Do Tax Credits Increase Heat Pump Adoption?

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Abstract

Economists have long argued that many recipients of clean energy subsidies are likely non-additional, but there are relatively few empirical studies. This paper uses U.S. monthly shipment data to test whether income tax credits increase heat pump adoption. When the tax credit increased from $300 to $2000 in January 2023, there was no increase in shipments. Then, when the tax credit expired in January 2026, there was no decrease in shipments. This lack of a discernible relationship persists after controlling for seasonal patterns, energy prices, and housing starts. The evidence suggests that most recipients of the $2000 tax credit were non-additional, and would have installed a heat pump even without the subsidy. The paper discusses implications for policy design, economic efficiency, and cost-effectiveness. Finally, the paper points out that heat pump shipments continue at a strong pace thus far in 2026 even without the tax credit, with large benefits for the environment.

Key Words: Climate Change, Fossil Fuels, Home Heating, Energy Efficiency, Fuel Substitution, Inframarginal Recipient, Non-Additional Recipient, Tax Expenditures

JEL: H23, Q41, Q42, Q48, Q54

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1 Introduction

Economists agree that pricing emissions directly would be the most efficient approach to reduce the negative externalities from fossil fuels. Instead, the dominant approach, particularly in the United States, has been to subsidize clean energy alternatives, including solar panels, electric vehicles, and heat pumps. One of the disadvantages of the subsidy approach, however, is that many subsidy recipients may be non-additional, getting paid for something they would have done regardless.

This paper uses monthly shipment data to test whether U.S. federal income tax credits increase heat pump adoption. The study takes advantage of large recent policy changes. Starting January 1, 2023 a household installing a heat pump could claim a tax credit of $2000, up from $300 in previous years. This $2000 tax credit remained throughout 2023-2025. The credit then expired at the end of 2025, going from $2000 to $0 overnight.[1]

We find no evidence that the $2000 tax credit increased heat pump adoption. When the tax credit increased from $300 to $2000, there was no increase in heat pump shipments. Then, when the tax credit expired, there was no decrease in heat pump shipments. This lack of evidence of a relationship between tax credits and heat pump adoption is clear in the raw data and persists after controlling for seasonal patterns, energy prices, and housing starts.

The evidence suggests that most recipients of the $2000 tax credit were non-additional. We suspect that most recipients did not learn about the tax credit until they did their taxes, months after installing a heat pump. Indeed, ancillary evidence from Google Trends

[1] The $2000 tax credit was part of the Inflation Reduction Act, which Bistline et al. (2023) describe as the "largest U.S. federal response to climate change to date", authorizing $40+ billion in clean energy tax credits for U.S. households, including this tax credit for residential air-source heat pumps. See `https://www.irs.gov/prior-year-forms-and-instructions` for prior year forms and instructions for Form 5695 "Residential Energy Credits" including year-by-year credit limits and other information.

suggests that the heat pump tax credit is not well known, even compared to other clean energy tax credits. Non-additional recipients reduce cost effectiveness because the government still must fund the subsidy, even when it is going to recipients for whom the policy results in no emissions reduction.

This is not an argument against heat pumps. To the contrary, heat pumps remain the most viable path for reducing fossil fuel consumption from residential space and water heating (e.g. National Academies, 2021), and this argument becomes even stronger as the U.S. electric grid becomes cleaner (Holland et al., 2020). But the results do corroborate the widely-held view among economists that pricing negative externalities directly would be a more effective way to encourage the adoption of clean energy technologies.

There may also be ways to make subsidies and other second-best policies more effective. The tax credit for electric vehicles was made available at the point-of-sale starting in 2024, and a similar approach could be used with heat pumps. As we discuss, there may also be ways to improve marketing and publicity. Subsidies are likely to be most effective at encouraging technology adoption when they are salient to buyers, so anything that can be done to make this information more available is likely to increase cost effectiveness.

Economists have long pointed out that many recipients of clean energy subsidies are likely to be non-additional (e.g. Joskow and Marron, 1992; Metcalf, 2009; Langer and Lemoine, 2022). Sallee (2025) writes, for example, "For subsidies targeting mature technologies like wind, solar, and EVs, the welfare costs associated with funding transfers can become a meaningful fraction of the total welfare effect of the policy because a large majority of the revenue is going to inframarginal recipients."

Although non-additionality has been widely discussed, there are relatively few empirical studies. Previous papers have examined subsidies for conventional hybrid vehicles (Chandra et al., 2010; Gallagher and Muehlegger, 2011; Sallee, 2011), electric vehicles (DeShazo et al., 2017; Muehlegger and Rapson, 2022; Allcott et al., 2024), rooftop solar (Hughes and Podolefsky, 2015), energy-efficiency (Boomhower and Davis, 2014; Houde and Aldy, 2017), and environmental offsets (e.g. Calel et al., 2025; Aspelund and Russo, forthcoming), but there has been little previous analysis of heat pumps.

Probably most similarly, Borenstein and Davis (2025) uses tax data to show that U.S. clean energy tax credits have gone predominantly to higher-income tax filers. The paper also plots annual aggregate data on the deployment of heat pumps, solar panels, and electric vehicles, juxtaposed against changes in the availability of tax credits. This paper extends Borenstein and Davis (2025) by focusing on the more recent $2000 tax credit including its expiration at the end of 2025, using monthly rather than annual data, and incorporating a regression analysis to control for seasonal patterns and energy prices.

2 Graphical Evidence

Figure 1 plots U.S. monthly shipments of air-source heat pumps before and after the beginning and end of the $2000 tax credit. These data come from the Air Conditioning, Heating, and Refrigeration Institute (AHRI), a trade association representing more than 90% of the U.S. heating and air conditioning equipment market. AHRI makes these data available at the national level only, not for U.S. regions or states.

The tax credit increases from $300 to $2000 on January 1, 2023, but there is no evidence of an increase in shipments. Then, the tax credit expires on January 1, 2026, but there is no evidence of a decrease in shipments. Thus, in neither case is there graphical evidence that the tax credit matters for heat pump shipments. There is also no evidence of anticipation in the final months of 2025. With the tax credit expiring, we might have expected a surge in installations at the end of 2025, but this does not appear to have happened.

These data describe shipments, not installations, so it is possible that the pattern would be different for installations. Still, it is striking that there seems to be no relationship between the tax credit and shipments. For example, even in February 2026, March 2026, and April 2026, there continues to be no evidence of a decrease. This is not what one would have expected if installations had declined sharply at the beginning of the year.

Figure 2 presents placebo tests using January 2024 and January 2025. The $2000 tax credit was in place continuously 2023-2025, so there was no change in the tax credit at those times, and so we should not expect to see a change in shipments driven by the tax credit. Indeed, the broader pattern is quite similar to Figure 1, with a pronounced winter-to-spring ramp in shipments in all years. Interestingly, the year with the strongest winter-to-spring ramp is 2026, with March 2026 shipments exceeding December 2025 shipments by 220,000 units (shown in Figure 1). This is not what you would expect if losing the tax credit were hurting demand.

3 Regression Estimates

Thus, the graphical evidence shows no increase when the $2000 tax credit started, and no decrease when the $2000 tax credit expired. Of course, it is prudent to be cautious when making comparisons over time. There could be offsetting factors in early 2023 that decreased demand and/or offsetting factors in early 2026 that increased demand. In this section, we move to a regression framework to control for seasonality, energy prices, and housing starts. We cannot rule out the possibility that there are additional omitted variables, but the regression allows us to assess the sensitivity of the results to these controls.

Table 1 reports regression estimates. The sample includes monthly data from January 2021 until April 2026, a total of 64 observations. We do not have a strong view about whether the dependent variable should be in levels or logs, so we present both versions. The independent variable of interest in all columns is 1($2000), an indicator variable for the 36 months (2023, 2024, and 2025) when the $2000 U.S. tax credit was available for heat pumps.

Consistent with the graphical evidence, there is no evidence that the $2000 tax credit increased heat pump shipments. In column (1) the $2000 tax credit is associated with a 26,400 unit decrease in monthly heat pump shipments. This is an 8% decrease relative to mean monthly shipments of 328,000. Similarly, the log specification in column (5) reveals a 9% decline in heat pump shipments. Neither of these estimates are statistically different from zero.

In columns (2) and (6) we add month-of-year fixed effects. These controls are potentially important because there is a pronounced seasonal pattern in heat pump shipments. During our sample period, average shipments per month (in thousands) by season were: spring (369), summer (376), fall (300), and winter (271). This spring/summer peak reflects the seasonality of new home construction and the timing of heat pump replacements and other retrofits. Adding month-of-year fixed effects to the regression increases the R^2 and shrinks the standard errors, but has little impact on the point estimates.

Columns (3) and (7) additionally control for U.S. monthly average residential electricity prices and Henry Hub natural gas prices, both normalized to reflect year 2026 dollars. We included these controls because previous research has found that energy prices are an important determinant of heat pump adoption (Davis, 2024; Anderson and Kirkpatrick, 2024). Adding these controls has only a small effect on the point estimates.

Finally, columns (4) and (8) control for housing starts. Heat pumps are commonly installed in new homes, particularly in southeastern states so broader patterns in new home construction are relevant and can be controlled for explicitly. Adding this control makes the point estimates modestly more negative.

Thus all eight point estimates are negative. We do not interpret this as the tax credit causing a decline in heat pump shipments. There is no reasonable economic argument why an available tax credit would reduce heat pump shipments. Instead, the negative point estimates likely reflect additional omitted variables. At the end of the day, identification here relies heavily on comparing the period 2023-2025 to the months before and after, so there is considerable scope for unmodeled changes over time to be biasing these estimates.

Instead, we interpret these results as providing no evidence that the $2000 tax credit increased heat pump shipments. The objective of the heat pump tax credit was to substantially accelerate home electrification, but neither the graphical evidence nor the regression estimates indicate that this happened.

4 Discussion

It is almost as if the tax credit did not matter at all. This is surprising. It costs about $8,000 to install an air-source heat pump in the United States, so a $2,000 tax credit is a substantial discount.[2] Economists have long modeled household energy-related technology adoption decisions as a tradeoff between upfront costs and operating costs (Hausman, 1979; Dubin and McFadden, 1984). Heat pumps have relatively low operating costs, so one would

[2]U.S. DOE/EIA "Updated Buildings Sector Appliance and Equipment Costs and Efficiencies", March 2023, reports costs of $6810 and $6940 for a typical air-source heat pump, in year 2022 dollars. Multiplying those values by 1.156 to reflect year 2026 dollars (using CPI-All Items) yields $8000. These costs include both equipment and installation, but not any necessary upgrades to the home's electrical service or ductwork.

expect a subsidy aimed at reducing the upfront cost to be effective.

4.1 Non-Additional Recipients

We suspect, however, that the U.S. tax credit for heat pumps has never been particularly well-known or particularly effective at increasing heat pump adoption. Instead, the lack of a relationship between the tax credit and shipments suggests that most households that received the $2000 tax credit were non-additional, getting paid for something they would have done regardless.

To some degree, this is a problem with all subsidies. It is hard to provide incentives for socially-beneficial behavior without substantial transfers to those who would have taken these actions anyway.

But there are reasons to believe that non-additionality is particularly problematic for tax credits. If you were setting out to minimize the incentive effect of a subsidy, you would probably end up with something like a tax credit. It is completely invisible at the point of sale. It does not appear in your energy bill or in the contractor's quote. The tax credit only shows up months later when the household files taxes, long after the technology adoption decision has been made.

Tax preparation tools like TurboTax probably increase the number of non-additional recipients. These tools are very effective, months later, in helping a tax filer learn about tax credits, ensuring that most eligible filers do indeed claim the credit. But they provide little help upfront when the household makes the technology adoption decision.

Another complication is that these tax credits are nonrefundable, so a filer needs tax liability in order to claim. This feature makes tax credits less equitable (Borenstein and

Davis, 2016, 2025), as millions of mostly lower- and middle-income filers are not eligible. But this feature also makes tax credits more confusing and uncertain from a household perspective, likely further reducing the incentive effect.

Non-additionality reduces cost-effectiveness. The government still must fund the subsidy, which imposes economic costs, but when the recipient is non-additional then the subsidy has done nothing to reduce the negative externalities from fossil fuels. A recent welfare analysis of a heat pump subsidy in the UK provides an illustration. Bernard et al. (2024) calculate that the marginal value of public funds (MVPF) of the subsidy is 1.24. That is, every £1 spent by the government on the subsidy yields £1.24 in societal benefits. Their calculation assumes that 50% of households are additional ("marginal" in their terminology). When they alternatively assume 25% additional, the MVPF goes down to 1.12, reflecting that the total decline in emissions has been cut in half.

Non-additionality also reduces learning-by-doing. One of the additional arguments for subsidizing clean energy technology is that this will help reduce costs as more technology is deployed. But with non-additional recipients, a subsidy is not actually stimulating additional adoption, so there is no additional learning. Paying households for something they would have done regardless yields no learning, just as it yields no emissions reduction.

4.2 Making Subsidies More Visible

The goal of a subsidy like this is to change behavior, to motivate people to do something they otherwise would not have done. But if the problem is information barriers, then it makes sense to think hard about how to better design the policy to make information more available.

One of the biggest changes in clean energy tax credits under the Inflation Reduction Act was a move toward point-of-sale subsidies. For example, starting in 2024, the electric vehicle tax credit was made available at the point-of-sale (Allcott et al., 2024). This same approach could be used with heat pumps. Point-of-sale subsidies have the potential to be more salient, while also helping to address cash flow constraints that many buyers face.

More generally, anything that could be done to make information about the tax credit more available would likely improve additionality. Figure 3 plots Google search trends for "Solar Tax Credit" and "Heat Pump Tax Credit" and, indeed, search intensity for the former is almost 5 times higher than search intensity for the latter. This reflects search behavior, not overall knowledge or additionality, but it does provide some suggestive corroboration to the notion that the heat pump tax credit is not particularly well-known, even compared to other clean energy tax credits.

The U.S. tax credit for heat pumps is not currently available, but could be reinstated by future legislation.[3] When and if the heat pump tax credit is reinstated, it would be worth thinking hard about how to better publicize the subsidy. President Obama installed solar panels on the White House in 2013-2014, President Trump displayed EVs on the lawn of the White House in 2025, and one could envision similar publicity for heat pumps and the heat pump tax credit.

Publicity could also be improved for state-level subsidies. Massachusetts and New York continue to offer rebates, subsidized financing, and other incentives for heat pumps, and

[3]This type of residential energy tax credit has been around for a long time, and is likely to be used again in the future. The Energy Tax Act of 1978 introduced the first U.S. energy tax credit almost fifty years ago. These tax credits were initially aimed at energy-efficiency, rooftop solar, and other technologies, but not heat pumps. Over the years the tax credits have expired and been reinstated repeatedly, with heat pumps first added with the Energy Policy Act of 2005. See Crandall-Hollick and Sherlock (2018) for a complete legislative history.

both states dedicate considerable resources to marketing.[4] Publicity includes digital advertising, television, and radio. Massachusetts governor Maura Healey held a press event in November 2025 about heat pumps to emphasize available state-level subsidies and New York Governor Kathy Hochul has made heat pump subsidies a recurring theme in her statements related to energy affordability. It would be interesting in future work to examine these states in particular to see if these efforts have resulted in more additionality.

5 Conclusion

Thus, there is no evidence that the $2000 tax credit increased heat pump adoption. This is based on comparisons over time and should be interpreted cautiously. But it seems based on the available data that most tax credit recipients were non-additional. This is bad news from the perspective of the cost-effectiveness of the tax credit. But the flip side is that if the tax credit does not matter, then when it goes away, there is little change in heat pump adoption.

Viewed in this way, the results are actually quite good news for heat pumps. It appears that the U.S. market for heat pumps is strong enough to continue forward even in the absence of federal subsidies. Previous research has shown that heat pump adoption in the United States is driven by geography, climate, and electricity prices, and it may simply be that these factors are more important than subsidies for driving adoption behavior.

This continued deployment of heat pumps is good news for the environment. U.S. households use 2.8 trillion cubic feet of natural gas, 3 billion gallons of propane, and 2.2 billion gallons of heating oil each year for space heating.[5] Heat pumps have the potential to

[4]See, e.g. `https://www.masssave.com/residential/` and `https://cleanheat.ny.gov`.

[5]U.S. DOE/EIA, "Annual Household Site End-Use Consumption by Fuel in the United States", Revised Data Released March 2024.

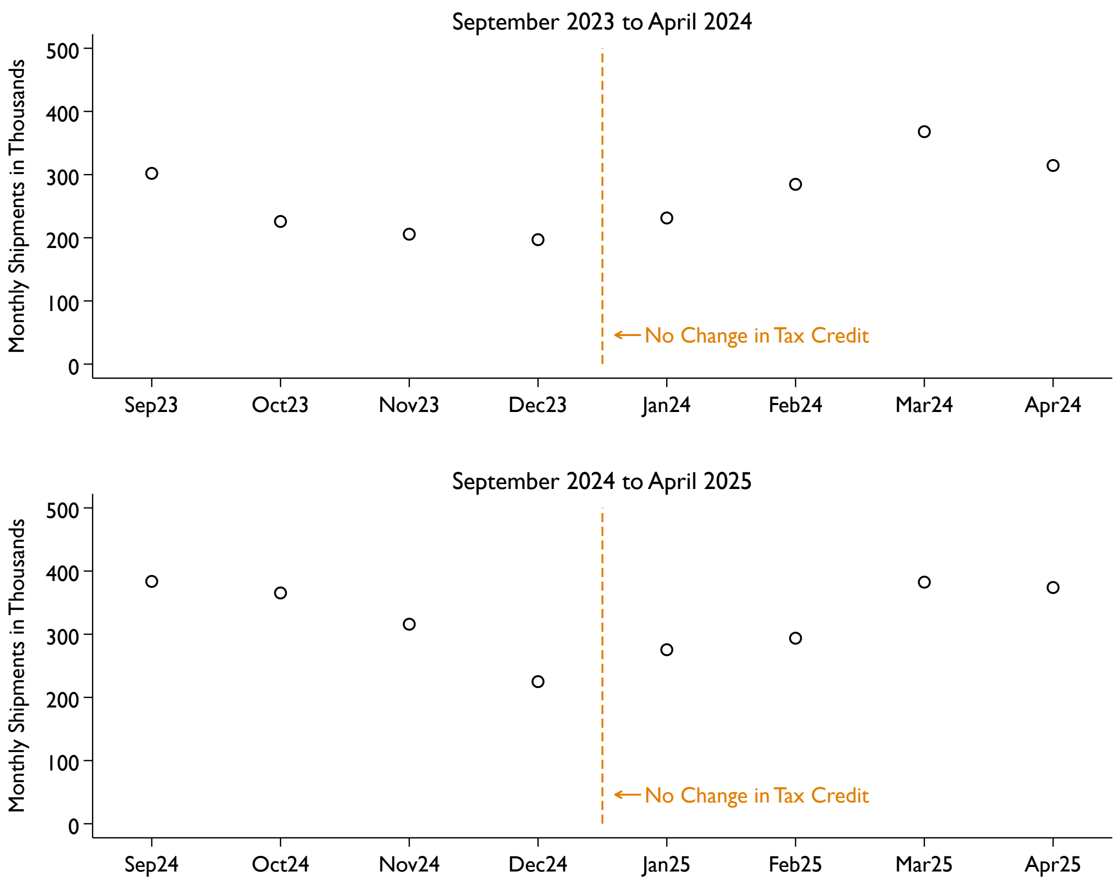
significantly decrease this fossil fuel consumption.

Tax credits are not the best way to incentivize heat pumps. It would be more efficient to price electricity, natural gas, heating oil, and propane all at social marginal cost (Borenstein and Bushnell, 2022a). Studies tend to find that if we did that, there would be many more heat pumps (Borenstein and Bushnell, 2022b). But in the meantime, the U.S. heat pump market will persevere, with large benefits for the environment.

Figure 1: Graphical Evidence

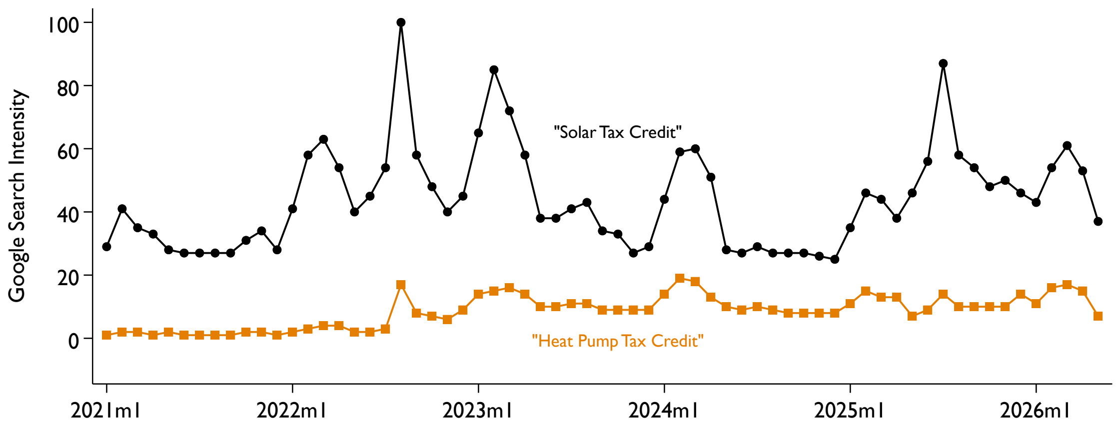
Notes: This figure plots U.S. monthly shipments of heat pumps before-and-after the beginning and end of the $2000 tax credit. The tax credit increases from $300 to $2000 on January 1, 2023, and Panel (A) plots shipments before and after the increase. The tax credit then expires January 1, 2026, and Panel (B) plots shipments before-and-after the expiration.

Figure 2: Placebo Tests Using January 2024 and 2025



Notes: This figure is constructed the same as Figure 1 except it is centered on January 2024 and January 2025. The $2000 tax credit was in place continuously during 2023, 2024, and 2025, so there was no change in the tax credit at those times.

Figure 3: Google Trends



Notes: This figure plots search trends for “Solar Tax Credit” and “Heat Pump Tax Credit”. Search intensity for “Solar Tax Credit” is almost 5 times higher than search intensity for “Heat Pump Tax Credit”. These data were extracted from Google Trends on July 17, 2026, for Geography “United States”, Custom Time Range 1/1/2021-5/1/2026. Google trends returns monthly data for windows 5+ years, as a normalized index 0-100 scaled to the peak within the chosen geography and time range. The average interest for these two search terms is 44 and 9, respectively. We also searched for “EV Tax Credit” and that yielded even higher search intensity than “Solar Tax Credit”. Google notes that their data collection changed 1/1/2022 so comparisons before and after that date should be interpreted with caution.

Table 1: The Effect of the $2000 Tax Credit on Heat Pump Shipments

	Levels				Logs			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1($2000)	-26.4	-27.4	-29.7	-35.6	-0.09	-0.10	-0.11	-0.13
	(20.9)	(15.9)	(14.7)	(13.8)	(.07)	(.05)	(.05)	(.05)
Month-of-Year FE	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Energy Prices	No	No	Yes	Yes	No	No	Yes	Yes
Housing Starts	No	No	No	Yes	No	No	No	Yes
Observations	64	64	64	64	64	64	64	64
R-squared	0.04	0.69	0.69	0.70	0.05	0.68	0.68	0.69

Note: This table reports coefficient estimates and standard errors from eight separate least squares regressions. In columns (1-4) the dependent variable is monthly heat pump shipments in thousands. The mean of this dependent variable is 328. In columns (5-8) the dependent variable is monthly heat pump shipments in thousands, in logs. The mean of this dependent variable is 5.8. The sample includes monthly data from January 2021 until April 2026, a total of 64 observations. The independent variable of interest 1($2000) is an indicator variable for the 36 months during 2023, 2024, and 2025 when the $2000 U.S. tax credit was available for heat pumps. Energy prices include U.S. monthly average residential electricity prices and Henry Hub natural gas prices, normalized to reflect year 2026 dollars. Housing starts is monthly new privately-owned housing units started, not seasonally adjusted (HOUSTNSA), from FRED. Standard errors, in parentheses, are Newey-West allowing for serial correlation up to six months.

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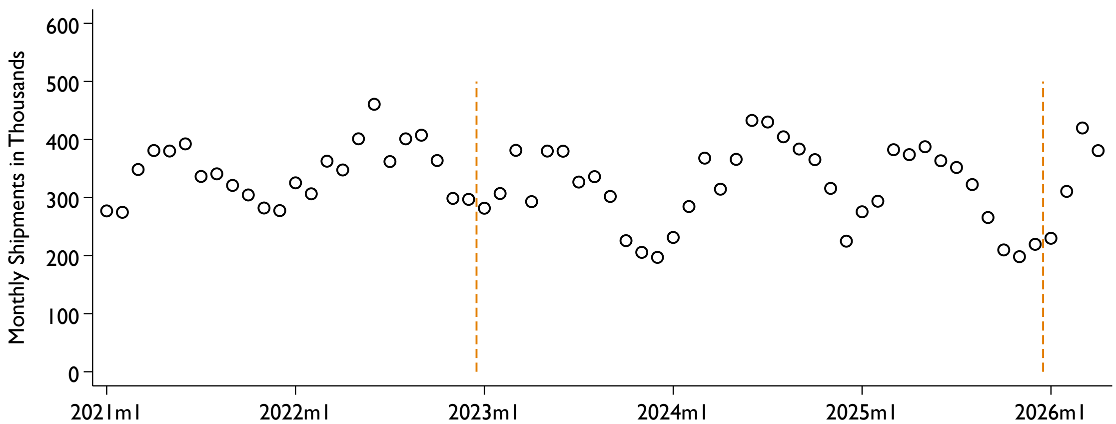
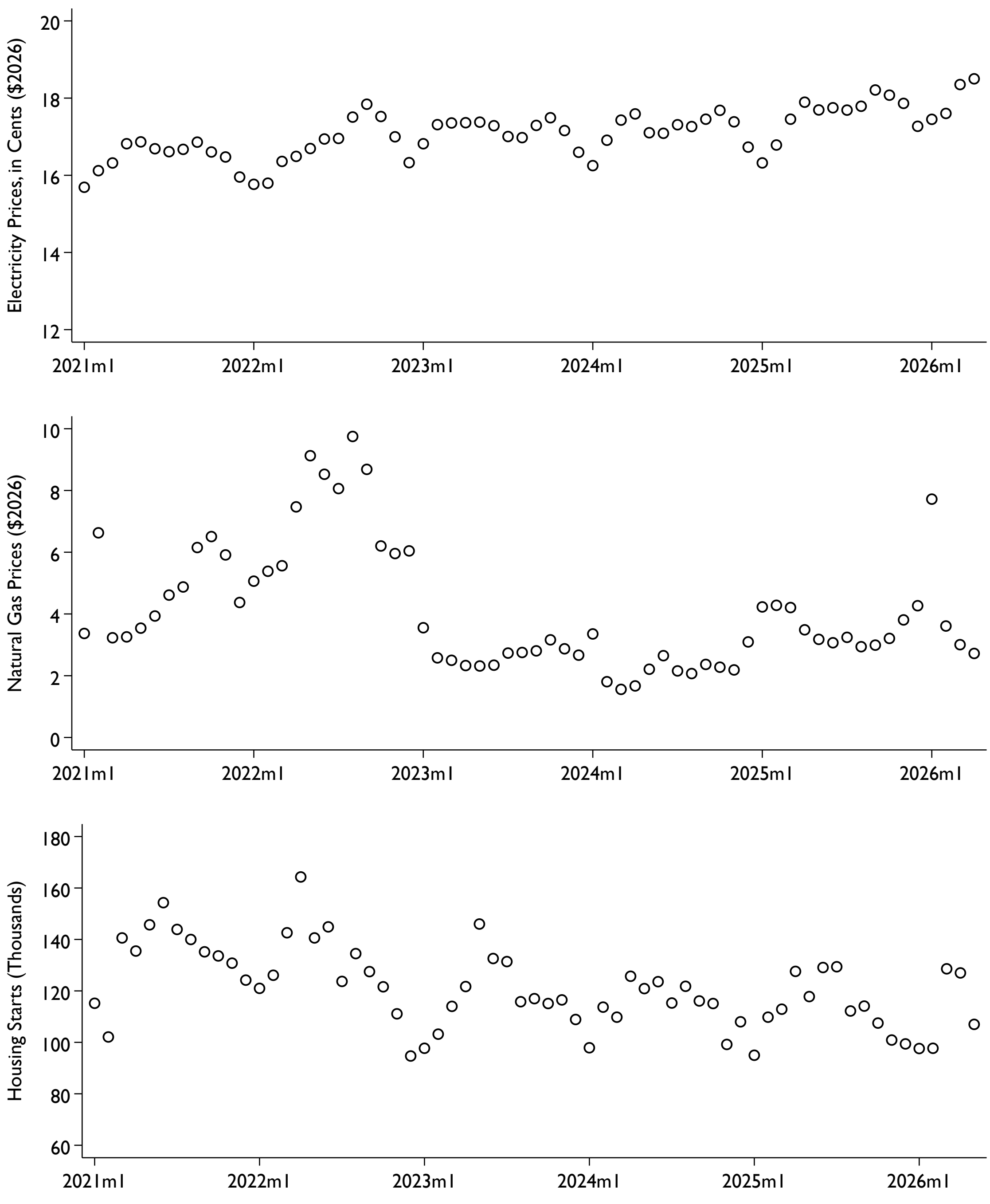
Appendix Figure 1: US Monthly Shipments of Air-Source Heat Pumps



Notes: These data come from the Air Conditioning, Heating, and Refrigeration Institute (AHRI), `https://www.ahrinet.org`. This figure plots the 64 monthly observations used in the regression analysis. The vertical lines indicate the beginning and end of the $2000 U.S. federal tax credit for heat pumps. There is a pronounced seasonal pattern in heat pump shipments, with higher shipments in the summer, much like the U.S. seasonal pattern for new home construction.

Appendix Figure 2: Control Variables



Notes: These panels plot the control variables used in Table 1, all as monthly observations from January 2021 to April 2026. Panel (A) is U.S. average residential electricity prices in cents per kilowatt-hour, and Panel (B) is Henry Hub natural gas prices, both normalized to reflect year 2026 dollars. Panel (C) is monthly new privately-owned housing units started, not seasonally adjusted (HOUSTNSA), from FRED.