

Can We Predict Residential Energy Usage with IRS Data?

A Study On 2010 Electric and Gas Usage Across Chicago Zip Codes

Aahil Navroz, Joseph Williams, Qi Suqian

April 2024

Abstract

Introduction

Motivation and Goals

Residential energy usage prediction is a complex and highly studied challenge. We do not seek to outperform current methods, rather to present and evaluate a novel method of predicting residential (household) energy usage: using self reported characteristics from the taxpayers within! As energy abatement and efficiency becomes increasingly critical due to climate change, we seek to present taxpayer data as a (potentially) relevant tool policymakers can use for determining residential energy policy. Thus, our goals are:

- *Effectively* model residential energy usage using IRS data.
- Analyze effectiveness of IRS data within our model, and to determine what overall taxpayer qualities **In particular Residential Energy Credits** correspond with real energy usage and reduction.

Background

Every April 15, millions of Americans submit their US Individual Income Tax Return Form 1040 [Reference Docs > Fig A] to the Internal Revenue Service (IRS). This is an important administrative and even cultural event within the country, and is also a significant source of demographic and personal finance information. A significant portion of taxpayers further include Form 5695, ‘Residential Energy Credits’ [Reference Docs > Fig B]. These tax credits were added to the Internal Revenue Code in 2005 by the Energy Policy Act of 2005 with the goal of rewarding taxpayers for their efforts towards energy efficiency. Therefore a secondary goal of our project is to *contextualize the role of household energy credits* in residential energy prediction using IRS data and by doing so create some framework for further study on the real effect of energy tax credits on abatement.

Methods

Our dataset is

Results

Conclusion

Appendix

Figures

Fig1 [Above]: *Average residential energy tax credits claimed where plotted circle radius corresponds to average adjusted gross income (AGI)*

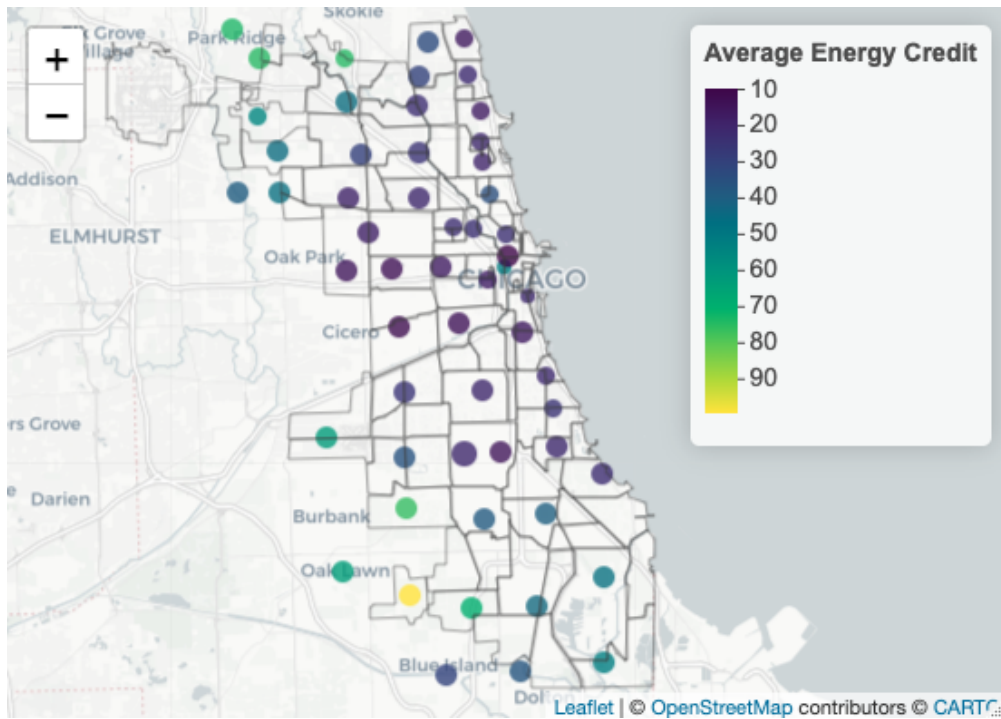


Fig2 [Above]: *Average residential energy tax credits claimed where plotted circle radius corresponds to Therms/SQFT*

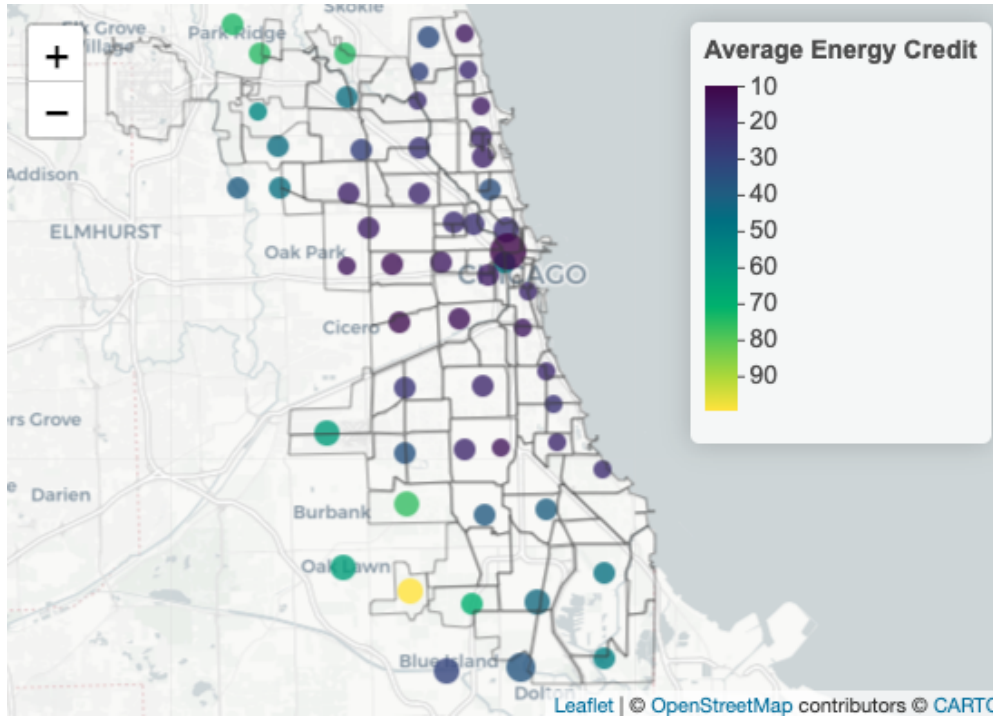


Fig3 [Above]: *Average residential energy tax credits claimed where plotted circle radius corresponds to KWH/SQFT*

Reference Tables

[Table A] *IRS Codebook*

Variable	Description
STATE	The State associated with the ZIP code
YEAR	Tax year of origin for published data
N1	Number of returns
MARS2	Number of joint returns
PREP	Number of returns with paid preparer's signature
N2	Number of individuals
A00100	Adjust gross income (AGI)
N00200	Number of returns with salaries and wages
A00200	Salaries and wages amount
N00300	Number of returns with taxable interest
A00300	Taxable interest amount
N00600	Number of returns with ordinary dividends
A00600	Ordinary dividends amount
N00650	Number of returns with qualified dividends
A00650	Qualified dividends amount
N00900	Number of returns with business or professional net income (less loss)
A00900	Business or professional net income (less loss) amount
N01000	Number of returns with net capital gain (less loss)
A01000	Net capital gain (less loss) amount
N01400	Number of returns with taxable individual retirement arrangements distributions
A01400	Taxable individual retirement arrangements distributions amount

Variable	Description
N01700	Number of returns with taxable pensions and annuities
A01700	Taxable pensions and annuities amount
SCHF	Number of farm returns
N02300	Number of returns with unemployment compensation
A02300	Unemployment compensation amount
N02500	Number of returns with taxable Social Security benefits
A02500	Taxable Social Security benefits amount
N03300	Number of returns with Self-employed (Keogh) retirement plans
A03300	Self-employed (Keogh) retirement plans amount
N04470	Number of returns with itemized deductions
A04470	Total itemized deductions amount
N18425	Number of returns with State and local income taxes
A18425	State and local income taxes amount
N18450	Number of returns with State and local general sales tax
A18450	State and local general sales tax amount
N18500	Number of returns with real estate taxes
A18500	Real estate taxes amount
N18300	Number of returns with Total taxes paid
A18300	Total taxes paid amount
N19300	Number of returns with Home mortgage interest paid
A19300	Home mortgage interest paid amount
N19700	Number of returns with Total charitable contributions
A19700	Total charitable contributions amount
N04800	Number of returns with taxable income
A04800	Taxable income amount
N09600	Number of returns with alternative minimum tax
A09600	Alternative minimum tax amount
N07100	Number of returns with total tax credits
A07100	Total tax credits amount
N07180	Number of returns with child and dependent care credit
A07180	Child and dependent care credit amount
N07260	Number of returns with residential energy tax credit
A07260	Residential energy tax credit amount
N59660	Number of returns with earned income credit
A59660	Earned income credit amount
N59720	Number of returns with excess earned income credit
A59720	Excess earned income credit (refundable) amount
N11070	Number of returns with refundable child tax credit or additional child tax credit
A11070	Refundable child tax credit or additional child tax credit amount
N06500	Number of returns with income tax after credits
A06500	Income tax after credits amount
N10300	Number of returns with tax liability
A10300	Total tax liability amount
N11901	Number of returns with tax due at time of filing
A11901	Tax due at time of filing amount
N11902	Number of returns with overpayments refunded
A11902	Overpayments refunded amount
NUMDEP	Number of dependents [variable unavailable after '17]

Reference Docs

[Fig A] Below: *IRS Form 1040*

Form 1040		Department of the Treasury—Internal Revenue Service		U.S. Individual Income Tax Return 2009		(99)	IRS Use Only—Do not write or staple in this space.	
Label (See instructions on page 14.) Use the IRS label. Otherwise, please print or type.	L A B E L H E R E	For the year Jan. 1–Dec. 31, 2009, or other tax year beginning , 2009, ending , 20		OMB No. 1545-0074				
		Your first name and initial		Last name		Your social security number		
		If a joint return, spouse's first name and initial		Last name		Spouse's social security number		
		Home address (number and street). If you have a P.O. box, see page 14.		Apt. no.		You must enter your SSN(s) above.		
		City, town or post office, state, and ZIP code. If you have a foreign address, see page 14.				Checking a box below will not change your tax or refund.		
Presidential Election Campaign		Check here if you, or your spouse if filing jointly, want \$3 to go to this fund (see page 14)				<input type="checkbox"/> You <input type="checkbox"/> Spouse		
Filing Status		1 <input type="checkbox"/> Single 2 <input type="checkbox"/> Married filing jointly (even if only one had income) 3 <input type="checkbox"/> Married filing separately. Enter spouse's SSN above and full name here. ▶ 4 <input type="checkbox"/> Head of household (with qualifying person). (See page 15.) If the qualifying person is a child but not your dependent, enter this child's name here. ▶ 5 <input type="checkbox"/> Qualifying widow(er) with dependent child (see page 16)						
Exemptions		6a <input type="checkbox"/> Yourself. If someone can claim you as a dependent, do not check box 6a b <input type="checkbox"/> Spouse c Dependents: (1) First name Last name (2) Dependent's social security number (3) Dependent's relationship to you (4) <input checked="" type="checkbox"/> If qualifying child for child tax credit (see page 17) If more than four dependents, see page 17 and check here <input type="checkbox"/> d Total number of exemptions claimed						
Income		7 Wages, salaries, tips, etc. Attach Form(s) W-2 7 8a Taxable interest. Attach Schedule B if required 8a 9a Ordinary dividends. Attach Schedule B if required 9a b Qualified dividends (see page 22) 9b 10 Taxable refunds, credits, or offsets of state and local income taxes (see page 23) 10 11 Alimony received 11 12 Business income or (loss). Attach Schedule C or C-EZ 12 13 Capital gain or (loss). Attach Schedule D if required. If not required, check here <input type="checkbox"/> 13 14 Other gains or (losses). Attach Form 4797 14 15a IRA distributions 15a b Taxable amount (see page 24) 15b 16a Pensions and annuities 16a b Taxable amount (see page 25) 16b 17 Rental real estate, royalties, partnerships, S corporations, trusts, etc. Attach Schedule E 17 18 Farm income or (loss). Attach Schedule F 18 19 Unemployment compensation in excess of \$2,400 per recipient (see page 27) 19 20a Social security benefits 20a b Taxable amount (see page 27) 20b 21 Other income. List type and amount (see page 29) 21 22 Add the amounts in the far right column for lines 7 through 21. This is your total income ▶ 22						
Adjusted Gross Income		23 Educator expenses (see page 29) 23 24 Certain business expenses of reservists, performing artists, and fee-basis government officials. Attach Form 2106 or 2106-EZ 24 25 Health savings account deduction. Attach Form 8889 25 26 Moving expenses. Attach Form 3903 26 27 One-half of self-employment tax. Attach Schedule SE 27 28 Self-employed SEP, SIMPLE, and qualified plans 28 29 Self-employed health insurance deduction (see page 30) 29 30 Penalty on early withdrawal of savings 30 31a Alimony paid b Recipient's SSN ▶ 31a 32 IRA deduction (see page 31) 32 33 Student loan interest deduction (see page 34) 33 34 Tuition and fees deduction. Attach Form 8917 34 35 Domestic production activities deduction. Attach Form 8903 35 36 Add lines 23 through 31a and 32 through 35 36 37 Subtract line 36 from line 22. This is your adjusted gross income ▶ 37						

For Disclosure, Privacy Act, and Paperwork Reduction Act Notice, see page 97.

Cat. No. 11320B

Form **1040** (2009)

[Fig B] Below: *IRS Form 5695: Residential Energy Tax Credit*

Form 5695 Department of the Treasury Internal Revenue Service Name(s) shown on return	Residential Energy Credits ▶ See instructions. ▶ Attach to Form 1040 or Form 1040NR.	OMB No. 1545-0074 <div style="border: 1px solid black; padding: 2px; display: inline-block;"> 2009 Attachment Sequence No. 158 </div> Your social security number
---	---	---

Before You Begin Part I: Figure the amount of any credit for the elderly or the disabled you are claiming.

Part I Nonbusiness Energy Property Credit (See instructions before completing this part.)		
1 Were the qualified energy efficiency improvements or residential energy property costs for your main home located in the United States? (see instructions) ▶	1	<input type="checkbox"/> Yes <input type="checkbox"/> No
Caution: If you checked the "No" box, you cannot claim the nonbusiness energy property credit. Do not complete Part I.		
2 Qualified energy efficiency improvements (see instructions).		
a Insulation material or system specifically and primarily designed to reduce the heat loss or gain of your home	2a	
b Exterior windows (including certain storm windows) and skylights	2b	
c Exterior doors (including certain storm doors)	2c	
d Metal roof with appropriate pigmented coatings, or asphalt roof with appropriate cooling granules, that are specifically and primarily designed to reduce the heat gain of your home, and the roof meets or exceeds the Energy Star program requirements in effect at the time of purchase or installation	2d	
3 Residential energy property costs (see instructions).		
a Energy-efficient building property	3a	
b Qualified natural gas, propane, or oil furnace or hot water boiler	3b	
c Advanced main air circulating fan used in a natural gas, propane, or oil furnace	3c	
4 Add lines 2a through 3c	4	
5 Multiply line 4 by 30% (.30)	5	
6 Maximum credit amount. (If you jointly occupied the home, see instructions)	6	\$1,500
7 Enter the smaller amount of line 5 or line 6	7	
8 Enter the amount from Form 1040, line 46, or Form 1040NR, line 43	8	
9 Enter the total, if any, of your credits from Form 1040, lines 47 through 50, and Schedule R, line 24; or Form 1040NR, lines 44 through 46	9	
10 Subtract line 9 from line 8. If zero or less, stop . You cannot take the nonbusiness energy property credit	10	
11 Nonbusiness energy property credit. Enter the smaller of line 7 or line 10	11	

For Paperwork Reduction Act Notice, see instructions. Cat. No. 13540P **Form 5695** (2009)