

The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar

**Adoption of Electric Vehicles:
Manufacturers' Incentive and Government Policy**

by

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Abstract:

Several countries have set the goal of replacing gasoline vehicles (GVs) by electric vehicles (EVs) within the next decade or two. Although the global EV sales have been increasing rapidly, the adoption rate of EVs still remains relatively low. To encourage the adoption of EVs, governments around the world are applying a variety of incentive schemes. Two natural questions arise: First, are the goals that governments aim at such as banning of GV's socially optimal? Second, how to design effective policies to align auto manufacturers' incentives with the socially optimal decisions? In the literature, auto manufacturers' incentives for EV adoption and their interactions with government policies are understudied especially through a game-theoretic analytical modelling approach. In this paper, we develop a game-theoretic model to address the above issues. Specifically, we consider a monopoly market where a single auto manufacturer produces GV's, EV's, or both. We first derive the manufacturer's optimal strategy under a fixed government subsidy to EV consumers, based on which we examine the manufacturer's incentive for EV adoption. Furthermore, we characterize what product(s) should be produced at social optimum. We then propose an EV-subsidy/environmental-tax policy and show the optimal policy parameters that achieve the maximum social welfare. Moreover, a duopoly market where a GV and an EV manufacturers compete is considered. We show that a single or both vehicle types may be produced at equilibrium, and derive the policy that aligns the competing manufacturers' incentives with the socially optimal decisions. Finally, the monopoly and duopoly markets are compared, and it is shown that the government should charge a higher environmental tax while offering a lower EV subsidy in the duopoly market than in the monopoly market.

Keywords: Electric vehicles; incentives for adoption; government policy; environment; subsidy

Bio:

Anming Zhang is a Full Professor in Operations and Logistics and holds Vancouver International Airport Authority Chair Professor in Air Transportation at Sauder School of Business, University of British Columbia (UBC). He served as the Head of the Operations and Logistics Division, Sauder School of Business (2003-2005), and as the Director of UBC's Centre for Transport Studies (2003-2004). He had been the Vice President (Academic & Program) for the World Air Transport Research Society (ATRS) between 2006 and 2017. Dr. Zhang is the recipient of the "Yokohama Special Prize for Outstanding Young Researcher" awarded at the 7th World Conference on Transportation Research (WCTR) in Sydney, Australia in 1995, and of the "WCTR-Society Prize", awarded to the overall best paper of the 8th WCTR in Antwerp, Belgium, in 1998. In June 2014, he won the "Best Overall Paper Prize" at the annual ITEA (International Transport Economics Association) Conference on Transportation Economics, Toulouse School of Economics, France.

Dr. Zhang has published over 150 refereed journal papers in the areas of transportation, logistics, industrial organization, and Chinese economy. He has co-authored two recent books: *Globalization and Strategic Alliances: The Case of the Airline Industry*, 2000, Pergamon Press, Oxford; and *Air Cargo in Mainland China and Hong Kong*, 2004, Ashgate, London (Chinese editions published both in Hong Kong and Mainland China).

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All are welcome!