Cars in Alaska

Karl Dunkle Werner

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Abstract

Abstract text here …

Outline

- Findings!
  - Sales counts per capita
  - Sales volumes per capita
  - Mean efficiency (gallons per mile)
  - Vehicle value
    * MSRP
    * Model year age
    * Auction price
- Contribute to some literature strands:
  - PIH
  - Fuel efficiency choice
  - IO of used auto markets
- Papers to compare
  - Hsieh
  - Busse et al. (2015) about fickle car buying
  - Presentation about subsidy in EVs
  - EITC literature (e.g. Goodman-Bacon and McGranahan 2008)

1 Introduction

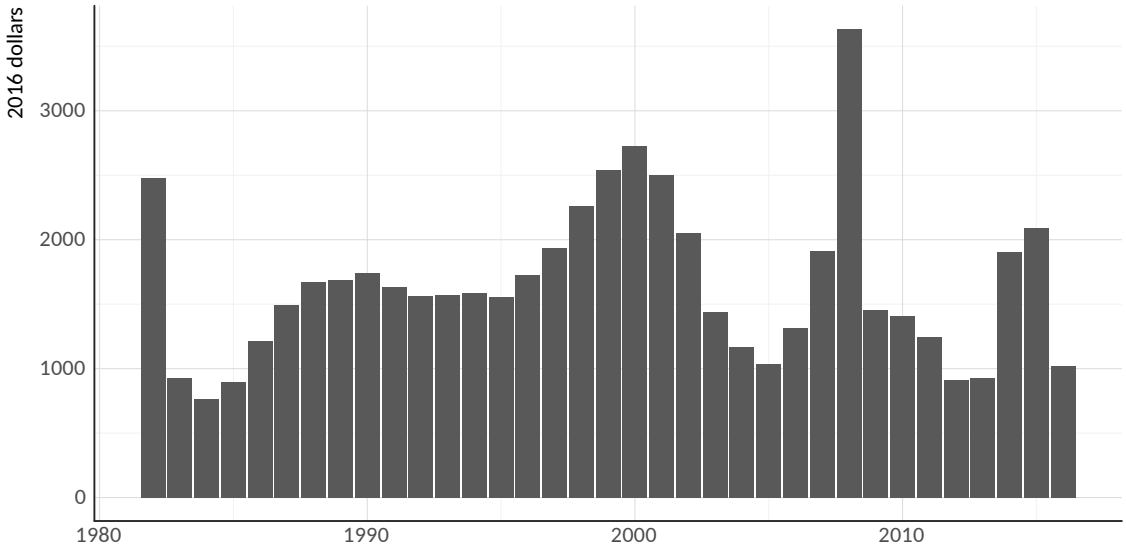
The Alaska Permanent Fund is an account set up to hold and invest a portion of the state's mineral rights revenue. These dividends are substantial, roughly $1000–2000 per person, as shown in figure 1. The fund has been sending dividend payments in the fourth quarter of each year to Alaskan residents since the 1980s (Hsieh 2003). In recent years, the payment has happened on the first Thursday in October. I will use this somewhat-arbitrary payment date as a source of variation in household's income, and therefore willingness to buy durable goods (specifically, cars).

It's worth mentioning a few of the dividend details before going on. The dividend is paid out of investment earnings – 10.5% of the past five years' earnings – not out of present-day oil revenue. The Permanent Fund investments are made in a broad variety of stocks and bonds.[1] The dividend the same amount for all recipients, with no means testing or other adjustments. Almost everyone in Alaska gets the dividend. Major exceptions are people who have lived in the state for less than a year and people serving time for some crimes. Approximately 91% of the state's population applies and about 95% of those applications are granted.

The principal data source in my analysis is the Manheim wholesale used vehicle auction data. The dataset records sale prices, vehicle identifiers, buyer and seller IDs and locations. After various cleaning measures, described in section 3.1.1, I have 48,014,789 observations of vehicle sales. These sales are between wholesalers such as auto dealerships, rental car agencies and vehicle leasing programs. In most of the following analysis, I focus on wholesalers with billing zip codes in Alaska who buy vehicles in the auctions. There are no auction sites in Alaska, so all of the purchases I observe for these dealers are from out of state. While I see when the vehicles were bought at auction, I don't know when they were delivered. Presumably, there can be some substantial delay shipping to Alaska; I examine the

1. The asset allocation is detailed in the Alaska Permanent Fund Corporation's website, `http://apfc.org/home/Content/investments/assetAllocation2009.cfm`

Figure 1: Alaska Permanent Fund payments per person



Source: Alaska Permanent Fund Division (APFD 2016).
Figures are adjusted for inflation using the annual average CPI (US BLS 2016). The 2008 total includes a one-time, $1200 bonus.

delay and anticipation effects as part of my analysis. Additionally, these are *used* vehicles only. I won't be able to discuss the market for new vehicles beyond theoretical speculation.

Importantly, I don't observe final sales to customers, so I don't know the timing or their purchases or the prices they face. I assume that cars bought by Alaskan dealers are sold to consumers with a not-to-long delay, since it's costly to hold unsold cars on the lot. (I do exclude cars that are bought and resold within a year.) The Manheim data are described in more detail in section 3.1.

2 Model

2.1 Consumers

People have preferences for vehicle traits and vehicle ownership, but are constrained by their budgets. They can therefore change what they buy when they have a check from the government. Even though the check is anticipated, they don't fully smooth because they don't build up enough savings in the course of their normal consumption path.

There are also behavioral possibilities, both in lack of smoothing and people treating dividend checks differently than they would treat their own savings. I won't really be able to disentangle these, since I don't have any situations where saved wealth is exogenously manipulated, but it's important to consider that responses may differ between this situation and others.

2.2 Auto dealers

"If the car has been there for more than three months, the dealer will be more anxious to sell it as quickly as possible."[2]

To make the model less complex, I'll assume auto-dealers don't exercise market power when they buy or sell their used cars, that they have a deep understanding of consumers' preferences, and that it's costly to hold inventory.

Assuming consumers buy more used cars upon receiving their dividend checks, dealers adjust. Specifically, the dealers know what kinds of cars will be popular and will buy these beforehand, making sure they're available when the dividends arrive.

It's also possible the dividend checks influence *new* car purchases. I don't have data on these.

2. Karimi (2012)

Assuming away market power is clearly a big assumption…

3 Data

3.1 Wholesale auto auctions

3,551,583

3.1.1 Cleaning auction data

Table 1: Cleaning Manheim auction data

Elimination category	Count removed	Details
Duplicate sales	3,551,583	Same VIN sold twice within a year.
Weird vehicles	20,257	Trailers, boats, air compressors, golf carts, vehicles with incomplete bodies, ATVs and RVs.
Bad odometer	563,074	Auction comments indicate odometer is flawed.
Damaged	2,520,692	Auction comments indicate vehicle is damaged.
Bad price	59,251	Auction price seems unreasonable, outside the interval $[100, \min\{80000, 1.5 \times \text{MSRP}\}]$.
Canadian	121,965	Auction comments indicate vehicle is Canadian.

NOTES: Data are from US Manheim auctions, 2002–2014. There are 54,929,542 sales before cleaning and 48,014,789 sales after. 22,436 of the cleaned sales are to Alaskan buyers. Cars that are listed for auction but not sold are not included. Rows are removed in the order listed.

The Manheim data are voluminous, and they include many kinds of sales outside the scope of this research.

3.2 VIN decoder

3.3 Gas prices

3.4 CEX

3.5 Vehicle registrations

4 Difference-in-differences results

For each of the outcomes below:

- Make a plot of the time trend of Alaska vs other states.

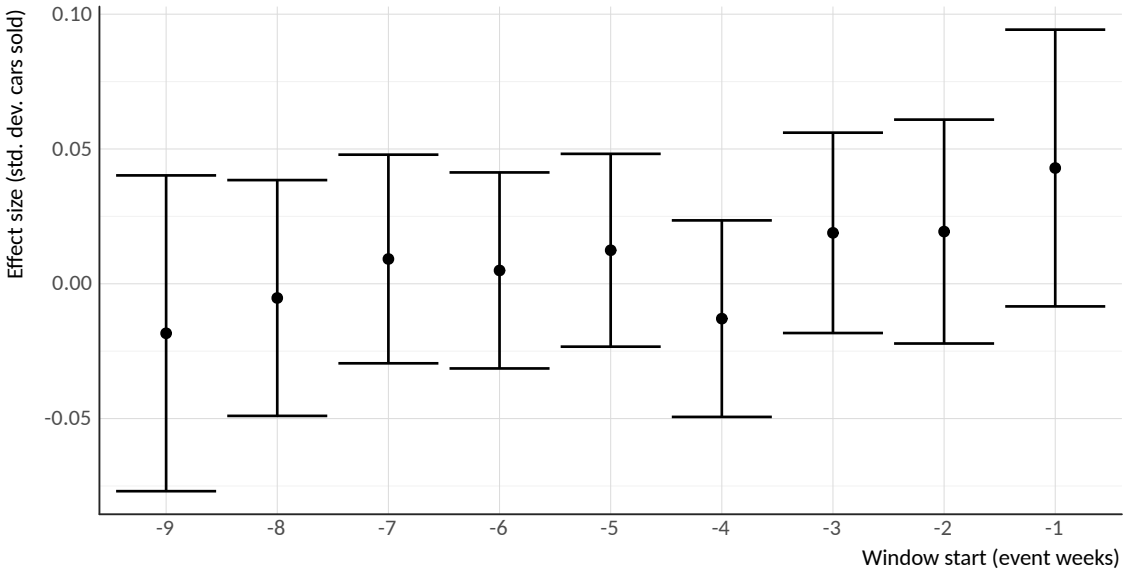
4.1 Picking control states

In considering which states are good controls for Alaska, it's worth diving a little more into the structure of the Manheim auction data. Auctions occur in 32 states and Puerto Rico, and Alaska is not among them. Therefore all purchases by Alaskan buyers are at out-of-state auctions. For the simple difference-in-differences below, I've chosen Idaho, Oregon and Utah. The choice is somewhat subjective; these states have a large fraction of their out-of-state purchases in the auction states where Alaskan dealers are buying. This heuristic is appealing because it captures the markets where Alaska is operating, as well as additional factors from buying out of state. A more robust approach is to use best-subset or synthetic controls methods described in Doudchenko and Imbens (2016).

4.2 Picking an anticipation window

Anecdotally, dealers know that customers buy more cars around the dividend date and around tax refunds, but they don't make additional efforts to stock up on vehicles before the dividend is sent. Instead, they just try to keep a certain number of cars on their lot, buying more as necessary.

Figure 2: Anticipation effects for sales count

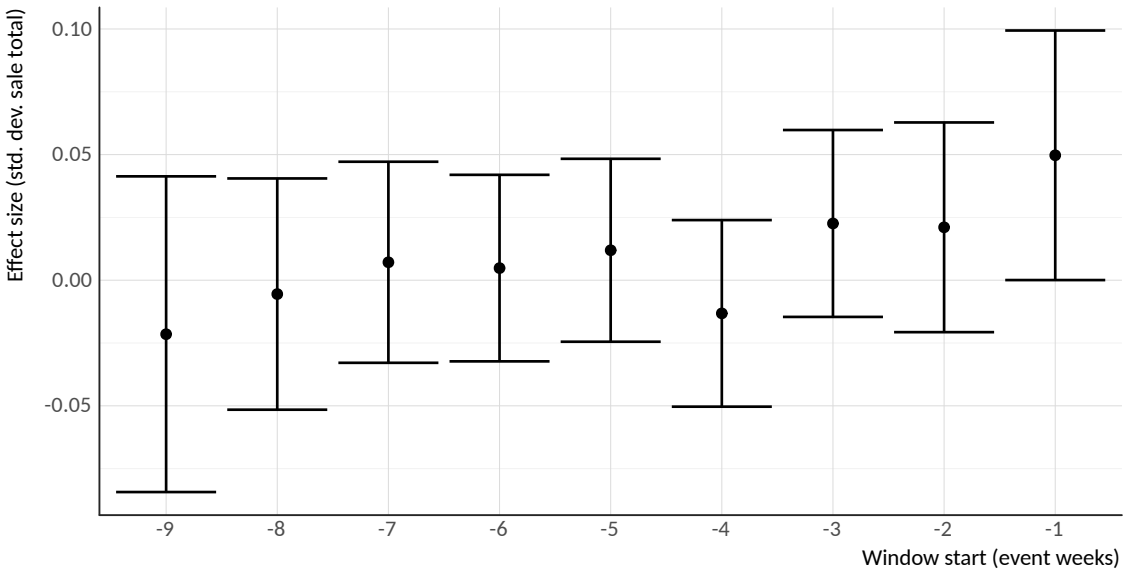


The plot shows the Alaska × anticipation coefficients (β_2) from the regression in equation 1, with varying anticipation windows. Error bars indicate 95% confidence intervals. The horizontal line at 1063 is the standard deviation of weekly counts. All windows end at −1 week.

Anecdata are often wrong, so maybe it's worth considering the theoretical predicting a dealer anticipation effect. Theory doesn't tell us, however, how long that anticipation window should be. To be as flexible as possible, I have estimated the results for varying windows from one to nine weeks of anticipation, as shown in figures 2 and 3. In all cases, the anticipation window ends the immediately before the dividend day.

None of the estimates are statistically significant, and they are all far below the standard deviation

Figure 3: Anticipation effects for sales totals



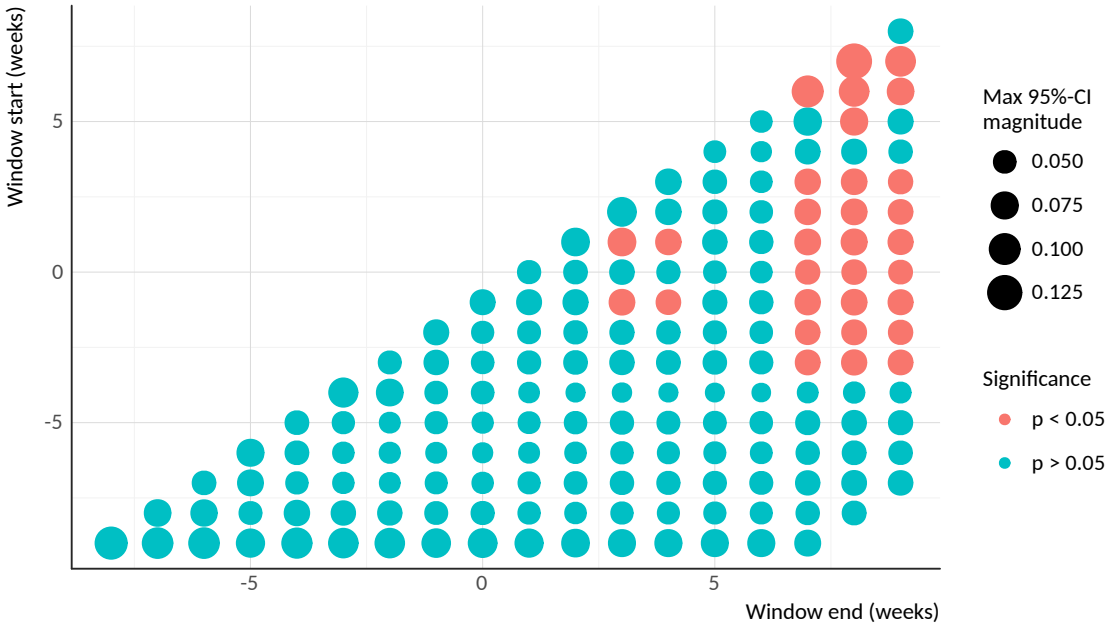
The plot shows the Alaska × anticipation coefficients (γ_2) from the regression in equation 1, with varying anticipation windows. Error bars indicate 95% confidence intervals. The horizontal line at 14,980 is the standard deviation of weekly sales volume (in thousands). All dollar amounts are in thousands of 2016 dollars. All windows end at −1 week.

of weekly sales counts and sales totals, as indicated by the horizontal lines at the top of the graphs. (Different states have somewhat different standard deviations, the pooled standard deviation is not driven by states with particularly large variation. The 95% confidence interval of the anticipation estimates less than are standard deviation for Alaska and every control state, as demonstrated in figure 7.) I default to calculating the pooled standard deviation across Alaska and the control states and across all weeks in the data. Calculating the standard deviation on only periods within the event window – from 70 days before the dividend is sent to 70 days after – gives slightly larger standard deviations, and therefore even smaller effect sizes.

Using daily data produces similar results. The coefficients are somewhat more variable and a couple are statistically significant, but they're still much smaller than the standard deviation. (See

figure 6.)

Figure 4: Sales totals effect size across windows, max 95% CI



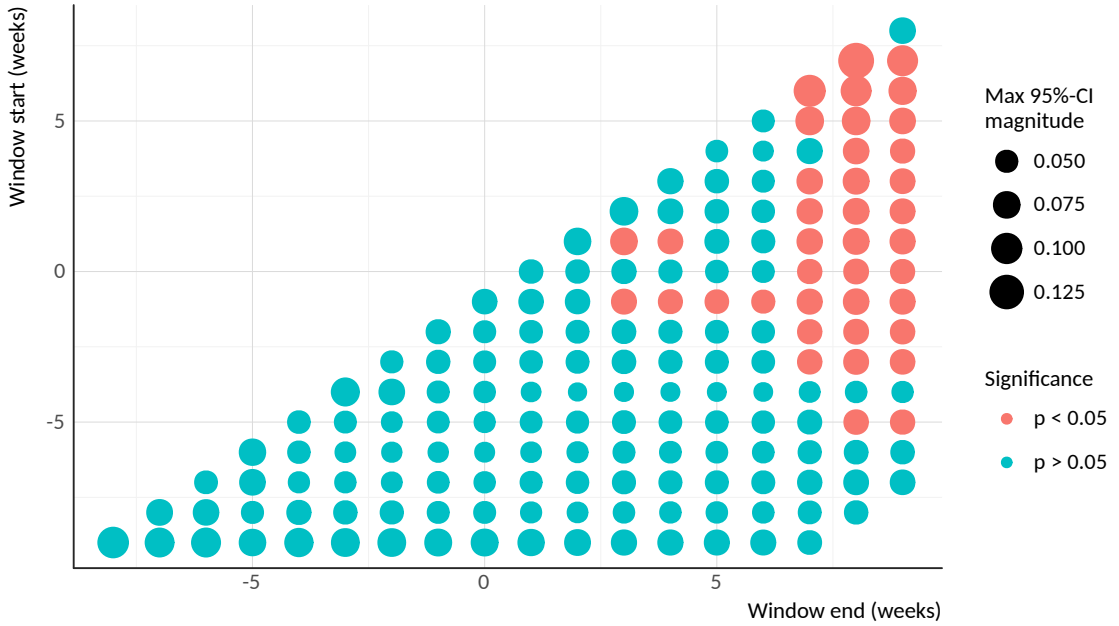
NOTES: The plot shows the Alaska × anticipation coefficients on total sales from a regression with a varying "anticipation" window. The y-axis shows is the start of the window relative to the dividend day, while the x-axis codes the end of the window. The size of the points is the maximum of the absolute value of the effect size of the 95% confidence intervals: $\max\left\{\hat{\psi} - 1.96\sqrt{\text{Var}(\hat{\psi})}, \hat{\psi} + 1.96\sqrt{\text{Var}(\hat{\psi})}\right\}$. A standard DD regression – where the window begins at zero and ends at the end of the period – is the rightmost point on the $y = 0$ line.

On the other hand, one might put more credence in the anecdotes. To show that there is still no effect on vehicle sales, I'll estimate an even more flexible treatment window.

4.3 Volume of cars sold

$$\begin{aligned}\text{Cars sold} = \beta_1 \text{ anticipation} + \beta_2 \text{ Alaska} \times \text{anticipation} + \beta_3 \text{ post-dividend} \\ + \beta_4 \text{ Alaska} \times \text{post-dividend} + \text{state and year fixed effects}\end{aligned} \tag{1}$$

Figure 5: Maximum sales count effect size confidence intervals



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Collapse data to a state-by-day panel and run DD regs of sale count per capita and sale volume per capita. Use all years, use event time relative to the dividend day and don't take into account any anticipation. Control for either a year FE or state GDP. Control for either daily or day-of-week FE. As a default, the cars sold in the set of states where Alaskan buyers are active (in a given year). Force the panel to be balanced by adding zeros (if necessary).

This is theoretically ambiguous – sales of *used* cars could go up or down with an income shock, or be unchanged.

4.4 Efficiency of cars sold

Repeat the previous, but with the average GPM of vehicles sold.

4.5 Quality of cars sold

Repeat the previous, but with the average MSRP of vehicles sold.

Repeat the previous, but with the model-year-age (relative to auction date) of vehicles sold.

5 Synthetic results

Do the previous DD section again, but with synthetic controls or, maybe, the fancier frameworks of Doudchenko and Imbens (2016) or Xu (2016)

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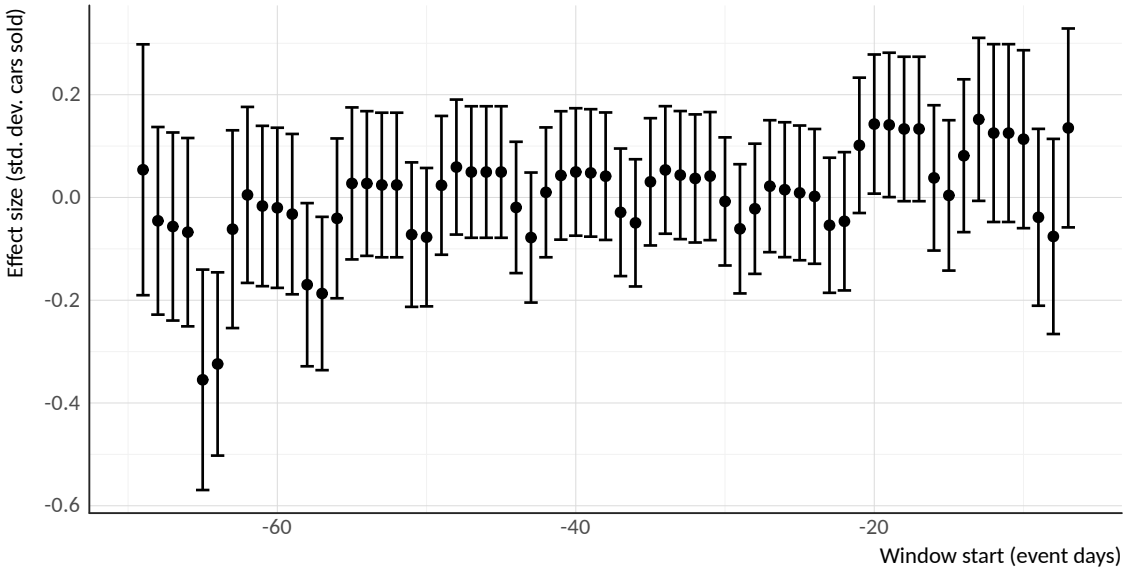
A Bonus figures

Figure 6: Treatment coefficients on Alaska × anticipation



The plot shows the Alaska × anticipation coefficients (β_2) from the regression in equation 1, with varying anticipation windows. All windows end at −1 event day.

Figure 7: Treatment coefficients on Alaska × anticipation, with state-specific standard deviation lines