How does pension generosity affect labor?

The effect of pension generosity on labor entry and exit

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Abstract

I exploit a policy change on U.S. federal workers' pension benefits to provide estimates of the effect of pension generosity on retirement decisions. Using a large administrative data set, I estimate elasticities of -0.1 to 0.1 showing that pension generosity has little effect on an individual's decision to retire. In the long run, I find that there is no effect of pension generosity on number of retirements or lifetime of labor supply. Further, I find that there is significant effects on retention and firm accessions. There is approximately 30% decrease in job quits and a half year increase in education of new hires. Altogether, this shows that pensions have little impact on retirement decisions, but are an important part of a worker's compensation.

Introduction

As countries age so does their workforce. This has put a strain on Pay-As-You-Go (PAYG) pension systems and, more generally, defined benefits pension systems. The key to maintaining financial solvency for pension systems is retirement behavior.[1] As workers live longer and do not change their retirement age, there is a larger strain on retirement systems due to more dependencies and less contributors. However if workers lengthen their labor force participation, then this increases contributions and decreases dependencies which eases financial strain. Thus for effective policy action, policymakers will need to understand the worker's trade off between another year of work or exiting the labor force. To understand this relationship, I utilize a quasi-experiment that led to increased pension benefit generosity and measure its effect on retirement behavior.

As stated by Gustman, Steinmeier, and Tabatabai (2010) in their book *Pensions in the Health and Retirement Study*, "[an individual's] support in retirement will depend in part on the proverbial three-legged stool:

[1]A literature has been devoted to migration and pension systems. Authors in this literature suggest migration cannot fully solve this problem. See Zaiceva and Zimmermann (2016).

personal saving, Social Security, and pensions". For most workers, retirement decisions rely heavily on Social Security and pension benefits. Social Security and pensions each provide, on average, 30% of a retiree's income. (Dushi and Trenkamp (2021)) Conditional on contributions to a pension plan, a more generous benefit package induces a wealth effect on workers. In general, this wealth effect causes workers to retire early (Blundell, French, and Tetlow (2016)), however the magnitude of this effect has been difficult to measure. Krueger and Pischke (1992) and Snyder and Evans (2006) both studied a "notched" set of workers from 1917-1922 who received lower Social Security benefits. These two papers found differential effects: Krueger and Pischke (1992) found no evidence of disemployment with higher benefit generosity whereas Snyder and Evans (2006) found large effects. The difference in these two stems from the methodology used. More recent work in this area has started to use bunching techniques to estimate this relationship.[2] [3] Brown (2013) identifies an exogenous policy change that affected retirement benefits for school teachers in the state of California. This policy changed the incentives for school teachers with 30 years of service by increasing the cap on the pension benefit growth rate. Brown (2013) found the policy had small effects with an elasticity of about 0.04 which implies that workers will adjust their retirement date by less than 2 months for an increase of 10% in compensation. Another similar paper to this is Manoli and Weber (2016) which used Austrian data to estimate the extensive margin of labor supply. Manoli and Weber (2016) use age discontinuities in the Austrian pension system to identify the impact of benefit generosity on retirement decisions. They find that almost no worker would delay retirement by 1.25 years for an increase of 25% in total retirement benefits. A complication is that changes in budget constraints may not be salient which reduces the precision of estimates. Lusardi and Mitchell (2007) showed that workers have poor knowledge of their pension and generally have low financial knowledge. These may lead the elasticity to be understated if workers are not salient of the change and/or do not understand the policy shock. This makes it difficult for policymakers to successfully implement policy as different types of policy may be more or less understood.

Defined benefit pension programs are common for public employee compensation and still prevalent for private employee compensation. (Munnell, Haverstick, and Soto (2007)) Previous research has focused on the impact of these programs on school teachers. (Koedel and Xiang (2017), Fitzpatrick (2010), Furgeson, Strauss, and Vogt (2006)) In theory, defined benefits pension programs induce labor immobility; defined benefits pensions are, generally, not portable across jobs which means workers may be deincentivized to change jobs. (Mitchell (1982)) Empirical research on whether defined benefits pension programs induce labor immobility relative to defined contributions has been ambiguous and limited to observational studies. (Gustman and Steinmeier

[2] See Saez (2010) for bunching techniques

[3] For early structural work see Rust (1989), Stock and Wise (1990) and Gustman and Steinmeier (1986). More recently, French (2005) and French and Jones (2011)

(1993), Ippolito (1991), Haverstick et al. (2010)) However direct studies of whether defined benefits pension programs influence retention rates have been sparse. Koedel and Xiang (2017) investigates the impact of a sudden increase in pension generosity for teachers in St. Louis. They find no effect of the pension generosity on retention, however they caveat they are using a comparison within the treated group to identify the effect. Additionally, research suggests that pension benefits are not highly valued when workers are deciding jobs. (Fitzpatrick (2010)) A concern in this literature is that there are few policies affecting pension generosity. This is problematic because observational studies may suffer from selection bias and the few policy studies could suffer from sample bias. In this study, I use a large dataset that has a diverse set of occupations and locations to understand how pensions affect a worker's job search.

In October of 2009, the "Non-Foreign Area Retirement Equity Assurance Act of 2009" (NFAREAA) was enacted. Under this policy, pension benefits increased by approximately 14% to 25% for workers who retired in non-foreign areas (such as Alaska or Hawaii). Thus the policy generates quasi-experimental variation and gives opportunity to identify the impact of pension benefits on retirement decisions. This paper utilizes an event study methodology across U.S. states to estimate this relationship. This paper utilizes administrative data on all federal employees since 1998. Data includes information on years of service, occupation data, demographic data, separations from the federal service and accessions to the federal service.

The analysis highlights several empirical results. First, there was a large change in retirements across the treated states. In the short run (3 years post policy), there is a 100% to 200% increase in retirements compared to pre-treatment baseline. In the long run (5-7 years post policy), there is little change in retirements yearly compared to pre-treatment baseline. I find that retention increases; there is approximately 30% decrease in job quits each year. Lastly, I find that the average education of a new hire is 0.5 years higher. The paper proceeds as follows. The second section of the paper provides background to the policy reform and introduces the data. The third section develops an econometric framework. The fourth section provide results. The fifth section concludes with policy implications.

Background

The Civil Service Retirement System (CSRS) and federal Employee Retirement System (FERS)[4], collectively, is one of the largest pension systems in the U.S., and more generally, in the world. This system has three major components: A FERS annuity (a defined benefit plan), Social Security (unless covered by CSRS), and a Thrift Savings Plan (an optional defined contribution plan). FERS contributions are mandatory for full time

[4]For information on the differences please see the following link: The Office of Personnel Management

employees. FERS is financed by contributions from active workers to retired workers with unfunded liabilities covered by the federal government. The average replacement rate is 33% and the median replacement rate is 34.9%. In general, the FERS annuity is calculated using the participants age, salary and years of service. Most employees are covered by FERS (the exceptions are for specific agencies such as the Central Intelligence Agency and the Foreign Service). Additionally, the U.S. Military is not apart of FERS or CSRS instead they operate under a different retirement system (called the Blended Retirement System).

In October of 2009, the "Non-Foreign Area Retirement Equity Assurance Act of 2009" was enacted. Previous to this act, workers working for the federal government in non-foreign areas such as Alaska, Hawaii, or Guam received a COLA to their wage for differences in prices of goods and services compared to Washington, DC. COLAs are non-taxable income and because of this are not used in calculating pension benefits. This meant workers in NFAs received similar wages to workers in the contiguous United States, but received disproportionately lower pension benefits. This bill transitioned COLAs to locality pay, which contributes to pension benefits, for each non-foreign area over a 3 year period. In Table 1, each NFA is displayed alongside the change in full locality pay, payable locality pay, and COLA from 2009 to 2015. Full locality pay is used for retirement calculations while payable locality pay is used for salary calculations. I distinguish each in the rest of the paper and explain the importance.

Table 1: OPM Nonforeign Locality and COLA Rates 2009-2015

	2009		**2010**			**2011**			**2012-2015**		
Region	**COLA**	**Locality**	**COLA**	**Payable Locality**	**Full Locality**	**COLA**	**Payable Locality**	**Full Locality**	**COLA**	**Payable Locality**	**Full Locality**
Anchorage, Alaska	23	0	19.03	4.72	14.16	10.56	16.46	24.69	5.57	24.69	24.69
Fairbanks, Alaska	23	0	19.03	4.72	14.16	10.56	16.46	24.69	5.57	24.69	24.69
Juneau, Alaska	23	0	19.03	4.72	14.16	10.56	16.46	24.69	5.57	24.69	24.69
Other Alaska	25	0	20.94	4.72	14.16	12.28	16.46	24.69	7.18	24.69	24.69
County of Honolulu, Hawaii	25	0	20.94	4.72	14.16	16.07	11.01	16.51	12.25	16.51	16.51
County of Hawaii, Hawaii	18	0	14.26	4.72	14.16	9.76	11.01	16.51	6.24	16.51	16.51
County of Kauai, Hawaii	25	0	20.94	4.72	14.16	16.07	11.01	16.51	12.25	16.51	16.51
County of Maui, Hawaii	25	0	20.94	4.72	14.16	16.07	11.01	16.51	12.25	16.51	16.51
Puerto Rico	14	0	10.44	4.72	14.16	7.18	9.44	14.16	4.2	14.16	14.16
U.S. Virgin Islands	25	0	20.94	4.72	14.16	17.23	9.44	14.16	13.84	14.16	14.16
Guam & Northern Mariana Islands	25	0	20.94	4.72	14.16	17.23	9.44	14.16	13.84	14.16	14.16
Other Possessions	0	0	0	4.72	14.16	0	9.44	14.16	0	14.16	14.16

Note: Column entries are percentages.

The calculation used by the Office of Personnel Management (OPM) to calculate pensions is as follows:

1.) if the worker is under the age of 62 or age 62 or older with less than 20 years of service:

$$1\% \times \text{Years of Service} \times \text{High 3 Average Salary}$$

2.) if the worker is older than 62 with 20 or more years of service:

$$1.1\% \times \text{Years of Service} \times \text{High 3 Average Salary}$$

Years of service are the total years working for the federal government. High 3 Average Salary is the average of the highest 3 continuous years of salary while working for the federal government. Since COLAs are non-taxable income, they have no impact on High 3 Average Salary. This implies switching COLAs to locality pay directly increased pension benefits by directly increasing the High 3 Average Salary.[5]

To be eligible for these benefits, workers must be above a certain age and/or above a specified number of service years. United States federal government workers can voluntarily retire under any one of the three conditions:[6]

1.) if the worker is above the age of 62 and they have 5 years of service

2.) if the worker is above the age of 60 and they have 20 years of service

3.) if the worker is above a minimum retirement age[7] and they have 30 years of service

The federal government implemented NFAREAA over a three year transitional period. Up until 2009, all NFAs had a 0% locality pay rate. In 2010, the payable locality pay rate increased to one third of the contiguous U.S. locality rate which was 14.16%.3 Additionally, the full locality rate was 14.16% which meant workers were eligible for a 14.16% increase in salary when calculating their High 3 Average Salary. At the same time, COLAs were offset by approximately 4%. The following year (year 2), each locale had its own established locality rate. Each locality then increased the payable locality rate to 2/3 of the full locality rate for the respective locale and decreased the COLA. Each NFA had a decrease in their COLA by an amount that would maintain their current after-tax wages. In the third year (2012), payable locality pay was increased

[5] For further explanation on how the High 3 Average Salary is calculated, please see Appendix E.

[6] For some occupations such as an air traffic controller, law enforcement, firefighter or military reserve technician or if the worker's federal agency has undergone a major change in function, workers can retire early.

[7] The minimum retirement age is dependent on the worker's year of birth, but is approximately 55 years old. Workers who retire prior to these thresholds are considered early retirees and receive diminished benefits. To be eligible for an early retirement, workers must be approximately 55 years old and have 10 years of service.

to the full locality rate for the respective locale and the COLA was decreased again in an offsetting amount.

To see the change in pension benefits, consider the benefits received by workers retiring each year in Alaska. Workers post 2013 would have approximately a 25% increase in pension benefits compared to workers prior to 2010. Figure 1 shows the theoretical increase in pension benefits for workers in Alaska over time. Additionally, I highlight the change in pension benefits across all NFAs in Table 1.

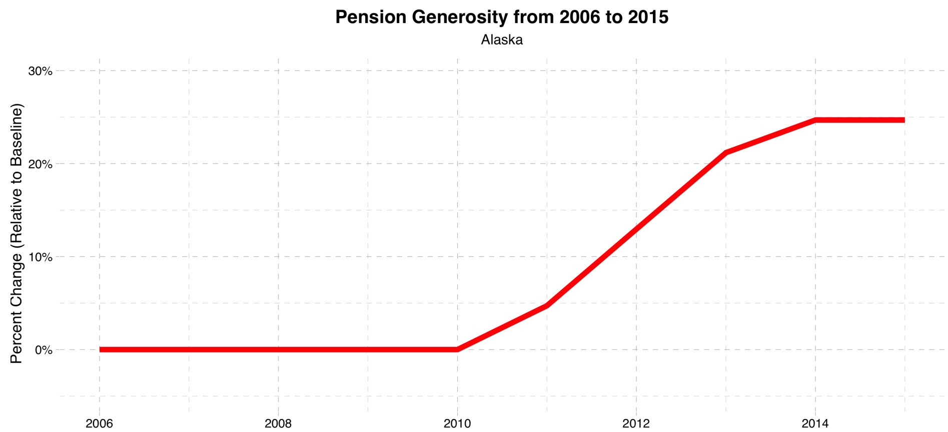


Figure 1: Change in Pension Benefits

This policy was rather generous. For workers in Alaska and Hawaii, this increased pension annuities for the average worker by $3822. All together, this demonstrates the quasi-experimental variation induced by the pension policy. The policy induced higher pension benefits for all workers residing in NFAs while all other states had no change in pension benefits. This provides an ideal setting to identify the impact of pension benefits on labor.

Model

I utilize a standard lifetime budget constraint model to understand the effects of a pension policy. Consider a standard addictive utility function, $U(C, L)$, where agents maximize over two goods: consumption, C, and labor, L.

I specify a pension benefits formula, $B(S, HAS)$, as follows:

$$B(S, HAS) = \gamma * S * HAS$$

where S is service years and HAS is the High 3 Average Salary. This is consistent with the OPM pension formula (and more generally Defined Benefits pension systems). The High 3 Average Salary is defined as follows:

$$HAS = \frac{1}{3} * w_{R-3} * \theta_{R-3} + \frac{1}{3} * w_{R-2} * \theta_{R-2} + \frac{1}{3} * w_{R-1} * \theta_{R-1}$$

where θ_R is a multiplier for how much of the wage is eligible for pension benefits at time, R.[8] Assume that wages are constant, $w_t = w_{t-1} = w$ for all time, t. This simplifies the High 3 Average Salary to:

$$HAS = (\frac{1}{3}\theta_{R-3} + \frac{1}{3}\theta_{R-2} + \frac{1}{3}\theta_{R-1}) * w$$

Define $\theta_t = \frac{1}{3}\theta_{t-3} + \frac{1}{3}\theta_{t-2} + \frac{1}{3}\theta_{t-1}$. This simplifies this into a simple formula:

$$HAS = \theta_t * w$$

From here forward I maintain the assumption of constant wages and now rewrite the benefits function as following:

$$B(S, \theta_t) = \gamma * S * \theta_t * w$$

I redefine this to be:

[8] For reference, θ_R will be 1, however an increase in pension generosity is an increase in θ_R at the specific time R

$$B(S, \theta_t) = \theta_t * BasePension$$

where

$$BasePension = \gamma * S * w$$

Thus an increase in θ_t is a multiplier for the base pension a worker will receive.

I now turn to the lifetime budget constraint. To simplify, let $\beta = 0$ and $R = 0$. I assume that the lifetime budget constraint takes the form:

$$C = \sum_{t=0}^{S} w(1 - \tau_C) + \sum_{t=S}^{T} B(S, \theta_t)$$

where C = lifetime consumption of market goods, w is wage, τ_C is contributions to pension benefits, T is the last period of life, and $B(S)$ is pension benefits as a function of service years, S.

With the assumption that wage is time invariant, I simplify this into:

$$C = S * w(1 - \tau_C) + (T - S)B(S, \theta_t)$$

Thus the lifetime consumption of goods is the sum of years worked plus the total benefits received from a pension benefit.

In Appendix A, I derive the following first-order condition:

$$-U_S(C, S) = U_C(C, S) * [(1 - \tau)w + B_S(S, \theta_t)(T - S) - B(S, \theta_t)]$$

This shows that in equilibrium, workers will balance the marginal benefits of consumption with the marginal disutility of work. In this case the marginal benefit of consumption is the additional salary earned from an extra service year plus the additional pension benefits however it comes at a cost: workers now enjoy one less year of pension benefits received today. This means that as workers age, the marginal incentive to work diminishes since they directly lose a year of benefits, $-B(S)$, for each year they work. Thus, the decision to work becomes more operative and a worker's decision to work is more elastic. A natural question is what happens if the benefit formula becomes more generous? Taking a partial derivative with respect to θ:

$$LHS = \frac{\partial}{\partial\theta}[-U_S(C,S)] = 0$$

$$RHS = \frac{\partial}{\partial\theta}U_C(C,S)[(1-\tau)w + B_S(S,\theta_t)(T-S) - B(S,\theta_t)]$$

$$RHS = U_C(C,S)[\frac{\partial}{\partial\theta}(1-\tau)w + \frac{\partial}{\partial\theta}B_S(S,\theta_t)(T-S) - \frac{\partial}{\partial\theta}B(S,\theta_t)]$$

$$RHS = U_C(C,S)[\frac{\partial}{\partial\theta}B_S(S,\theta_t)(T-S) - \frac{\partial}{\partial\theta}B(S,\theta_t)]$$

$$\frac{\partial}{\partial\theta}B_S(S,\theta_t)(T-S) - \frac{\partial}{\partial\theta}B(S,\theta_t)$$

I now replace each equation with the benefit equation defined above:

$$\frac{\partial}{\partial\theta}\gamma * \theta_t * w_R * (T-S) - \frac{\partial}{\partial\theta}S * \gamma * \theta_t * w_R$$

$$\frac{\partial}{\partial\theta}\gamma * \theta_t * w_R * (T-2S)$$

To simplify, let:

$$FuturePensionGains = \gamma * w_R * (T-S)$$

which gives the following equation:

$$\frac{\partial}{\partial\theta} * \theta_t * [FuturePensionGains - BasePension]$$

Thus an increase in pension benefits has a positive or negative impact on utility of marginal consumption depending on $FuturePensionGains - BasePension$. Suppose that $FuturePensionGains - BasePension$

is positive, then this will make the term positive which increases the marginal utility of consumption. Thus workers will increase consumption to return to equilibrium. If $FuturePensionGains - BasePension$ is negative, then this will decrease the marginal utility of consumption. Thus workers will decrease consumption to return to equilibrium. For either scenario, an increase or decrease in consumption, the worker will change their service years, S.

Do pension benefits affect retirement decisions? The effect is dependent on how much agents will accrue in terms of total lifetime wealth from the pension shock.[9] A natural result here is that the elasticity of labor supply for older workers will be smaller than the elasticity of younger workers. This is because $FuturePensionGains$ is dependent on lifespan $T - S$. Previous literature finds small elasticities close to 0.01-0.10.

This model can also be extended to understand the effect of pension increases on retention and accessions. For the retention and accessions, I add a job search model and evaluate the effect of pension generosity.

[9] A further variation of this model is by making the discount rate greater than 0. This will reduce dampen the effect because agents will discount future earnings.

Data

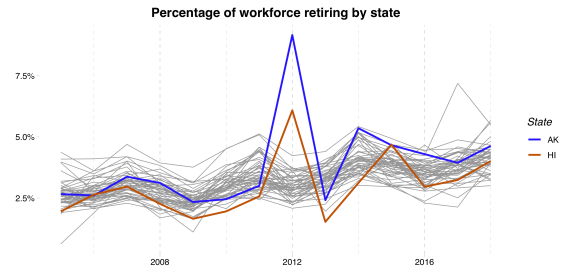
The data used in this analysis comes from the Office of Personnel Management (OPM) which collects data on federal employees for administration purposes. The data contains information on the federal civilian workforce and military. The data is at the worker-year level from 1999 to 2020 and provides detailed information on salary, education level, occupation, agency, age level, years of service and other workplace data. The data is cross-sectional for each year with no worker identifiers. Altogether, there are three data sets: the first provides a cross-section of all workers employed by the federal government in September; the second provides a cross-section of monthly accessions into the federal government; and the last one provides a cross-section of monthly separations out of the federal government. I separate out the Department of Veterans Affairs due to the following: there are low counts of employees within Alaska and Hawaii relative to other states and a policy in 2016 allowed individuals to take a phased retirement which induced workers to begin their retirement earlier.[10] Additionally, I remove the Department of Homeland Security due to a large workforce size change between 2004 and 2012. I include separate analysis for each of the following in Appendix F and Appendix G.

For workforce exits, the large majority of workers exiting are leaving due to retirement, quitting or transferring. This can be seen in the summary statistics, Figure 8. While transferring is not necessarily costly, retirement and job quits can be. On average, 1% to 5% of the workforce for any given state is retiring in a given year which can be seen in 2. Most workers retire with 30.1 years of service and receive approximately a 33% replacement rate in terms of salary.

For workforce entries, there are three types of accessions into the workforce: transfers, competitive service and excepted service. Transfers are individuals moving within the federal workforce across agencies or states. Competitive service are jobs that require an open posting to all job applicants and have prespecified hiring conditions. Excepted service are jobs that require a less specified hiring conditions due to lack of applicants or hiring conditions.[11] This can be seen in Figure 8.

[10]Please see VA Directive 5009/11.
[11]Please see the following link: OPM for information

Summary Statistics - Workforce Exit



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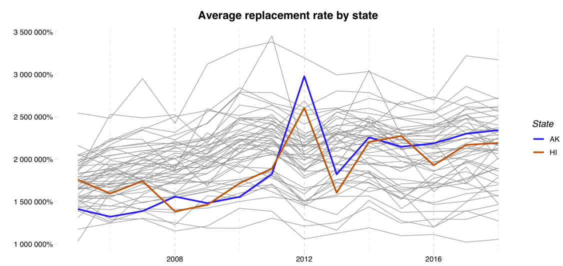

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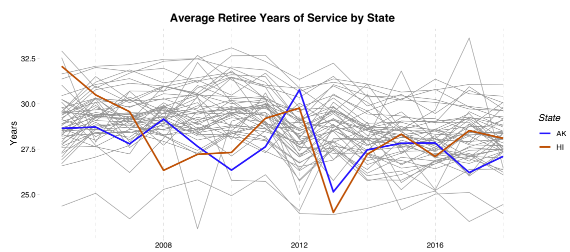

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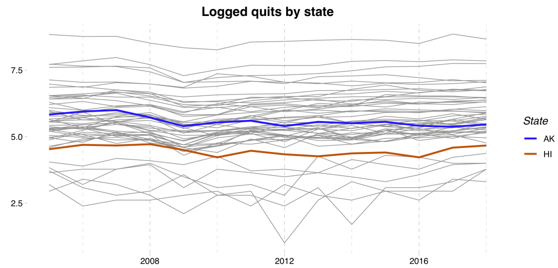
Figure 2: Summary statistics - year level



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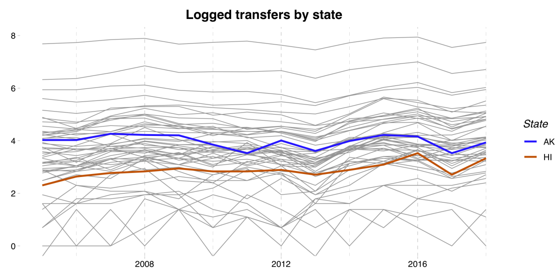

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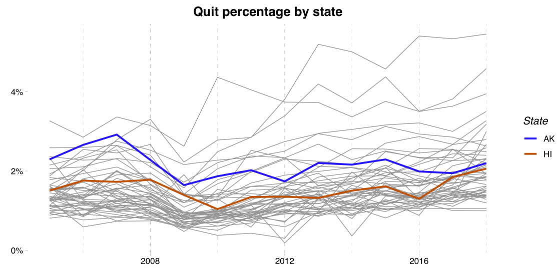
Figure 3: Summary statistics - year level



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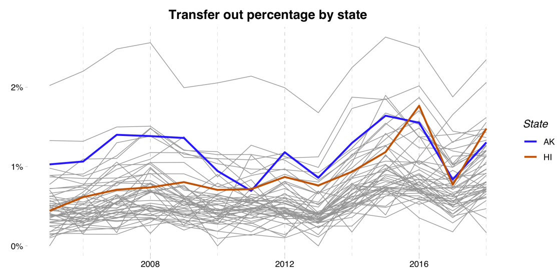

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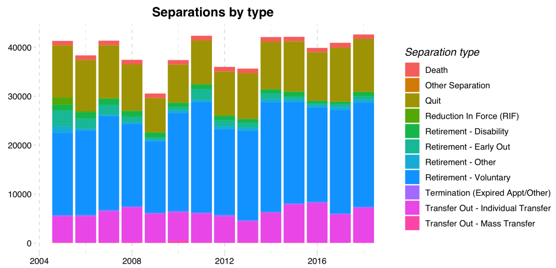
Figure 4: Summary statistics - year level



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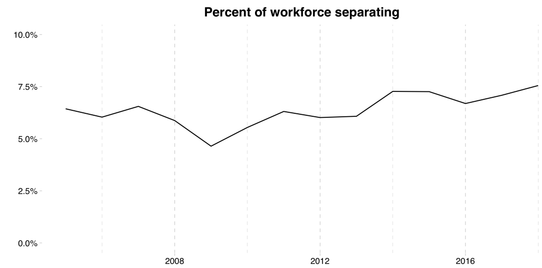

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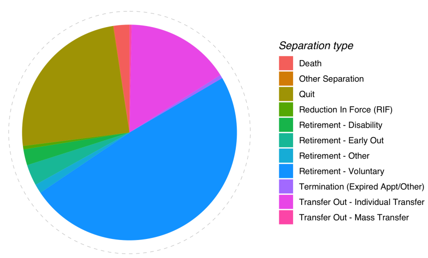

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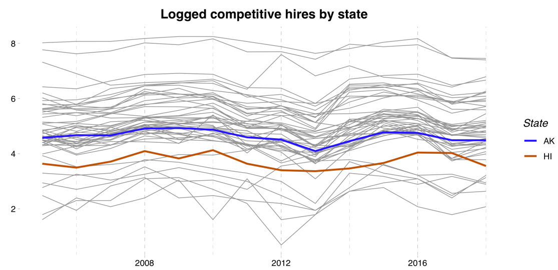
Figure 5: Separation summary statistics

Summary Statistics - Workforce Entry



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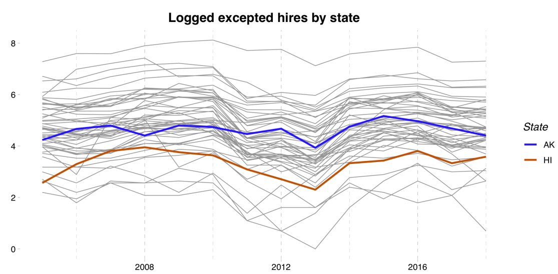

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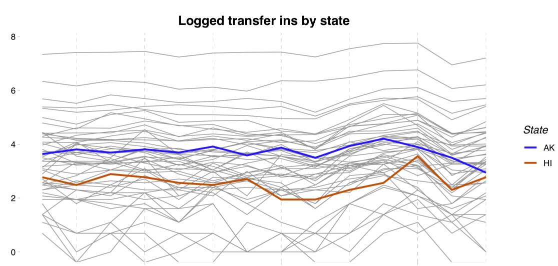

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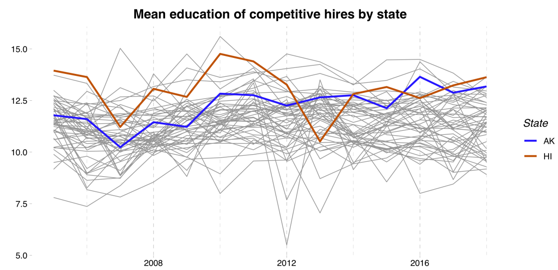
Figure 6: Summary statistics - year level



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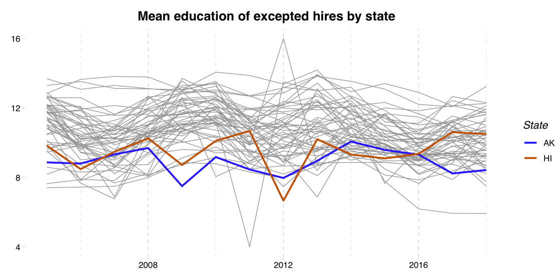

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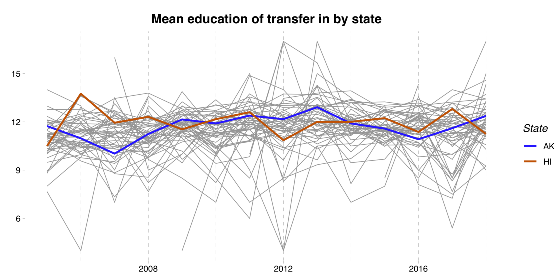

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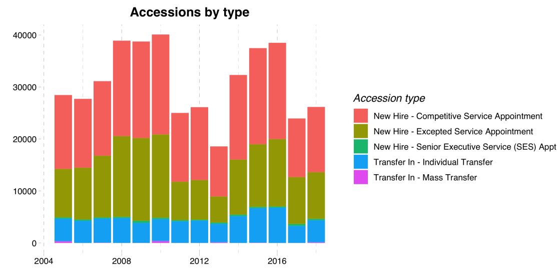
Figure 7: Summary statistics - year level



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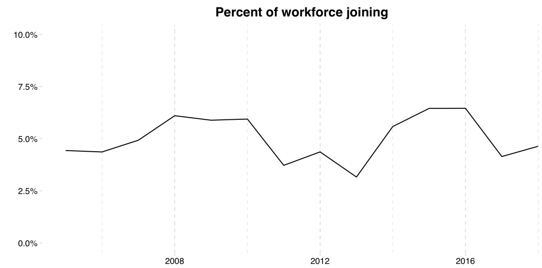

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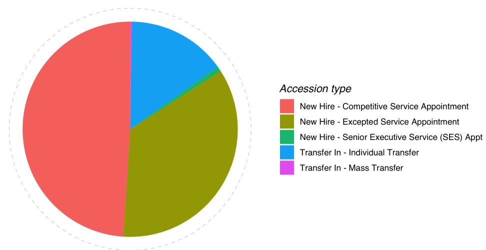

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Figure 8: Accession summary statistics

Summary Statistics - Workforce Change

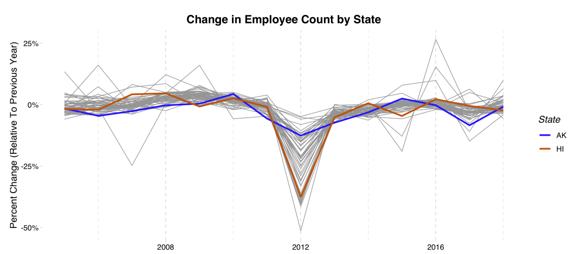


Figure 9: Change in workforce size

Econometric Framework

Adopting notation from Clarke and Tapia-Schythe (2021), I use a standard event-study framework to identify the impact of the pension policy. Specifically the model used is:

$$OutcomeVariable_{s,t} = \alpha + \sum_{j=2}^{J} \beta_j (\text{Lag } j)_{s,t} \times Treat_s + \sum_{k=1}^{K} \gamma_k (\text{Lead } k)_{s,t} \times Treat_s + \mu_s + \lambda_t + X'_{s,t}\Gamma + \epsilon_{s,t}$$

for state s at time t where μ_s and γ_t are state and time fixed effects, $X_{s,t}$ are (optionally) time-varying controls, and $\epsilon_{s,t}$ is an unobserved error term. For this setting, I do not use time-varying controls and rely on state and time fixed effects. I cluster standard errors at the state level.

For the control group, I use the 10 largest states (excluding Washington D.C. and Virginia). A concern in this setting is that smaller states suffer from noisier outcomes which reduces precision of estimates. To counter this, I use the top 10 largest states. For robustness, I include additional results with various control groups. Alternative control groups do not change estimates significantly.

To identify long term effects, I use the following framework:

$$OutcomeVariable_{s,t} = \alpha + \gamma PostEvent_{s,t} \times Treat_s + \mu_s + \lambda_t + X'_{s,t}\Gamma + \epsilon_{s,t}$$

The coefficient of interest is γ which identifies the impact of treatment in the long run. In this setting, long run will be denoted as all years post 2013. I include only years 2005 to 2009 as the relevant pre-treatment time period. This implies 2010 through 2013 are not used in this regression framework.

For high frequency data, such as monthly outcome variables, I use a cubic spline alongside the monthly event study. I split the data into groups as the following: pre-intervention (all months until December 2009); intervention (January 2010 to December 2012); and post-intervention (January 2012 forward).

I include regression results with the following framework for comparing outcome variables across ages:

$$OutcomeVariable_{s,t} = \alpha + \sum_{j=1}^{3} \beta_j (\text{Lead } j)_{s,t} + \gamma PostEvent_{s,t} \times Treat_s + \mu_s + \lambda_t + X'_{s,t}\Gamma + \epsilon_{s,t}$$

This allows the opportunity to compare the pre trend estimate against both the short term effect (captured by β_j) and the long term effect (captured by γ). This is useful for exploring heterogeneity when sample sizes become limited. Since small samples can bias a reference point, using multiple pre treatment periods provides a stable reference point.

In these results, I focus on non-military, full-time workers. This leaves 15,669,095 employments, 547,957 separations, and 433,151 accessions across time. I separate out military workers due to the fact they have a separate retirement system as discussed above.

For regressions with logged outcome variables, specifically at the monthly level, there are intervals with 0 counts. Due to this, I use the following in those cases: $log(x + 1)$.

Results

Workforce Exit - Retirements

The ideal experiment to calculate delaying behavior in retirement would be to have a worker's target retirement age and then see how it changes prior and post policy. Since it is not feasible to identify when a worker is planning to retire prior to policy, I rely on an event study to generate a counter factual. In Figure 10a, it shows that there is a large deviation of workers who did not retire in 2010, 2011, and 2013. This indicates that a significant amount of workers delayed their retirement age. I find in Table 2 that one year post the policy, there is approximately -15.25% decrease; two years post there is a -5.64% decrease; three years post there is a 114.27% increase; and four years post there is a -36.46% decrease. I make the following assumption: the missing mass of workers in 2010, 2011 and 2013 chose to retire in 2012. This is a plausible assumption given that the missing mass in those years combined is approximately the size of the increase in retirements in 2012. This can be seen in Table 2 where the sum of the missing mass from 2010, 2011, and 2013 is approximately -57% and the increase in retirements in 2012 is 114%. This provides an opportunity to estimate elasticities of those who selected into retiring in 2012.[12] The relevant elasticity of interest is the percent change in service years given a percent change in pension benefits.[13] To calculate elasticities, I separate out Hawaii and Alaska due to each having a different pension increase. I find that for workers who delayed their retirement for 2 years, the elasticity is 0.26 in Alaska and 0.56 in Hawaii. For workers that retired 1 year earlier, the elasticity is -0.14 in Alaska and -0.21 in Hawaii. Accounting for the workers that did not change their retirement date, the representative range of elasticities are from 0.06 to -0.04 in Alaska and 0.05 to -0.09 in Hawaii. The upper bound of these elasticities fall in line with the literature, previous reports have shown an upper bound of 0.1, however the lower bound is below previous estimates. This may be reconcilable with the fact that this policy is anticipated so workers may have less frictions allowing them to change their retirement plans. Previous research relies on unanticipated shocks to estimate the effect of pension policy on retirement decisions.

I separate out groups by age to look at heterogeneous effects of pension generosity. OPM provides information about workers within 5 year age bins and so I focus on the 3 age groups that make up 94.78% of retirements: 55-59, 60-64, and 65+. I find in Table 4 that age 55-59 had a -41.66% decline in retirements 2 years prior to the policy. Age 60-64 and 65+ had a -29.13% and -30.39% decrease in retirements. This indicates that older workers (60-64 and 65+) did not delay retirement as often compared to younger workers (55-59). In the year post 2012, there was a large mass of workers who retired early. I find that for age 55-59, there was a

[12]Note: this is not exactly perfect. An alternative method is grouping all pre-periods together as a reference year. This provides more reasonable estimates if one is willing to assume that there is no pre-treatment trends.

[13]Please see Appendix D for methodology on calculating elasticity.

-35.73% decline in retirements whereas for age 60-64 and 65+, there was a -89.87% and -56.56% decrease. This indicates that older workers were more likely to take an early retirement due to the pension increase. These facts align with the model presented earlier in the paper. Older workers will have a lower elasticity of labor supply with respect to pension benefits relative to younger workers.

In the long run, workers are less responsive to pension changes. In Table 3, I find that there was close to no change in the number of retirements yearly and there was almost no change in the service years at retirement. Workers in the short run cannot smooth their consumption from the pension shock and because of this retire early. Workers in the long run however have time to smooth their consumption. Since workers are not decreasing their years of service, this suggests that workers are instead increasing consumption. This could be due to preferences for consumption over leisure or due to constraints (such as Social Security retirement age or savings constraints). Altogether, this suggests that pensions have little effect on workers' retirement decisions in the long run.

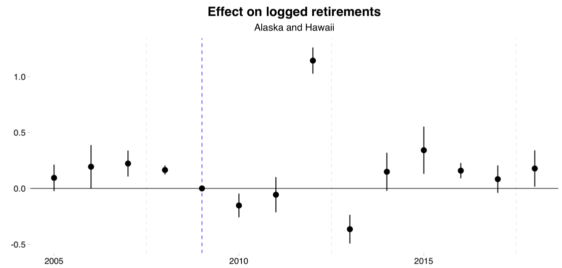
A concern may be that workers are unaware of the increase in pension generosity. I include an event study at the monthly level in Figure 11a. The coefficient of interest shows a large increase in retirements at the end of December 2012. This is when there was the largest jump in pension benefits.[14] I also include two other event studies for the average service years and average pension alongside which show that there is preemptive movement. This can be more clearly seen in the spline version 11b. These suggest that workers were aware of the policy and preemptively changed their retirement plans.

Additionally, I include an analysis excluding year 2009. This is due to the fact that the policy is passed in October of 2009 which may have led to partial treatment. I do find a significant decrease in retirements the year of 2009. When accounting for anticipation, I find the following elasticities: 0.1 to -0.13. This does not significantly change the elasticity range.

This policy induced a large portion of workers to change their retirement plans however the elasticities are relatively small suggesting that pension generosity has a small effect on retirement timing. A novel opportunity here is to isolate the effect of an early retirement. This paper finds elasticities that are in range of previous research. This paper extends this by finding a lower bound showing that pension generosity induces workers to retire earlier. The lower bound is estimated between -0.04 to -0.09. This is a relatively small elasticity and is comparable to the positive elasticity measured. In the long run, this policy has little to no effect on a worker's decision to retire. I find little difference in service years before and after the policy. This suggests that the marginal utility of consumption may be relatively high and workers are consuming

[14]Note: individuals retired prior to the full benefit meaning individuals received a 22% increase rather than a 24% increase in pension benefits. This suggests workers were not willing to wait 1 more year for 2% benefits.

more rather than enjoying leisure. Alternatively, workers may have a retirement age focal point which implies that the effect of pension generosity will be reduced. This focal point may be from the firm level (such as a minimum retirement age) or at the national level (such as Social Security retirement age). Further research should elucidate the different possible mechanisms at play.



(a)

(b)

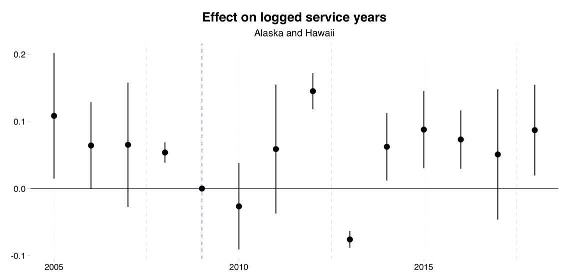


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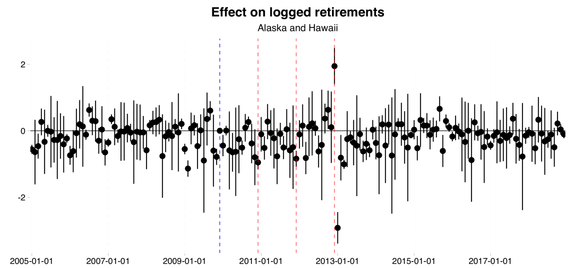
Figure 10: Effect of pension generosity on yearly logged outcomes



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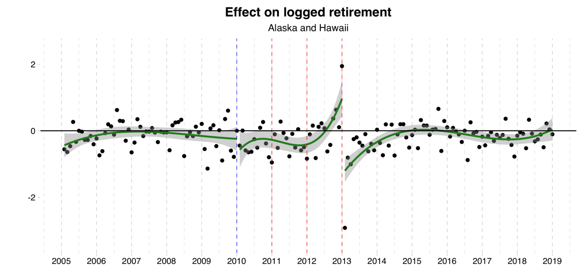

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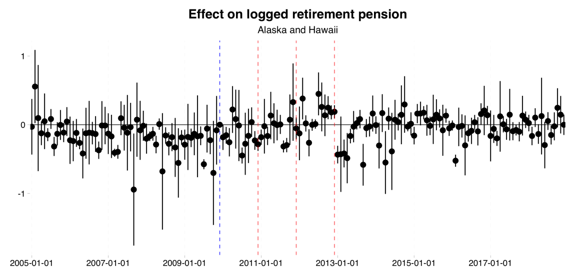

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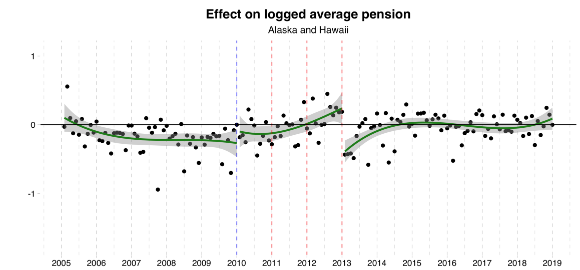

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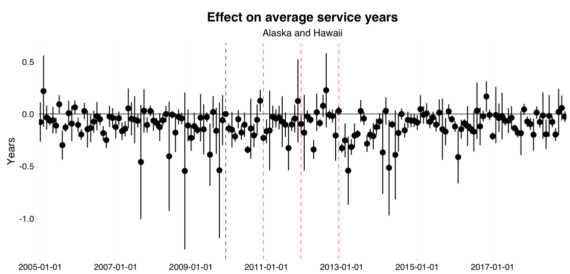

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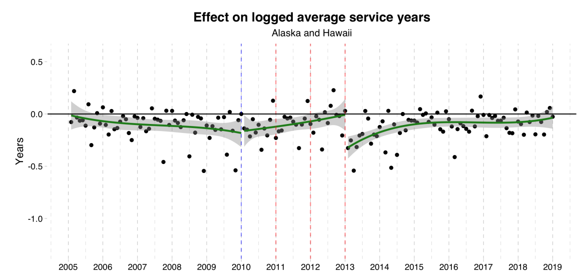


(f)

Figure 11: Effect of pension generosity on monthly logged outcomes

Table 2: Event Study: AK and HI

Dependent Variables:	Logged retirements	Logged pension	Logged service years
Model:	(1)	(2)	(3)
Variables			
treat × year = 2005	0.0943 (0.0605)	0.1940*** (0.0355)	0.1083** (0.0477)
treat × year = 2006	0.1939* (0.0990)	0.0682 (0.0580)	0.0641* (0.0331)
treat × year = 2007	0.2225*** (0.0592)	0.0750 (0.0693)	0.0652 (0.0473)
treat × year = 2008	0.1646*** (0.0209)	0.0093 (0.0466)	0.0537*** (0.0077)
treat × year = 2010	-0.1525*** (0.0540)	0.0165 (0.0355)	-0.0265 (0.0328)
treat × year = 2011	-0.0564 (0.0803)	0.1439*** (0.0193)	0.0588 (0.0490)
treat × year = 2012	1.143*** (0.0598)	0.3772*** (0.0272)	0.1451*** (0.0137)
treat × year = 2013	-0.3646*** (0.0655)	0.0845** (0.0409)	-0.0759*** (0.0064)
treat × year = 2014	0.1489* (0.0868)	0.2612*** (0.0167)	0.0623** (0.0256)
treat × year = 2015	0.3415*** (0.1076)	0.2232*** (0.0097)	0.0878*** (0.0294)
treat × year = 2016	0.1587*** (0.0350)	0.2144*** (0.0277)	0.0730*** (0.0222)
treat × year = 2017	0.0830 (0.0626)	0.2016*** (0.0247)	0.0508 (0.0496)
treat × year = 2018	0.1780** (0.0830)	0.2316*** (0.0146)	0.0870** (0.0345)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	714	714	714
R^2	0.98722	0.91073	0.67509
Within R^2	0.19700	0.15917	0.11281

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 3: Long run impact

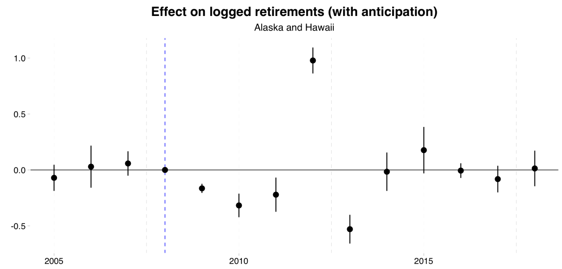
Dependent Variables:	Logged retirements	Logged service years	Logged pension
Model:	(1)	(2)	(3)
Variables			
treat × long_run = 1	0.0132	-0.0006	0.1398***
	(0.0194)	(0.0040)	(0.0301)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	459	459	459
R^2	0.98688	0.64483	0.91141
Within R^2	0.00010	4.38×10^{-6}	0.07122

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 4: Effect on logged retirements by age

Dependent Variable:	Logged retirements		
	65+	60	55
Model:	(1)	(2)	(3)
Variables			
treat × year = 2010	-0.3039*** (0.0586)	-0.2913*** (0.0541)	-0.4166*** (0.0825)
treat × year = 2011	-0.0470 (0.0806)	-0.2323* (0.1382)	-0.4074*** (0.0571)
treat × year = 2012	0.9089*** (0.0856)	0.9315*** (0.1278)	1.170*** (0.0308)
treat × year = 2013	-0.5656*** (0.0763)	-0.8987*** (0.1075)	-0.3573*** (0.0926)
treat × year = long_run	-0.0099 (0.0377)	0.0504 (0.0305)	-0.0030 (0.0270)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	305	306	306
R^2	0.98302	0.99050	0.98583
Within R^2	0.19003	0.39826	0.29810

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*



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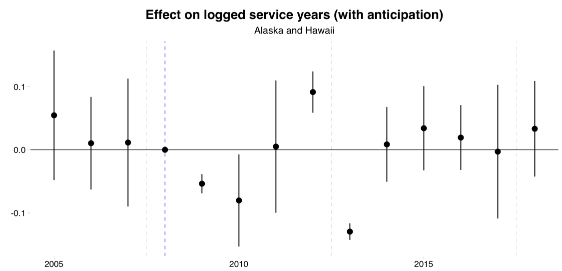

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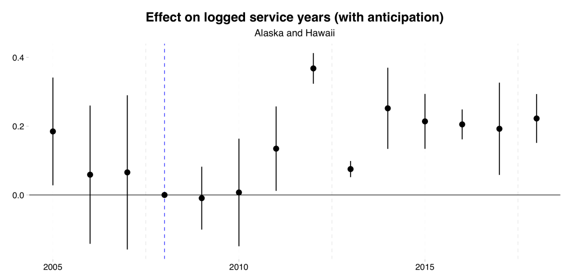


(c)

Figure 12: Effect of pension generosity on yearly logged outcomes - anticipation

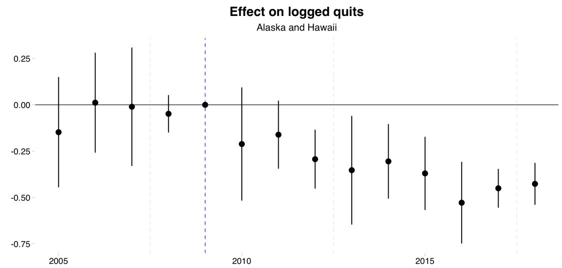
Table 5: Event Study: AK and HI with Anticipation

Dependent Variables:	Logged retirements	Logged service years	Logged pension
Model:	(1)	(2)	(3)
Variables			
treat × year = 2005	-0.0703 (0.0596)	0.0546 (0.0524)	0.1847** (0.0799)
treat × year = 2006	0.0293 (0.0959)	0.0104 (0.0374)	0.0590 (0.1025)
treat × year = 2007	0.0579 (0.0556)	0.0115 (0.0517)	0.0657 (0.1144)
treat × year = 2009	-0.1646*** (0.0209)	-0.0537*** (0.0077)	-0.0093 (0.0466)
treat × year = 2010	-0.3170*** (0.0537)	-0.0802** (0.0372)	0.0072 (0.0798)
treat × year = 2011	-0.2210*** (0.0779)	0.0051 (0.0534)	0.1346** (0.0626)
treat × year = 2012	0.9781*** (0.0592)	0.0914*** (0.0167)	0.3679*** (0.0227)
treat × year = 2013	-0.5292*** (0.0655)	-0.1296*** (0.0067)	0.0752*** (0.0120)
treat × year = 2014	-0.0157 (0.0876)	0.0085 (0.0302)	0.2519*** (0.0602)
treat × year = 2015	0.1769 (0.1058)	0.0341 (0.0340)	0.2139*** (0.0407)
treat × year = 2016	-0.0059 (0.0334)	0.0193 (0.0262)	0.2051*** (0.0222)
treat × year = 2017	-0.0816 (0.0607)	-0.0029 (0.0540)	0.1924*** (0.0684)
treat × year = 2018	0.0135 (0.0811)	0.0333 (0.0386)	0.2224*** (0.0362)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	714	714	714
R^2	0.98722	0.67509	0.91073
Within R^2	0.19700	0.11281	0.15917

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Workforce Exit - Retention

I first test to see if there is a change in *LogQuits* using an event study. I find that there is a large decrease in quits post policy which can be seen in Figure 13a and 13b. This decrease is larger for workers below the age of 50 compared to workers that are age 50 or above however is negative for both. Using a pre post model, I find that in Table 6, there is a 24.3% and 42.6% decrease in job quits above 50 and below 50, respectively. This indicates that Defined Benefits programs are effective at increasing retention. I further test to see if this effects the number of transfers out of Alaska. I find that there is a non-significant decrease in transfers out for both workers above and below 50. I find that the effect is larger for workers below 50 compared to workers above 50. This signals that workers below the age of 50 are more responsive to changes in compensation. Combined, these show that retention of workers increased indicating that pension benefits are an important factor in a worker's job search decision.



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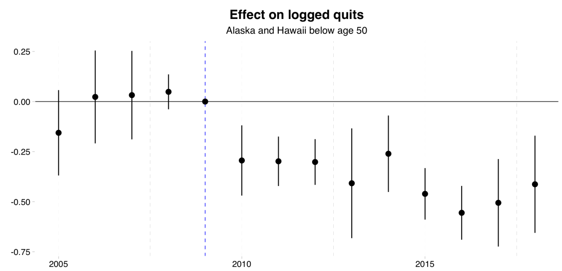

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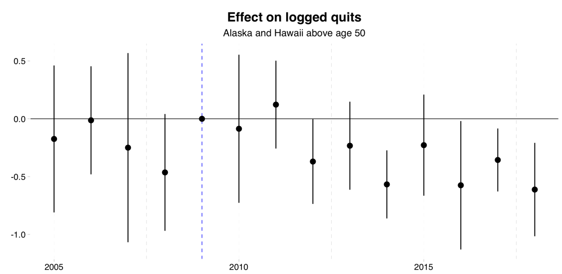

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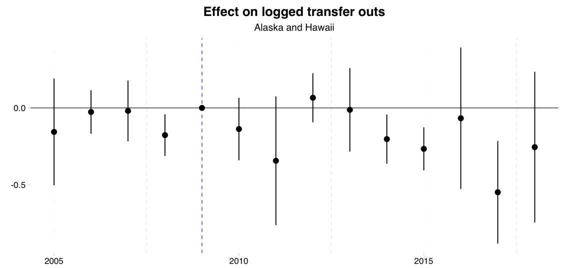
Figure 13: Logged yearly quits



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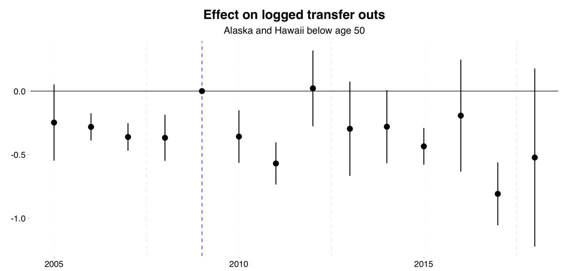

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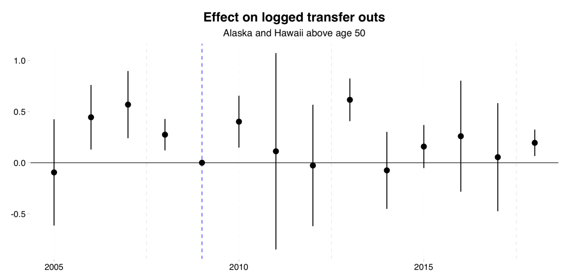

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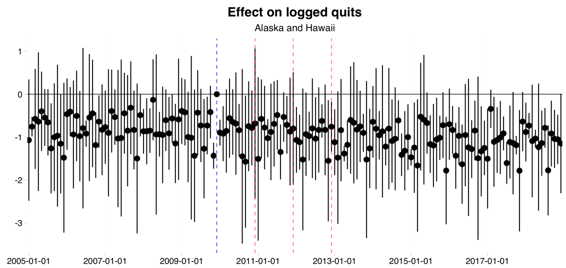
Figure 14: Logged transfer outs



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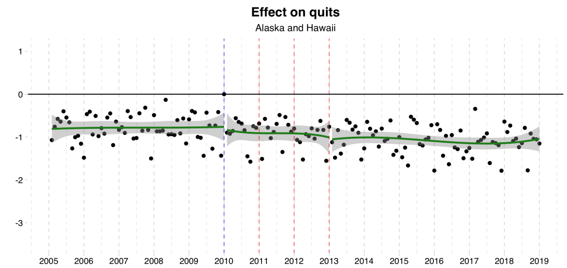

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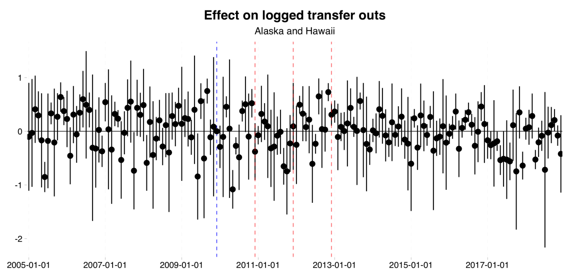

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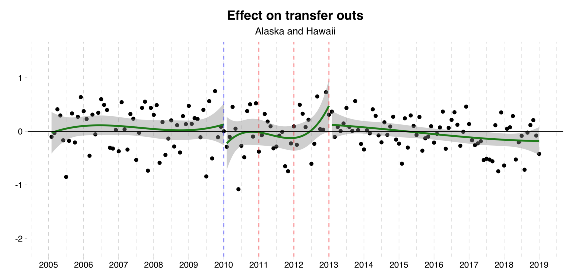


(d)

Figure 15: Logged monthly quits

Table 6: Long run effect on retention by age

Dependent Variables:	Logged transfer outs		Logged job quits	
	above 50	below 50	above 50	below 50
Model:	(1)	(2)	(3)	(4)
Variables				
treat × long_run = 1	-0.1806	-0.1330	-0.2426*	-0.4259***
	(0.2184)	(0.2313)	(0.1215)	(0.0901)
Fixed-effects				
year	Yes	Yes	Yes	Yes
fips	Yes	Yes	Yes	Yes
Fit statistics				
Observations	440	454	454	459
R^2	0.91788	0.96251	0.93838	0.97185
Within R^2	0.00246	0.00249	0.00663	0.04134

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Workforce Entry - Accessions

Given that net compensation increased for workers, I test to see if there was a change in accessions to Alaska. In a standard model, an exogenous increase in wages would lead to more competition for a given job, holding constant labor demand. A challenge in this setting is quantifying quality of a worker. I rely on education level[15] as an observable measure of quality. There are three types of accessions into the workforce: transfers, competitive service and excepted service. Transfers are individuals moving within the federal workforce across agencies or states. Competitive service are jobs that require an open posting to all job applicants and have prespecified hiring conditions. Excepted service are jobs that require a less specified hiring conditions due to lack of applicants or hiring conditions.[16] I test to see if the observable quality of competitive service jobs changed. I find in Table 9 that the average education level of a competitive hire is approximately 0.55 years higher and the average education level of an excepted hire is approximately 0.47. This shows that the observable quality of newly hired workers increased in terms of education level. Together, these show that there was an increase in worker quality of those hired for competitive hires. One possible mechanism explaining this is that due to less job quits, firms are hiring only highly qualified applicants which increases the average quality of a new hire. However this seems unlikely. If there were less quits, then the firm would hire less individuals. There is no change in the number of accessions in the treated states which can be seen in Figure 16. I test to see if there is a change in the composition of hires and find there is a small decrease in competitive hires relative to excepted hires in Figure 7. This suggests that the effect is driven by higher educated applicants applying for federal jobs.

[15] I utilize the education level provided by OPM to quantify this. For more information on education levels please see Appendix H.

[16] Please see the following link: OPM for information

Total Hires

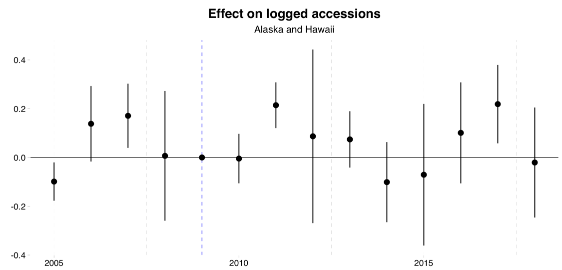
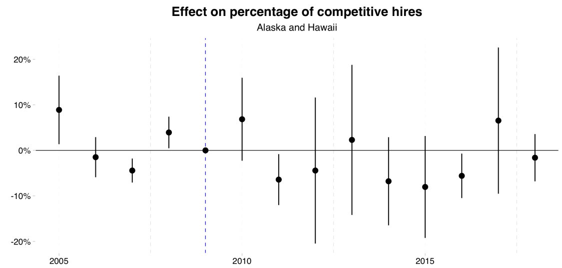


Figure 16: Logged accessions

Effect on Composition of Hires



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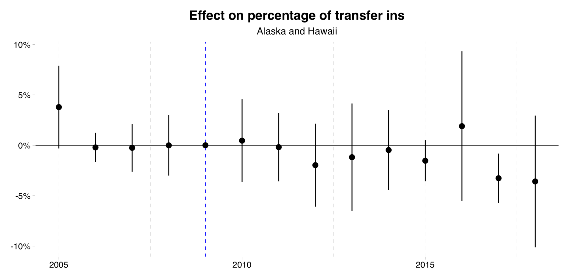

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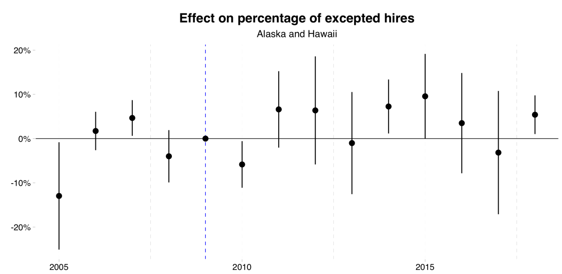

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Figure 17: Effect on ratio of hires

Table 7: Long run effect on ratio of hires

Dependent Variables:	Competitive (%)	Transfer (%)	Excepted (%)
Model:	(1)	(2)	(3)
Variables			
treat × long_run = 1	-0.0482*	-0.0222***	0.0715**
	(0.0274)	(0.0053)	(0.0278)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	459	459	459
R^2	0.48461	0.76575	0.64277
Within R^2	0.00426	0.00474	0.00999

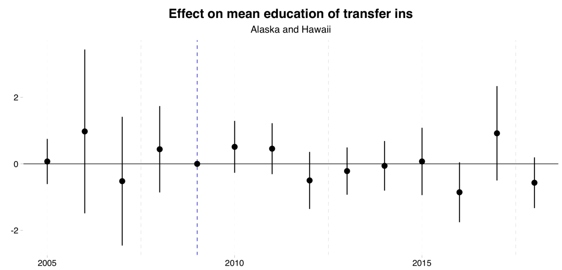
Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 8: Long run effect on type of hires

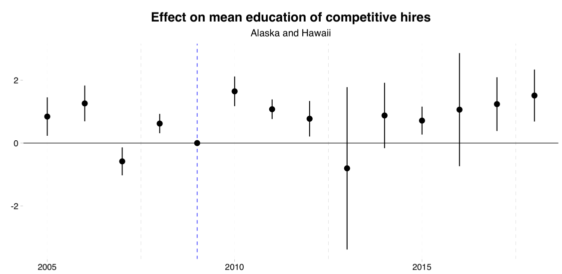
Dependent Variables:	log_comp_hire	log_transfer_in	log_excep_hire
Model:	(1)	(2)	(3)
Variables			
treat × long_run = 1	-0.1474**	-0.2380***	0.1731**
	(0.0607)	(0.0447)	(0.0737)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	459	453	459
R^2	0.96235	0.95134	0.94911
Within R^2	0.00385	0.00551	0.00424

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Observable Quality of Workers



(a)



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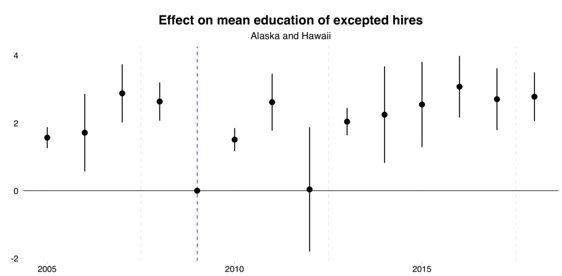


(c)

Figure 18: Effect on observable quality of accessions

Table 9: Long run effect on worker quality

Dependent Variables:	Competitive	Excepted	Transfer
		Mean Ed	
Model:	(1)	(2)	(3)
Variables			
treat × long_run = 1	0.5455	0.4720**	-0.3262
	(0.5668)	(0.1869)	(0.3374)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	459	459	453
R^2	0.55580	0.67333	0.30623
Within R^2	0.00404	0.00315	0.00069

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Wages

As mentioned previously, COLAs decrease and locality pay increases. As a result, taxable income increases. However what is less certain is the change in post-tax income. Conditional on a worker's tax bracket, this change could be positive or negative. I use TAXSIM35 from NBER to estimate a worker's tax rate. For pensions, I use the pension rate which is 0.8% prior to 2013, 3.3% from 2013 to 2014 and 4.1% from 2014 on as specified on by OPM. For marriage status, I assume that all workers are single filers since marriage status is not available in the dataset. Combined this allows me to estimate the tax liability for workers previous and post policy. I find that the average worker post tax income changed by - $227. This shows that Alaska and Hawaii had no differential wages due to the policy as intended by policymakers. This highlights that wages are not the main driver of retirement behavior.

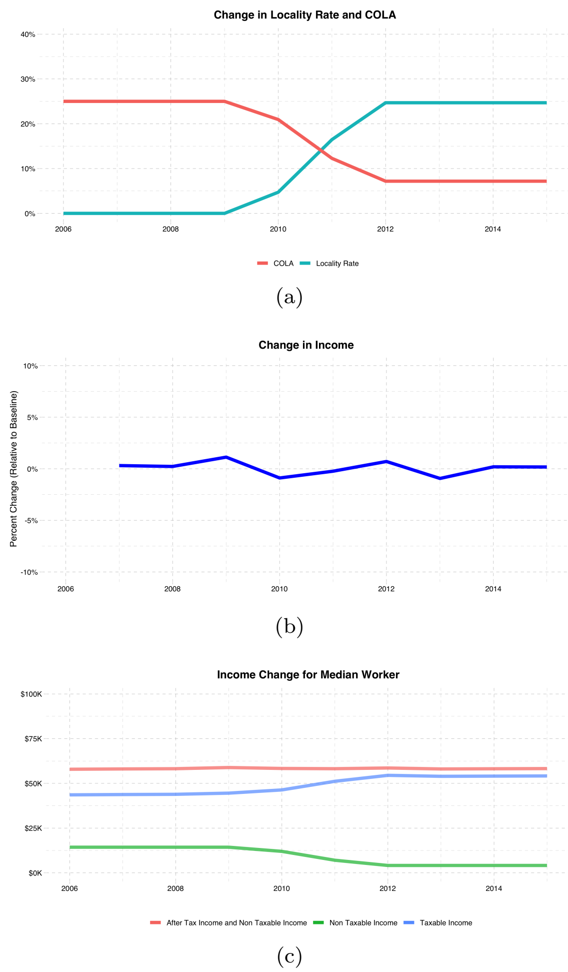
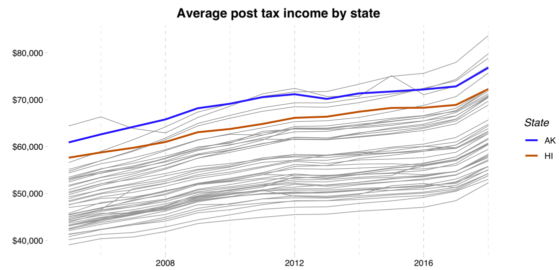
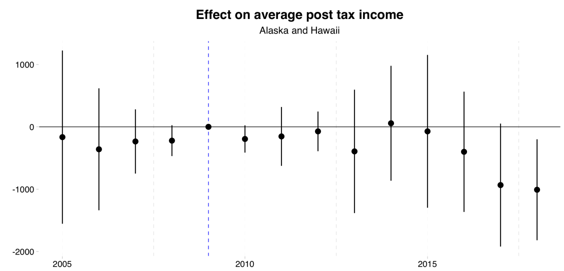


Figure 19: Theoretical change in compensation



(a)



(b)

Figure 20: Wage Statistics

Table 10: Long run impact

Dependent Variable:	Post Tax Income
Model:	(1)
Variables	
treat × long_run = 1	-226.5
	(338.6)
Fixed-effects	
year	Yes
fips	Yes
Fit statistics	
Observations	459
R^2	0.97790
Within R^2	0.00030

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Conclusion

This paper provides direct evidence of the effect of pension generosity on labor. The evidence presented suggests that workers in the long run do not change their lfetime of labor supply with respect to pension generosity. In the short run, I find that the elasticity of lifetime of labor supply with respect to pension generosity is between 0.06 and -0.09. The upper bound falls in live with previous literature however the lower bound is lower than previously reported in the literature. A reason for this may be that differentiating early and delayed retirements can be difficult in an unanticipated policy setting. I further find a large significant negative effect of pension generosity on job quits. Previous literature finds ambiguous effects however sample selection may be an important factor. Lastly, this paper provides some evidence that pensions may play a role in hiring highly qualified workers. Taken together, this paper provides new evidence on retirement behavior using a large, representative sample. The evidence shown suggests that pension benefits have large impacts on labor retention while smaller effects on retirement and labor quality.

Appendix

A Derivation of FOCs

$$\max_{C,S} U(C,S)$$

where C is aggregate consumption and S is total number of service years. The agent has the following lifetime consumption constraint:

$$C = S * w_t(1 - \tau_C) + (T - S) * B(S, \theta_t)$$

To solve for the first order condition, I use a Lagrangian:

$$L = U(C,S) + \lambda(S * w_t(1 - \tau_C) + (T - S) * B(S, \theta_t) - C)$$

$$L_C = 0 \rightarrow U_C(C,S) = \lambda$$

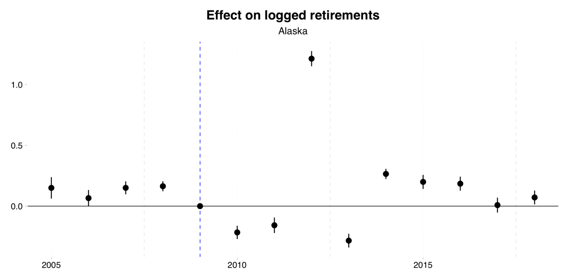
$$L_S = 0 \rightarrow -U_S(C,S) = \lambda(w(1 - \tau_C) + (T - S)B_S(S, \theta_t) - B(S, \theta_t))$$

Combining the first order conditions gives the following Euler equation

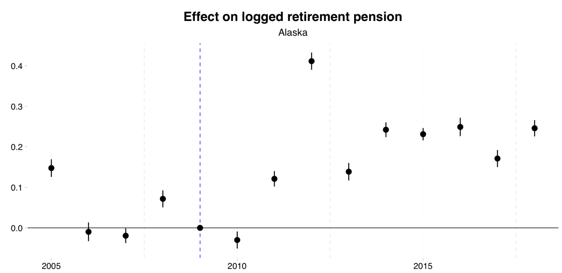
$$-U_S(C,S) = U_C(C,S)(w(1 - \tau_C) + (T - S)B_S(S, \theta_t) - B(S, \theta_t))$$

B Alaska

B.1 Retirements



(a)



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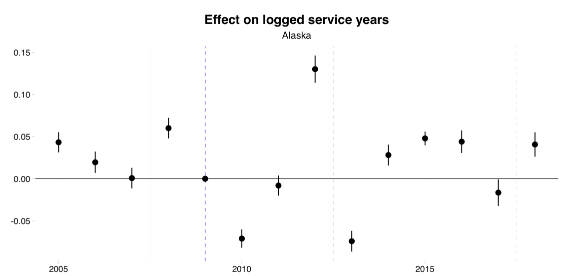
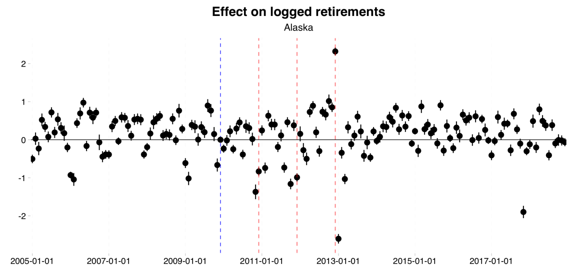
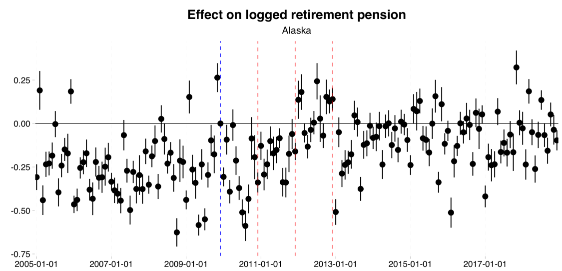


(c)

Figure 21: Effect of pension generosity on yearly logged outcomes



(a)



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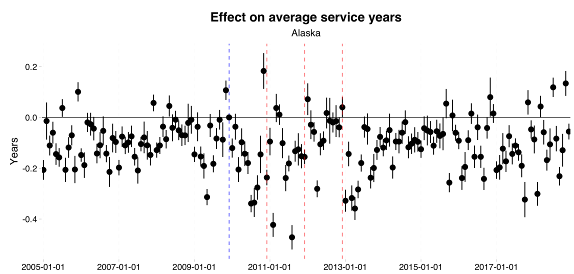
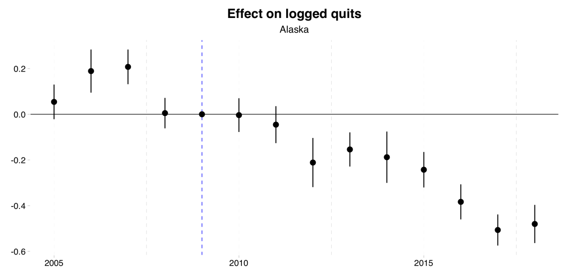


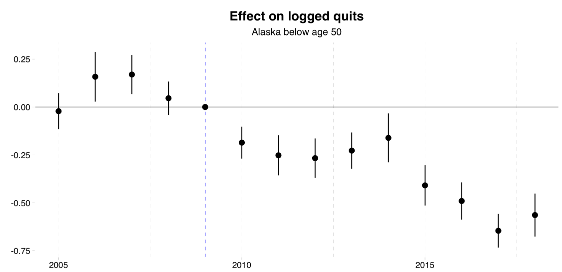
(c)

Figure 22: Effect of pension generosity on monthly logged outcomes

B.2 Retention



(a)



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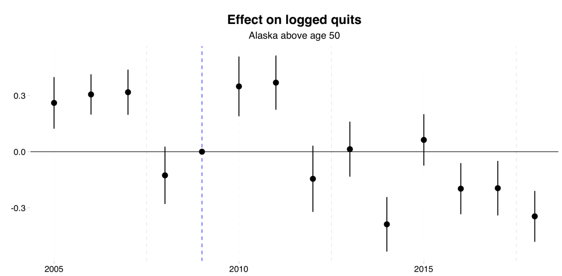
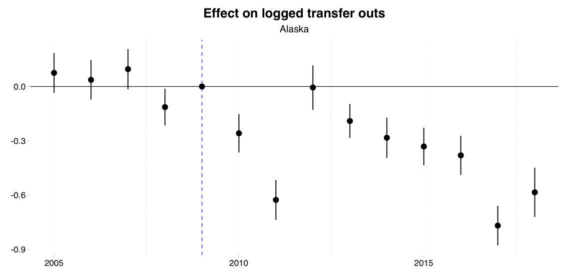
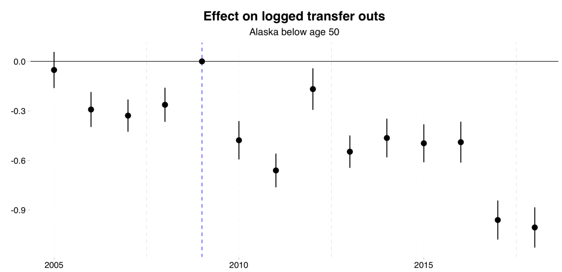


(c)

Figure 23: Logged yearly quits



(a)



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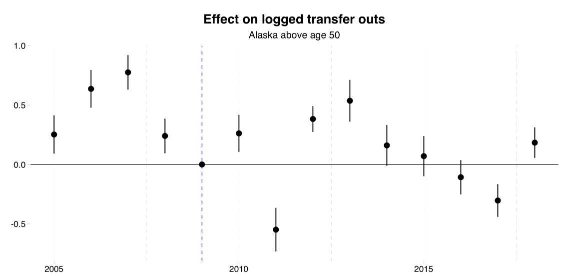


(c)

Figure 24: Logged transfer outs

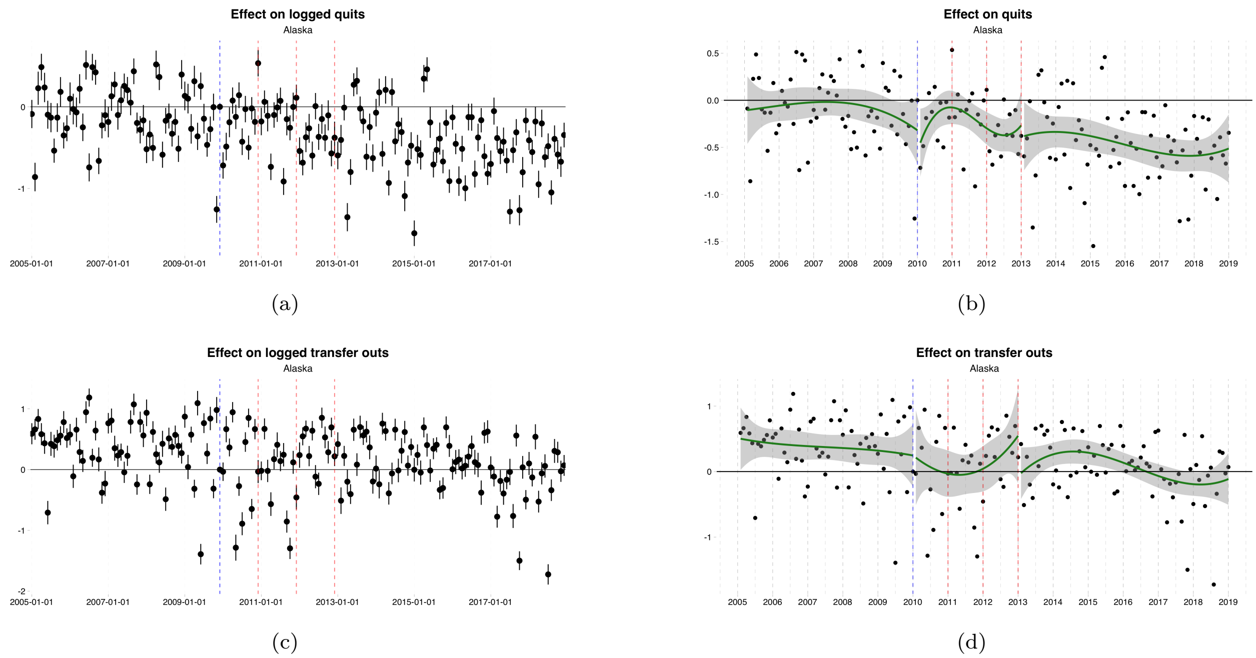


Figure 25: Logged monthly quits

B.3 Accessions

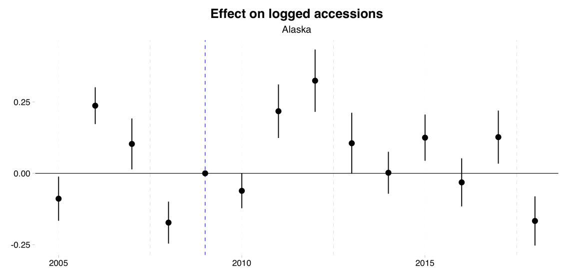
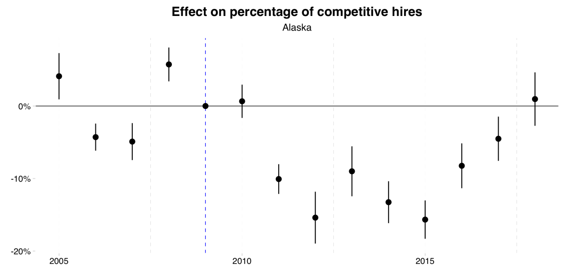
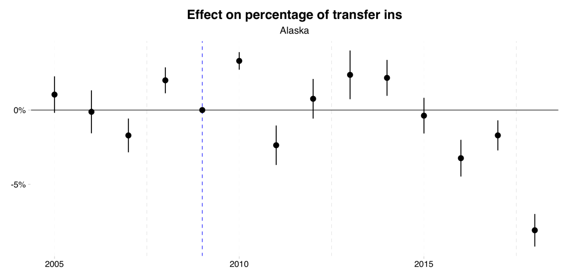


Figure 26: Logged accessions



(a)



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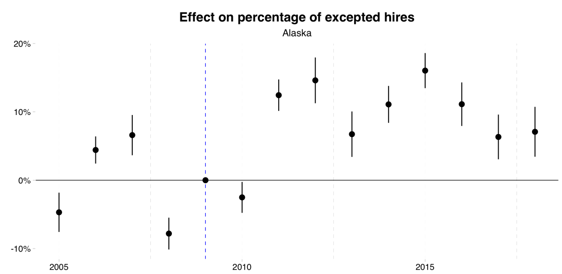
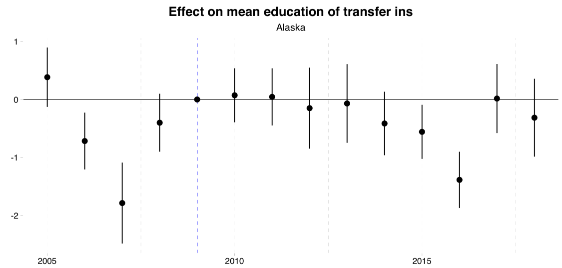


(c)

Figure 27: Effect on ratio of hires



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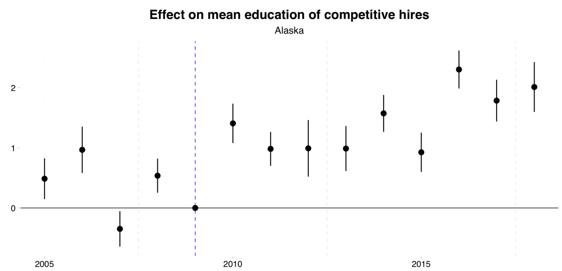

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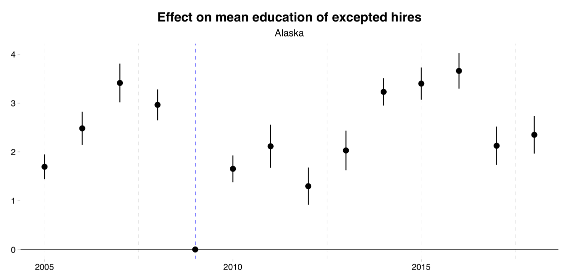
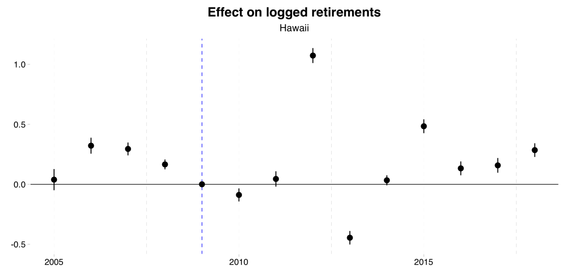


(c)

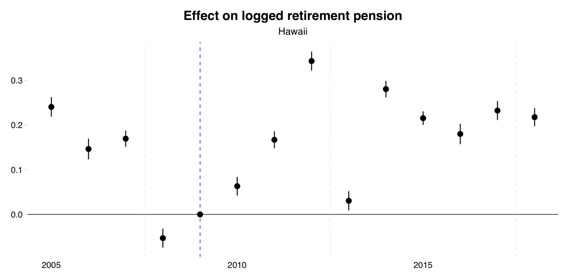
Figure 28: Effect on observable quality of accessions

C Hawaii

C.1 Retirements



(a)



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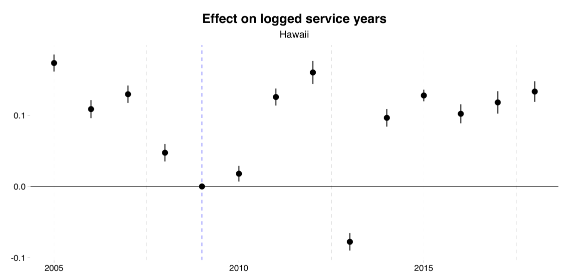
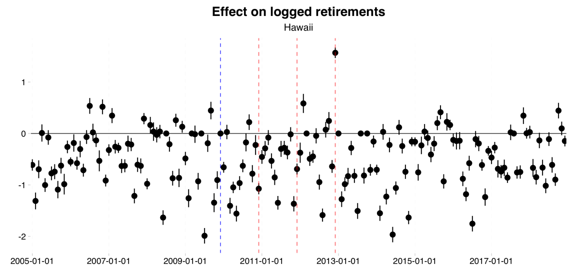
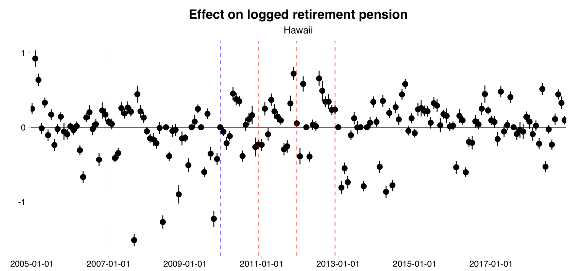


(c)

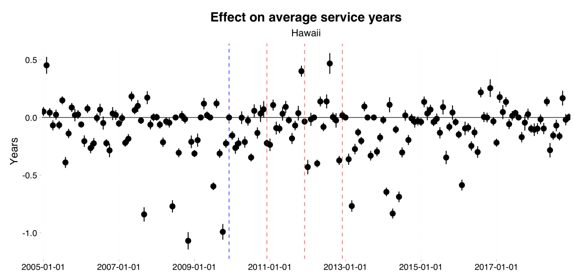
Figure 29: Effect of pension generosity on yearly logged outcomes



(a)



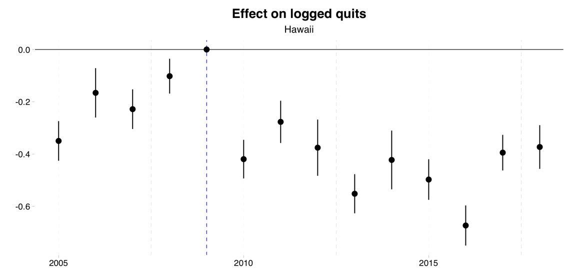
(b)



(c)

Figure 30: Effect of pension generosity on monthly logged outcomes – Alaska

C.2 Retention



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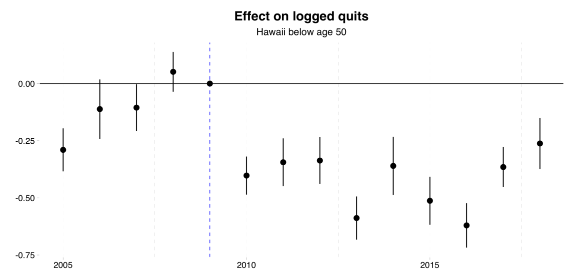

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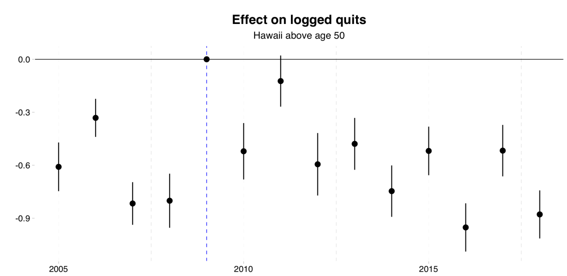
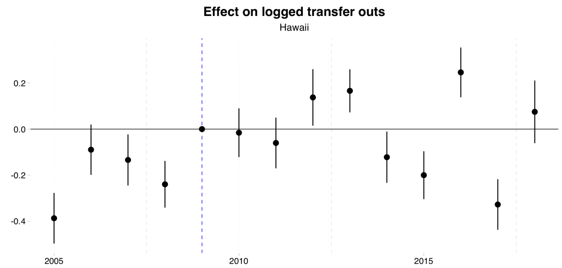


(c)

Figure 31: Logged yearly quits



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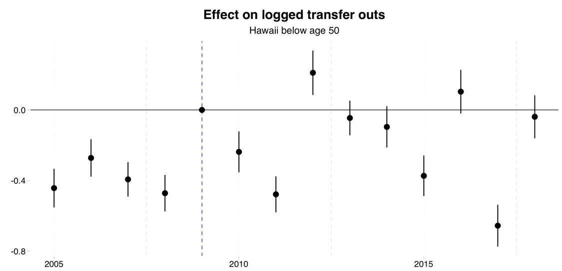

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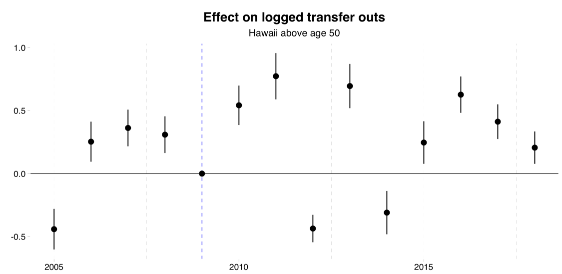
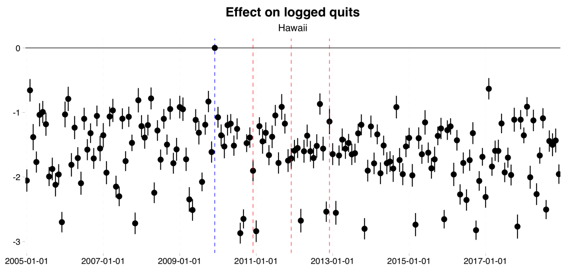
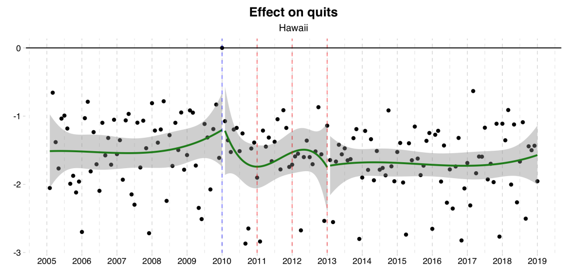


(c)

Figure 32: Logged transfer outs



(a)



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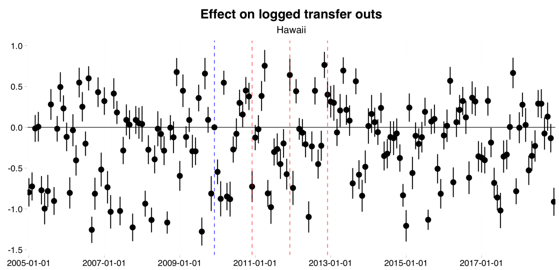

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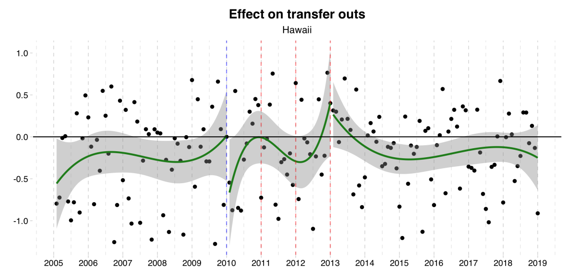


(d)

Figure 33: Logged monthly quits

C.3 Accessions

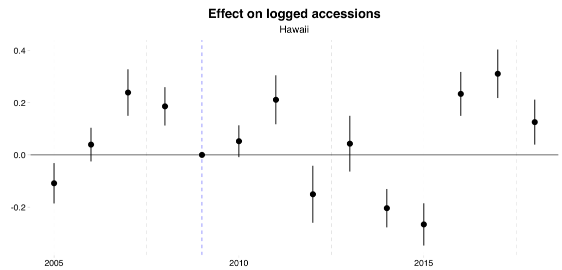
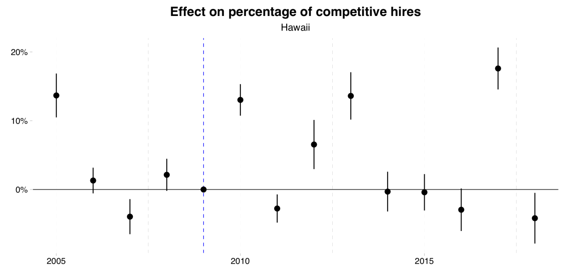


Figure 34: Logged accessions



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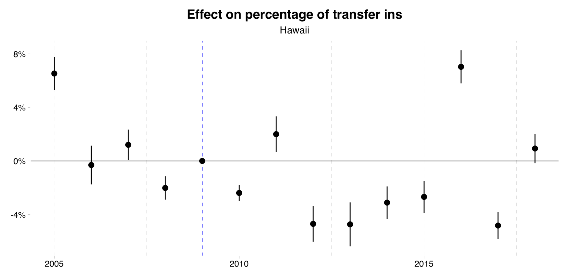

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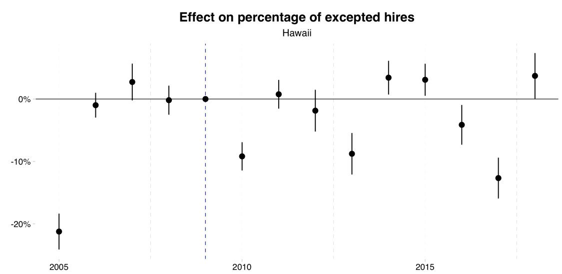
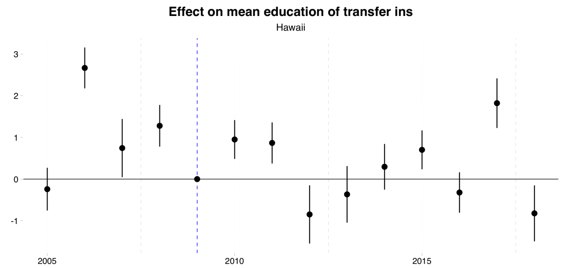


(c)

Figure 35: Effect on ratio of hires



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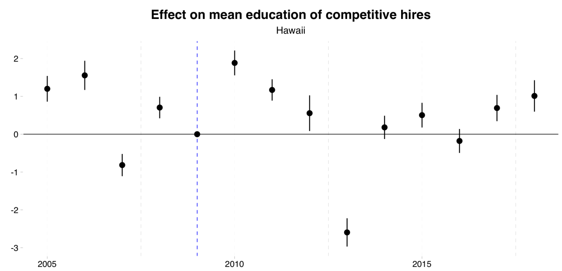

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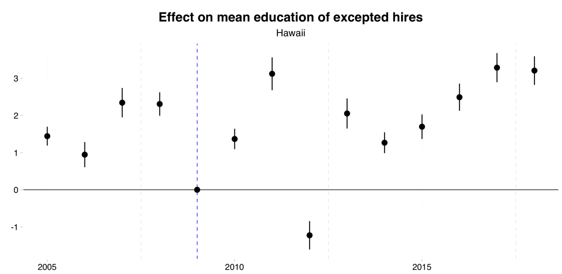


(c)

Figure 36: Effect on observable quality of accessions

D Elasticity Calculation

To calculate the elasticities, I do the following exercise:

1.) There is a $X\%$ of workers with an average Y years of service retiring in a given year. There exists some portion of workers who do not retire, $(1-X)\%$, that have an average Z years of service.

2.) In the counterfactual where both groups retire simultaneous, the average service years should be no different than the average, B, which is the sum of the fixed effect for that given year and that given state.

3.) This provides the following equation: $X\% * Y + (1-X)\% * Z = B$.

4.) I observe all terms, except for Z. Solving for Z, $Z = \frac{B - X\% * Y}{(1-X)\%}$.

5.) The percent change in pensions is constant for each worker, there is a 22

6.) I calculate the percent change in service years by finding the number of years a workers delayed retirement/retired early and dividing by the average service years, $\frac{\Delta ServiceYears}{Z}$.

7.) This results in $Elas = \frac{\frac{\Delta ServiceYears}{Z}}{\Delta Pensions}$.

8.) Since this only applies to workers that delayed, to make the estimate representative I multiply the elasticity by the percent of those who retired and add in the workers that did not delay, $X\% * Elas + (1 - X\%) * 0 = RepElas$.

E High-3 Average Salary

By definition of OPM: "Your "high-3" average salary is figured by averaging your highest basic pay over any 3 consecutive service."

Suppose there is a government worker, i, with salary S_i who works in Alaska. Starting in 2010, worker i would receive a growth in basic pay of $X\%$. Taking an average at the end of 2010, that worker i would have a "high-3" average salary of $\frac{S_i + S_i + S_i * (1+X)}{3}$. The following year, with a growth in basic pay of $Y\%$, that worker i would have a "high-3" average salary of $\frac{S_i + S_i * (1+Y) + S_i * (1+X)}{3}$. The following year, with a growth in basic pay of $Z\%$, that worker i would have a "high-3" average salary of $\frac{S_i * (1+Z) + S_i * (1+Y) + S_i * (1+X)}{3}$. The following year, with no growth, that worker i would have a "high-3" average salary of $\frac{S_i * (1+Z) + S_i * (1+Z) + S_i * (1+Y)}{3}$. The following year, with no growth, that worker i would have a "high-3" average salary of $\frac{S_i * (1+Z) + S_i * (1+Z) + S_i * (1+Z)}{3}$. Since we know that Z is the final percentage and the government took a phased in approach, then we can recalculate above.

"High-3" Salary amount after 0 years: S_i

"High-3" Salary amount after 1 year: $\frac{S_i + S_i + S_i * (1 + \frac{Z}{3})}{3} = S_i * \frac{1+1+1+\frac{Z}{3}}{3} = S_i * (1 + \frac{Z}{9})$

"High-3" Salary amount after 2 years: $\frac{S_i + S_i * (1 + \frac{2*Z}{3}) + S_i * (1 + \frac{Z}{3})}{3} = S_i * \frac{1+1+\frac{2*Z}{3}+1+\frac{Z}{3}}{3} =$ $S_i * (1 + \frac{Z}{3})$

"High-3" Salary amount after 3 years: $\frac{S_i * (1+Z) + S_i * (1 + \frac{2*Z}{3}) + S_i * (1 + \frac{Z}{3})}{3} = S_i * \frac{1+Z+1+\frac{2*Z}{3}+1+\frac{Z}{3}}{3} =$ $S_i * (1 + \frac{2*Z}{3})$

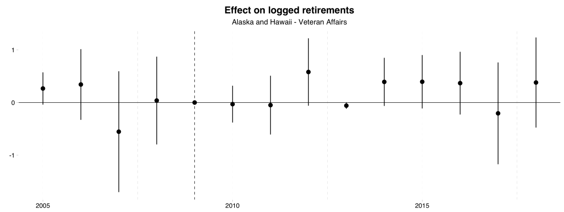
"High-3" Salary amount after 4 years: $\frac{S_i * (1+Z) + S_i * (1+Z) + S_i * (1 + \frac{2*Z}{3})}{3} = S_i * \frac{1+Z+1+Z+1+\frac{2*Z}{3}}{3} =$ $S_i * (1 + \frac{8*Z}{9})$

"High-3" Salary amount after 5 years: $\frac{S_i * (1+Z) + S_i * (1+Z) + S_i * (1+Z)}{3} = S_i * \frac{1+Z+1+Z+1+Z}{3} =$ $S_i * (1+Z)$

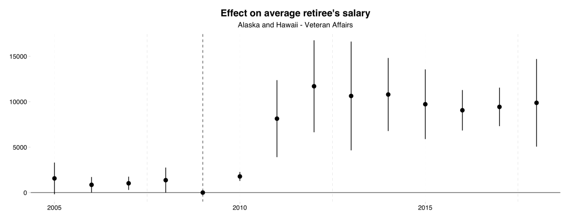
For Hawaii, the locality pay change is approximately 20

For Alaska, the locality pay change is approximately 25

F Department of Veterans Affairs



(a)



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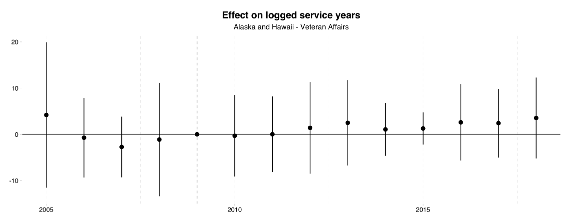


(c)

Figure 37: Effect of pension generosity on yearly logged outcomes - Veteran Affairs

G Department of Homeland Security

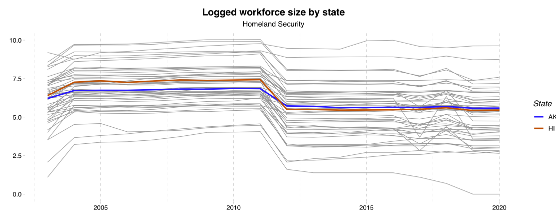


Figure 38: Homeland Security

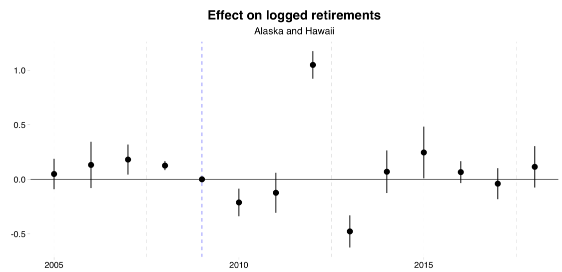
H Education

Years of Education	Description
01	No formal education or some elementary school - did not complete
02	Elementary school completed - no high school
03	Some high school - did not complete
04	High school graduate or certificate of equivalency
05	Terminal occupational program - did not complete
06	Terminal occupational program - certificate of completion, diploma or equivalent
07	Some college - less than one year
08	One year college
09	Two years college
10	Associate degree
11	Three years college
12	Four years college
13	Bachelor's degree
14	Post-bachelor's
15	First professional
16	Post-first professional
17	Master's degree
18	Post-master's
19	Sixth-year degree
20	Post-sixth year
21	Doctorate degree
22	Post-doctorate
**	**-Unspecified
	No education level reported

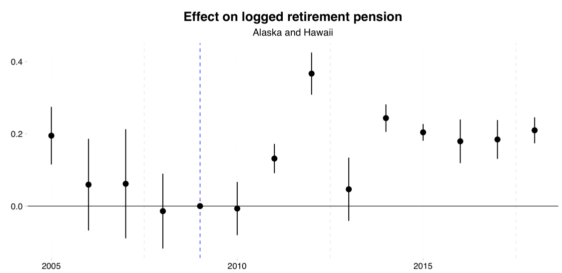
I Benefit-Cost Analysis

J Robustness Check: Large States as Control

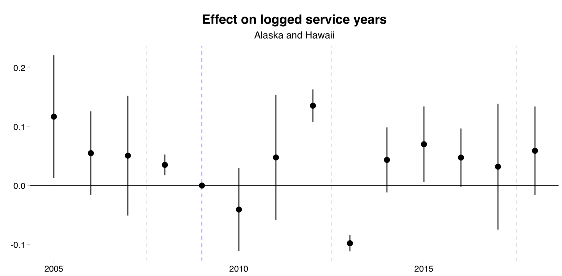
J.1 Retirements



(a)



(b)



(c)

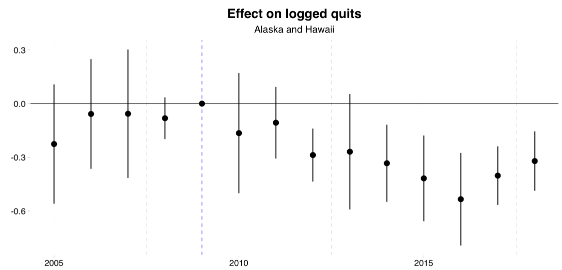
Figure 39: Effect of pension generosity on yearly logged outcomes

Table 11: Long run impact

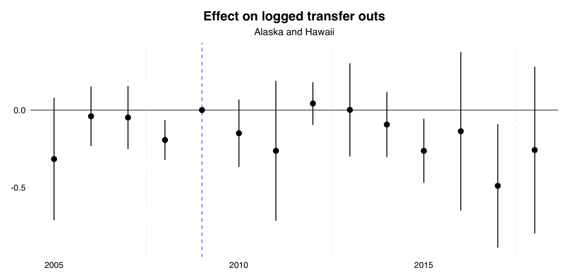
Dependent Variables:	Logged retirements	Logged service years	Logged pension
Model:	(1)	(2)	(3)
Variables			
treat $\times$ long_run = 1	-0.0307	-0.0140*	0.1288***
	(0.0221)	(0.0074)	(0.0332)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	108	108	108
R^2	0.99203	0.69674	0.92470
Within R^2	0.00624	0.01908	0.29566

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

J.2 Retention



(a)



(b)

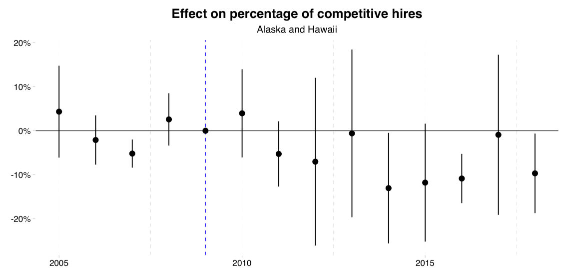
Figure 40: Logged yearly quits and transfers

Table 12: Long run effect on retention by age

Dependent Variables:	Logged transfer outs		Logged job quits	
	above 50	below 50	above 50	below 50
Model:	(1)	(2)	(3)	(4)
Variables				
treat $\times$ long_run = 1	-0.1123	-0.0831	-0.2067	-0.3385**
	(0.2431)	(0.2518)	(0.1337)	(0.1119)
Fixed-effects				
year	Yes	Yes	Yes	Yes
fips	Yes	Yes	Yes	Yes
Fit statistics				
Observations	108	108	108	108
R^2	0.93132	0.96183	0.95021	0.97469
Within R^2	0.00908	0.00890	0.05437	0.18982

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

J.3 Accessions



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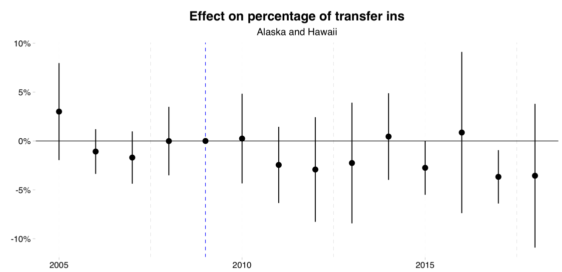

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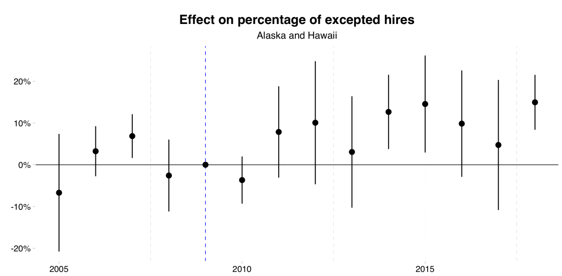
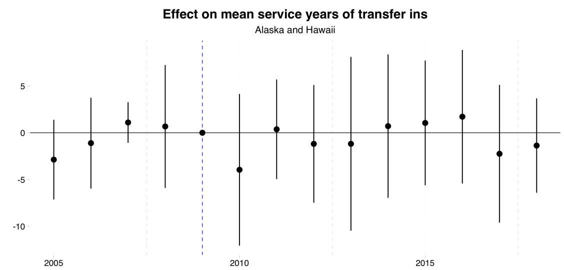
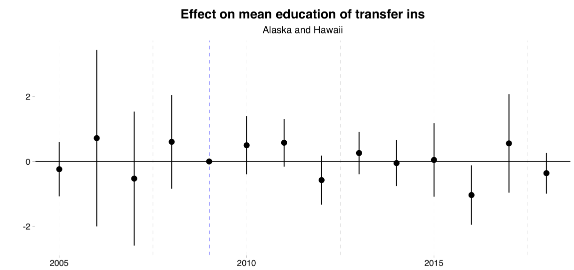


(c)

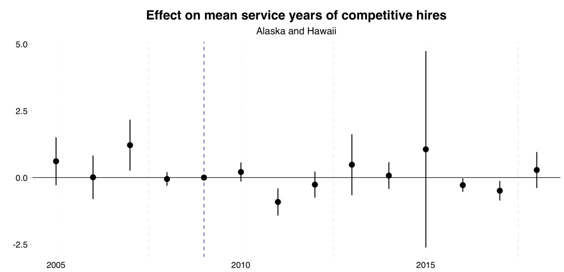
Figure 41: Effect on ratio of hires



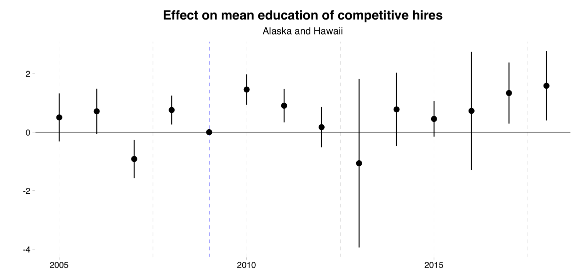
(a)



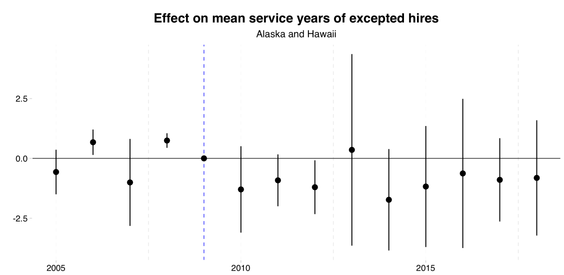
(b)



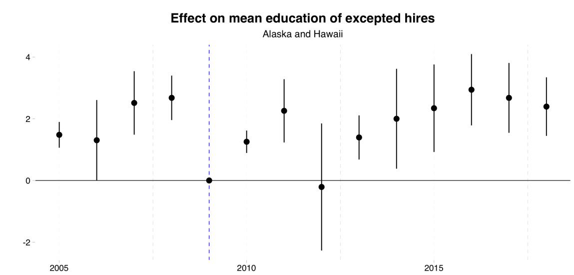
(c)



(d)



(e)



(f)

Figure 42: Effect on observable quality of accessions

Table 13: Long run effect on worker quality

Dependent Variables:	Competitive		Excepted		Transfer	
	Mean Ed	Mean LOS	Mean Ed	Mean LOS	Mean Ed	Mean LOS
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
treat × long_run = 1	0.7119	-0.3177	0.4772	-1.011	-0.3078	0.5219
	(0.6508)	(0.5256)	(0.3726)	(0.7708)	(0.3668)	(1.181)
Fixed-effects						
year	Yes	Yes	Yes	Yes	Yes	Yes
fips	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics						
Observations	108	108	108	108	108	108
R^2	0.72109	0.52352	0.66338	0.66636	0.58962	0.74837
Within R^2	0.04171	0.01212	0.01666	0.13984	0.01209	0.00707

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 14: Long run effect on ratio of hires

Dependent Variables:	Competitive (%)	Transfer (%)	Excepted (%)
Model:	(1)	(2)	(3)
Variables			
treat × long_run = 1	-0.0916**	-0.0179*	0.1115**
	(0.0359)	(0.0095)	(0.0384)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	108	108	108
R^2	0.51217	0.79125	0.63848
Within R^2	0.06864	0.01826	0.10243

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

Table 15: Long run effect on type of hires

Dependent Variables:	log_comp_hire	log_transfer_in	log_excep_hire
Model:	(1)	(2)	(3)
Variables			
treat $\times$ long_run = 1	-0.2210*	-0.1561*	0.2910**
	(0.1090)	(0.0783)	(0.1005)
Fixed-effects			
year	Yes	Yes	Yes
fips	Yes	Yes	Yes
Fit statistics			
Observations	108	108	108
R^2	0.93927	0.94657	0.93812
Within R^2	0.03580	0.02036	0.05941

Clustered (fips) standard-errors in parentheses
*Signif. Codes: ***: 0.01, **: 0.05, *: 0.1*

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