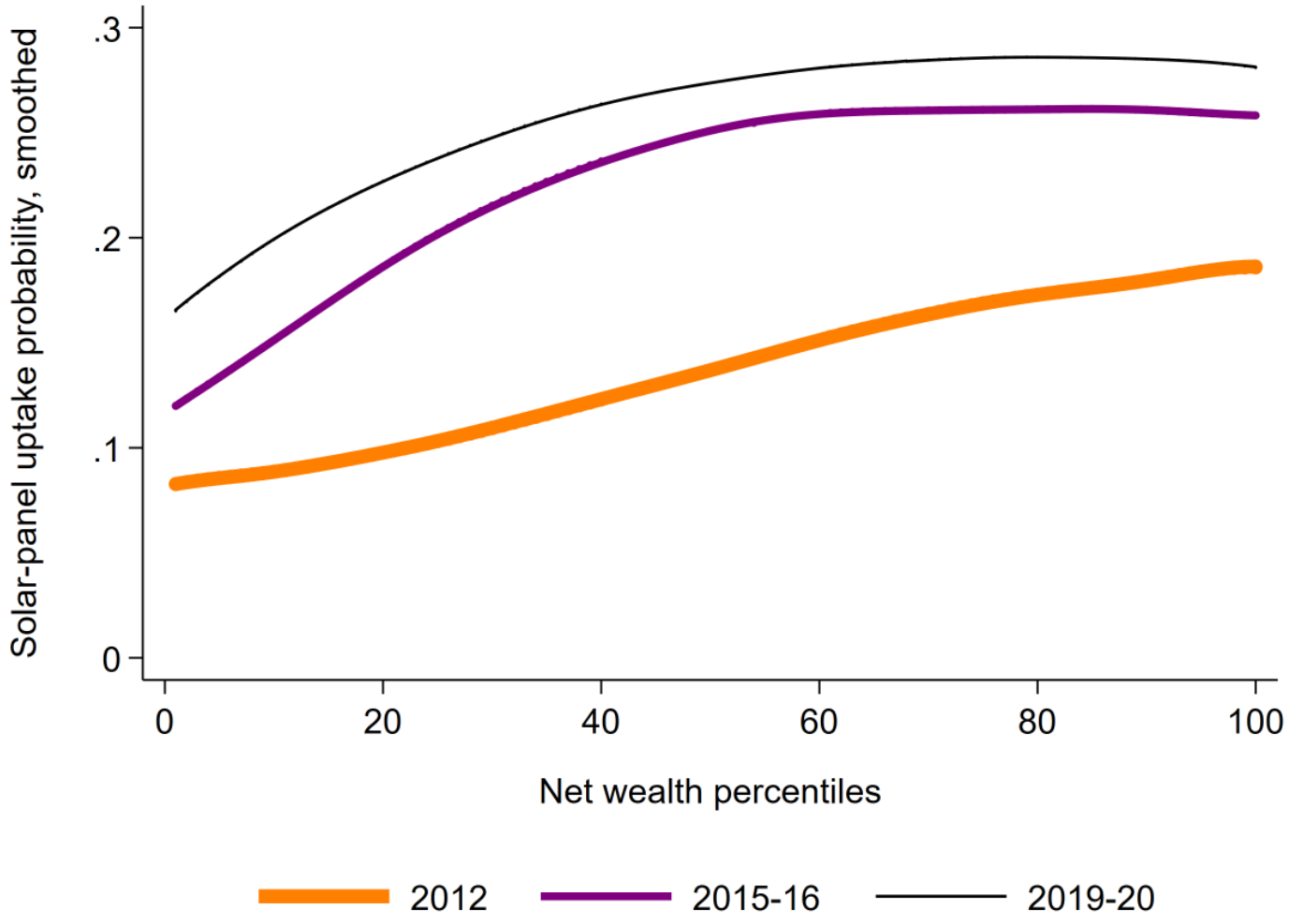
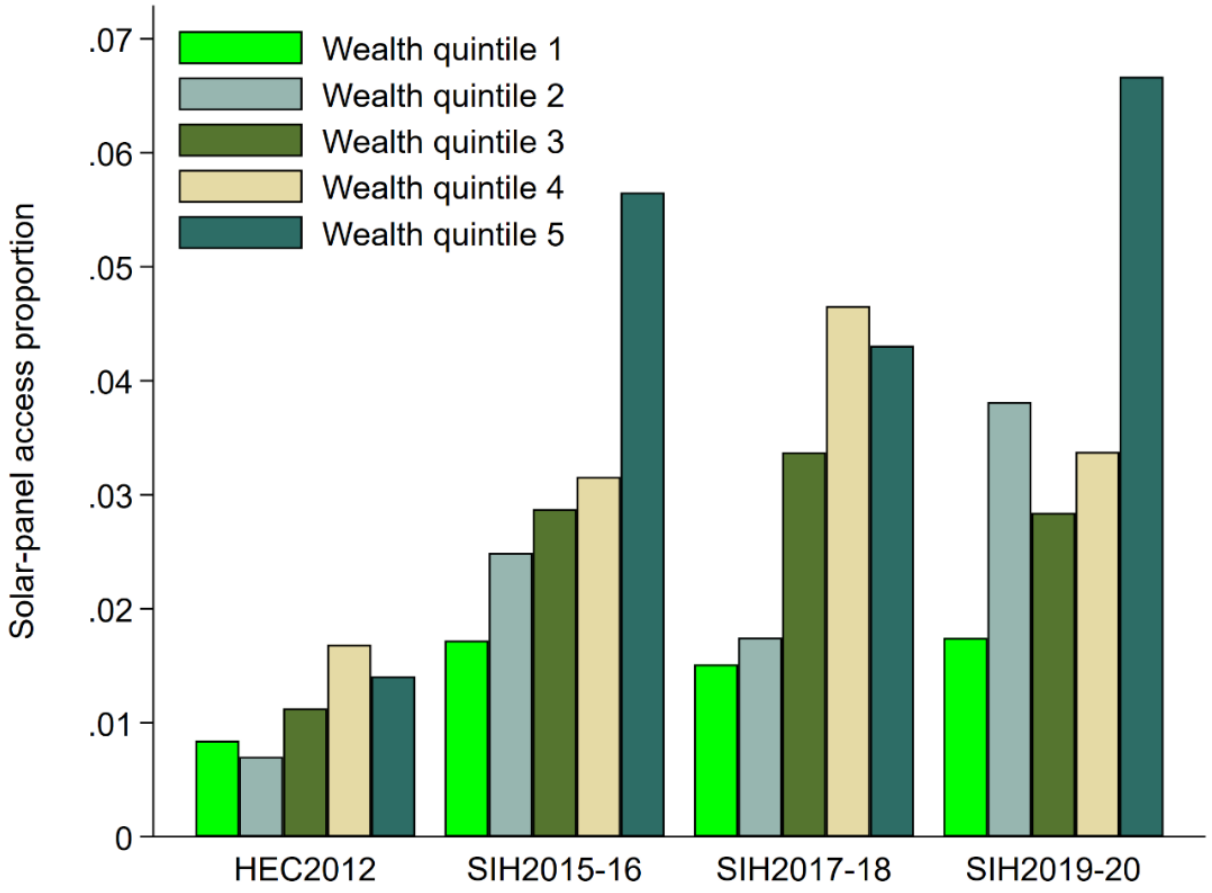
Australian homeowner solar panel uptake



Australian renter solar panel access



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Challenges

Complexity

- Are auctions for government subsidies too complicated for individuals / households?
  - Perhaps not, as many individuals are familiar with:
    - House price auctions
    - Auctions on eBay or other websites

Uncertainty: how much can/will consumers pay?

- If consumers are asked what level of subsidy they require, many may not give an 'appropriate' answer
  - However, over 3 million households have already considered this issue, at least implicitly, as this is the number of Australian households who have solar panels already
  - It will be useful to understand the spectrum of responses, as opposed to binary or categorical responses of likelihood to invest
    - Information elicitation

Strategic bidding

- Would consumers bid more than they require?
  - Competition gives an incentive for lower bids
    - High bids are unsuccessful in a reverse auction
- What number of bidders is necessary to give a competitive market?
- If the bids are too high from the government's perspective, there is no obligation to accept; a reservation price can be set

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Where to implement

Features to support reverse auctions for households

- Jurisdictions where there are larger numbers of potential consumers will be suitable, to give a more competitive auction context
- The business sector could be a target alongside the household sector in many countries
- Research can consider how many bidders are necessary
- Government with existing subsidy schemes for solar panels already have some information on willingness to pay

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- Best R., Chareunsy A., Taylor M. Changes in inequality for solar panel uptake by Australian homeowners (2023) Ecological Economics 209, 107851
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Can billions of dollars be saved on subsidies for a given number of electric vehicles and other technologies?

Policy suggestion

- Energy subsidies can differ across recipients

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  - For example, rebates or low-interest loans for solar panels, batteries, or electric vehicles (EVs) can differ more across recipients

Policy suggestion

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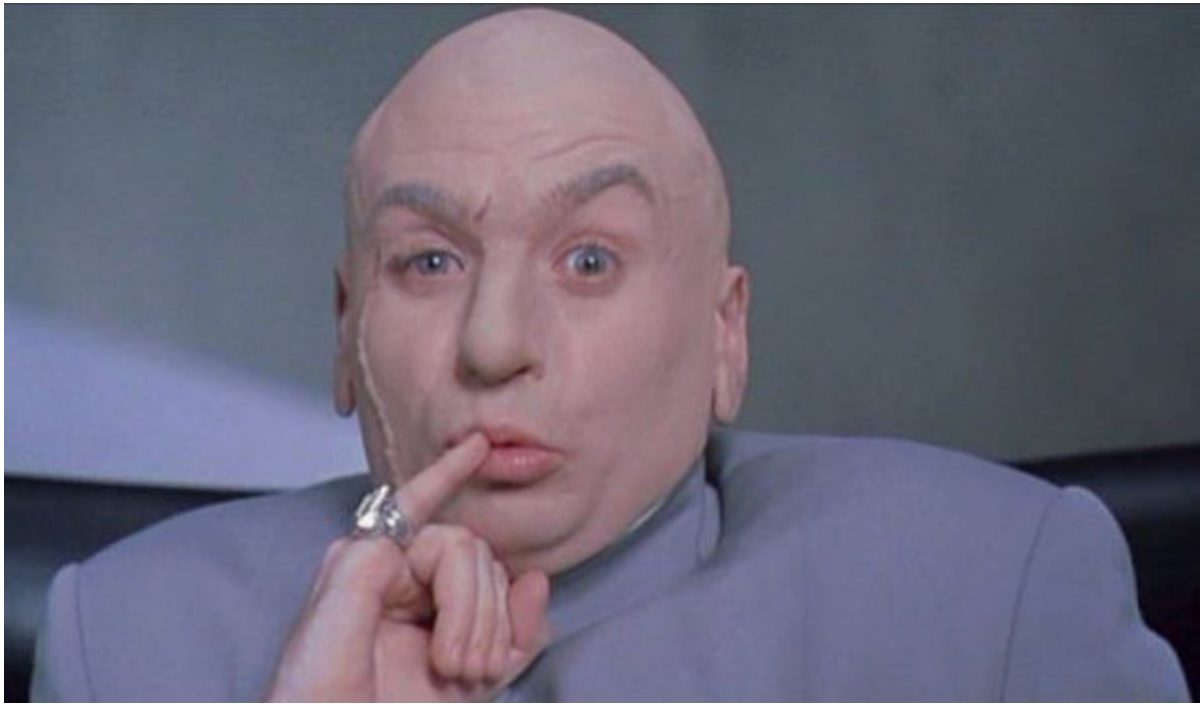
  - For example, rebates or low-interest loans for solar panels, batteries, or electric vehicles (EVs) can differ more across recipients
  - Higher subsidies for individuals / households with lower income / assets can improve both efficiency and equity of subsidies
    - Or varying support for businesses based on turnover / income

Potential US government spending on EV subsidies



- One million dollars? ……..
- $100 billion dollars…….

Source: https://www.pinterest.com.au/pin/1002613935783073767/

Potential US government spending on EV subsidies

- One example is the US Inflation Reduction Act where there are “tax credits” of $7,500 for EV purchases.
  - EV uptake in the US has been projected to be 4.6 million in 2030 (S&P) or roughly 30 million in the 8 years to 2032.
  - This would equate to 30 million x 7,500 or US$225,000,000,000.
  - Actual outcomes could be much different, but total spending could still be big.
- Subsidies for other technologies in other countries would generally be less, but still likely add up to large amounts

S&P: https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/electric-power/100623-ira-impacts-expected-to-drive-up-ev-sales-more-than-double-previous-forecast

Past policies

- Past/current policies often provide the same level of support for all eligible recipients
  - Or occasionally the same level of support per unit of energy (e.g. Small-scale Renewable Energy Scheme, premium feed-in tariff)
  - Caveat: Schemes are increasingly means tested, although those within the category of 'eligible' usually receive the same subsidy
- There are different precedents for varying support by recipient according to income or assets:
  - Welfare payments by Australian Government
    - Can differ continuously between 0 and max.

The challenge of policy design

Goldilocks and the 3 ….

Source: https://www.pinterest.com.au/pin/416231190551989325/visual-search/?x=16&y=16&w=268&h=411&cropSource=6&surfaceType=flashlight

The challenge of policy design

Goldilocks and the 3 ….

Policy characteristics:

The challenge of policy design

Goldilocks and the 3 ….

Policy characteristics:

- Efficiency (not too hot)
- Effectiveness (not too cold)
- Equity (it's hard to get it just right)

The challenge of policy design

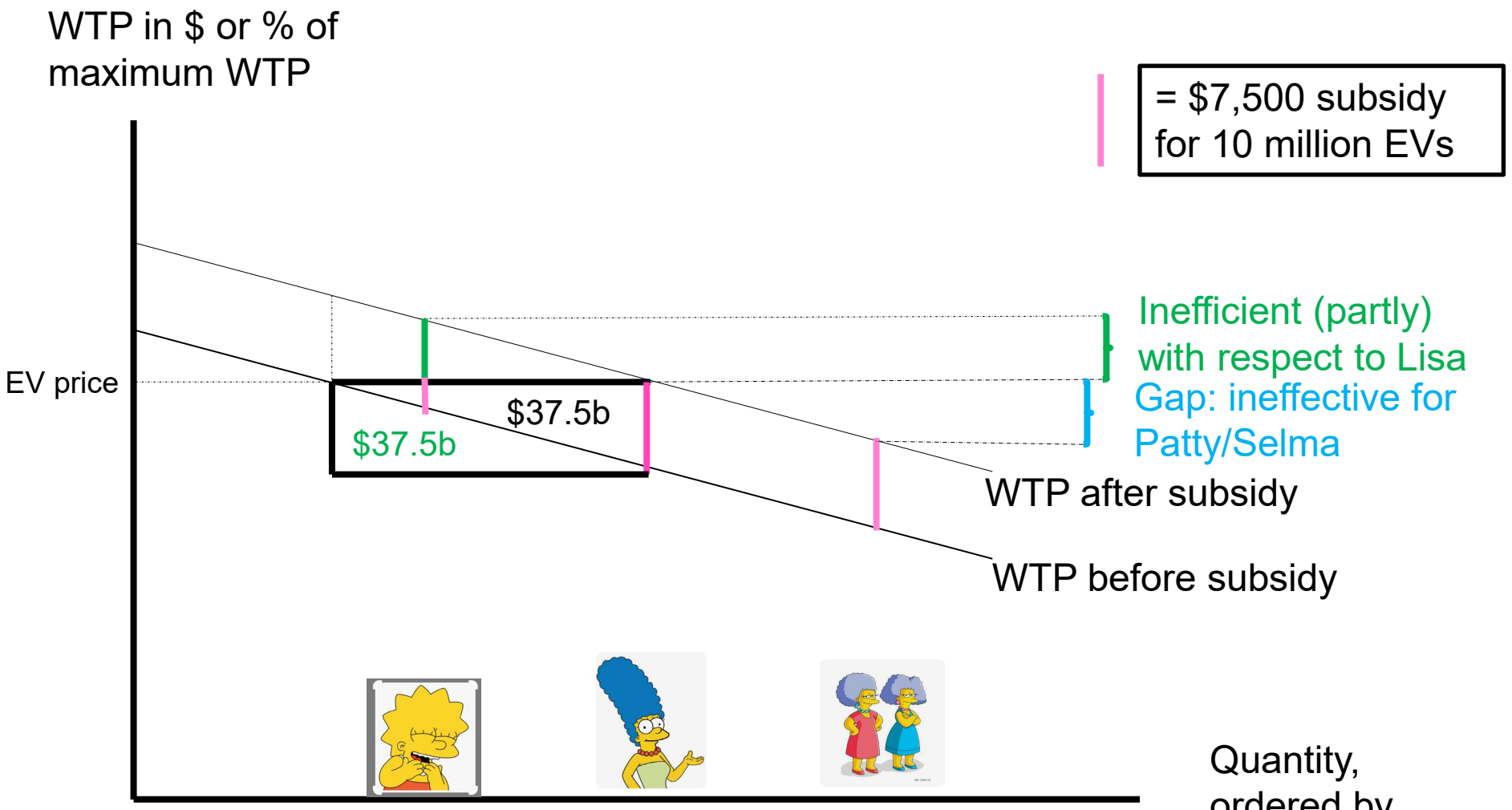
Goldilocks and the 3 ….

Policy characteristics:

- Efficiency (not too hot)
- Effectiveness (not too cold)
- Equity (it's hard to get it just right)

Policy support probably needs to vary across recipients to be efficient/effective/equitable

Willingness to pay (WTP) varies by person



Major uncertainty

- Projection of EV sales
- Is the WTP line (demand) linear?
  - Or convex or concave?
- But given the large amount of money involved, even small proportionate improvements in efficiency/effectiveness/equity, by varying payment amounts by recipient, could have a large absolute impact (e.g. for a given quantity of EV sales, billions of dollars could be saved in countries like the US, millions of dollars in smaller countries).

How to determine and implement varying support

- Set schedules based on:
  - Revealed preference
  - Hypothetical studies of intentions which collect willingness to pay for technologies / subsidies required, and relate these intentions to economic resources
- Experiments / auctions

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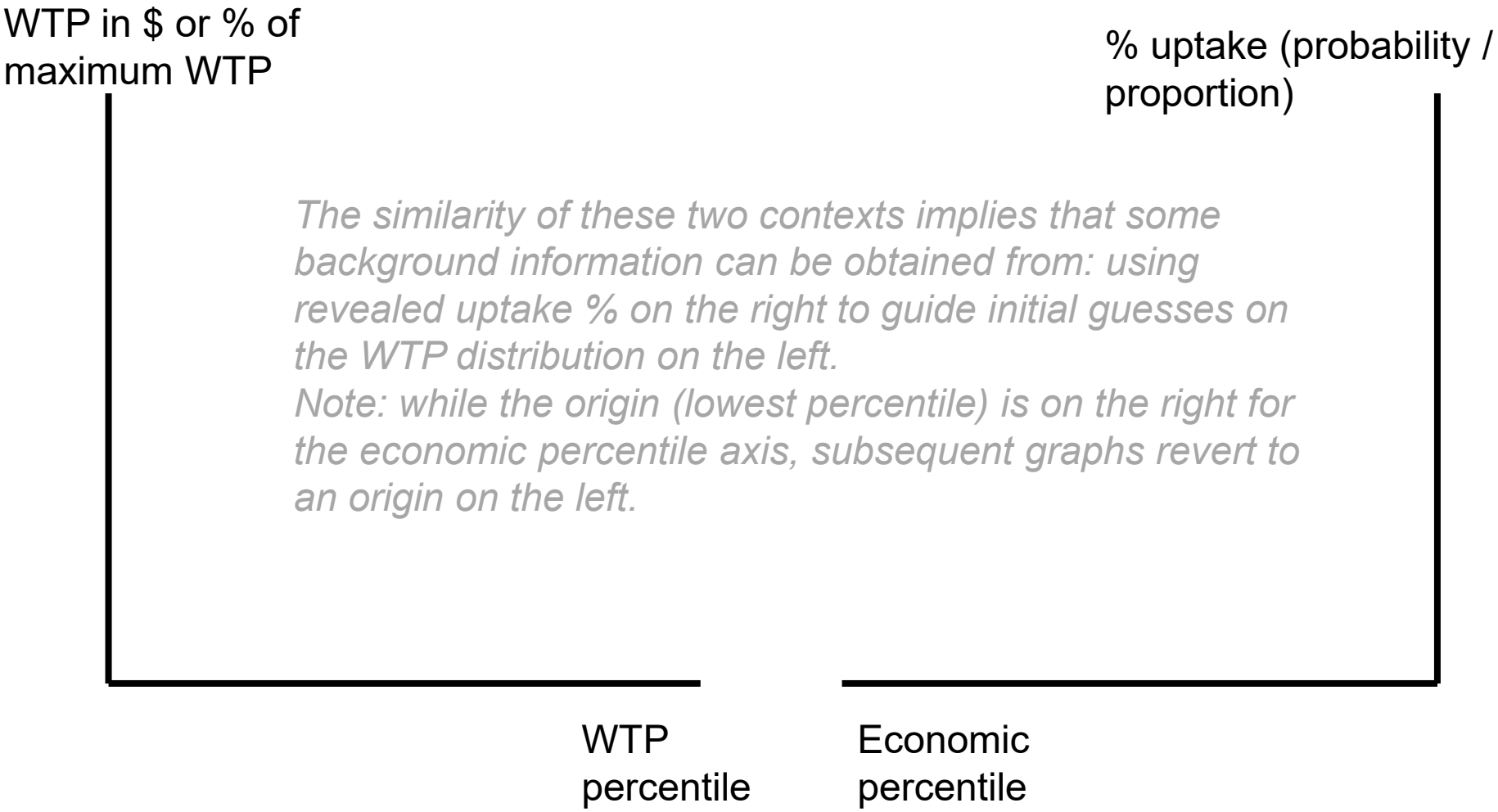
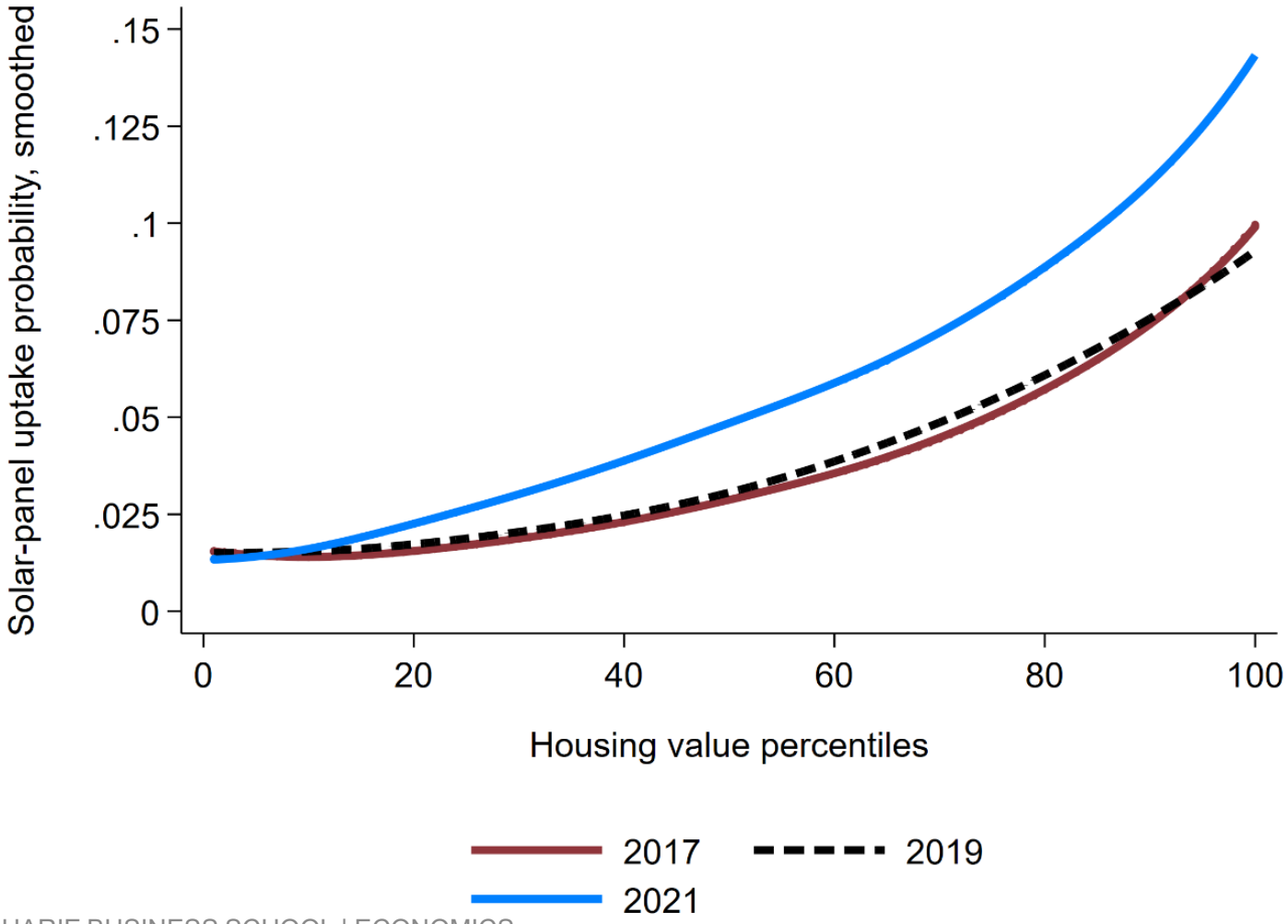
Revealed preference

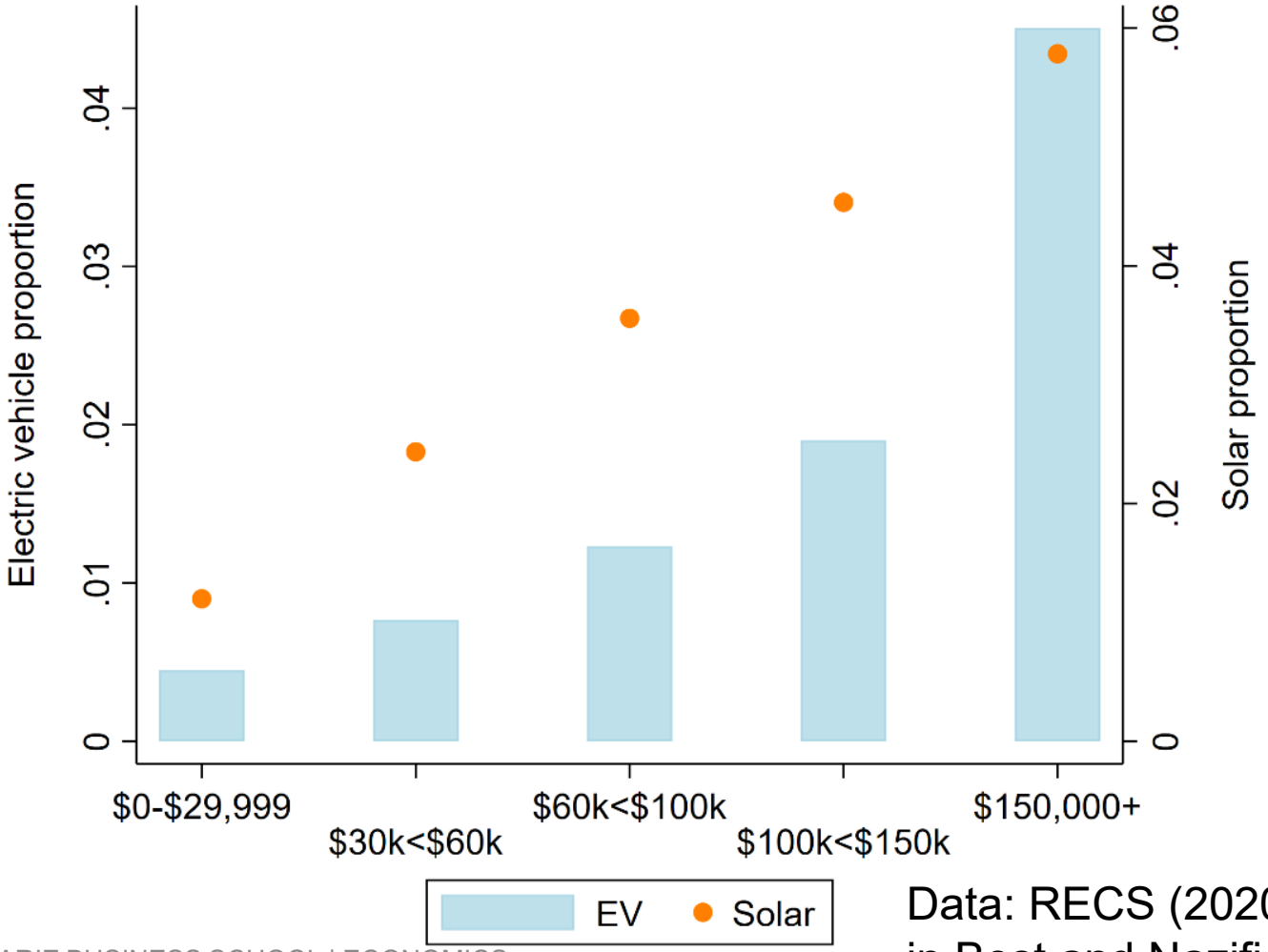
Willingness to pay (WTP)



US homeowner solar panel uptake

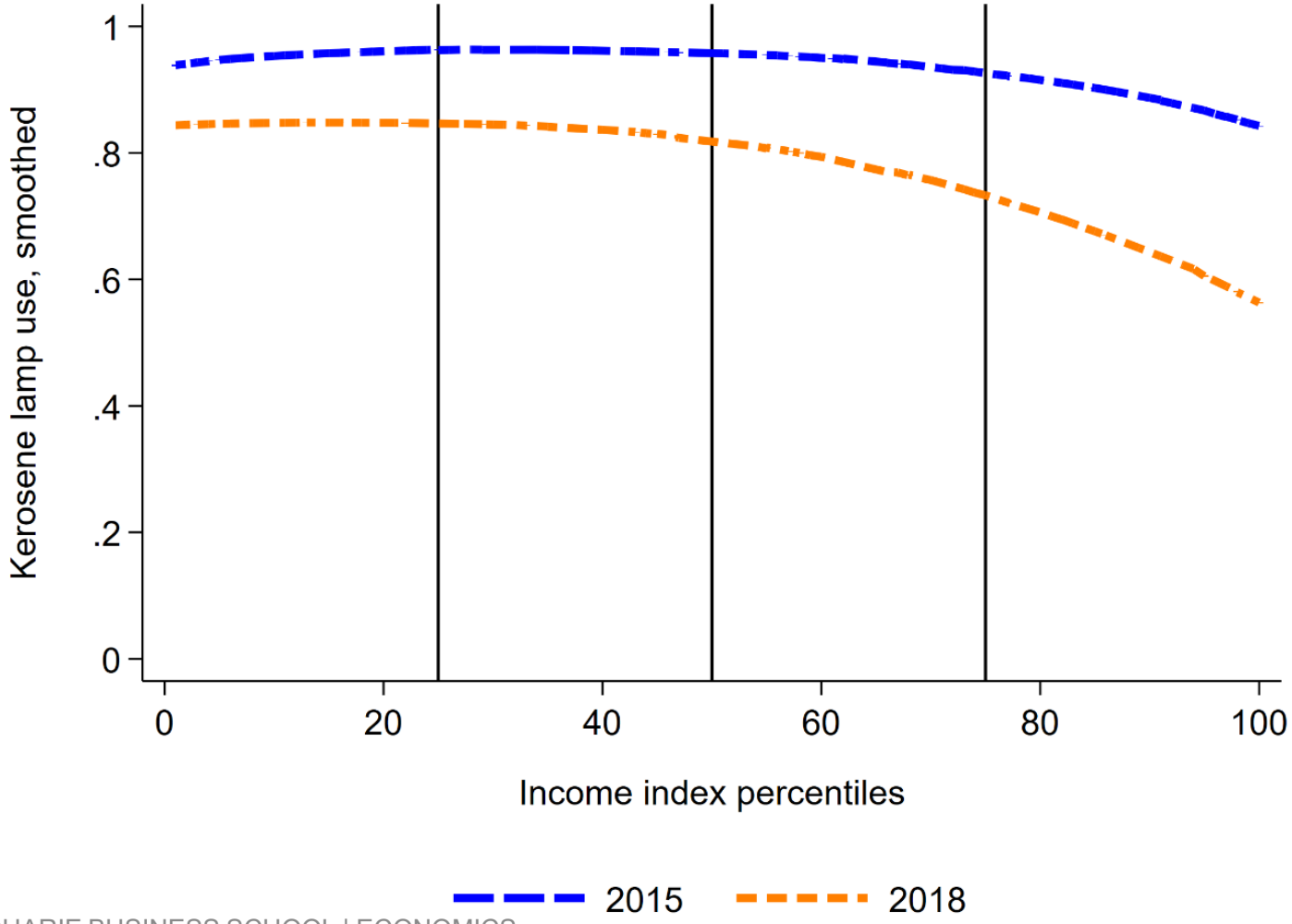


US EV and solar panel uptake



Data: RECS (2020) as used in Best and Nazifi (2023)

Kerosene lamp use, northern India



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Household surveys on intentions: willingness to pay across economic distributions

Opportunity for data collectors

- With large household surveys, add extra questions:
  - How much would you be willing to pay (WTP) for….(EV/solar/battery/energy-efficient appliance…..)
    - Or what subsidy do you require?
- Then find how this WTP varies across income or asset distributions
- Compare to the revealed preference distributions

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Experiments / auctions

Structures and mechanisms

- Experiments / auctions can also involve concise questions:
  - How much would you be willing to pay (WTP) for….(EV/solar/battery/energy-efficient appliance…..)
    - Or what subsidy do you require?
      - Would people give inflated values?
        - Reverse auction mechanism for subsidies so that competition incentivizes people to give their true values (or risk missing out entirely)

Implementation risks?

- Would auctions be too complicated?
  - Concise question on previous slide
  - Familiar with house price auctions
  - eBay auctions
- Auctions could be trialed in a hypothetical context and/or with partly funded outcomes through a lottery approach
- Actual auctions are still controllable: if bids are not acceptable: don’t accept

Possible experiments

- Experimental changes:
  - Control: the concise question given previously
  - Treatment 1: explain that an auction determines the successful subsidy bids
  - Treatment 2: explain that sub-auctions of people with similar economic characteristics determine the successful subsidy bids
  - Treatment 3: Nudges based on environmental or social information

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