Does Retrofitted Insulation Reduce Household Energy Use? Theory and Practice

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EXECUTIVE SUMMARY

Several countries have introduced large-scale, subsidised retrofit insulation schemes designed to reduce household energy use and to improve housing conditions. Each of New Zealand, Australia, USA, Canada and UK has introduced such a scheme since the mid-2000s. This study evaluates the impact on household energy use of New Zealand's Warm Up New Zealand: Heat Smart (WUNZ:HS) scheme, which subsidised the costs to homeowners of retrofitting insulation and installing clean heat devices.

We present background material regarding the scheme and outline a simple theoretical model of household energy choice. We then estimate a difference-in-difference model of the energy savings that result from each of the insulation and clean heat treatments. Energy use in treated houses is compared to the average energy use of from one to ten control houses before and after insulation and clean heat treatment. Control houses are matched to treated houses across a wide range of house characteristics. The study uses a sample of over 12,000 treated houses with over 325,000 house-month observations.

We find that there are statistically significant reductions in metered household energy consumption as a result of insulation treatment. Annual savings in electricity and in total metered energy (electricity plus reticulated gas) from retrofitted insulation are in the order of 2%. Insulation treatment is most effective in saving metered energy as (monthly average) temperatures become colder. Installation of efficient clean heating in the form of heat pumps is found to increase electricity use by approximately 1.6% but to

leave total metered energy use approximately unchanged. Some of the increased energy use following heat pump installation appears to be due to the use of heat pumps as air conditioning units in warmer months.

A comparison of our results with ex ante engineering estimates of energy savings supports a ‘take-back’ or ‘rebound’ effect, whereby households use energy efficiency savings to boost internal temperatures. Estimated energy savings are approximately one-third of those modelled using engineering estimates that ignore the take-back effect. This finding is consistent with health benefits (found in related studies) that accrue from the treatments leading to warmer houses.