

Tax credit for energy savings and free-ridership. Evidences from France.

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Overview

Due to global warming and the importance of the residential sector in French households' direct CO₂ emissions (34% in 2010), retrofitting the existing building stock is a major concern. Well known in the literature, the "energy efficiency gap" (Jaffe and Stavins, 1994) refers to the set of barriers preventing households from undertaking such energy saving investments. To overcome them, a lot of measures have been implemented in the 1970's after the oil crises, and more recently in the context of global warming awareness: economic incentives, such as zero rate loan, subsidies, income tax credit or non-economic incentives such as regulation and informative tools.

Tax credit has been one of the main instruments. In the US, the tax credit created by the Energy Tax Act from 1978 to 1986 has been studied in several papers (Hassett and Metcalf, 1995). There is no strong consensus on its positive effect. Especially, there is concern about potential free-ridership (Grosche and Vance, 2009). Free-ridership occurs if the subsidized household would have undertaken the energy saving activity even in the absence of the subsidy. Despite its uncertain efficiency, an important tax credit has been implemented in France since 2005. If the measure has been successful in terms of numbers of retrofitted households (4.2 million of households between 2005 and 2008), it has induced large public expenses, which makes potential free-ridership a burning issue.

This empirical paper assesses the economic and environmental efficiency of the French tax credit. On the environmental side, we assess the additional energy conservation and effective energy savings brought by the tax credit. On the economic side, we thrive to: i) determine whether retrofitting investments are triggered by the rate level or by the mere fact of implementing an incentive and if it depends on the type of household; ii) quantify the free-riding effect, and iii) to investigate the effects of the eligibility conditions on the global policy impact

Methods

This paper uses the method of revealed preferences. This method is rarely chosen due to the difficulty of getting proper data. However, when available, these data provide robust results as the analysis is based on real choices, as opposed to choice experiment methods (K. Train, 2003). The annual survey "Energy Management" supervised by ADEME, the French Agency for Environment and Energy Management provides appropriate data for a revealed preferences analysis. A renewable panel of 10000 households has been annually questioned since 2000 on their residential energy consumption and investments they have or not made in order to improve the energy efficiency of their dwelling. For those who have invested (10-15% each year), a second questionnaire details the measures and the circumstances, especially which kind of incentives they benefited from. Socioeconomic variables are also provided. We used two econometric methods to estimate the effect of tax credit on retrofitting decision and on the corresponding energy savings. Energy savings by investment and dwelling type are derived from a physical thermal model.

We have first implemented non-parametric models developed in the public policies evaluation's field (Givord, 2010). We found two natural experiments to assess the effect of tax credit on energy savings. The first one is the introduction of tax credit in 2005. People benefiting from tax credit belong to treatment group and others belong to control group. Tax credit is eligible for all households, which implies a potential self-selection bias. Therefore, given the longitudinal nature of our data, we use an approach based on panel data regressions. We used a pooled tobit model since: i) energy savings are censored data (no energy savings if no retrofitting decision), and ii) individual effects and explanatory variables may be correlated (models with random individual effects being in this case irrelevant, Greene, 2004). A second estimation focuses on a special case in which we have a clear distinction between control and treatment groups. Indeed, in 2006, the tax credit rate has been majored from 25% to 40% for some retrofitting investments only for households which have moved less than

three years ago in dwellings built before 1977. These two natural experiments enabled to compare the effects of a tax credit introduction vs. a tax credit rate level increase.

The second method we used borrows from structural econometrics. We used a choice model with three alternatives (Train, 1994): no retrofit, retrofit benefiting from tax credit, retrofit without benefiting from tax credit. The underlying utility corresponding to each alternative is a reduced form of a theoretical microeconomic model of durable good consumption. The durable good corresponds to the energy saving measure. The main choice attributes are the initial cost of investment and the future economic gains due to potential energy savings and anticipated energy prices. This model enabled us to assess the free-rider problem. Once the model is fitted, we simulate a scenario without the tax credit alternative in order to assess energy savings made by households in absence of tax credit. Then we can calculate the additional energy savings due to tax credit. We used both simple logit model and mixed logit model in order to make socioeconomic variables interact with choice attributes.

Results

Preliminary results suggest a significant positive effect on both retrofitting decision and energy savings. The comparison between the two natural experiments indicates that the introduction of the incentive has a more prominent effect than its level rate increase. The natural experiment on the marginal increase of the level rate in 2006 shows weaker effect (less than 4% increase in the probability of making an investment) than the one estimated when tax credit has been introduced in 2005 (20%-35% increase in the probability of making an investment depending on the retrofitting type).

Tax credit has been modulated as a function of the retrofitting measures. We observed that free-ridership depended on the type of energy saving measures, as well as on the level rate. Additional energy savings due to tax credit have been more than 70% of investments benefiting from tax credit for wall and roof insulation whereas it has been around 50-55% for double-glazing or renewables.

Finally, considering beneficiaries' profile thanks to mixed logit's results, interaction effects between tax credit and both income and ownership are highly significant. The French tax credit has been unable to solve the split incentives problem between owners and renters and to overcome liquidity constraints. The extension (in 2010) of tax credit eligibility to landlords remains to consider.

Conclusions

Using revealed preferences methods, regressions based on panel data and both non parametric and parametric econometrics, this paper assesses the efficiency of the French tax credit implemented in 2005. It shows that tax credit efficiency, especially free-ridership, depends on both tax credit design (level rate and conditions of eligibility on energy saving investment) and socio-economic profile of beneficiaries. Finally, it provides recommendations for future tax credit improvements.

References

- Givord Pauline, 2010, « Insee - Document recherche - Méthodes économétriques pour l'évaluation de politiques publiques ».
- Greene William H, 2004, « Fixed Effects and Bias Due to the Incidental Parameters Problem in the Tobit Model », *Econometric Reviews*, vol. 23, n° 2, p. 125–147.
- Grosche Peter and Vance Colin, 2009, « Willingness to Pay for Energy Conservation and Free-Ridership on Subsidization: Evidence from Germany », *Energy Journal*, vol. 30, n° 2, p. 135–153.
- Hassett Kevin A. and Metcalf Gilbert E., 1995, « Energy tax credits and residential conservation investment: Evidence from panel data », *Journal of Public Economics*, vol. 57, n° 2, p. 201–217.
- Jaffe Adam B. and Stavins Robert N., 1994, « The energy-efficiency gap What does it mean? », *Energy Policy*, vol. 22, n° 10, p. 804–810.
- Train Kenneth, 2003, *Discrete choice methods with simulation*, Cambridge University Press.
- Train Kenneth E., 1994, « Estimation of net savings from energy-conservation programs », *Energy*, vol. 19, n° 4, p. 423–441.