**Trade-off and synergies in policy incentives on mitigating CO2 emissions from the passenger cars in five major economies**

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**ABSTRACT**

The rapid growth in emissions in the transport sector of the world is driven by the road sector, which have increased by more than 50% since 1990. In particular, the Passenger Light-Duty Vehicle(PLDV) fleet is projected to expand to 1.7 billion in 2035. Policy incentives send consumers and car manufacturers a signal intended to influence purchasing decisions and the adoption of low-emissions vehicles. The levels and the structure of policy incentives are necessary to influence the adoption of new-car technologies. The design, level and structure of the instruments determines the effectiveness of the policies and achieving the emissions-reduction target in the long run. Policy incentives are almost always introduced simultaneously. These incentives interact, providing price and regulatory signals to purchase decisions, thereby compounding the effect on the transitions to low emissions vehicles.

The effect of the policy incentives are typically heterogenous across both countries and time and can be non-linear. Understanding the interactions can lead to gains in the efficiency and effectiveness of policy incentives. Using a dynamic model of technological change and with scenario analysis, we explore the impact of various policy incentives across five major economies: the US, UK, China, Japan and India. These markets possess very different characteristics that are the result of different histories of policies and regulations.

This study aims to quantify the trade-off and synergies in policy incentives in mitigating CO2 emissions from passenger cars in the five major economies. Subsequently, we will discuss the possible options to minimize the trade-off effect and enable synergies in policy design. We find that there is a trade-off effect between the financial incentives under this analysis, while the degree of the trade-off effect depends on the stringency of individual policy incentives in each country. There is a reinforcement effect between EV mandates and other policy incentives. The EV mandate increases the model’s availability and the visibility of EVs. As a result of technological lock-in effect, an EV mandate is necessary to reduce the lock-in effect by creating a reinforcement effect between EV mandate and other policy incentives. The size of the reinforcement effect depends on specific countries and the sizes of the policy incentives. Overall, the policy effectiveness is lower among countries with a dominant technology or that have very low market shares of low emissions PLDVs compared with countries with relatively larger EV fleet shares.

Therefore, to increase the effectiveness of financial incentives, it is useful to introduce regulatory measures that increase the number of EVs on the road and hence EV infrastructure, due to the reinforcement effect between the financial incentives and the EV mandate. While it is important to have an effective policy framework that reduces emissions significantly, a policy needs to be cost efficient to be feasible. In most cases, combinations of two policies lead to higher efficiencies than when the less efficient policy is introduced independently.

**Key words:** **Passenger car, CO2 emissions, policy interactions**

**Category Number**: 10　 **JEL Classification Code:Q4,Q5**