Appendix to

Longer-Run Evidence on Whether Building Energy Codes Reduce Residential Energy Consumption

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In this appendix, I briefly discuss the potential for alternative approaches that control explicitly for residence age when estimating the overall energy code effects in Section 3.1 of the main paper. I report selected results and explain why the specifications reported in the main text are preferred.

In principle, one could control for age in specification (1). But with the data set being used here, there is too much collinearity between age and year to reliably distinguish them and, more important, to estimate the effect of the building code. The BCCRs are always "older" than the ACCRs in each year. This is due to the fact that only one energy code change is under study. A better data set to separately identify age and vintage effects in this way would include residences built over many years and spanning more than one energy code change. The data set used in Levinson (2014) provides an example. In contrast, the strength of the quasi-experiment being used here—with residences having been built just before or after the code change—is that the BCCRs and ACCRs are very close in age, yet subject to different building codes.

It is, however, possible to eliminate the collinearity and account for age with an alternative specification that drops the time trend and controls for month-of-year and weather. This model would take the form

$$\begin{aligned} Y_{ijt} &= \delta CodeChange_i + \boldsymbol{\gamma AGE}_{it} + \boldsymbol{\beta X}_i + f(ACDD_t, ACDD_t) \\ &\quad + \boldsymbol{Month}_t + \boldsymbol{Zipcode}_i + \varepsilon_{it}. \end{aligned}$$

The difference between this model and specification (1) is the inclusion of age categories and month-year dummies are replaced with month-of-year dummies and weather variables, where ACDD and AHDD enter as quadratics. Table A1 reports the estimated coefficients of interest on the code change variable for models with the left-hand-side variable of electricity, natural gas, or the combined energy measure. The table also reports the estimated percentage differences that are comparable to those in Table 1. These results suggest statistically significant and substantially larger effects than those presented in the main text.

Table A1

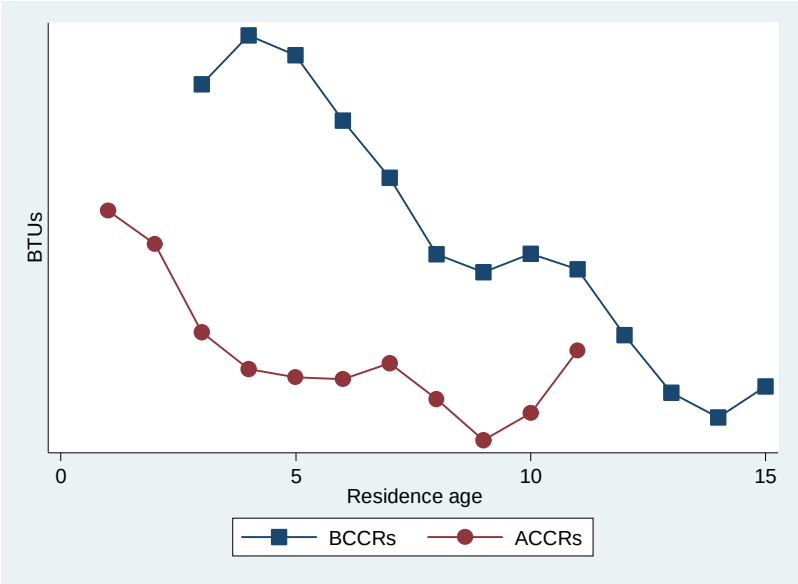
	Electricity	Natural gas	Combined
Code Change	-75.718^{***}	-4.375^{***}	-0.695^{***}
	(16.035)	(0.552)	(0.081)
Percent difference	-7.2%	-20.5%	-12.1%

*** indicates statistical significance at the 99% level

The results presented in Table A1 are reasonable to the extent that there is no time trend remaining after accounting for the month-of-year and weather effects. For if a time trend remains, the models may be subject to omitted variables bias that erroneously attributes building codes effects to what are essentially comparisons across residences for consuming energy in different years, but are the same age. Unfortunately, the evidence suggests that omitting the time trend is problematic.

Figure A1 plots the relative BTU consumption for pre- and post-code change residences at different ages. Specifically, the figure plots the residuals of the model above excluding AGE_i and $CodeChange_i$, and taking averages across BCCRs and ACCRs at each age. Note that the relative magnitudes are what matters and not the scaling. Not only is consumption going down with age (perhaps because of the omitted time trend), the curves share a very similar pattern with the ACCRs a few years "younger." Shifting the ACCRs to the right would bring similar years of consumption into alignment for the two groups. In effect, the similarity of the pattern suggests that omitting the time trend is problematic when estimating the effect of the building code. This occurs here perhaps because of the small differences in the age of the residences, which for reasons described above provides the strength of the preferred approach taken in the main text of the paper.

Figure A1



Reference

Levinson, Arik. 2014. How Much Energy Do Building Energy Codes Really Save? Evidence From California. NBER Working Paper 20797, National Bureau of Economic Research, Cambridge, MA.