Free-Riding on Energy Efficiency Subsidies: the Case of Natural Gas Furnaces in Canada

Executive Summary

Research has shown that home energy efficiency improvements are among the most cost effective options for significantly reducing greenhouse gas emissions and improving energy efficiency. As a result, many governments have offered home retrofit subsidies, in the form of grants, low-interest loans, or tax rebates, to stimulate the adoption of energy efficient products.

However, one of the drawbacks of such programs is that there is no way to distinguish between the target group – homeowners who use the subsidies to improve energy efficiency – and those who were planning to undertake a retrofit anyway and simply pocket the cash. Homeowners in the latter group are referred to as free-riders, since they do not change the efficiency level of their house beyond what they would have done without the subsidy. Free-riding is a major source of inefficiency in program design, since (i) taxation imposes a distortionary cost on the economy, and (ii) given limited government budgets, money spent on free-riders is money that is not available to effect real change.

To date, a number of economic studies have sought to quantify the extent of free-riding in home retrofit subsidy programs, mostly in the U.S. and Europe. Typically these studies indicate that the proportion of subsidies flowing to free-riders is high – anywhere from 40 to 90 percent of the total funds dispersed by the programs under study.

Our focus in this paper is on evaluating combined federal-provincial home retrofit programs in force in Canada between April 1, 2007 and March 31, 2011. Focusing on natural gas furnaces, we use a large administrative dataset with information on more than 300,000 participating households in British Columbia, Alberta, Saskatchewan, Manitoba, and Ontario. With this information, we estimate a discrete-choice statistical model to determine the sensitivity of households' choices to changes in subsidy rates and operating costs of the various furnace options. Using our estimated model, we then simulate a counterfactual scenario in which retrofit grants are not offered. By comparing this scenario with actual furnace choices, we are able to estimate what proportion of high efficiency natural gas furnaces purchased during the sample period were due to the retrofit grants and what proportion would have occurred anyway.

Our simulations suggest that around 50 percent of the subsidies were received by homeowners that would have adopted the high efficiency furnaces during the sample period even without the subsidy. Our simulations also suggest that over the long term (at the time of eventual furnace replacement), about 80 percent of homeowners would have chosen an identical furnace even without a subsidy.

We extend our analysis in two other directions. First, we couple the administrative database with census information on income. We find that the program targets middle- and high-income households, and excludes low-income households, primarily because high-income households are more likely than low-income households to own their home.

Second, we estimate the impact of the program on greenhouse gas emissions. Our findings suggest that the program reduced emissions by around 4 Mt CO_2 in total (over the life of the furnaces). Then, comparing the CO_2 reductions with total subsidy disbursements, we find that the program had a cost effectiveness of between $70 and $110 per tonne of CO_2, depending on assumptions. These costs are very high compared with other available options for emissions reduction, often in the range of $5 - $30 per tonne of CO_2.

Our paper builds on the prior literature in at least three respects. First, our analysis is based on a large administrative database. In contrast, much of the prior literature uses much smaller datasets, and these are often derived from surveys rather than from administrative records. Second, our dataset covers a program that offered financial incentives of varying size, between regions and over time, while the basic structure of the program remained constant. This variation provides us with an effective means to isolate the effect of subsidies on retrofit choices. Third, we identify a significant difference between the short- and long-run measures of free-riding. This difference indicates that many recipients who appear to be using the subsidies to increase the long-run energy efficiency of their homes are in fact simply bringing forward the replacement date for a change which they would have made eventually anyway.

In the end, we conclude that the combined federal- provincial retrofit subsidy program in Canada during the period of study was characterized by a high rate of free riding and therefore it represented an expensive way to reduce greenhouse gas emissions. We also find that the program was regressive, as the grants were predominantly received by higher income households. For these reasons, we believe that this type of program is not the most effective way for governments to encourage adoption of high-efficiency technologies and to reduce greenhouse gas emissions.