Carbon Tax Saliency: The Case of B.C. Diesel Demand

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Overview

In 2008, the government of the province of British Columbia broke new ground in North America by introducing a revenue-neutral carbon tax on fossil fuels. The initial rate was set at \$10/ton of CO_2 which was then increased annually by \$5 increments to reach \$30/ton in 2012. We focus on monthly diesel use which is mostly related to commercial activities. Our objective is to measure user reaction to the new tax. Exploiting the sample time series properties, we study the long run reaction via a cointegration equation, linking diesel use, its total price, and income, and the short run reaction using an error correction model (ECM).

Our research questions are as follows: first, is there a cointegration function linking diesel use to total price and income over the sample period, and if such a function exists, what is the associated long run price elasticity estimate? Second, do we find additional short run effects related to diesel price that is net of carbon tax (denoted hereafter as price net-of-carbon-tax) and to carbon tax? If such short run effects are present, do they differ? That is, is there evidence of short run carbon tax saliency? More precisely, given the long run relationship between quantity and total price of diesel, are there separate short run effects of diesel price net-of-carbon-tax and of carbon tax that can be uncovered in the dynamic adjustment part of the error correction model (ECM)? Third, given that the carbon tax increased by equal increments over a four-year period, can we observe changes in the saliency of the tax over time? To the best of our knowledge, our paper is the first to use the time series methodology (i.e. cointegration and ECM) to analyze the saliency of carbon tax applied to refined oil products, and to examine for possible time-varying effects of the latter on diesel demand.

Methods

Exploiting the sample time series properties, we study the long run reaction via a cointegration equation, linking diesel use, its total price, and income, and the short run reaction using an error correction model (ECM). Carbon tax saliency is interpreted as a short run phenomenon that shows up in the dynamic adjustment of the error correction model (ECM).

Results

First, statistical tests show the presence of unit roots in the levels of the three key variables i.e., diesel consumption per capita, diesel price, and income per capita, and the stationarity of first differences of the above series is not rejected. Second, Johansen test results conclude that there is one cointegrating relationship linking diesel consumption per capita, diesel price, and income per capita over the sample period. The application of the dynamic ordinary least squares (DOLS) method introduced by Stock and Watson (1993) to estimate the linear cointegration function yields a long run price elasticity of –0.52 estimated at the sample average. Third, the estimation of an error correction model that allows for dynamic adjustments points to additional short run effects that are associated with the introduction of the B.C. carbon tax but not with changes of price net-of-carbon-tax. Hence our results support the view that the B.C. carbon tax applied to diesel use displays saliency. Fourth, according to our parameter estimates, a 1 cent increase in carbon tax induces a one-time decrease in monthly per capita diesel sales of 4.17 litres (or 6.7% of average monthly sales over the sample period). Fifth, we find evidence of time-variation of this impact over the 2009-2012 period.

Conclusion

The main objective of a revenue-neutral carbon tax is to reduce CO_2 emissions that cause global warming. An obvious question that arises in this respect is the effectiveness of the policy instrument in light of the objective. We estimate that the B.C. carbon tax of \$30/ton CO_2 brought about a permanent 3.29% reduction in diesel use. This is however quite small if we consider Canada's commitment to reduce greenhouse gas emission by 30% in 2030 relative to 2005 emissions, as stated in the 2015 Paris agreement.

References

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