Anna Alberini, Andrea Bigano and Marco Boeri

FREE-RIDING OPPORTUNITIES: ENERGY EFFICIENCY INCENTIVES AND ITALIAN HOMEOWNERS

Anna Alberini: AREC, 2200 Symons Hall, University of Maryland, College Park, MD 20742, USA; ph 001 301 405-1267; aalberini@arec.umd.edu
Andrea Bigano: FEEM, Corso Magenta 63, 20123 Milano, Italy; ph +39 02 520 36988; andrea.bigano@feem.it
Marco Boeri: Queen's University, Belfast, Northern Ireland; marco.boeri2007@gmail.com

Overview

In recent years, incentives such as rebates and tax credits have been offered to homeowners in the US and several European countries to encourage energy-efficiency home renovations and appliance replacement. One concern with these policies, however, is that they might result in free-riding behavior, which occurs when the economic agents targeted by the policy take the incentives, but would have done the home renovations or appliance replacement anyway (Grosche and Vance, 2009; Joskow and Marron, 1992; Malm, 1996). Clearly, if that is the case, the policy is cost-ineffective (i.e., the cost of each ton of carbon emissions reduced is very high).

Is free riding widespread in the presence of incentives, and is always as severe as these earlier studies have found? In this paper, attention is focused on a tax deduction policy for homeowners hat has been in place in Italy since January 2007.

Effective from January 1, 2007, a new national law allowed homeowners to deduct from their income taxes up to 55% of the expenses sustained to implement certain types of energy efficiency renovations or source of renewable energy in existing homes (commercial buildings). These include the replacement of the heating system, attic and wall insulation, windows and doors replacement, the entire building envelope, and solar panels to be used for heating water (photovoltaics are specifically excluded because addressed by other legislation). ENEA (the Italian Renewable Energy Agency) (2008, 2009, 2010) reports that there were 106,000 filings for the tax deduction for tax year 2007, 248,000 for tax year 2008 and 237,000 for tax year 2009. ENEA (2010) reports that in 2009, 49% of the filings were for windows and doors replacement, 30% for heating system replacement, 15% for solar panels, 4% for attic or floor insulation ("horizontal" in the language of the law), and 2% for "vertical" wall insulation.

Methods

We examine the effect of the policy by looking at home renovations and appliance replacements of Italian households from 1997 to 2009, a documented in 13 waves of the Italian Consumer Expenditure Survey (I-CEX). Our dataset is multi-year cross-sections, covers a total of 13 years and about 23,000 households each year. I-CEX collects information about the most recent energy bills, and "regular" and "extraordinary" home maintenance expenditures incurred in the last three months prior to the interview, including the replacement of heating system, windows and doors, and insulation and related renovations. Clearly, these are the very same renovations targeted by the tax-deduction incentive policy, and so we can examine whether they have become more frequent when the incentive is present.

Our goal is to use these data to estimate the regression equations:

$$\Pr(y_{it}^{(k)} = 1) = \Phi(\mathbf{x}_{it}\boldsymbol{\alpha} + GasHeat_{it} \cdot \boldsymbol{\beta} + \mathbf{D}_t\boldsymbol{\gamma}) \quad (1)$$

where (k) denotes the type of energy-efficiency renovation covered by the policy (e.g., heating system, doors and windows, etc.), y is a dummy that takes on a value of one of the renovation was done in the three months prior to the interview, *i* denotes household and *t* the year, and Φ( ) denotes the cdf of the standard normal distribution.

Vector **x** includes determinants of investment and controls, such as energy prices, heating and cooling degree days, dwelling characteristics, household characteristics and month of the survey. Importantly, **x** includes economy-wide

factors (e.g., a recession) and conditions of the real estate market that might affect a household's propensity to invest in its home.

D is a vector of year dummies and/or a dummy for whether the incentive policy is in place. If the tax deduction policy has had no effect on investment (which suggests that there is free-riding), we would expect the coefficient on the policy dummy to be statistically insignificant.

We note that equation (1) controls for the choice of heating fuel through dummy GasHeat (which is equal to 1 if the household uses piped gas, and 0 for all other fuels). We treat the type of heating system as endogenous and for this reason, following Evans and Schwab (1995), we estimate a bivariate probit model where the first equation explains energy-efficiency renovation (k) conditional on all regressors and HeatType, and the second equation explains HeatType as a function of instruments, including one identifying instrument. Our identifying instrument is a proxy for the availability of network gas at the home of the respondent, which we construct as (length of the gas pipelines in the Region[1] of residents)×(whether the respondent lives in a city).

Results and Conclusions

Our sample will be restricted to the homeowners in the I-CEX, since renters are unlikely to undertake building renovations. We find that our bivariate probit model does an excellent job of predicting whether a home is served by piped gas heat, with all instruments, and especially our identifying instrument, being very strong. We also find that the decision to replace the heating system or windows and doors is positively associated with gas prices, negatively associated with employment and sales on the real estate market, and that the coefficient on the policy is statistically insiginificant. More work, however, is needed before these results can be viewed as definitive.

References

ENEA (2008), Le detrazioni fiscali del 55% per la riqualificazione energetica del patrimonio edilizio esistente nel 2007, Rome, Italy, http://efficienzaenergetica.acs.enea.it/doc/rapporto_2007.pdf

ENEA (2009), Le detrazioni fiscali del 55% per la riqualificazione energetica del patrimonio edilizio esistente nel 2008, Rome, Italy, http://efficienzaenergetica.acs.enea.it/doc/rapporto_2008.pdf

ENEA (2010), Le detrazioni fiscali del 55% per la riqualificazione energetica del patrimonio edilizio esistente nel 2009, Rome, Italy, http://efficienzaenergetica.acs.enea.it/doc/rapporto_2009.pdf

Evans, William N. and Robert Schwab (1995), "Finishing High School and Starting College: Do Catholic Schools Make a Difference?" *Quarterly Journal of Economics*, CX(4), 941-974.

Joskow, P.L. and D.B. Marron (1992), "What Does a MegaWatt Really Cost? Evidence from Utility Conservation Programs," *The Energy Journal*, 13, 41-73.

Malm, E. (1996), "An Action-based Estimate of the Free-rider Fraction in Electric Utility DSM Programs," *The Energy Journal*, 25, 19-44.

Grösche, P. and C. Vance (2009), "Willingness-to-Pay for Energy Conservation and Free-ridership on Subsidization: Evidence from Germany," *The Energy Journal*, 30, 141-160.

[1] In Italy, a Region is a jurisdiction with authority similar to that of a US State, a Canadian Province, or a German Länder. There are a total of 21 Regions in Italy.