

Range-Based Subsidies and Product Upgrading of Electric Vehicles in China

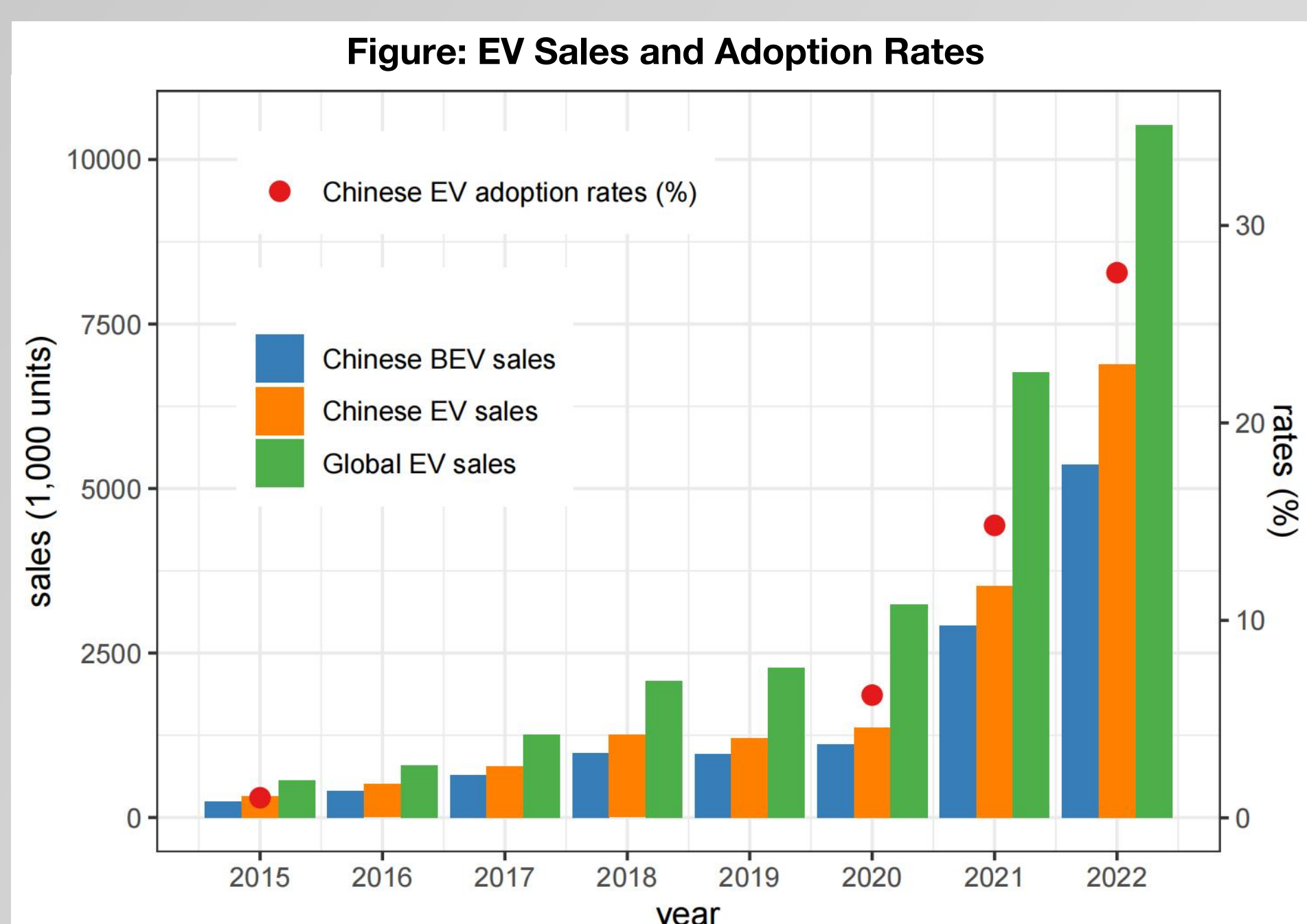
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Questions

Do range-based subsidies provided to electric vehicle (EV) consumers incentivize EV manufacturers to invest in reducing the production cost per kilometer of range?

Background

- Chinese local automobile manufacturers had long been considered as only capable of producing low-quality products
- After 2008, the Chinese government implemented a package of industrial policies to support the EV industry:
 - Consumer subsidies (studied by this paper), financial support to the EV supply chain, infrastructure, R&D
- Chinese EVs succeeded in gaining domestic and global presence:
 - EV sales \uparrow 14 times in 2016-2020
 - 65% of the global EV sales in 2022
 - EV export almost doubled in 2021-2022
 - SAIC exported 1 million vehicles in 2022



Methods

Use product-level data to estimate a dynamic structural model where

- Heterogeneous multi-product firms maximize expected discounted profits in finite periods (static: prices, range; dynamic: investment)
- A static logit model of heterogeneous consumers maximizing utility

Use counterfactuals to evaluate the impact of consumer subsidies

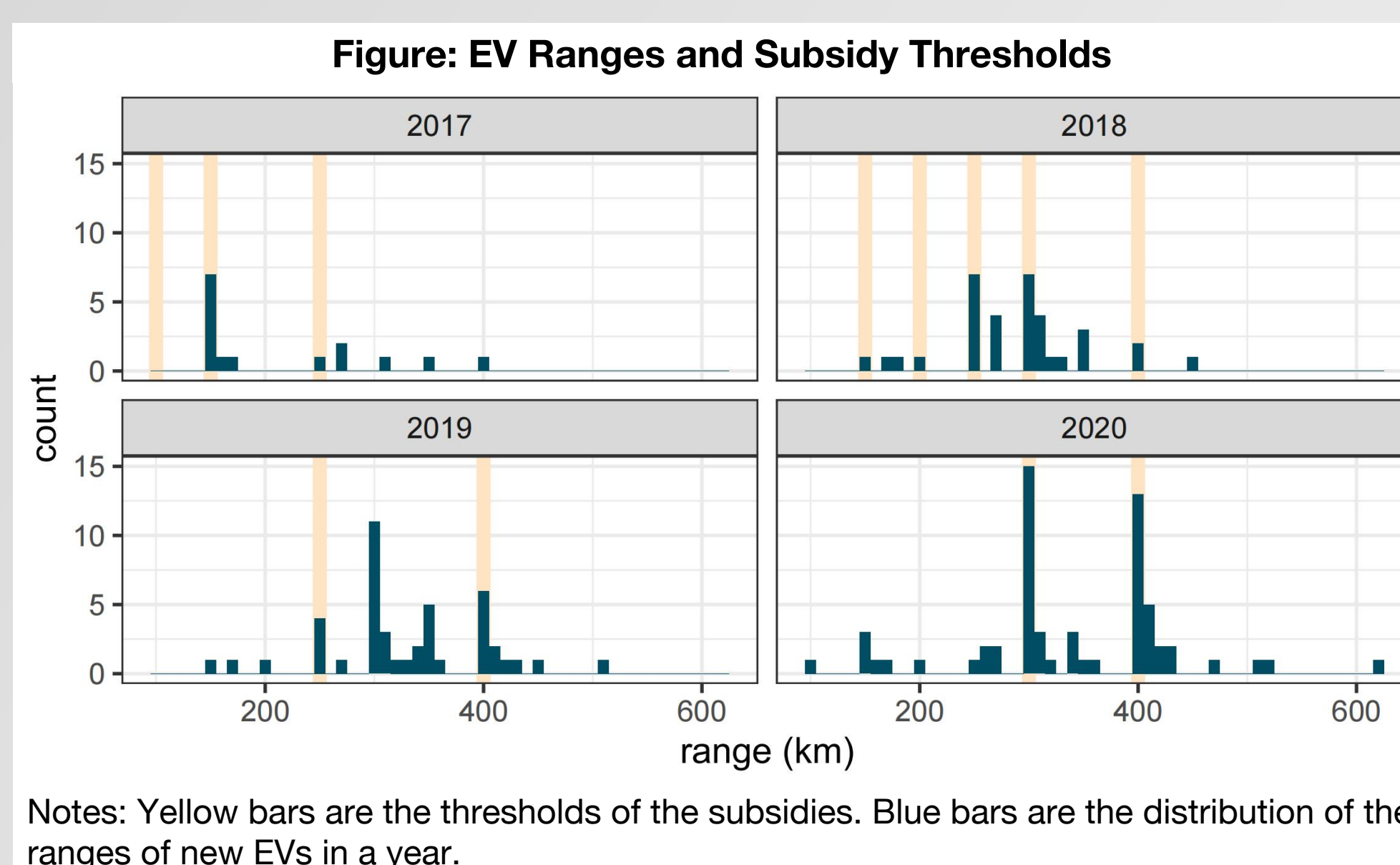
Contributions

Present new empirical evidence demonstrating that range-based subsidies:

- Have the capability to stimulate product enhancements on the supply side by targeting consumer demand
- Continue to exert influence even after the removal of demand-side stimulations

Stylized Facts

- Chinese range-based subsidies (RBS) to consumers played a substantial role
 - Subsidy-price ratios ranged between 16-64% with a mean of 25%
 - 34% of the EVs sold (sales) received subsidies
 - The range of new EVs clustered around and moved with the thresholds



Notes: Yellow bars are the thresholds of the subsidies. Blue bars are the distribution of the ranges of new EVs in a year.

- Li et al. (2022): consumer subsidies explained half of the EV sales
- The RBS and prices declined while sales increased over time

Table: Subsidies in Different Years and for Different Ranges (10,000 RMB)

range (km)	2016	2017	2018	2019	2020	2021	2022
[0, 100)	0	0	0	0	0	0	0
[100, 150)	2.5	2	0	0	0	0	0
[150, 200)	4.5	3.6	1.5	0	0	0	0
[200, 250)	4.5	3.6	2.4	0	0	0	0
[250, 300)	5.5	4.4	3.4	1.8	0	0	0
[300, 400)	5.5	4.4	4.5	1.8	1.62	1.3	0.91
[400, ∞)	5.5	4.4	5	2.5	2.25	1.8	1.26
Average price	19.6	19.5	16.8	16.8	16.2	16.4	—

Notes: The average exchange rate to USD during this period was about 6.5.

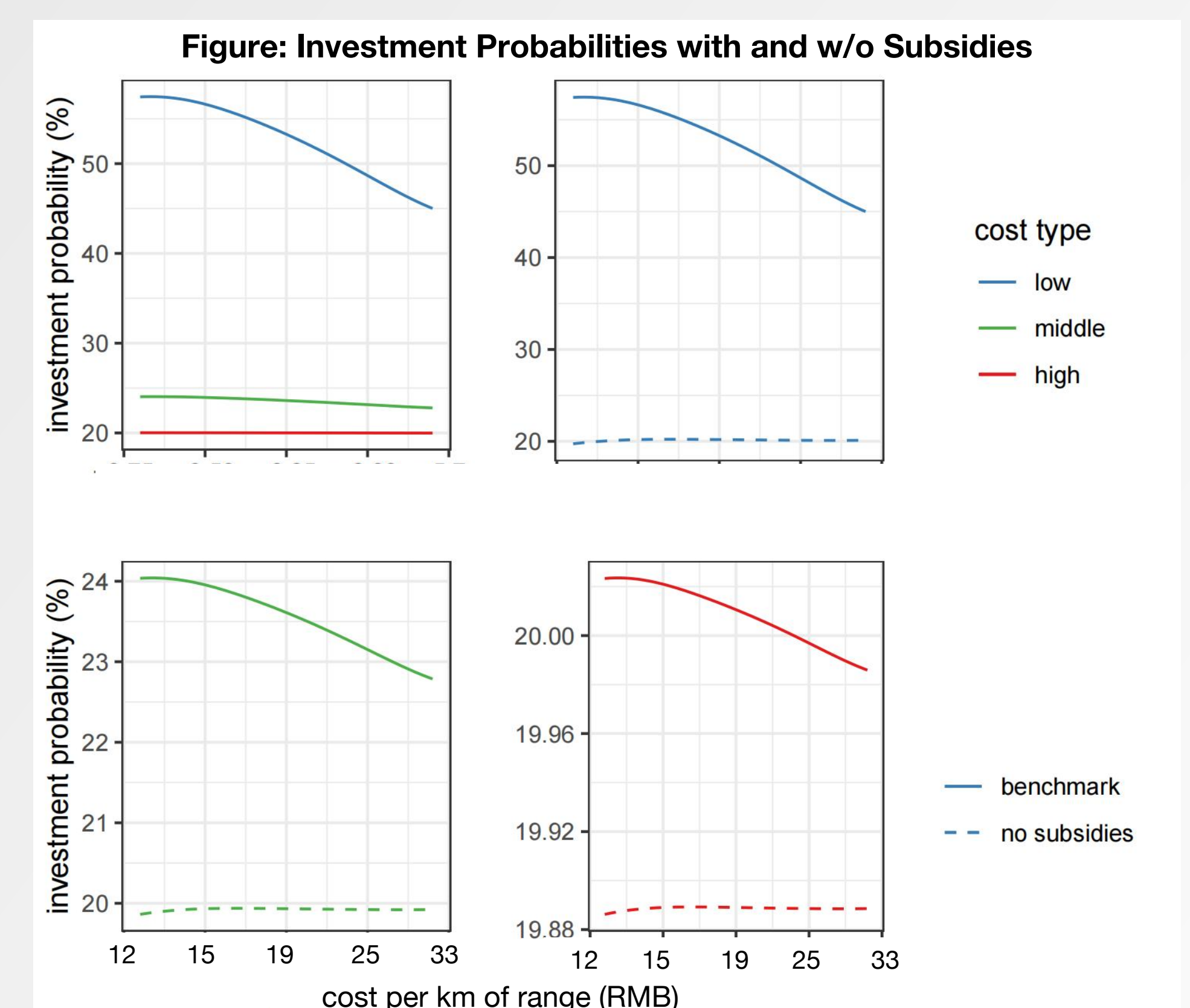
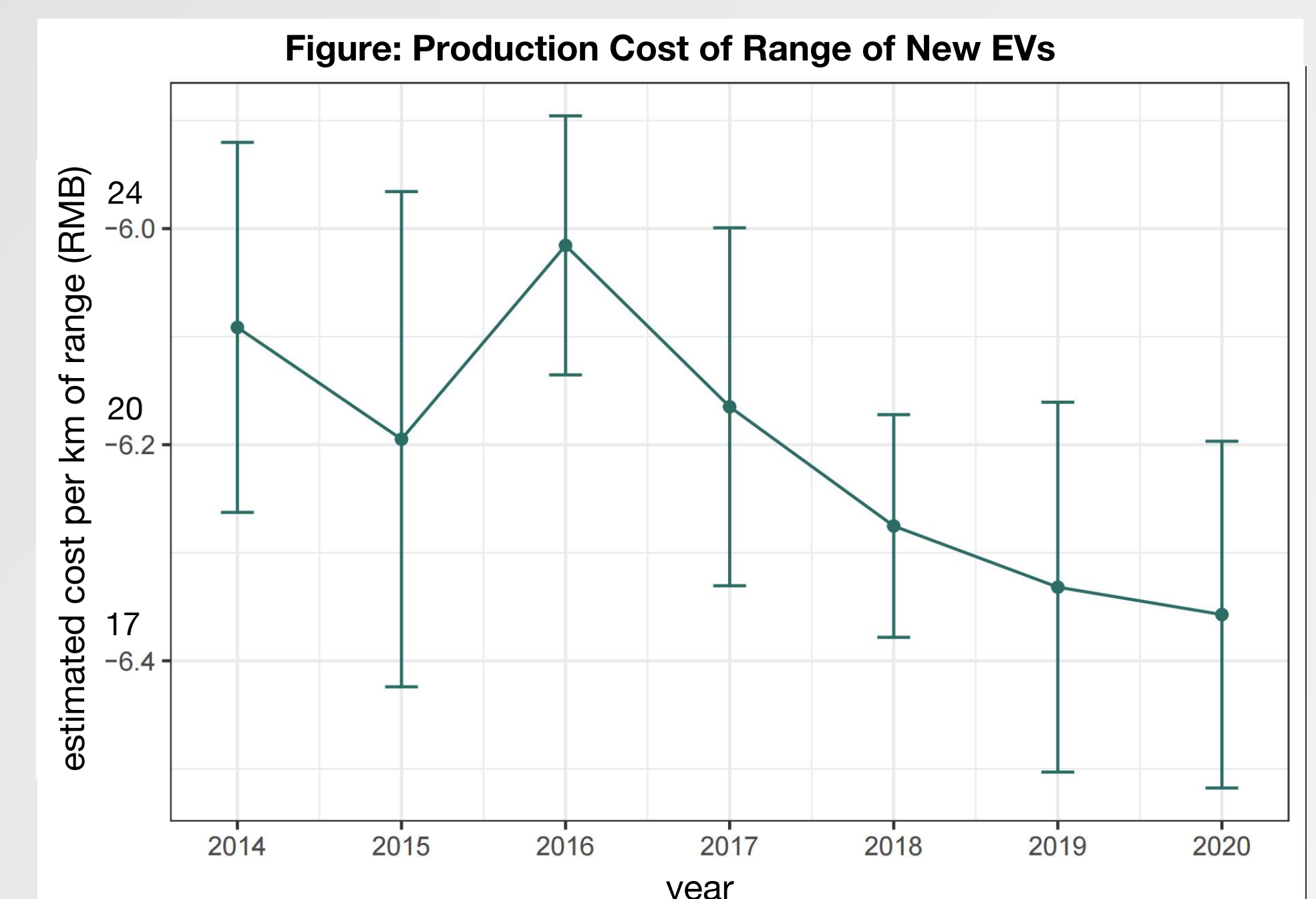
- The range of new EVs increased, but not at the cost of vehicle sizes
- Battery density increased
- The main competition is with gasoline producers not among EV producers
 - EV producers' market shares \leq 2%, mean 0.1%, median 0.02%

References

Li, S., X. Zhu, Y. Ma, F. Zhang, and H. Zhou (2022): "The Role of Government in the Market for Electric Vehicles: Evidence from China," Journal of Policy Analysis and Management, 41, 450-485, publisher: John Wiley & Sons, Ltd.

Main Results

- The estimated production cost per km of range declined in 2016-2020
- EV subsidies to consumers raised the investment probabilities of low-cost (high market-share) firms by 25-38%



Conclusion

- Range-based subsidies (RBS) to consumers \uparrow the investment probabilities by up to 38%
- This impact is larger for manufacturers with lower costs and higher market shares
- This implies RBS can be used to induce technological adoption or product upgrading
- This also implies environmental benefits and welfare gains of RBS are very likely larger than the existing estimates

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