DISTRIBUTIONAL EFFECTS OF A REVENUE-NEUTRAL STEERING TAX ON ENERGY: EMPIRICAL EVIDENCE FROM SWISS HOUSEHOLD DATA

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Overview

The Swiss government has decided to phase out nuclear power and to reduce CO_2 emissions until 2020 by 20% below 1990 levels. Currently, the federal council is deciding about a more ambitious reduction target for 2030. In order to further reduce energy consumption and to achieve the reduction objectives, the federal council of Switzerland intents to replace its promotion system with a steering mechanism after 2020. The idea behind the steering tax is that various energy sources are taxed to give individuals incentives to reduce energy consumption and, hence, lower emissions in a cost-effective way. The tax revenues are afterwards redistributed to the households on a per capita basis. While the steering tax is revenue neutral on the aggregate level, the actual impact for individuals can vary considerably and distributional effects might be a concern (OECD, 2006). The objective of this paper is to analyze how the introduction of a steering tax will affect the welfare of Swiss households. In a first step, we estimate the consumption behavior of Swiss households and derive price elasticities, income elasticities and Engel curves. Subsequently, we simulate the welfare impact from the envisioned steering tax on energy and fuels for different types of households, income categories and regions.

Methods

We estimate an Exact Affine Stone Index (EASI) demand system of ten expenditure categories, including energy and transportation. The EASI demand system, suggested by Lewbel and Pendakur (2009), possesses several advantages over similar consumer demand models. First, real expenditures can be considered up to an arbitrary higher order polynomial enabling the Engel curves to assume any shape. Furthermore, interactions of demographic characteristics with prices and expenditures can be included easily. Finally, linearity in parameters and additive error terms, make empirical implementation and interpretation straightforward.

The EASI demand system is estimated by a three-stage least squares (3SLS) approach, accounting for potential endogeneity issues. Using repeated cross-sectional data from 2001 to 2011 of the Swiss Household Budget Survey (HBS), we estimate price and income elasticities as well as Engel curves. In order to capture dynamic effects, we also construct a pseudo panel from the HBS dataset by taking into account individual heterogeneity. Based on the estimation results, we simulate the welfare impact of the envisioned steering tax of the Swiss government. Moreover, we propose an alternative redistribution scheme, based on the OECD-modified equivalence scale. To compare income across different types of households, equivalence scales are applied. The welfare gains or losses are measured by computing compensating variation measures.

Results

The estimates of price elasticities show that food outside and recreation are the most price elastic categories, followed by food at home and energy. In general, most estimates are close to unit elasticity or above. An exception is the very low price elasticity of transportation. Cross-price effects are small for most expenditure categories, especially for energy and other goods. The estimated income elasticities show that food at home, energy, housing and communication are necessity goods, while food outside, clothing, housing equipment, transportation and recreation tend to be luxury goods. Comparing Engel curves of different household types reveals that there exist considerable differences in the energy and transportation spending patterns. The estimates from repeated cross-sectional data and the pseudo panel are very similar.

The results of the welfare analysis show that without redistributing tax revenues, low-income households end up with the highest welfare loss relative to their income. After a per capita redistribution of tax revenues, however, poorer households − especially families with children − are better off. The introduction of a steering tax on energy would therefore be progressive and neither harm low-income households nor families in Switzerland. The largest welfare losses experience richer households with high expenditures for energy and/or private transportation. In particular, these would be homeowners, car owners and older households. The envisioned steering tax with a per capita redistribution would reduce energy consumption by approximately 18.6 percent and transportation by 5.0 percent. The observed regional differences can be explained to a large extent by the differing composition of household types within the seven regions in Switzerland.

Conclusions

The results of the welfare analysis show that the introduction of a steering tax on energy and fuels would generate substantial distributional effects. With regard to the income distribution, we find that the steering tax would be progressive and neither harm low-income households nor families in Switzerland. Rich households are generally worse off, with the exception of households without a car. The elastic price elasticity of energy results in a substantial reduction of 18.6 percent in households' energy consumption and of 5.0 percent in private transportation after the introduction of the steering tax.

The per capita redistribution is a simple and easy to implement redistribution scheme with the desired effect, namely a considerable reduction in energy consumption. However, the distributional effects of the steering tax can be large for some households. The comparison with our alternative redistribution scheme shows that the magnitude of distributional effects would be lower, while the reductions in energy consumption and in private transportation are approximately the same as with the per capita redistribution of tax revenues. Moreover, the OECD redistribution scheme would be more in favor of single and older households.

References

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