An Ex-post Analysis of the 2008 Car Tax Change on Transport CO2 Emissions using a Car Stock Model

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Abstract

Policies incentivising energy efficiency are a key measure for mitigating greenhouse gas emissions, yet there is little retrospective analysis on the impact of these policies. This paper assesses private car CO_2 emissions and car tax revenue in Ireland over the 10-year period following the introduction of an emissions-based car taxation policy in 2008, after which new car sales shifted strongly towards diesel and less energy-intensive cars. We build on a model of the Irish car stock, which uses new car sales, activity, and carbon intensity data to develop a detailed bottom-up picture of historic CO_2 emissions from the car fleet. We construct a counterfactual scenario for the Irish car stock based on what would have happened had the emissions profile of new car sales followed EU-wide trends from 2008, rather than the fast improvements seen following the change in car tax. Carbon intensity of the total car fleet reduced to 164 gCO_2/km in 2018 from 186 gCO_2/km in 2008. Without the tax intervention, and following EU-wide trends, carbon intensity of the total car fleet would have been 168 gCO_2/km. If the improvement in new car energy intensity in Ireland had followed EU-wide trends, private car emissions would have been higher; this study calculates cumulative CO_2 saving of 1.6 Mt CO_2 from 2008 to 2018 because of the tax change. The tax change also led to a fall in annual motor tax revenues. Recorded receipts from annual motor tax were €0.77 billion in 2018, which would have been nearly €1 billion under the pre-2008 tax regime. Furthermore, differences between the test-rated and on-road carbon intensity grew over the period in question, which diminished both the CO_2 savings and tax revenue from cars. Annual motor tax receipts would have amounted to €1.25 billion in 2018 under the new regime if rated emissions matched on-road performance. Over the ten years, the cost of abatement was €684 per tonne of CO_2 avoided. This paper demonstrates how ex-post analysis can be used to learn from the past and provide insights for taxation policy approaches into the future to reduce transport related CO_2 emissions.