Economic Consequences of Public Pension Underfunding Transparency: Evidence from Housing Market and Local Economics

Abstract: This paper sheds light on the mechanisms through which state pension underfunding influences local housing markets and economies. Using both a contiguous border-county approach and a single state study in California, I find that counties from states with more severe pension underfunding experience lower growth in housing prices. Such effect is stronger after two GASB regulation changes that enhance the transparency and salience of states' pension underfunding, and the media plays an important role in disseminating such information. More underfunded states cut back on public spending, and local economic activities are also negatively affected when pension shortfalls are revealed.

Keywords: pension underfunding; housing market; pension reporting; economic consequences; local economies
JEL Classifications: H75; H83; G12; M48; O18; R30; R31

1. INTRODUCTION

The public pension liabilities for countries around the world have been growing at a concerning speed. As of September 2019, public pension plans in the United States—mostly defined benefits (DB) plans—have over $4.41 trillion of invested assets and cover the pension benefits of around 14.7 million active public employees (about 13.8% of the US workforce) and 10.3 million retirees (NASRA, 2019). However, the state governments' pension underfunding gap is estimated to be at least $1.6 trillion, and based on lower expected return assumptions, the pension underfunding gap can be as big as 4 to 6 trillion dollars (Rauh, 2016). Yet, the broader economic impact of the public pension underfunding is still under-researched.

This paper investigates the questions of whether public pension underfunding can affect the real economies, and how an improvement in the measurement and transparency of governments' pension underfunding amplifies the effect. By applying both a contiguous border county approach and a single-state analysis in California, I find that state-level pension underfunding suppresses the growth of local housing prices and local economic activities. Such effect is stronger after the adoption of two government pension accounting regulations GASB 67 and GASB 68 that significantly enhance the accuracy, transparency, and accessibility of government pension underfunding information. I provide evidence that an increase in individual attention and media coverage on governments' pension underfunding intensifies the effects by influencing the decision makings of both the governments and less sophisticated individuals such as taxpayers, voters, and homebuyers. Furthermore, I show that governments spend less on healthcare and police forces, and that local economic outcomes including the number of business establishments and public employment are negatively affected when governments' pension underfunding information is revealed after the GASB regulations.

Governments' efforts to reduce pension underfunding can have impacts on the housing market directly via property taxes, or indirectly through other forms of taxation and reduction on public spending. If a government wants to divert more funds to the pension plans, they need to either increase taxes or cut spending on other projects. If the tax is in the form of property taxes, the housing market will be negatively impacted (Bai et al., 2014). For example, Illinois has been using property taxes to get funding for its teacher pension plans, and it has experienced low growth in the housing market.[1] If the government imposes taxes on other categories, such as sales tax, it will make the state less attractive for the taxpayers (both individuals and business owners), posing a negative pressure on the housing market growth. [2] Governments can also divert funds from other public projects to fund the pension plans, such as in the case of California. The reduction in public spending will make the regions less attractive to existing and potential homeowners.[3] In the fiscal year 2017, state and local governments on average diverted 4.7% of direct general spending to pension plans. Some states, such as Illinois and Connecticut, spent 10-25% of their budgets on these plans (NARSA, 2019). If existing and potential homeowners expect higher taxes and worse public services in a certain region, they will be less willing to reside or invest in the regions, which pushes down the demands and potentially increases the supplies of housing properties, causing the

[1] For example, since 1996, total property tax extensions (total taxes billed) in Illinois have increased by 52 percent after adjusting for inflation. A recent report reveals that the increase is due to the diversion of the state education fund to teacher's pensions, as well as the growth in local government employee pensions and benefits. About 31% of the property taxes go to teacher pension funds, and 14% of those go to employee benefits (Divounguy, Hill and Tabor, 2018).

[2] In a five-year plan released by the Civil Federation in Illinois to stabilize the state's financial condition in 2018, the state proposes an expansion of taxable basis in sales taxes by 14 additional categories, cutting spending growth to 2.1%, and removing all state exclusion on all federal taxable retirement income. See "State of Illinois FY2019 Recommended Operating and Capital Budgets: Analysis and Recommendations, The Institute of Illinois' Fiscal Sustainability, 2018".

[3] In a budgeting meeting of the City of South Pasadena in California in March 2019, the City Council expected that due to pension underfunding pressure from the CalPERS plan, there will be potential cuts to employees and services in the city. This includes eliminating crime prevention programs, the police cadet program, and certain special events such as Concerts in the Park and junior/senior programs. See "City Budget Facing $1million Deficit, Cuts, Taxes on Horizon", March 15, 2019. https://southpasadenareview.com/city-budget-facing-1-million-deficit/

housing market to growth more slowly. Thus, the funding status of government pension plans have important implications on government budgeting and the soundness of local economies. Take Illinois as an example, the state has lost more than 18,000 residents since 2010 according to the latest Census Bureau release, citing poor housing and high taxes as the major reasons for leaving.[4]

I first focus on the implications of pension underfunding on the local housing market for the following reasons. Housing prices have the advantage of being timely, transparent, and sensitive to changes in the real estate market's expectation of property values (Muth, 1960 and 1963; Olsen, 1969; Smith et al., 1988). Thus, even if the governments have not yet implemented tax increase of spending cut policy, rational housing market investors will be able to form ***expectation*** of governments' future actions and change their valuations of the housing properties accordingly. Thus, compared to other outcomes such as population loss, I am more likely to observe reaction in the housing market in a timelier manner. Housing is also one of the most important assets in the US economy. In 2015 the housing sector accounted for 15.6% of total US economic activity, and total household real estate holdings were worth more than $22.5 trillion (National Association of Realtors, 2016). The housing market thus provides a valuable setting to understand the welfare implications of government pension underfunding.

However, it is empirically difficult to evaluate the impact of pension underfunding on the housing market for several reasons. First, there could be omitted variables that affect both state level pension underfunding and state economic conditions. Second, reversed causality would be an issue, since a worse-performing housing market can lead to worse state financials, and thus worse pension underfunding. Third, and importantly, there are concerns that whether governments would take real actions to reduce pension underfunding, and that whether taxpayers or

[4] Source: Illinois policy, "Blame Illinois Exodus on Jobs, housing, tax policy". https://www.illinoispolicy.org/blame-illinois-exodus-on-jobs-housing-tax-policy/

homeowners really understand the implications of pension shortfalls. Previous studies find mixed results on the relations between pension underfunding and housing markets using limited data and constrained econometrical methods. For example, Epple and Schipper (1981) propose a negative relationship between pension underfunding and housing prices in a theoretical setting, but Leeds (1985) does not find the result with a simple OLS regression of 67 cities in Chicago. MacKay (2014) studies the housing market's reaction to negative pension funding news about the city of San Diego in 2006 and finds that housing prices drop following the news. Bagchi (2017) studies the state of Pennsylvania during the year 1990 to 2011 and finds no relation between housing prices and pension underfunding.

The mixed results from prior literature are partially due to the limitations in data and econometrical approaches. Another important factor that was often overlooked is that governments' pension information used to be highly inaccurate and untransparent in the United States due to the previous government accounting regulations. Unlike the corporate pension reporting, the previous pension reporting rules (GASB 25 and 27) did not require governments to report their total pension liabilities on their balance sheet. Governments were also notorious for manipulating their pension accounts to appear to be significantly less underfunded (Novy-Marx and Raul, 2009; Naughton et al., 2015). The calculation of future pension liabilities was based on inaccurate and usually arbitrarily high return rate assumptions. Governments thus had few incentives to reduce the pension shortfalls and were reluctant to implement auxiliary policies to fund the pension plans. Second, the problematic accounting made it very difficult to be acquired and analyzed by less-sophisticated individuals such as taxpayers and existing and potential homeowners. It is thus not surprising that the homeowners or taxpayers were not able to properly incorporate the pension shortfall when making decisions.

To overcome such obstacles, I exploit a regulatory shock that significantly enhances the transparency and attention on state pension plans' underfunding status. The Government Accounting Standard Board (GASB) in the United States recently released two new pension reporting rules, GASB 67 (Financial Reporting for Pension Plans, effective for plan years starting after June 15, 2013) and GASB 68 (Accounting and Financial Reporting for Pensions, effective for fiscal years starting after June 15, 2014). These rules significantly change the ways how pension liabilities should be measured and disclosed for pension plans and sponsoring governments. For example, pension plans are now required to use a lower "blended discount rate" approach to discount their future pension obligations. Also, sponsoring governments are required to recognize the full total pension liabilities on their balance sheet. Thus, it would be harder for governments to cover up the actual pension shortfalls, and they face more pressures to take actions to reduce the underfunding of pension plans. I hypothesize that following the regulation changes, the governments' pension underfunding status will be more transparent, accurate, and more salient for the interested parties, including taxpayers, citizens, and potential and existing homeowners who are less sophisticated. As a result, they will be less willing to reside and invest in states with a larger pension shortfall, fearing future government actions including tax increases and spending cuts to fund the pension plans, and the housing price growths in those states will be suppressed.

To empirically test my hypothesis, I adopt the contiguous county approach and I compare the housing price growth rates within pairs of adjacent counties on opposite sides of state borders. I find that during the sample period from the year 2012 to 2017, counties from states with larger revealed pension underfunding have lower housing price growth compared to adjacent counties in other states. Such effect is stronger in the post-GASB period. An increase in pension underfunding from the 25^{th} percentile to the 75^{th} percentile is associated with a 0.41 percentage points decrease

in housing price growth rate, which translates to a relative decline of 17 percent. The results are robust when using alternative pension underfunding measures and alternative housing market indicators. The evidence consistently suggests that improved transparency of states' pension underfunding suppresses housing market growth.

To better understand the information channels through which pension underfunding are communicated to the stakeholders, I examine the changes in individual attention and media coverage on public pension issues around the regulation changes. First, I find an increase in individual attention on public pension underfunding by looking at the Google search volumes of related keywords. Second, by using the Ravenpack news dataset, I observe an increase in media coverage of pension-related topics and of government actions around the rule changes. Further cross-sectional analyses show that the regions with more news coverage and with more negative news regarding the government pension plans experience lower growth in housing prices. The media thus serves as a crucial channel to communicate pension information to the public, especially when taxpayers and citizens do not usually read governments' financial statements. The test also provides more assurance that the observed reaction in the housing market is due to pension-related information, rather than other concurrent events.

I further design a series of additional cross-sectional tests to understand the differential impacts of the regulation changes on different states. First, I identify states that rely more on debt financing and have a large debt-to-revenue ratio. These states are more vulnerable to the increase in total liabilities following the rule changes, since it could lead to a higher cost of borrowing in the future (Anantharaman and Chuk, 2018; Boyer, 2018). Second, I explore how union power affects the relation between pension underfunding and housing price growth. Powerful unions make it harder for governments to renegotiate pension benefits with current and future employees

(Boyer, 2018). Third, I examine how political constraints on renegotiating employees' pension benefits influence the relation between pension underfunding and housing price growth. More explicit protections make it harder for governments to reduce pension benefits. The results suggest that after the GASB rule changes, the negative relation between pension underfunding and housing price growth is stronger in states with larger reliances on debt financing, greater union presence, more stringent constitutional provisions to renegotiate public employees' pension benefits, and more intense news coverage that has negative sentiments.

Next, I provide evidence on the effect of pension underfunding on governments' spending and taxes. I find that more underfunded governments cut their spending on healthcare and police forces only in the periods after the GASB regulations. There is some evidence that more these governments collect higher property taxes, although such actions exist even before the adoption of the GASB regulations. Since governments might take longer to implement actual policies regarding pension deficits, we can expect more future actions by the governments, as discussed in the latter section of the paper.

I supplement my analyses with additional evidence on the impact of pension underfunding on future government actions and local economies. In terms of public employment, I find that local public payrolls and the number of full-time equivalent public workers decrease in less-funded states after the rule changes. In terms of local economic activities, I find that there are fewer business establishments in counties from states with larger pension-funding gaps, and that the effect is stronger after the GASB pension rule changes. In sum, I provide evidence that local economic activities are affected by the transparency and quality of government pension information.

Although the contiguous county approach has many advantages, there are still concerns

that the paired counties are not similar enough. To address this issue, and to provide more insights on the impacts of pension underfunding and the GASB rule changes, I test my main hypothesis within the state of California. I choose California because the California Public Employees Retirement System (CalPERS) and California State Teachers Retirement System (CalSTRS) are the two biggest pension plans in the United States. Their $360 billion assets represent over 10% of all US public pension plan assets. In addition, the amount of unfunded pension liabilities in California is significant ($846 billion by the end of 2017) and constitutes more than half of the state's total liabilities ($1.5 trillion). I find that the housing prices in California cities that have larger pension burdens (net pension liabilities per household) experience lower sales-to-list ratios, higher growth in housing inventories on the market, and lower growth in housing prices. These results become stronger after the GASB rule changes. I further test the relations between housing price growth and city-level pension burden using a neighboring zip codes sample, and I find that the housing prices grow more slowly in zip codes situated in more underfunded cities.

My paper makes several contributions. First, I add on the literature that studies the economic impacts of pension underfunding. By using a larger sample and adopting more a rigorous econometrical approach, I provide timely and quantitative evidence that pension underfunding can negatively affect the local housing market and local economic activities and public employment. Given that the real estate is one of the most important investments for individuals in the United States, my study has important implications for the effect of public pension plan health on individual welfare and local economic growth.

Second, I add to the literature that studies the real effects of government reporting regulations. I provide novel evidence that the changes in recognition and disclosure requirements for government pension plans have real effects beyond changes on the paper. I find that the public

accounting rule changes significantly enhance the individuals' and the media's attention on pension underfunding issues as well as pressure governments to take real actions to increase funding to pension plans, which in turns affects the pricing of housing market and the activities in other business sectors.

Third, I provide evidence on the detailed mechanisms through which pension-related information is communicated to taxpayers and citizens. My analyses suggest that the media plays an important role in processing and disseminating such information by increasing the coverage and discussing the relevant tax and spending implications by the governments. The paper thus supplements other studies that demonstrate the media's role in asset pricing, including Soo (2018), Bushee et al. (2010), and Bushee and Miller (2012).

Last but not least, I extend the literature that studies the usefulness of government financial information. Unlike prior studies that focus on (more sophisticated) municipal bond investors, I focus on potential and existing homeowners, taxpayers, and citizens as important stakeholders of governments' financial information. I find that public information about governments' pension liabilities is relevant to citizens' residential and investment decisions.

The rest of the paper is as follows. Section 2 introduces the institutional background of pension reporting regulation changes, Section 3 discusses the identification strategy, Section 4 introduces the data and sample used in this study, Section 5 discusses results of additional tests and robustness tests, and Section 6 concludes.

2. PUBLIC PENSION REPORTING RULE CHANGES

Although the total state pension underfunding is huge, such information was not reflected on both the pension funds and the sponsoring governments' financial statements according to the prior pension accounting rules. The prior rules governing public pension accounting were GASB

25 and GASB 27, which were effective since 1994. GASB 25 governed reporting by pension plans (such as the CalPERS and CalSTRS), and GASB 27 governed reporting by employers (state and local governments). Several features distinguished the GASB rules from SFAS 158 (Employers' Accounting for Defined Benefit Pension and Other Postretirement Plans), which is the equivalent pension accounting standard in the corporate setting.

First, the measurement of pension liabilities was different. Under SFAS 158, companies use a risk-free equivalent rate to discount their pension liabilities. In contrast, under GASB 25, governments used an estimated rate of investment return (ERR) on pension assets to discount the future pension obligations to present values. The rule allowed governments to make unrealistic assumptions about investment returns and to overstate the discount rates. It also encouraged governments to invest in risky assets, because a higher expected investment return led to a lower present value of future pension liabilities (Naughton et al., 2015; Kido et al., 2012).

A second difference involved the measurement of pension plan assets. Under GASB 25, an actuarial value of assets based on a multiyear average of market values (which allows smoothing of fluctuations in asset returns) was used, as opposed to the fair-value approach under SFAS 158. Further, when calculating pension expenses, governments were allowed to use any of six different actuarial cost allocation methods, each of which could be applied two ways (either as a level dollar amount each year or as a level percentage of payroll in each year). This made it very difficult to compare the pension-funding situation across different governments (Anantharaman and Chuk, 2018).[5]

Under GASB 27, the reporting of pension obligations was also different from under SFAS

[5] Source: GASB's New Pension Standards: Setting the Record Straight. https://www.gasb.org/cs/ContentServer?c=Page&cid=1176160432178&d=&pagename=GASB%2FPage%2FGASBSectionPage

158. Under SFAS 158, companies need to recognize and disclose the TOTAL present values of future pension obligation payments on their balance sheets. In contrast, under GASB 27, the present values of future pension obligation payments were off-balance sheets. The pension liabilities account reflected only the difference between the actuarial required contribution and the actual pension payments *for a single year*, such that a government with a large, underfunded pension could report zero pension liabilities on its balance sheet if it had met its annual required payment to the pension plan in full for a given year. Thus, it was difficult to tell the actual amount of the full pension liabilities.

In October 2012, GASB released two new rules, GASB 67 (Financial Reporting for Pension Plans, effective for plan years starting after June 15, 2013) and GASB 68 (Accounting and Financial Reporting for Pensions, effective for fiscal years starting after June 15, 2014), which completely superseded GASB 25 and 27. The two new rules narrow down the gaps of the pension accounting rules between governments and corporations.

GASB 67 affects the ***measurement*** of government pension plans assets. First, the new rule eliminates the use of asset smoothing and requires pension plan assets to be marked to market values, so that the asset values are more accurate and relevant. Second, when calculating pension liabilities, GASB 67 requires that a new "blended discount rate" approach be used. For the years in which the projected fiduciary net position (the market value of current assets) and future contributions are anticipated to be sufficient to cover projected benefit payments, the benefit payments are to be discounted at the long-term assumed rate of return. For the estimated unfunded benefit payments, a 20-year, high-quality (AA/Aa or higher), tax-exempt municipal bond yield is to be used. The present value of benefits, calculated using the two different discount rates, is then used to calculate a single discount rate (blended discount rate) for the plan. I illustrate in Appendix

II how the blended interest rate is determined, and provide a numerical example of how pension liabilities are calculated. For poorly-funded plans, this blended approach has typically reduced the discount rate, which is used to calculate the present value of pension liabilities. In addition, GASB 67 standardizes the actuarial cost allocation method that governments use to calculate their pension obligations. Instead of the 12 methods that were previously available, the rules now allow only one actuarial cost method: the entry age method.[6] The elimination of multiple cost allocation methods makes it easier to compare pension obligations across different plans.

GASB 68 makes several key adjustments to the ***reporting*** of pension information on governments' financial statements. For the first time, the governments' shares of net pension liability (NPL), which equals total pension liabilities minus total pension plan assets, must be recognized and disclosed on the sponsoring governments' balance sheet, and the difference between NPL and current period pension payments is reflected on the income statement as pension expenses. Also, additional disclosures about the pension interest rate assumptions and related information are required in the footnotes. Some examples of the new disclosures under GASB 68 are presented in Appendix IV.

The measurement and disclosure requirements under GASB 67 and 68 have led to significant changes in balance sheets and introduced extra volatilities to the income statements of the sponsoring governments. In the fiscal year 2015, aggregate state governments' reported pension debts on their balance sheets increased to $537 billion from $80 billion in 2014: a 570% rise. This lowered states' overall net positions by 29%, from $1.3 trillion to $956 billion (Mercatus

[6] The entry age method is used for calculating the present value of employee benefits (PVB). This method allocates the PVB of a plan member equally over the working lifetime of the member, from his or her entry age, or date of membership, through his or her assumed exit age(s). For more details about the entry age method and other actuarial cost methods, see "GASB 67/68: Calculation specifics on individual entry age normal and recognition of deferred inflows/outflows, PERiScope, 2014".

Center, 2017). Together, the GASB 67 and 68 rules change the way pension liabilities are measured and reported and significantly improve the accuracy, comparability, and salience of the pension funding status in the United States. They also limit governments' discretion in manipulating the reported size of their pension liabilities.

3. IDENTIFICATION STRATEGY

To examine how state-level pension underfunding affects the local housing market, I adopt the contiguous border-county approach, and I examine the relation between county-level housing price growth and state-level pension underfunding within pairs of two adjacent counties on opposite sides of the state borders around the GASB rule changes. The contiguous border-county approach is widely used in the economic and finance literature to study the influence of state-level regulations, such as US bank branching deregulation (Huang, 2008), minimum wage regulations (Dube et al., 2010; Rohlin, 2011), and foreclosure regulations (Mian et al., 2015). Counties are commonly used as the unit of analysis in the literature, because such approach can minimize the endogeneity problem that the economic performances of a single county (or the counties on the state borders) can lead to state-level policy changes (Huang, 2008). This approach compares the economic performance of adjacent counties separated by state borders, where the two states are differently impacted by the regulation change/policies of interest. Since the counties are immediately adjacent to each other, they are very similar in observable aspects such as geographical locations and climates. What's more, they are very similar in *unobservable* aspects that researchers cannot, or very difficult to control for. Thus, they share very similar economic growth absent any state-level regulation change or influence. Prior research shows that contiguous border counties provide significantly better control groups than randomly selected counties or counties chosen using a propensity score matching approach (Huang, 2008; Dube et al 2010).

Another important reason why I adopt the contiguous county approach is that prior research shows that economic mobility is the most active across state borders through the influence of tax venue (Bradford, 1978; Kotlikoff and Summers, 1987; Harberger, 1995; Gravelle and Smetters, 2001). Thus, to the extent that state-level pension underfunding leads to pressures in tax policy change, we are most likely to identify such effects in the border counties where mobility is the highest. In addition, state governments can have influence on the taxing policies and budget allocations of county-level governments.[7] Hence, it is reasonable to assume that the state-underfunding situation will affect county-level governments' decisions and economic activities.

4. DATA AND SAMPLE

I collect data from a wide range of sources for my study. Appendix I provides the definitions and sources of all variables. For the main test, I identify adjacent county-pairs along state borders using the US Census Bureau County Adjacent file. This generates a total of 1,308 unique county- pairs.[8] Following Dube et al. (2010), I structure the dataset such that each county-year is an observation and the two counties in each county-pair are identified by a unique county-pair indicator.[9] Figure 5 presents a map of the US, with highlighted adjacent counties along state borders. The states of Alaska and Hawaii are excluded from my sample because they do not share a border with another state.

Pension Underfunding Measures

To test the aggregate effect of GASB regulation changes, I manually construct a dataset of the state governments' pension underfunding information available to the public before and after

[7] The US constitution does not mention local governments. The Tenth Amendment reserves authority-giving power to the states and states can choose how much authority they want to grant to their local governments. 39 states employ Dillon's Rule, which states that a local government can only engage in an activity only if it is specifically sanctioned by the state governments (National League of Cities, 2016; Richardson et al,2003).
[8] As of 2016, there are 3,007 counties in the US.
[9] Thus, a county can appear in the datasets as many times as it can be paired with a cross-border county. The standard errors of the regressions are adjusted to handle the multi-paring issue following Dube et al. (2010).

the changes. Before the GASB regulations, interested parties can access public pension plans' financial reports for relevant information. I obtain this information from the Public Plan Data (PPD). PPD is a database about state and local pension plans, assembled and maintained by the Center for Retirement Research at Boston College and the Center for State and Local Government Excellence. I manually collect the state's shares in each pension plan from the pension plan's financial statements, and I calculate the state governments' net pension liabilities (NPL) by summing up the net pension liabilities for all the state-level pension plans multiplied by the state's shares in each plan.[10] After the adoption of GASB 68, the public can collect state governments' pension underfunding from their financial reports. I manually collect the *disclosed* net pension liability (NPL) on the statement of financial position from state governments' CAFR (Comprehensive Audited Financial Report). This information is made available by GASB 68 and is accessible only since the fiscal year 2015 (the calendar year 2016). I then scale the net pension liabilities by state revenues to create the measure of pension underfunding.

I collect an alternative measure of pension underfunding from the Federal Reserve. This measure is equal to the *adjusted* state net pension liabilities divided by state revenues, where plan liabilities are collected from the Table L.120.b of *the Financial Accounts of the United States* and are *adjusted* using the discount rate equal to AAA-rated corporate bond interest rates. The Federal Reserve only starts to publish this data online since 2016, but the data from previous periods starting from the year 2000 are also make available. Total plan assets are collected by the Census Bureau in the annual survey of state-level defined benefits plans and are marked to market values.[11]

[10] The state governments do not share 100 percent of the plans' liabilities as some local governments also participate in state pension plans.

[11] For more information about the measurement of pension plan assets, please refer to footnote 7 of the FEDS Notes: State and Local Pension Funding in the Enhanced Financial Accounts, https://www.federalreserve.gov/econresdata/notes/feds-notes/2016/state-and-local-pension-funding-in-the-enhanced-financial-accounts-20160205.html#fn1

The adjustments are very close to the calculation approach adopted by credit rating agencies such as Moody's when evaluating state governments' financial conditions, making the rates less biased by governments' manipulation.[12] Thus, the Federal Reserve state pension underfunding status is a proxy of the pension underfunding status of the state governments that could be calculated by more sophisticated investors. The Pearson correlations between the Federal Reserve underfunding and the disclosed pension underfunding measure I used for the analyses is 0.68.

Housing price growth

I obtain the annual residential home prices from the Federal Housing Finance Agency (FHFA). The FHFA Housing Price Index (HPI) is a broad measure of the movement of single-family house prices, which tracks average price changes in repeat sales or refinancing on the same properties (see footnote 3 for a more detailed explanation). The index is constructed to control for the types and locations of houses on sales, making it an effective measure of housing price appreciation. A higher HPI indicates a higher level of housing prices in the region. The FHFA HPI is used in many studies of US housing prices, including Kerr et al. (2015) and Main et al. (2015). Its main drawback is that it only covers properties under a certain value, because Fannie Mae and Freddie Mac mortgages are only available for properties not exceeding the conforming loan limit (ranging roughly from $417,000 to $625,000 for one-unit properties in different counties). Thus, I control for the conforming loan limits in my analysis, and in a robustness test, I use an alternative measure of housing prices, the Zillow Home Prices. I obtain data about building permits and new construction from the US Census Bureau website.

Media sentiments measures

I obtain the articles containing keywords relating to government pensions from the

[12] See "Moody's proposes adjustments to US public sector pension data, 2012". https://www.moodys.com/research/Moodys-proposes-adjustments-to-US-public-sector-pension-data--PR_249988.

Ravenpack news database. Ravenpack is a data analytics provider specialized in news analytics and text analysis. It provides text analysis for news and social media contents from various web sources, capturing local, regional, and national newspapers in different regions. It is also possible to identify the main "entity" that a news article is covering.[13] In my paper, I select the entities being covered in the news articles to be either a "Place", which refers to a geographical location such as state/county/city, or an "Organization", which can refer to government entities.

For the control variables, I obtain government financials from the Government Finance Database constructed by Pierson et al. (2015). The database is an organized dataset that contains all US Census Bureau data about government financials. Please refer to Appendix I for the sources of the other control variables.

The final sample of contiguous border counties consists of 10,440 county-year observations from 1,308 unique county-pairs, covering the years 2012–2017, which corresponds to a period covering three years before and after the GASB regulation changes[14] The observations in each regression vary depending on the data availability of the variables. Table 2 Panel A provides the descriptive statistics of the variables, and Panel B provides the correlations between the variables. I create a variable, HPGdiff, which equals the difference in annual housing price growth between two adjacent counties. From the descriptive statistics, we can see that the absolute value of the mean (median) is only 0.02 (0.02) before but becomes 0.06 (0.12) after the GASB rule changes. This suggests that, during this period, there are significant changes that drive discrepancies in housing price growth along the state borders.

[13] For more information about Ravenpack, please visit https://app.ravenpack.com/about/.
[14] Following Dube et al. (2010), I keep unpaired counties that have full information for the regression analysis in the sample as well. The results are quantitatively similar when unpaired counties are excluded from the sample.

5. EMPIRICAL RESULTS

5.1 Pension Underfunding and Housing Price Growth

To test the relationship between pension underfunding and housing price growth around the GASB pension regulation changes, I use the contiguous border-county sample for my analysis. I estimate various versions of equation (1) for the period before (Pre-GASB, from the year 2012 to the year 2014) and the period after the GASB rule changes (Post-GASB, from the year 2015 to the year 2017), and estimate the below regressions:

$$HPG_{ip,t} = \alpha_1 Underfunding_{ip,t-1} + Controls + Fixed\,Effects + \varepsilon_i \quad (1)$$

$$HPG_{ip,t} = \alpha_1 Underfunding_{ip,t-1} + \beta_1 Underfunding_{ip,t-1} \times POST + Controls + Fixed\,Effects + \varepsilon_i \quad (2)$$

The dependent variable $HPG_{ip,t}$ is the annual change in the FHFA housing price index (HPI) for county i in county-pair p, denoted in percentage. The key independent variable in Equation (1) and (2), $Underfunding_{ip,t-1}$, is the ratios of state's net pension liabilities (NPL) as a percentage of total state revenues disclosed on the governments' financial statements, at year t-1.[15] I use the lagged underfunding because the public pension plans/state governments usually release their financial statements with a time lag of six months to one year. Also, the use of lagged underfunding partially alleviates the concern that a bad economy can lead to both worse-funded pensions and lower housing price growth. $POST$ is an indicator that equals 1 for the period between 2015 and 2017, and 0 for the period between 2012 and 2014.[16] I set the post-treatment period to start from the year 2015 because the effective date of GASB 68 (accounting for government

[15] All the results in this paper hold when I use the state's GDP instead of revenues as the deflator when calculating Underfunding.

[16] Another reason to limit the sample to the year 2017 is due to the federal tax changes in 2018 that reduce taxpayers' ability to deduct state and local tax from their federal returns.

financial statements) is for the reporting period after June 2014, and the new numbers will be usually available to the public in the calendar year of 2015. In one specification, I also interact the main variable $Underfunding_{ip,t-1}$ with dummy indicators for each year to understand when exactly the effect started to manifest. $Controls$ is a vector of twelve control variables including $lnLoanLimit_{ipt}$, $PropTaxRate_{ipt}$, $lnPerCapInc_{ipt}$, $lnRevenue_{ipt}$, $EduQuality_{ipt}$, $IncTaxRate_{ipt}$, $Coindex_{ipt}$, $Foreclosure_{ipt}$, $PoConstraint_{ipt}$, $DebtRatio_{ipt}$, $PctUnion_{ipt}$, and $lagMedianPrice_{ipt}$. These are a set of county- and state-level variables that can influence the housing market. County-level variables include the conforming mortgage loan limits, property tax rate, per capita income, total revenues, and education quality (proxied by student-to-teacher ratio). State-level variables include the maximum income tax rates, debt-to- revenue ratio, political constraints to negotiating pension benefits, as well as the coincident economic activity index.[17] I also control for the probability of foreclosures in each state, since prior literature shows that foreclosures depress the growth in housing prices (Main et al., 2015). Because foreclosure is more likely in states that do not require juridical procedures for foreclosures, I create an indicator variable, Foreclosure, which equals 1 if the state where the county is located requires such procedures, and 0 otherwise.[18] I also control for the natural log of the median home price at the county level, since the growth rate of housing prices might be affected by the housing price level.

I estimate Equations (1) for both the period before and after the GASB regulation changes.

[17] The maximum income tax rate is used as an instrument of the state-level marginal income tax rates. See NBER-Maximum State Income Tax Rates for more information. https://users.nber.org/~taxsim/state-rates/. The Coincident Economic Activity Index includes four indicators: nonfarm payroll employment, the unemployment rate, average hours worked in manufacturing, and wages and salaries. The trend for each state's index is set to match the trend for gross state product.

[18] Some states require that a foreclosure sale take place through the courts, and a lender must sue a borrower in court before conducting an auction to sell the property. Other states do not have such a requirement and give lenders the automatic right to sell the delinquent property after providing only a notice of sale to the borrower. For more information, please refer to Mian, Sufi and Trebbi (2015).

I estimate Equation (2) for the entire sample period. In all specifications, I include county-pair times year fixed effects, θpt following Mian et al. (2015) and Dube et al (2010). This strategy is crucial to the research design. The county-pair fixed effects control for time-invariant differences across the bordering county-pairs. Thus, the model only captures the variance within each county-pair. This is important because some states border one another in very different geographical areas (Mian et al, 2015). County pair times year fixed effects capture the unobserved, time-varying heterogeneity across different county-pairs, allowing me to control for pair-specific shocks at a given year. The inclusion of county-pair-year fixed effects ensures that the estimates are robust to a wide range of unobservable omitted variables that could otherwise confound the analysis. In the last specification, I interact the main independent variables with year dummies for each year. In all specifications, I cluster the standard errors by state-border level and by individual state level following Dube et al. (2010). Since a single county can be paired with multiple cross-state counties, there could be mechanical correlations across county-pairs that might influence the inferences along the entire state border. The double-clustering could adjust the biases arising from this situation.

Table 3 presents the regression results of Equation (1) and (2). The results indicate that state level pension underfunding is negatively associated with the housing price growth rates in the adjacent counties, but such effect is only significant after the adoption of GASB 67 and 68. The effect is economically significant, an increase in pension underfunding from the 25th percentile to the 75th percentile (from 11.249% to 52.944%) is associated with a decrease of 0.41 percentage points in housing price growth rate, which translates to a relative decline of 17 percent. Column four indicates that the results starts to show in the year 2014, and the biggest effect come from the year 2017, which is the period when the governments' financial statements in the fiscal year 2015

and 2016 with the updated pension liabilities information become available. In Table A2 in the Online Appendix, I show that the results hold when I use the adjusted pension underfunding indicator from the Federal Reserve. In Table A3, I show that the results are consistent when I use the level of housing price as the dependent variable and include county fixed effects (so that we can control for the existing housing price differences across different counties).

Table 4 presents the results of estimating different versions of equations (1) by replacing the dependent variable to $lnPerCapNHP_{ip,t-1}$, which is the natural log of per capita new housing permits, available only until 2016. Housing permits—the approvals required by the local government before the construction of a new building can legally occur (Census Bureau, 2019)—are another important indicator of the health of the housing market. The results indicate that counties from states with worse funding status in the previous year grant significantly fewer new housing permits only after the GASB rule changes. Taken together, my evidence suggests that pension underfunding suppresses growth in the local housing market and that the GASB rule changes manifest the effect.

5.2. Individual Attention and Media Coverage around GASB Regulation Changes

Next, to better understand the mechanism underlying the observed relationship between pension underfunding and local housing price growth, I provide evidence on the changes in individual attention and media coverage on government pension-related topics around the regulation changes. Figure 1.1 to Figure 1.4 show the Google Search Volume for the keywords "Pension Crisis", "Government Pension" for the whole United States and in the state of Illinois, and "GASB 67 & GASB 68" during the year 2010 to 2020. The figures show that the individual attention on government pension matters is increasing in general, and there is a spike of individual interest around late 2012 and 2013, which correspond to the announcement of GASB 67 and 68

and the effective dates of GASB 67.

Figure 2 shows the numbers of unique news articles mentioning keywords relating to government pension and pension underfunding: (pension crisis OR government pension OR state pension OR government pension crisis OR pension underfunding) in the headlines in the US from 2010 to 2020 from Ravenpack.[19] As shown in the graphs, media coverage of the pension crisis spikes in 2013– 2015, which is the period of the announcement and adoption of GASB pension rule changes. Further, news articles that mentioned both the above list of pension-related keywords and "spending or "tax" in the headlines also spike around the GASB rule changes.[20] I manually checked these mentions to make sure that the keywords correspond to the intended meaning. These findings provide evidence that the media formed expectations about potential tax increases and service cuts after the pension underfunding became more visible. Figure 3 shows the average sentiment of the news articles from 2010 to 2020. A negative sentiment score indicates a negative tone; a score lower than -0.5 indicates a very negative tone. From the graph, we observe that the tone of pension-related news articles became more negative around the GASB rule changes and in recent years, reflecting the media's increasingly pessimistic outlook about the pension problem.

In Table A1 of the Online Appendix, I show the regression results of the relations between news coverage and news sentiments at the state-level and state pension underfunding. The results reveal that the number of news articles is higher for states with larger underfunding after the GASB regulation changes, and the average news sentiments are in general more negative, although not significant. The combined effect is that more underfunded states have more negative media exposure after GASB. Together, the results suggest that GASB regulations attract more news

[19] The choice of using articles that contain the keywords in the headline rather than in the full article search will lower the number of articles found but has the advantage of making sure the articles are more relevant for the topics.
[20] Note that this was before the Tax Cuts and Jobs Act of 2017.

coverage on state pension-related issues.

There is also survey evidence supporting the argument that citizens care about tax uncertainties. According to a survey by Gallup in 2013, more than 50% of the residents in Illinois and Connecticut said that they would move to another state if possible, quoting tax concerns as a key driver. [21] Figure 4 shows that since 2012, housing price growth in Illinois has been 49% lower than the average US housing price growth, reflecting people's relative unwillingness to live and invest in Illinois.

5.3 Cross-Sectional Results

In the cross-sectional tests, I exploit the variation in the level of impact of the GASB rule changes across different states. This allows me to examine factors that may cause the housing markets to react more strongly to states' pension underfunding. I estimate different versions of equation (3) for the entire sample period (2012–2017):

$$HPG_{ip,t} = \alpha_1 Underfunding_{ip,t-1} + \beta_1 FACTOR_{ip,t} \times Underfunding_{ip,t-1} \times POST + \beta_2 FACTOR_{ip,t} \times Underfunding_{ip,t-1} + \beta_3 FACTOR_{ip,t} \times POST + \beta_{14} Underfunding_{ip,t-1} \times POST + \beta_5 FACTOR_{ip,t} + Controls + Fixed\ Effects + \varepsilon i \quad (3)$$

$FACTOR_{ip,t}$ is one of the three factors that are described in section 3.2: (1) $DebtRatio$ the debt-to-revenue ratio of a state; (2) $pctUnion_{ip,t}$, the percentage of public employees that are part of a labor union in a state, (3) $Constraint_{ip,t}$, the level of a state's political constraint ($Constraint_{ip,t}$). Following Munnel and Quinn (2012) and Boyer (2018), I assign a value from 0 to 3 to different levels of constraints, with 3 representing the highest constraint level. Further

[21] See the survey at https://news.gallup.com/poll/168770/half-illinois-connecticut-move-elsewhere.aspx

details are shown in Appendix V; and (4) $NEWS$, which is the product of the number of pension-related news articles and the average sentiments of these articles in a given year in a state. $\beta 1$, the coefficient of interest, represents the effect of different factors on the strength of the relationship between pension underfunding and housing price growth. I expect $\beta 1$ to be negative. In all specifications, I control for the county-pair interacted with year fixed effects.

Table 5 presents the OLS regression results of cross-sectional regressions. The coefficients of the three-way interaction term, $pctUnion\ (or\ NEWS) \times Underfunding \times POST$, are negative and significant, which indicates that after the GASB 67 and 68 adoptions, underfunded states with higher union presence and more intensive and negative news coverage experience even lower housing price growth. The results also show that underfunded states with more debts outstanding and with more constraints to renegotiate employees' benefits experience lower growth in housing prices, although such effects are not significantly stronger post-GASB adoption. Together, these results shed light on the channel on how pension underfunding can affect the housing market, and under what circumstances the effect will be stronger. In addition, this provides stronger evidence that the GASB accounting rules are driving the observed effects since the intensity of the effects vary with predictive factors that are related to state pension plans.

5.4 Future governments' spending and taxes

In Table 6, I provide empirical evidence on the effects of pension underfunding on governments' spending and taxing behaviors. I find that more underfunded governments on average spend less on police-related activities and healthcare, but only in periods after the GASB regulation changes. This is consistent with the hypothesis that governments are now faced with more pressures to cut spending and increase findings to their pension plans after the GASB regulations exposed the actual underfunding situation. More underfunded governments also charge

higher property taxes, although such a phenomenon also existed before the GASB regulation changes.

Many governments have also taken concrete actions to counter the effects of the new accounting rules and the deep pension underfunding, consistent with the market's expectation. According to a report by NARSA (National Association of State Retirement Administrators), some states have imposed new taxes or raise current tax rates in order to get more funding for their pension plans, including Arizona (sales tax, 2017), Florida (sales tax, 2016), Nebraska (dining tax), Illinois (Marijuana tax and property tax) and Pennsylvania (insurance premium tax). Some states have also charged higher public service fees including imposing surcharges on 911 phone lines and increase city water and sewage fees (Illinois, 2014 and 2016). California has revealed a five-year budget plan that involves both sales tax increasing and surcharges on parking lots.[22] The list is not exhaustive, and it is still growing. In the meantime, many governments have also started to engage in pension plan reforms for future plan members, although it will only help lower the pension burden from future employees.

6. ADDITIONAL TESTS AND ROBUSTNESS TESTS

6.1 Local Housing Price and Pension Underfunding: California

My previous analyses are conducted at the adjacent county-pair level. Although the adjacent- county approach has the advantage of creating comparable counties, there are still concerns that the adjacent counties are not similar enough. To alleviate this concern, and to provide more insights into the pension underfunding problem, I supplement my analysis with a test of local housing prices and city pension burdens (total pension liabilities over total city revenues) in the state of California. Cities within the same state are highly similar but have different pension

[22] NARSA, Funding policies. https://www.nasra.org/funding

burdens because they have different shares in the state's public pension plans. I expect that the housing prices in a city with a higher pension burden will grow more slowly than in another comparable city.

The choice of the state of California is natural, since CalPERS, with 1.9 million members, is the biggest public pension plan in the US. In addition, nearly all the cities in California participate in CalPERS, making it possible to conduct the test.[23] California's local governments are also heavily affected by volatility in pension costs. At least half of the employer contributions to state retirement systems in California come from local governments, which have smaller budgets and fewer ways to generate revenue when faced with higher pension costs. One estimate suggests that city pension costs will nearly double, reaching up to 16% of general fund budgets, by 2024–25.22[24] Thus, it is important to understand the impact of pension underfunding on California cities.

To conduct the tests, I collect information on California's city-level pension burden from the Pension Tracker. Organized by Joe Nation, a professor of public policy at Stanford, the Pension Tracker collects information about California cities' funding status from various sources, including CalPERS, the State Controller's Office, and the US Census Bureau.[25] I obtain city-level housing price information from RedFin, a real estate brokerage headquartered in Seattle.[26] The database provides a wide range of housing market–related indicators, including the average sales-to-listings ratio, the number of total homes sold, total inventories, and median sales prices, as well as the year-to-year changes in these numbers.

[23] Among the 482 cities in California, 427 participated in CalPERS by the end of 2018. Source: California Policy Center, 2018, https://californiapolicycenter.org/much-will-cities-counties-pay-calpers/
[24] Public Pension in California, Public Policy Institute of California, 2019. https://www.ppic.org/publication/public-pensions-in-california/
[25]For more information about Pension Tracker, please visit their website: https://www.pensiontracker.org/about_pension_tracker.php
[26] For more information about RedFin, please visit their website: http://press.redfin.com/company-timeline

To provide more power to my test, I implement an alternative analysis at the neighboring zip code level. The housing markets in two neighboring zip codes from two different cities should be similar in both observable and unobservable aspects, but will be exposed to different tax and spending uncertainties due to the differential pension burdens of the cities. I obtain zip-code level housing price indexes from the FHFA.[27] Next, I identify neighboring zip codes at the border of two cities. To do this, I first obtain a zip code distance dataset from the National Bureau of Economic Research (NBER).[28] I only keep zip codes from the California cities (where the first two digits of the 5-digit zip codes are from 90 to 96), and I match each zip code to its corresponding cities.[29] I keep zipcode pairs that are less than 10 miles (or 5 miles) apart but are from two different cities. In this way, I can identify zip codes that are close enough to be similar but are exposed to different pension risks due to their respective cities' pension burdens.

After applying the criteria and matching with the FHFA housing price dataset, the final sample is highly concentrated around the counties of Los Angeles, Orange, Riverside, San Bernardino, and Ventura. Thus, I further constrain my sample to only zip codes in Los Angeles County. This also allows me to avoid special areas, such as Silicon Valley, whose housing markets might be very different from others in California. I expect that the housing prices at the zip code level will grow more slowly if the zip code is situated in a city with a larger pension burden.

Table 7 provides the result of city-level housing price growth and pension burden during

[27] The reason I do not conduct my main test at the zip code level is that zip code level housing price data are very sparse in most states (especially along the state borders). The availability of the data is better in California and a few other states. Please refer to the FHFA zip code HPI map for a more direct view. https://www.fhfa.gov/DataTools/Tools/Pages/HPI-ZIP5-Map.aspx.

[28] See ZIP Code Distance File Database: https://www.nber.org/data/zip-code-distance-database.html

[29] Zip code, which is the coding for the postal delivery area, does not perfectly correspond to geographical areas such as cities and counties. A zip code is sometimes shared by several cities. However, the US States Postal Service assigns a primary city to a certain zip code, which enables a rough matching between zip code and city. Also, biases in matching the cities will only bias against finding a significant result of my test. I refer to the zip code-city link in the zip code database: https://www.zip-codes.com/state/ca.asp

the years 2012–2017. The coefficients of the variable $lnPensionBurden$ (the natural log of the market value or total unfunded pension liabilities per household) are negative and significantly related to the average sales-to-listings ratio, the total number of homes sold and the growth of median sales prices, and are positively related to the growth of total inventories. Taken together, the results show that there is less demand and more supply in the local housing markets of cities with heavier pension burdens, and that the housing price growth drops as a result. The effect becomes stronger after the GASB accounting rule changes in 2014.

Table 8 provides the results for the neighboring zip code level test in the county of Los Angeles. I present the results both for zip codes situated within 10 miles and 5 miles of each other, and the results are similar. The housing prices in zip codes in cities with larger pension burdens grow more slowly than prices in neighboring zip codes. The effect is again stronger in the period after the GASB rule changes. To conclude, California city-level tests offer consistent evidence that pension underfunding suppresses local housing market growth.

6.2 Pension Underfunding and Public Employment

In addition to the reaction of the housing market, I expect that governments will also adjust their employment policies regarding future employees following the enhanced transparency of pension liabilities. If governments are concerned about pension underfunding due to pressure from the citizens and media, they may take action to reduce growth in employee benefits, such as by cutting the number of existing employees (to the extent possible) or new recruitments, or by promising fewer benefits going forward. For example, the Harvey County in the state of Illinois laid off 18 firefighters and 13 police officers in 2018 in order to fulfill a court order to pay back pension benefits.[30] Another mechanism that could lead to government action is that the new

[30] See "Police, firemen and other government workers will be laid off to cover pension costs". https://www.illinoispolicy.org/harvey-pension-crisis-leads-to-mass-layoffs/

pension rules provide better information for the governments themselves. As governments become more aware of the consequences of their pension obligations, they are likely to be more cautious in their future employment decisions.[31] I expect that after the GASB rule changes, the total public payrolls and the number of total full-time equivalent public employees will decline more in states that have more severe pension problems.

Table 9 presents the results on how pension funding status and the GASB rule changes affect total public payrolls and the number of full-time equivalent public employees. The results suggest that after the GASB rule changes, the public payrolls and the number of public employees decrease in counties with greater pension underfunding, relative to adjacent counties. This suggests that governments have begun to adjust their employment policies in response to the effects of the GASB rule changes. Specifically, the affected governments could be recruiting fewer new employees, and the total payrolls decrease as a result.

6.3 GASB Accounting Rule Changes and Business Activities

If taxpayers and citizens who become aware of pension-funding shortfalls try to relocate from or invest less in regions with greater underfunding, I expect that local economic activities will be negatively affected. To measure this impact, I study the number of county-level business establishments, which is highly related to local economic activity. I use the County Business Patterns (CBP) data from the US Census to measure business activities. The CBP data is an annual series of subnational economic data by industry and is available up to the year 2016. This series includes the number of establishments, employment during the week of March 12, first quarter payroll, and annual payroll. According to the US Census, the CBP series is useful for studying the economic activity of small areas and analyzing economic changes over time.

[31]Similar effects have been documented in the private sector employee benefits accounting rule changes, SFAS 106. See Mittelstaedt et al, (1995) for more information.

Table 10 presents the results of the impact of GASB pension rule changes on the number of total business establishments in the county. I control for variables that are likely to affect county-level business activities from prior literature (Carlino and Mills, 1987). The coefficients on the interaction term of pension underfunding status and the POST indicator are negative, suggesting that, after the GASB rule changes, the number of business establishments is lower in counties from states with larger pension underfunding. The evidence further supports the argument that pension underfunding negatively affects local economies.

6.4 Alternative Housing Price Measures

In the previous analysis, I use the FHFA Housing Price Index growth to measure housing price growth in different counties. One drawback to the FHFA HPI is that it does not capture prices for houses whose values exceed the county-specific conforming loan limits. As a robustness check, I use an alternative housing price measure: the Zillow Home Value. Founded in 2003, Zillow is an online real estate database company that is traded on NASDAQ.[32] Zillow provides county-level median home prices (single-family, condominium, and co-operative homes with a county record) for 1,943 counties from 1996 to 2019. However, the data include only very limited observations for county pairs on the state borders, and it lacks data for states that have non-disclosure policies for their real estate transaction prices, so the power of the test is limited. The correlation between the Zillow Housing Value Index and the FHFA Housing Price Index is 0.85. In Table A4 of the Online Appendix, I show the results of using Zillow home value as well as Zillow annual housing price growth rate as dependent variables. The results, in general, are consistent with my previous results.

[32] For more information about Zillow, please visit https://www.zillow.com/.

6.5 Excluding Certain County-pairs

For robustness tests, I exclude certain county-pairs that might affect the results. First, the state of California is special for several reasons. In addition to having huge pension systems, California is the state with the most expensive housing in the United States and is known for having less new housing than other states (due to both political and geographical reasons) (Legislative Analyst's Office, 2015). Thus, there is some concern that data from California will bias the results. To address this concern, I replicate the main tests while excluding California counties and their neighboring counties. This excludes 240 observations. In Table B1 of the Internet Appendix, I present the results. All the inferences remain statistically unchanged.

In addition, as noted by previous studies (Dube et al., 2010), the counties situated along the state borders in the western US tend to span larger geographical areas, relative to counties in other regions. In the West, the adjacent counties in a pair may therefore contain areas that are more distant and less similar than areas in other adjacent county pairs, which could undermine the identification strategy. To address this concern, I replicate the main tests while excluding county pairs situated in the western US, including counties from Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, California, Oregon, and Washington. This reduces the sample size by 1,580 observations. Table B2 in the Internet Appendix presents the results. All the inferences remain statistically unchanged.

7. CONCLUSION

In light of the recent concerns about an approaching public pension crisis, I study the economic consequences of public pension underfunding and the transparency of such information. I find that the revelation of the severe state-level pension underfunding following the GASB 67 and 68 regulation changes induces a negative outlook regarding future tax increases and service

cuts, leading to slower growth in housing prices. The negative relation is stronger in states that are more affected by the regulation changes. I also show that state governments start to cut public spending on healthcare and police forces when pension underfunding becomes more transparent. Public employment outcomes (including the number of full-time equivalent public employees and total public payroll) and local business activities are also negatively affected by the reporting of pension underfunding.

This paper also sheds light on the channels through which public pension underfunding can have real effects on the economy. I provide novel evidence that changes in accounting regulations can induce changes in media coverage and individual attention and stimulate actual government actions. The results should be helpful for the governments, the regulators as well as taxpayers and citizens to better understand the implications of pension underfunding.

REFERENCES

Allen, Abigail M., and Reining Petacchi. "Public pension accounting reform: Preparer incentives and user interest." Harvard Business School Accounting & Management Unit Working Paper 15-043 (2018).

American Legislative Exchange Council, Thurston Powers, Erica Young, Elliot Young and Bob Williams. "Unaccountable and Unaffordable", 2017

Anantharaman, Divya and Chuk, Elizabeth C. "The Impact of Governmental Accounting Standards on Public-Sector Pension Funding." 2018 Working Paper

Andonov, Aleksandar, Yael V. Hochberg, and Joshua D. Rauh. "Political representation and governance: Evidence from the investment decisions of public pension funds." The Journal of Finance 73.5 (2018): 2041-2086.

Aubry, Jean-Pierre and Crawford, Caroline V., Does Public Pension Funding Affect Where People Move? Center for Retirement Research, 2016 Working Paper

Bagchi, Sutirtha, "Do Unfunded Obligations of Public-Sector Pension Plans Get Capitalized into House Prices?", 2017 Working Paper

Bai, ChongEn, Qi Li, and Min Ouyang. "Property taxes and home prices: A tale of two cities." Journal of Econometrics 180.1 (2014): 1-15.

Bailey, Martin J., Richard F. Muth, and Hugh O. Nourse. "A regression method for real estate price index construction." Journal of the American Statistical Association 58.304 (1963): 933-942.

Ball, Ray. "Discussion of accounting for research and development costs: The impact on research and development expenditures." Journal of Accounting Research (1980): 27-37.

Bens, Daniel A., and Steven J. Monahan. "Altering Investment Decisions to Manage Financial Reporting Outcomes: Asset-Backed Commercial Paper Conduits and FIN 46." Journal of Accounting Research 46.5 (2008): 1017-1055

Bohn, Henning, and Robert P. Inman. "Balanced-budget rules and public deficits: evidence from the US states." Carnegie-Rochester conference series on public policy. Vol. 45. North-Holland, 1996.

Bonsall IV, Samuel B., Joseph Comprix, and Karl A. Muller III. "State Pension Accounting Estimates and Strong Public Unions." Contemporary Accounting Research (2018).

Boyer, Chuck, "Public pensions, political economy and state government borrowing costs", 2020 Working Paper

Bradford, David F., 1978, Factor prices may be constant but factor returns are not, Economics Letters 1, 199 – 203.

Brown, Jeffrey R., and David W. Wilcox. "Discounting state and local pension liabilities." American Economic Review 99.2 (2009): 538-42.

Bushee, Brian J., et al. "The role of the business press as an information intermediary." Journal of Accounting Research 48.1 (2010): 1-19.

Bushee, Brian J., and Gregory S. Miller. "Investor relations, firm visibility, and investor following." The Accounting Review 87.3 (2012): 867-897.

Carlino, Gerald A., and Edwin S. Mills. "The determinants of county growth." Journal of Regional Science 27.1 (1987): 39-54.

Census Bureau, Building Permit Survey. https://www.census.gov/construction/bps/

Chuk, Elizabeth C. "Economic consequences of mandated accounting disclosures: Evidence from pension accounting standards." The Accounting Review 88.2 (2012): 395-427.

Cohen, Roger, Andrew Lai, and Charles Steindel.2014. "State Income Taxes and Interstate Migration." Business Economics 49(3): 176-190.

Dagher, Jihad, and Yangfan Sun. "Borrower protection and the supply of credit: Evidence from foreclosure laws." Journal of Financial Economics 121.1 (2016): 195-209.
Divounguy Orphe, Hill Bryce, and Tabor Joe, Pensions make Illinois property taxes among nation's most painful, Illinoise Policy Institution (2018)
Dube, Arindrajit, T. William Lester, and Michael Reich. "Minimum wage effects across state borders: Estimates using contiguous counties." The review of economics and statistics92.4 (2010): 945-964.
Dukes, Roland E., Thomas R. Dyckman, and John A. Elliott. "Accounting for research and development costs: The impact on research and development expenditures." Journal of Accounting Research (1980): 1-26.
Engelberg J E, Parsons C A. The causal impact of media in financial markets[J]. The Journal of Finance, 2011, 66(1): 67-97.
Epple, Dennis, and Katherine Schipper. "Municipal pension funding: A theory and some evidence." Public Choice 37.1 (1981): 141-178.Federal Accounting Standards Advisory Board (FASAB). Statement of Federal Financial Accounting Concepts No. 1 (SFFAC 1): Objectives of Federal Financial Reporting (1993).
Fang L, Peress J. Media coverage and the cross-section of stock returns[J]. The Journal of Finance, 2009, 64(5): 2023-2052.
Feiock, Richard C., et al. "Political conflict, fiscal stress, and administrative turnover in American cities." State and Local Government Review 33.2 (2001): 101-108.
GASB, "GASB Pension revamp introduces major improvements", 2012; https://www.gasb.org/cs/ContentServer?c=GASBContent_C&cid=1176160319691&d=Touch&pagename=GASB%2FGASBContent_C%2FUsersArticlePage
Glaeser, Edward L., and Giacomo AM Ponzetto. "Shrouded costs of government: The political economy of state and local public pensions." Journal of Public Economics 116 (2014): 89-105.
Graham, John R., Michelle Hanlon, and Terry Shevlin. "Real effects of accounting rules: Evidence from multinational firms's investment location and profit repatriation decisions." Journal of Accounting Research 49.1 (2011): 137-185.
Gravelle, Jane, and Kent Smetters, 2001, Who bears the burden of the corporate tax in the open economy?, Working Paper 8280, National Bureau of Economic Research.
Guerrieri, Veronica, Daniel Hartley, and Erik Hurst. "Endogenous gentrification and housing price dynamics." Journal of Public Economics 100 (2013): 45-60.
Hall, Robert E., and Dale W. Jorgenson. "Tax policy and investment behavior." American economic review 57.3 (1967): 391-414.
Harberger, Arnold C., 1995, Chapter 2 The ABCs of Corporation Tax Incidence: Insights into the Open-Economy Case, in Tax Policy and Economic Growth, volume 1, 51–73 (American Council for Capital Formation).
Hoynes, Hilary Williamson, and Daniel McFadden. The impact of demographics on housing and non-housing wealth in the United States. No. w4666. National Bureau of Economic Research, 1994.
Huang, Rocco R. "Evaluating the real effect of bank branching deregulation: Comparing contiguous counties across US state borders." Journal of Financial Economics 87.3 (2008): 678-705.
Kanodia, Chandra, and Haresh Sapra. "A real effects perspective to accounting measurement and disclosure: Implications and insights for future research." Journal of Accounting Research 54.2 (2016): 623-676.

Kerr, Sari Pekkala, William R. Kerr, and Ramana Nanda. "House Prices, Home Equity and Entrepreneurship: Evidence from US Census Micro Data." (2015).
Kido, Nolan, Reining Petacchi, and Joseph Weber. "The influence of elections on the accounting choices of governmental entities." Journal of Accounting Research 50.2 (2012): 443-476.
Leeds, Michael A. "Property values and pension underfunding in the local public sector." Journal of Urban Economics 18.1 (1985): 34-46.
Legislative Analyst's Office. "California's High Housing Costs: Causes and Consequences" LAO Report (2015)
Lucas Jr, Robert E. "Econometric policy evaluation: A critique." Carnegie-Rochester conference series on public policy. Vol. 1. North-Holland, 1976.
Lucas Jr, Robert E. "On the mechanics of economic development." Journal of monetary economics 22.1 (1988): 3-42.
MacKay, Robert C. "Implicit debt capitalization in local housing prices: An example of unfunded pension liabilities." National Tax Journal 67.1 (2014): 77.
Mercatus Center, George Mason University, Weinberg and Norcoss, "GASB 67 and GASB 68: What the New Accounting Standards Mean for Public Pension Reporting", 2017.
Mian, Atif, Amir Sufi, and Francesco Trebbi. "Foreclosures, house prices, and the real economy." The Journal of Finance 70.6 (2015): 2587-2634.
Mittelstaedt, H. Fred, William D. Nichols, and Philip R. Regier. "SFAS No. 106 and benefit reductions in employer-sponsored retiree health care plans." Accounting Review (1995): 535-556.
Moodys' Investor Service. July 2017. Rating Symbols and Definitions. Moodys' Corporation, Inc.
Morrissey, Monique "Understanding Cuts to Public Pensions", 2014, Economy Policy Institute. https://www.epi.org/publication/understanding-cuts-public-pensions/
Munnell, Alicia H, and Laura Quinby, 2012, Legal constraints on changes in state and local pensions,Center for Retirement Research at Boston College
Muth, Richard F. "The demand for non-farm housing." The demand for durable goods (1960): 29-96.
National Association of Realtor, "Social Benefits of Homeownership and Stable Housing", 2016.
NARSA, NARSA Issue Brief, 2019, "State and Local Government Spending on Public Employee Retirement Systems".
National League of Cities, 2016. "Cities 101-Delegation of Power", https://www.nlc.org/resource/cities-101-delegation-of-power
Naughton, James, Reining Petacchi, and Joseph Weber. "Public pension accounting rules and economic outcomes." Journal of Accounting and Economics 59.2-3 (2015): 221-241.
Novy-Marx, Robert, and Joshua Rauh. 2014. "The Revenue Demands of Public Employee Pension Promises." American Economic Journal: Economic Policy, 6 (1): 193-229.
Novy-Marx, Robert, and Joshua D. Rauh. "The liabilities and risks of state-sponsored pension plans." Journal of Economic Perspectives 23.4 (2009): 191-210.
Olsen, Edgar O. "A competitive theory of the housing market." The American Economic Review 59.4 (1969): 612-622.
Pierson, Kawika, Michael L. Hand, and Fred Thompson. "The government finance database: A common resource for quantitative research in public financial analysis." PloS one 10.6 (2015): e0130119.
Rauh, Joshua D. "Are state public pensions sustainable? Why the federal government should worry about state pension liabilities." (2010).
Reuters, 2018; "Battered by Great Recession, underfunded public pensions to persist".

https://www.reuters.com/article/us-financial-crisis2008-municipals-pensi/battered-by-great-recession-underfunded-public-pensions-to-persist-idUSKBN1H20EG
Rich, Kevin T., and Jean X. Zhang. 2015. Unfunded public pension liabilities and local citizen oversight. Accounting Horizons 29(1): 23-39.
Richardson, Jesse J., Meghan Zimmerman Gough, and Robert Puentes. Is home rule the answer?: clarifying the influence of Dillon's rule on growth management. Center on Urban and Metropolitan Policy, the Brookings Institution, 2003.
Rohlin, Shawn M. "State minimum wages and business location: Evidence from a refined border approach." Journal of Urban Economics 69.1 (2011): 103-117.
SFFAC1, para.11. Statement of Federal Financial Accounting Concepts. SFFAC 1. http://files.fasab.gov/pdffiles/handbook_sffac_1.pdf
Smith, Lawrence B., Kenneth T. Rosen, and George Fallis. "Recent developments in economic models of housing markets." Journal of economic literature 26.1 (1988): 29-64.
S&P Ratings Services. July 2013. RatingsDirect: Credit FAQ: Standard & Poor's Approach to Pension Liabilities in Light of GAB 67 and 68. Standard & Poor's Financial Services LLC.
Tiebout, Charles M. 1956. "A Pure Theory of Local Expenditures." Journal of Political Economy 64(5):416-24
Soo, Cindy K. "Quantifying sentiment with news media across local housing markets." The Review of Financial Studies 31.10 (2018): 3689-3719.
Urban Institute, 2019. "State and Local Government Pension" https://www.urban.org/policy-centers/cross-center-initiatives/state-and-local-finance-initiative/projects/state-and-local-backgrounders/state-and-local-government-pensions

Appendix I Variable Definitions

Variable Name	Definition	Source
Underfunding	State-level net pension underfunding position (pension liabilities minus pension assets) as a percentage of total state revenues in year t-1. The data before fiscal year 2014 is collected and estimated using data from the Public Plan Data; the data after fiscal year 2014 is hand collected from state governments' CAFR.	Public Plan Data, https://publicplansdata.org/
HPI	FHFA Housing Price Index (available both at the county level and zip code level).	FHFA https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx
HPG	Annual growth rate of FHFA Housing Price Index at the county level.	FHFA https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx
lnpercapNHP	County-level new housing permits granted per 10,000 population.	US Census Bureau-Building Permits Survey https://www.census.gov/construction/bps The Government Finance Database http://willamette.edu/mba/research-impact/public-datasets/index.html
POST	An indicator variable that equals 1 for periods between 2015 and 2017, and 0 for the year between 2012 and 2014.	
lnLoanLimit	The natural log of county-specific maximum conforming loan limits for mortgages to be acquired by Fannie Mae and Freddie Mac	FHFA https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx
PropTaxRate	County-level property tax rate.	Tax Policy Centre, https://money.cnn.com/interactive/real-estate/property-tax/?fbclid=IwAR2zgdKigBMseAz3V6vqhEnaNgH1W9VSlQ0ZfpmX_QcL34UBdFqKdvju0VU
lnPerCapInc	The natural log of county-level per-capita income.	US Census Bureau
lnRevenue	The natural log of total revenues at the county-level.	The Government Finance Database http://willamette.edu/mba/research-impact/public-datasets/index.html
EduQuality	County-level pupil-to-teacher ratios.	US Department of Education
Foreclosure	An indicator equals to 1 if the county is in a state which requires a judicial process for foreclosures, and 0 otherwise.	Dagher and Sun (2016)
IncTaxRate	The marginal income tax rates (after mortgage interest deductions) for each state.	NBER, Maximum State Income Tax Rates, https://users.nber.org/~taxsim/state-rates/
Coindex	The economic coincident indexes for the two states.	US Census Bureau
DebtRatio	The debt-to-total revenue ratio of the state.	The Government Finance Database http://willamette.edu/mba/research-impact/public-datasets/index.html
pctUnion	The percentage of public-sector employees that are part of a union (or represented by a union) in the state.	http://unionstats.gsu.edu/

Appendix I (Continued)

Variable Name	Definition	Source
Constraint	A categorical variable that equals 3 if the state the county resides has explicit constitutional protection for pension benefits for both past and future employees in the form of state constitution, equals 2 if there is protection in the form of contract laws or property laws, equals 1 if there is promissory estoppel protection, and 0 otherwise.	Munnel and Quinn (2012); Boyer (2018)
lagMedianPrice	The natural log of median home value at the county-level.	National Association of Realtors https://www.nar.realtor/research-and-statistics/housing-statistics/county-median-home-prices-and-monthly-mortgage-payment
lnEducation	The natural log of one plus the total expenditures on education at the county level.	The Government Finance Database http://willamette.edu/mba/research-impact/public-datasets/index.html
lnHealth	The natural log of one plus the total expenditures on healthcare at the county level.	The Government Finance Database http://willamette.edu/mba/research-impact/public-datasets/index.html
lnPolice	The natural log of one plus the total expenditures on police forces at the county level.	The Government Finance Database http://willamette.edu/mba/research-impact/public-datasets/index.html
lnNumEST	The natural log of the number of business establishments in a county.	US Census-County Business Pattern https://www.census.gov/programs-surveys/cbp.html
lnPublicPay	The natural log of public payroll in the two counties	Bureau of Labor Statistics https://www.bls.gov/data/#employment
lnFTEEmploy	The natural log of the total number of full-time equivalent public employees of a county.	Bureau of Labor Statistics https://www.bls.gov/data/#employment
TotalWageRate	State-level wage tax rates.	The Government Finance Database http://willamette.edu/mba/research-impact/public-datasets/index.html
CalHPG	Zip code-level FHFA housing price growth index growth in California.	FHFA https://www.fhfa.gov/DataTools/Downloads/Pages/House-Price-Index.aspx
lnPensionBurden	The natural log of the market value of pension liabilities (discounted using CalPERS' 2017 Termination Liability Discount Rate of 3.0 %) per household in the city in California.	The Pension Tracker, https://www.pensiontracker.org/
SalestoListYoY	The year-to-year growth in the average sales-to-listings ratio of California cities.	RedFin, https://www.redfin.com/blog/data-center/
InventoryYoY	The year-to-year growth in the total housing inventories of California cities.	RedFin, https://www.redfin.com/blog/data-center/
MedianPriceYoY	The year-to-year growth in the median home sales prices of California cities.	RedFin, https://www.redfin.com/blog/data-center/
CalProTaxRate	The property tax rate for California city.	California Department of Tax and Fee Administration. https://www.cdtfa.ca.gov/taxes-and-fees/rates.aspx

Appendix II Illustration of Blended Discount Rate Calculation

1. Steps for determining the blended discount rate

Step 1: Determine the projected benefit payments.
Projected benefit payments should include all benefits to be provided to all current active and inactive plan members through the pension plan in accordance with the benefit terms and any additional legal agreements to provide benefits that are in force at the pension plan's fiscal year-end. Benefits expected to be paid to future employees should be excluded.
Projected benefit payments should include the effects of automatic postemployment benefit changes, including automatic COLAs (Cost of living adjustments).

Step 2: Determine the projected pension plan's fiduciary net position.
Projections of the pension plan's fiduciary net position should incorporate all cash flows inflows, (i.e., contributions from employers, non-employer contributing entities, and current active plan members.), and outflows (benefit payments, expenses) intended to finance benefits of current active and inactive plan members (status at the pension plan's fiscal year-end).
Unlike benefit payment projections, expected contributions from future members can be included to the extent that these contributions exceed the expected service cost associated with these new members.
If the plan's contribution rate is set by statue or a formal written funding policy, then professional judgement can be used in projecting the most recent five years of contribution history into the future. If not, then the average contribution over the most recent five-year period is the maximum projected future contribution.

Step 3: Determine the single equivalent discount rate
The discount rate should be the single rate that reflects the following:
a. The long-term expected rate of return on pension plan investments that are expected to be used to finance the payment of benefits, to the extent that (1) the pension plan's fiduciary net position is projected to be sufficient to make projected benefit payments and (2) pension plan assets are expected to be invested using a strategy to achieve that return.
b. A yield or index rate for 20-year, tax-exempt general obligation municipal bonds with an average rating of AA/Aa or higher (or equivalent quality on another rating scale), to the extent that the conditions in (a) are not met.
c. Solve for the single equivalent discount rate that, when applied to all the cash flows, produces the same total present value as the dual discount rate streams described above; this single equivalent discount rate ("blended rate") is used to calculate the total liability per GASB 67/68.

Appendix II (continued)
2. Numerical Example of Net Pension Liabilities Calculation Using Blended Discount Rate Under GASB 67

Total benefit payments the plan has promised to pay from the year 2020-2030:	$500,000.00
Annual payment:	$50,000.00
Amount of benefit payment the employer has in assets (sufficient for 8 year's payment from the year 2020 to 2028)	$400,000.00
Amount of benefit payment the employer does not have in assets (from 2028-2030)	$100,000.00
The expected investment return of 7.50% is used only on the amount of the employer's liability that it does have in assets to cover:	$292,865.18
The 20-year Municipal Bond Rate is used on the amount of the employer's liability that it does not have an equal number of assets to cover. (The 20-year Municipal Bond Rate for AA+ rate bond is about 4.00%):	$68,907.55
Add these two discounted amounts together to obtain the present value of total benefit payment $292,865.18+$94,304.73=	$361,722.7
Blended discount rate:	6.4%
If calculated using 7.5% discount rate for the full pension liabilities (GASB 25):	$343,204.05
Difference between GASB 67 and GASB 25:	**$18,518.65**
% increase in pension liabilities from GASB 25 to GASB 67:	**5.40%**

The higher the portion of benefit payment the employee does not have in assets, the lower the blended discount rate will be, and the higher the present value of pension liabilities.

References:

1. GASB 67, 2012; Section: Measurement of the Net Pension Liabilities. https://www.gasb.org/jsp/GASB/Document_C/DocumentPage?cid=1176160220594&acceptedDisclaimer=true
2. Anatharaman and Chuk, 2018; Appendix I. p42-43.
3. Indiana Government presentations, GASB 67&68 and the Changes Impacting Reporting and the Auditing of Pension Data, 2015, https://www.in.gov/sboa/files/McGladreyGASB_67_68_SBOA_Presentation.pdf

Appendix III Examples of News Articles

Example news: extracted from Ravenpack database:
Title: *Moody's downgrades Chicago amid pension crisis, CNN,*
https://money.cnn.com/2014/03/04/news/chicago-credit-rating/

Sentiment Score = -0.66 (Very Negative)

What choice did Harrisburg have? The state is broke. School districts, which foot part of the bill, recoiled at the higher property taxes that would be needed to keep the underfunded public-employee and schoolteacher pension plans as solvent as the law demands. But some lawmakers were resolved not to waste this year's pension crisis. And union leaders agreed to meet them part way." I told [Evans], 'All the Republicans will be voting yes. However, we'd like to offer some amendments,'" State Rep. Bill Adolph (R., Delaware) said.
Under Evans' bill, long-term minimum pension subsidies from the state and school districts were increased, in exchange for delaying the balloon payments that had threatened to boost subsidies for the pension systems from $1.4 billion this year to $5.9 billion two years from now. With the new law, they still rise, to $2.5 billion, and more in future years.
Adolph and Rep. Glen Grell (R., Cumberland) said they wanted to go further: Reduce pensions for new workers hired, starting next year. Push most workers' retirement age to 65, from 60. End big up-front payouts as a retirement option. Make workers stay on the job 10 years, instead of five, before qualifying for pensions. And give them 2 percent of their top pay for each year they work, down from 2.5 percent.
…….
"Is it a cure? Absolutely not," said James McAneny, head of the Pennsylvania Public Employees Retirement Commission. It's a way to soften the blow of closing the multibillion-dollar gap between what Pennsylvania owes and what it has set aside to pay.
McAneny blames not just higher pensions and lower payments after the 2001 law, but a 2003 law that further lowered public pension subsidies in hopes the stock market would recover.
"We pretended we didn't need more money for the plans because the systems were going to earn their way out of it," McAneny said. "We almost did." But the stock market collapse of 2008 dropped both plans' assets back to 2001 levels, while their obligations to future retirees kept growing. State revenue also fell, closing off higher state subsidies as a way out of the mess.

Appendix IV Sample of Disclosure of NPL in state CAFRs

1. California CAFR FY2015 (units: $ Thousands)

The highlighted text shows the recognition of net pension liability on the government financial statement.

Government-wide Financial Statements

	Primary Government			Component Units
	Governmental Activities	Business-type Activities	Total	
LIABILITIES				
Current liabilities:				
Accounts payable	$ 21,753,559	$ 317,610	$ 22,071,169	$ 2,440,495
Due to component units	168,660	—	168,660	—
Due to other governments	11,437,475	125,000	11,562,475	2
Revenues received in advance	1,452,360	312,303	1,764,663	1,140,375
Tax overpayments	4,385,298	—	4,385,298	—
Deposits	472,920	—	472,920	863,825
Contracts and notes payable	105	—	105	26,518
Unclaimed property liability	773,487	—	773,487	—
Interest payable	1,203,862	67,119	1,270,981	49,787
Securities lending obligations	—	—	—	812,088
Benefits payable	—	474,410	474,410	—
Current portion of long-term obligations	5,070,767	2,077,542	7,148,309	4,137,025
Other current liabilities	672,168	466,770	1,138,938	1,768,877
Total current liabilities	47,390,661	3,840,754	51,231,415	11,238,992
Noncurrent liabilities:				
Loans payable	—	5,670,653	5,670,653	—
Lottery prizes and annuities	—	742,955	742,955	—
Compensated absences payable	3,680,640	188,390	3,869,030	286,796
Workers compensation benefits payable	3,447,670	2,976	3,450,646	410,329
Certificates of participation, commercial paper, and other borrowings	481,885	89,001	570,886	2,424
Capital lease obligations	214,930	1,135,691	1,350,621	463,503
General obligation bonds payable	77,527,575	579,318	78,106,893	—
Revenue bonds payable	17,738,950	11,669,577	29,408,527	19,461,720
Mandated cost claims payable	2,376,998	—	2,376,998	—
Net other postemployment benefits obligation	21,593,644	735,176	22,328,820	9,524,839
Net pension liability	57,456,241	6,248,976	63,705,217	10,814,302
Revenues received in advance	—	13,213	13,213	—
Other noncurrent liabilities	2,378,587	435,137	2,813,724	1,845,620
Total noncurrent liabilities	186,897,120	27,511,063	214,408,183	42,809,533
Total liabilities	**234,287,781**	**31,351,817**	**265,639,598**	**54,048,525**
DEFERRED INFLOWS OF RESOURCES	**11,989,171**	**2,002,482**	**13,991,653**	**5,368,446**
Total liabilities and deferred inflows of resources	**$ 246,276,952**	**$ 33,354,299**	**$ 279,631,251**	**$ 59,416,971**

(continued)

Appendix IV (Continued)

2. California CAFR FY2015, Notes to NPL

***Sensitivity of the Net Pension Liability to Changes in the Discount Rate*:** Table 30 shows the net pension liability of the State, with regard to the PERF plans, calculated using the discount rate of 7.65%, as well as what the State's net pension liability would be if it were calculated using a discount rate that is one percentage point lower (6.65%) or one percentage point higher (8.65%) than the current rate.

Table 30

Net Pension Liability Sensitivity – PERF Plans
June 30, 2015
(amounts in thousands)

	Current Rate -1%	Current Rate 7.65%	Current Rate +1%
State Miscellaneous	$ 35,024,779	$ 23,808,612	$ 14,184,286
State Industrial	998,904	541,458	153,711
State Safety	2,750,450	1,478,126	397,559
State Peace Officers and Firefighters	15,304,428	10,158,286	5,835,514
California Highway Patrol	4,813,585	3,403,638	2,218,532
Total PERF plans	**$ 58,892,146**	**$ 39,390,120**	**$ 22,789,602**

Appendix V Legal Basis for Protection of Public Pension Rights under State Laws

	Accruals Protected			
Type of Provisions	**Past and Future**	**Past, and maybe Future**	**Past only**	**None**
State Constitution (Constraint=3)	AK, IL, NY	AZ	HI, LA, MI	
Contract (Constraint=2)	AL, CA, GA, KS, MA, NE, NV, NH, ND, OR, PA, TN, VT, WA, WV	CO, ID, MD, MS, NJ, RI, SC	AR, DE, FL, IA, KY, MO, MT, NC, OK, SD, UT, VA	
Property (Constraint=2)	ME, WY	CT, NM, OH	WI	
Promissory Estoppel[a] (Constraint=1)	MN			
Gratuity (Constraint=0)				IN, TX[b]

(Table recreated from Table 1 in Munnell and Quinby [2012])
a Promissory estoppel is the protection of a promise even where no contract has been explicitly stated.
b This gratuity approach applies only to state-administered plans. Accruals in many locally administered plans are protected under the Texas constitution.
Sources: Cloud (2011); Monahan (2010); National Conference on Public Employee Retirement Systems (2007); Mumford and Pareja (1997); Reinke (2011); Staman (2011); Simko (1996); and consultations with plan legal counsels when accompanied by a decisive court ruling.

Figure 1 Google Search Volume for Pension-Related Keywords

The below figures shows the time series of the Google Search Volume Index for the keywords related to pensions and pension regulations during the year 2010 to 2019. Figure 1.1 and 1.2 presents the results for searches for words “pension crisis” and “government pension” respectively. Figure 1.3 shows the searches for the word “government pensions” in the state of Illinois. Figure 1.4 shows the searches for the words “GASB 67” of “GASB 68”.

Figure 1.1

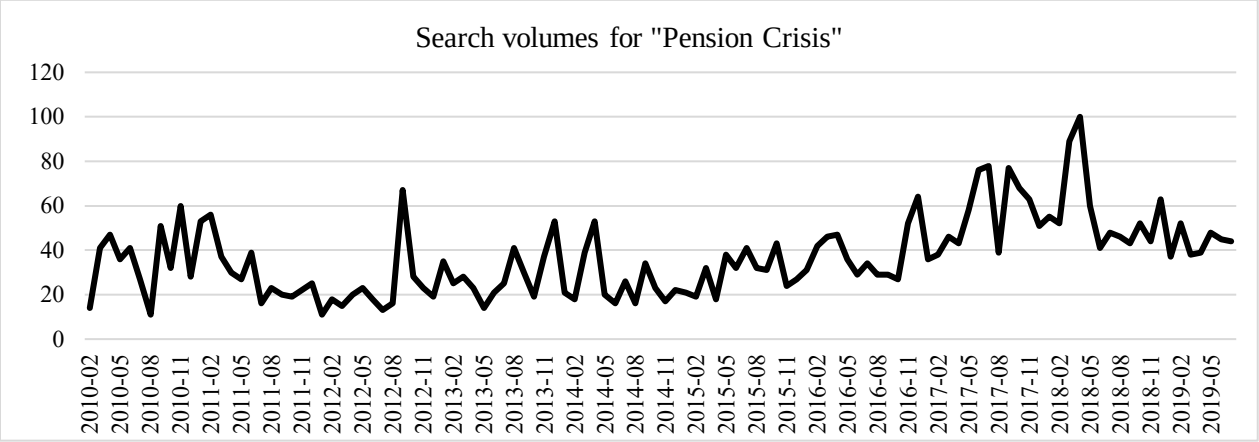

Figure 1.2

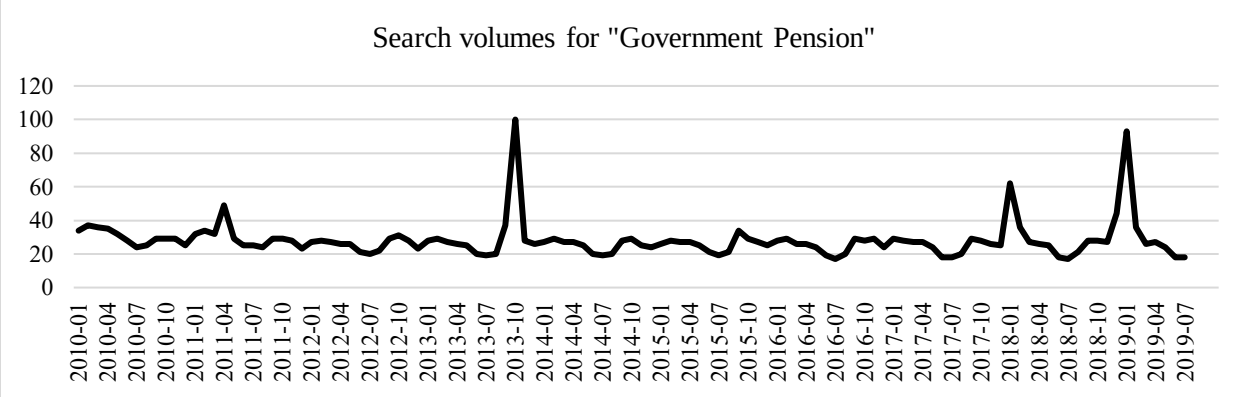

Figure 1.3

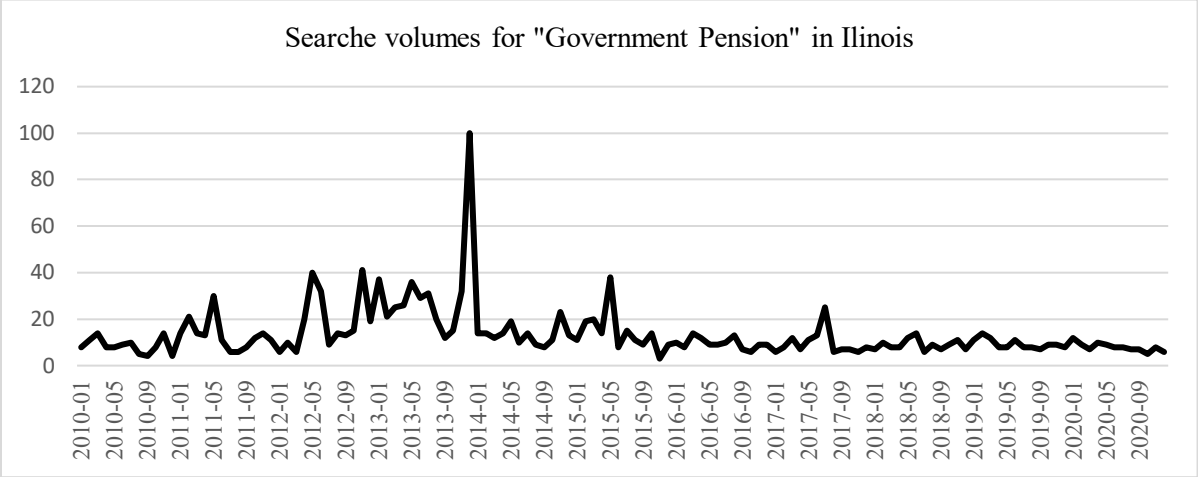

Figure 1.4

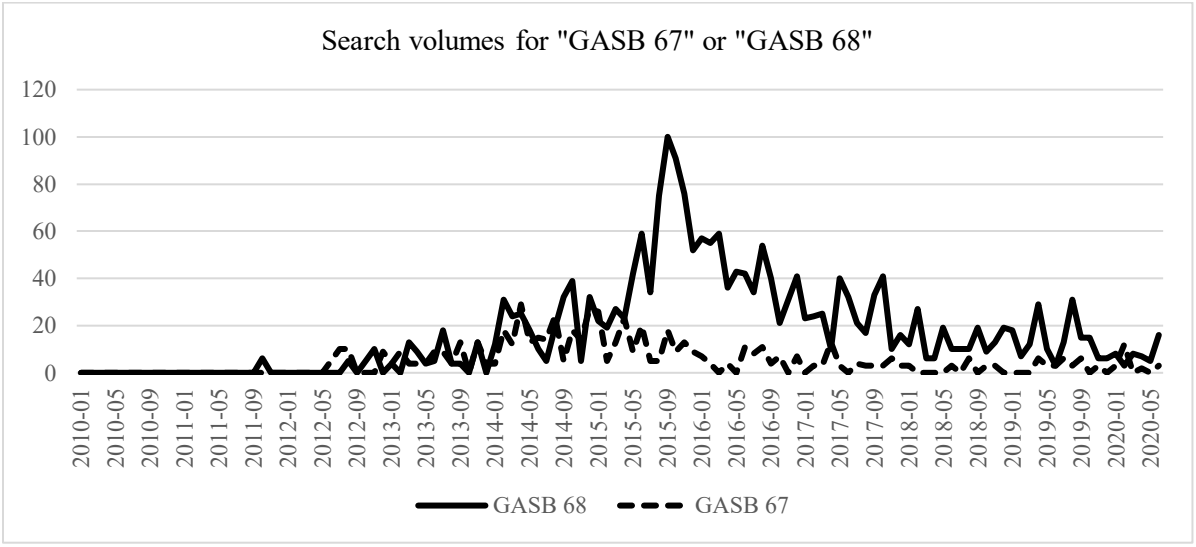

Figure 2 Times-series of Media Coverage of Public Pension

Figure 2.1 shows the time series of the number of unique news articles that have mentioned the key "government pension", "state pension", "pension crisis", or "pension underfunding" in the headlines, from the year 2010 to the year 2020 (November). Figure 2.2 shows the time series of the number of news articles that have mentioned the above pension-related keywords plus either the word "tax" or "spending". The news articles are extracted from the Ravenpack database for the US regions.

Figure 2.1

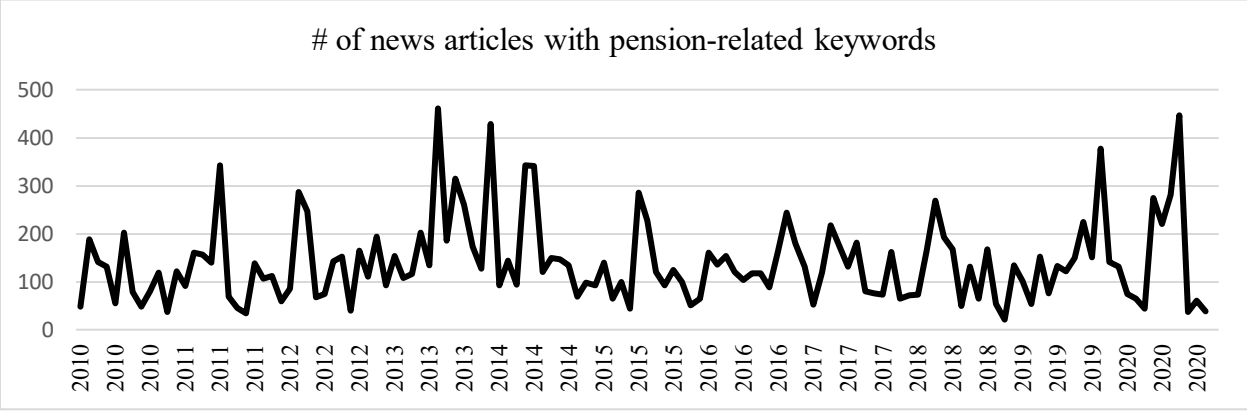

Figure 2.2

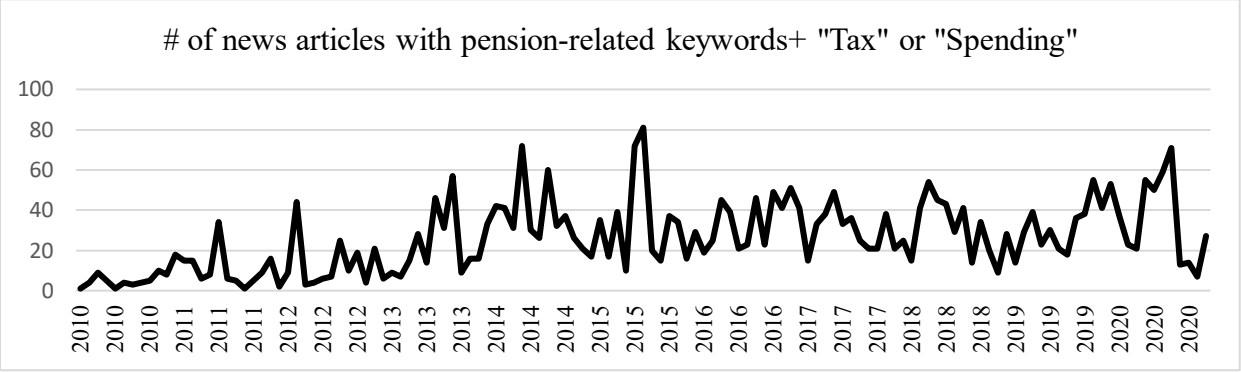

Figure 3 News Sentiments Relating to Pension Underfunding

The below graph shows the time series of the average sentiment of news articles that have mentioned the keywords "government pension", "state pension", "pension crisis", or "pension underfunding" in the headlines, from January 2010 to November 2020 in the US regions. The news articles are extracted from the news database Ravenpack. The sentiment score used is the "CSS" score from Ravenpack, which is measured based on the tone of the entire article whose headlines contain the relevant keywords. The sentiment score and the news sentiment have the following relation: a score larger than 0.5: Very positive; a score between 0 and 0.5: Positive; A score equals to 0: Neutral; A score between -0.5 to 0: Negative; A score lower than -0.5: Very negative. See Appendix III for examples of articles.

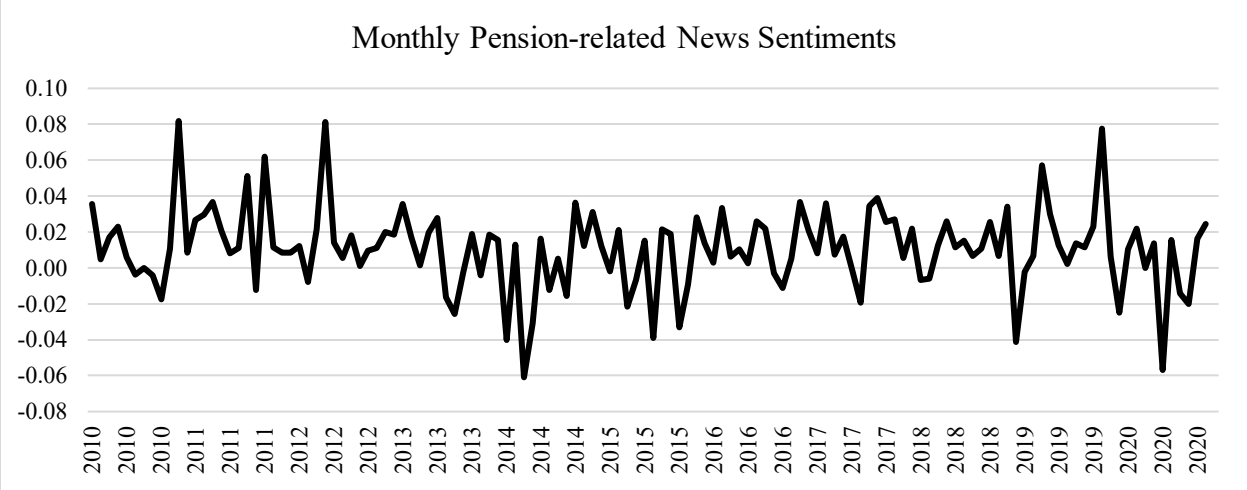

Figure 4 Illinois Housing Price Growth vs US growth

The below figure shows the all-transaction housing price indexes for the United States and of the state of Illinois from January 2012 to January 2019. The all transaction housing price index is retrieved from Fred https://fred.stlouisfed.org/series/USSTHPI.

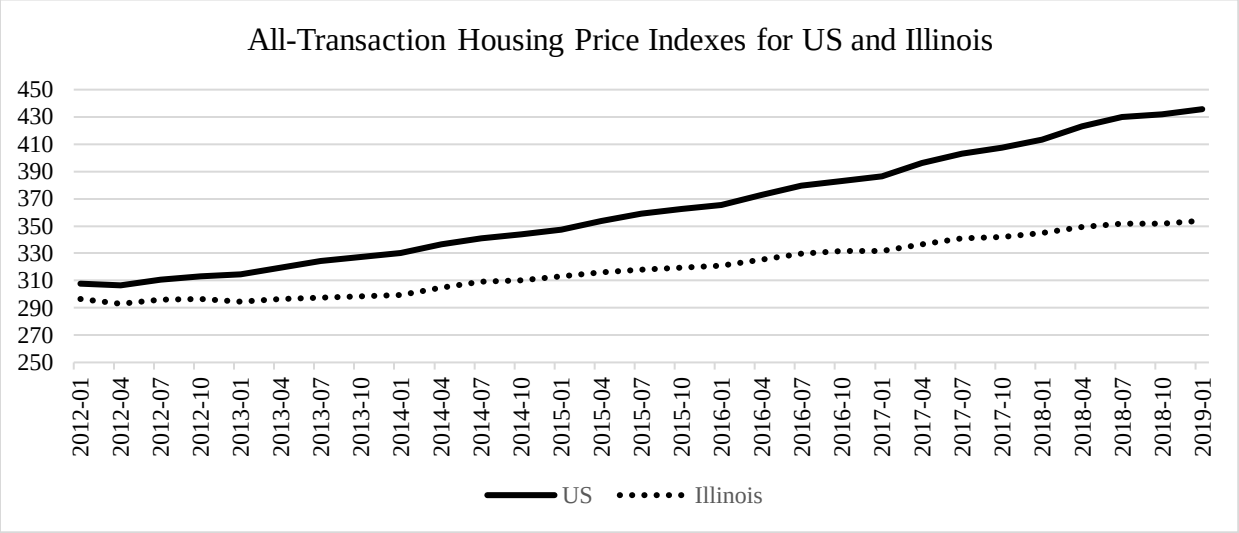

Figure 5 US Adjacent Counties on State Borders

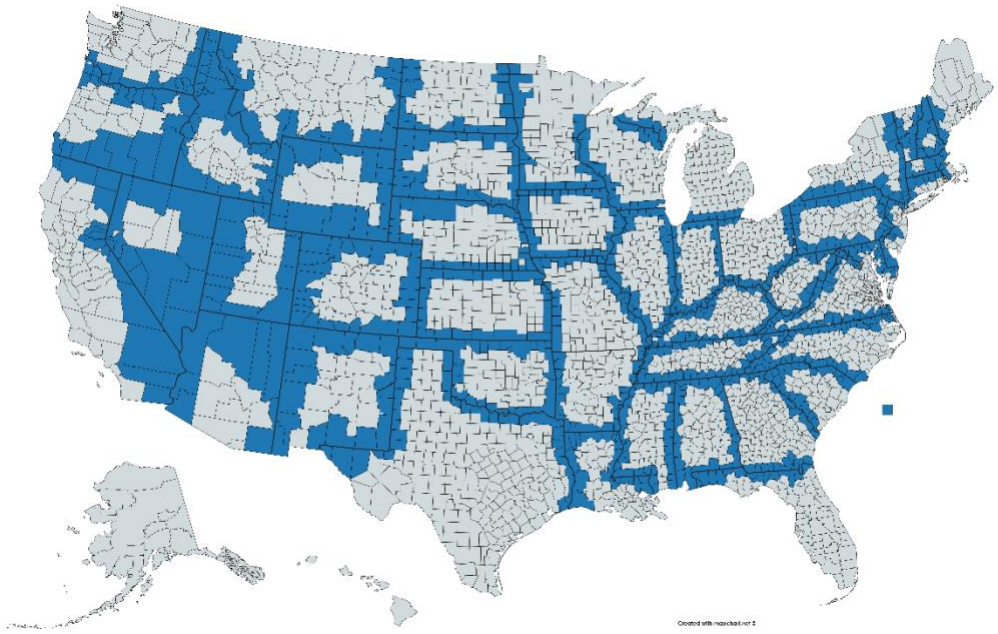

Table 1 Local Employee Retirement Plans by States

This table provides the number of local retirement plans in each state in the United States for the fiscal year 2017. Source: US Census Bureau, State and Locally Administered Defined Benefit Pension Systems, 2017; Annual Survey of Public Pensions, August 2018.

State	Number of Plans	State	Number of Plans
Alabama	15	Montana	92
Alaska	2	Nebraska	26
Arizona	80	Nevada	0
Arkansas	151	New Hampshire	3
California	76	New Jersey	9
Colorado	64	New Mexico	0
Connecticut	206	New York	6
Delaware	17	North Carolina	49
District of Columbia	7	North Dakota	14
Florida	476	Ohio	1
Georgia	45	Oklahoma	14
Hawaii	0	Oregon	17
Idaho	3	Pennsylvania	1594
Illinois	651	Rhode Island	34
Indiana	238	South Carolina	6
Iowa	8	South Dakota	1
Kansas	11	Tennessee	39
Kentucky	26	Texas	133
Louisiana	17	Utah	2
Maine	0	Vermont	7
Maryland	72	Virginia	30
Massachusetts	92	Washington	50
Michigan	141	West Virginia	57
Minnesota	567	Wisconsin	3
Mississippi	0	Wyoming	0
Missouri	79	Total	5232

Table 2 Descriptive Statistics

Panel A Contiguous-border County Sample

This table presents the descriptive statistics for different variables using the contiguous-border county sample. The sample period is from the year 2012 to the year 2017 unless indicated otherwise. Please refer to Appendix I for the variable descriptions.

stats	N	Mean	S.D	Min	p25	p50	p75	Max
HPG (%)	10440	2.448	5.512	-11.770	-0.860	2.280	5.290	19.730
lnpercapNHP (from 2012-2016)	4814	2.855	1.221	-1.843	2.120	2.947	3.713	6.366
Underfunding(%)	10440	38.674	35.686	-12.577	11.249	31.462	52.944	158.749
NetPensionLiabilities(,000)	10440	7211	20127	-37415	0.000	1040	4089	116024
LoanLimt	10440	12.959	0.081	12.941	12.941	12.941	12.941	13.346
PropertyTax	10440	0.067	0.251	0.000	0.000	0.000	0.000	1.000
PerCapInc	10440	10.375	0.298	9.387	10.168	10.356	10.556	12.362
lnRevenue	10440	16.994	0.880	14.677	16.458	17.044	17.572	19.683
EducQuality	10440	14.432	4.280	2.200	12.790	14.420	15.900	490.700
IncTaxRate	10440	40.985	2.962	35.000	39.020	40.610	43.810	49.300
Coindex	10440	152.143	24.586	91.060	134.220	146.230	163.850	268.680
Foreclosure	10440	0.404	0.491	0.000	0.000	0.000	1.000	1.000
Constraint	10440	0.735	0.930	0.000	0.000	0.000	2.000	3.000
DebtRatio	10440	0.483	0.256	0.115	0.317	0.434	0.581	2.455
pctUnion	10440	9.345	4.734	1.600	5.300	8.600	12.600	25.200
NEWS	10440	3.321	25.633	-26.120	-0.400	0.380	1.640	364.900
MedianPrice(,000)	10440	150.302	86.576	33.842	94.009	125.850	176.792	1033.669
lagMedianPrice	10440	11.796	0.476	10.429	11.451	11.743	12.083	13.849
lnEducation	5228	16.042	0.840	14.011	15.601	16.068	16.614	18.298
lnHealth	5228	13.550	0.953	11.388	12.835	13.421	14.188	16.036
lnPolice	5228	12.289	0.886	10.217	11.562	12.294	12.986	14.468
FTEEmployee (,000)	10220	109.694	91.800	11.158	53.501	85.518	136.861	829.358
lnFTEEmployee	10220	11.319	0.782	9.320	10.887	11.356	11.827	13.628
PublicPayroll	10220	19.584	0.871	17.241	19.094	19.556	20.142	22.455
lnNumEST	7544	8.312	1.505	1.792	7.256	8.134	9.219	13.590
ZillowYoY	1459	0.030	0.083	-0.400	-0.012	0.027	0.068	0.517
ZillowHomePrice(,000)	1459	252.852	137.467	54.000	154.000	221.200	326.300	1319.800

Table 2 (Continued)

Panel B California Cities Sample

This table presents the descriptive statistics for different variables using the California City-level sample. The sample period is from the year 2012 to the year 2017. Please refer to Appendix I for the variable descriptions.

stats	N	Mean	S.D	Min	p25	p50	p75	Max
SaletoListYoY	1545	0.001	0.024	-0.008	0.001	0.010	0.197	0.001
InventoryYoY	1545	0.056	0.600	-0.220	0.000	0.262	12.750	0.056
MedSalePriceYoY	1545	0.108	0.131	0.033	0.093	0.170	1.210	0.108
lnPensionBurden	1545	8.840	1.254	0.693	8.205	9.175	9.657	11.681
lnCityRevenue	1545	7.197	0.637	4.905	6.766	7.160	7.555	11.206
PropertyTaxRate	1545	0.056	0.075	0.000	0.009	0.023	0.091	0.452

Panel C California Neighbouring Zip Codes Sample

This table presents the descriptive statistics for different variables using the California contiguous zip code level sample. The sample period is from the year 2012 to the year 2017. Please refer to Appendix I for the variable descriptions.

stats	N	Mean	S.D.	Min	p25	p50	p75	Max
Zip code distances < 10 mile								
CalHPG (%)	18519	8.061	5.708	-37.290	4.700	8.080	11.500	35.340
lnPensionBurden	18519	9.412	0.829	4.277	9.157	9.556	9.889	11.591
lnCityRevenue	18519	20.094	2.424	15.176	18.172	19.381	23.311	23.563
CalProTaxRate	18519	0.074	0.095	0.023	0.000	0.037	0.125	0.452
Zip code distances < 5 mile								
CalHPG (%)	3741	8.222	5.569	-14.760	5.080	8.270	11.550	35.340
lnPensionBurden	3741	9.426	0.828	6.525	9.054	9.519	9.889	11.591
lnCityRevenue	3741	19.798	2.342	15.953	18.168	18.912	21.616	23.563
CalProTaxRate	3741	0.084	0.109	0.000	0.023	0.037	0.147	0.452

Table 2 Panel B Correlation Matrix

This table presents the pairwise correlations between key variables. The Pearson correlations at the bottom diagonal and the Spearman correlations at the top diagonal. Please refer to Appendix I for the variable descriptions.

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
(1)	HPG		-0.17	0.06	-0.01	-0.09	-0.03	-0.12	0.00	0.01	-0.03	-0.01	-0.12	-0.08	-0.02	-0.07
			(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.84)	(0.17)	(0.00)	(0.05)	(0.00)	(0.00)	(0.00)	(0.00)
(2)	Underfunding	-0.23		0.05	0.04	0.29	0.07	0.18	-0.11	0.12	0.03	0.20	0.19	0.23	0.32	0.37
		(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(3)	lnLoanlimit	0.07	0.01		0.04	0.12	0.06	0.27	0.07	0.01	-0.04	-0.07	0.20	0.14	0.13	0.15
		(0.00)	(0.02)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(4)	IncTaxRate	-0.02	0.09	0.02		0.17	-0.11	0.14	-0.13	0.03	0.08	0.10	0.11	0.16	0.16	0.15
		(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(5)	lnRevenue	-0.07	0.31	0.15	0.09		0.09	0.17	-0.02	0.21	0.13	-0.09	0.08	0.19	0.90	0.92
		(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(6)	Coindex	0.03	0.07	0.02	-0.08	0.08		0.44	0.03	-0.06	-0.29	-0.09	-0.13	-0.34	0.08	0.17
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(7)	lnPerCapInc	-0.06	0.16	0.35	0.12	0.14	0.39		0.03	-0.09	0.10	-0.07	0.21	0.28	0.09	0.22
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(8)	PropTaxRate	0.00	-0.11	0.07	-0.14	-0.02	0.00	0.03		-0.13	0.04	0.14	0.01	-0.19	0.00	0.01
		(0.37)	(0.00)	(0.00)	(0.00)	(0.00)	(0.45)	(0.00)		(0.00)	(0.00)	(0.00)	(0.10)	(0.00)	(0.82)	(0.05)
(9)	EduQuality	0.00	0.11	0.01	0.01	0.14	0.01	-0.09	-0.06		0.00	-0.13	0.00	0.07	0.20	0.19
		(0.90)	(0.00)	(0.01)	(0.24)	(0.00)	(0.06)	(0.00)	(0.00)		(0.38)	(0.00)	(0.84)	(0.00)	(0.00)	(0.00)
(10)	Foreclosure	-0.03	0.12	0.01	0.09	0.15	-0.27	0.09	0.04	-0.01		-0.09	0.27	0.24	0.10	0.12
		(0.00)	(0.00)	(0.09)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.04)		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
(11)	Constraint	0.00	0.27	-0.06	0.11	-0.10	-0.06	-0.07	0.08	-0.08	-0.10		0.10	-0.19	-0.03	-0.07
		(0.45)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)	(0.00)
(12)	DebtRatio	-0.12	0.24	0.19	0.15	0.00	-0.10	0.23	-0.03	-0.02	0.19	0.09		0.43	0.09	0.11
		(0.00)	(0.00)	(0.00)	(0.00)	(0.88)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)	(0.00)
(13)	pctUnion	-0.08	0.26	0.21	0.11	0.30	-0.31	0.23	-0.19	0.09	0.22	-0.20	0.41		0.07	0.16
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)		(0.00)	(0.00)
(14)	lnFTEEmployee	-0.03	0.31	0.14	0.06	0.92	0.10	0.05	0.02	0.20	0.10	-0.06	0.00	0.17		0.97
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.92)	(0.00)		(0.00)
(15)	lnPublicPayroll	-0.07	0.36	0.16	0.05	0.93	0.17	0.16	0.02	0.20	0.13	-0.10	0.05	0.24	0.98	
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	

Table 3 Regression Results of Pension Underfunding and Housing Price Growth in Adjacent Counties

This table presents the regression results of the relation between pension underfunding and housing price growth in adjacent counties from the year 2012 to the year 2017. The dependent variable is HPG, which is the annual growth rate of the housing price index (HPI) of the county; $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1; $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014, $lnLoanLimit$ is the natural log of county-specific maximum conforming loan limits for mortgages to be acquired by Fannie Mae and Freddie Mac, $PropTaxRate$ is the county level property tax rate; $lnPerCapInc$ is the natural log of income per capita at the county level; $lnRevenue$ is the natural log of total revenues of the county; $EduQuality$ is the pupil-to-teacher ratio of the county; $IncTaxRate$ is the marginal income tax rate at the state level, $Coindex$ is the coincident index of the state; Foreclosure is the indicator of whether there is juridical foreclosure process in the state, and 0 otherwise, $Debtratio$ is total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union; $Constraint$ is a categorical variable that ranges from 0 to 3 depending on the level of political constraint the state face to renegotiate pension benefits, $lagMedianPrice$ is the natural log of the median home prices in the county in year t-1. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
Underfunding×POST			-0.006*	
			(-1.94)	
Underfunding	-0.003	-0.008*	-0.002	0.002
	(-0.69)	(-1.95)	(-0.47)	(0.28)
Underfunding × Year2012				0.003
				(0.50)
Underfunding × Year2013				0.004
				(-0.55)
Underfunding × Year2014				-0.006
				(-0.67)
Underfunding × Year2015				-0.006
				(-0.78)
Underfunding × Year2016				-0.006
				(-0.70)
Underfunding × Year2017				-0.019***
				(-3.03)

Table 3 (Continued)

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
lnLoanlimit	3.229**	-0.880	1.108	1.098
	(2.59)	(-0.63)	(1.19)	(1.19)
PropTaxRate	0.157	-0.745	-0.277	-0.295
	(0.47)	(-1.04)	(-0.78)	(-0.84)
lnPerCapInc	3.156***	2.561***	2.851***	2.872***
	(6.10)	(3.10)	(5.65)	(5.66)
lnRevenue	-0.319**	0.049	-0.151	-0.160
	(-2.25)	(0.23)	(-1.04)	(-1.12)
EduQuality	0.152**	0.122**	0.134***	0.134***
	(2.41)	(2.48)	(3.01)	(3.00)
IncTaxRate	-0.084	-0.017	-0.049	-0.048
	(-1.48)	(-0.22)	(-0.90)	(-0.89)
Coindex	-0.001	0.022**	0.014**	0.014**
	(-0.17)	(2.65)	(2.13)	(2.18)
Foreclosure	0.102	-0.289	-0.080	-0.087
	(0.50)	(-0.88)	(-0.37)	(-0.40)
Constraint	0.004	-0.305**	-0.149	-0.155
	(0.03)	(-2.16)	(-1.47)	(-1.54)
Debtratio	-0.990*	0.188	-0.477	-0.409
	(-1.69)	(0.16)	(-0.92)	(-0.78)
pctUnion	0.003	0.015	0.017	0.019
	(0.07)	(0.32)	(0.46)	(0.50)
lagMedianPrice	-1.232**	-1.185**	-1.238***	-1.246***
	(-2.64)	(-2.06)	(-3.25)	(-3.26)
County-pair × Year FE	Y	Y	Y	Y
Observations	5,292	5,148	10,440	10,440
R-squared	0.677	0.571	0.648	0.649
Adj. R-squared	0.351	0.138	0.294	0.295

Table 4 Regression Results of Pension Underfunding and New Housing Permits in Adjacent Counties

This table presents the regression results of the relation between pension underfunding and new housing permits in adjacent counties from the year 2012 to the year 2016. The dependent variables is $lnpercapNHP$, which equals the natural log per capita new housing permits granted by the governments at the county level; $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1; $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014, $lnLoanLimit$ is the natural log of county-specific maximum conforming loan limits for mortgages to be acquired by Fannie Mae and Freddie Mac, $PropTaxRate$ is the county level property tax rate; $lnPerCapInc$ is the natural log of income per capita at the county level; $lnRevenue$ is the natural log of total revenues of the county; $EduQuality$ is the pupil-to-teacher ratio of the county; $IncTaxRate$ is the marginal income tax rate at the state level, $Coindex$ is the coincident index of the state; Foreclosure is the indicator of whether there is juridical foreclosure process in the state, and 0 otherwise, $Debtratio$ is total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union; $Constraint$ is a categorical variable that ranges from 0 to 3 depending on the level of political constraint the state face to renegotiate pension benefits, $lagMedianPrice$ is the natural log of the median home prices in the county in year t-1. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

	Pre-GASB (2012-2014)	Post-GASB (2015-2016)	Full Period (2012-2016)	Full Period (2012-2016)
	(1)	(2)	(3)	(4)
VARIABLES	lnpercapNHP	lnpercapNHP	lnpercapNHP	lnpercapNHP
Underfunding× POST			-0.001	-0.001
			(-1.35)	(-0.49)
Underfunding	-0.002	-0.004**		
	(-1.23)	(-2.31)		
Underfunding × Year2012				0.34**
				(2.57)
Underfunding × Year2013				-0.001
				(-0.90)
Underfunding × Year2014				-0.002
				(-1.21)
Underfunding × Year2015				-0.002
				(-1.27)
Underfunding × Year2016				-0.005***
				(-2.76)

Table 4 (Continued)

	Pre-GASB (2012-2014)	Post-GASB (2015-2016)	Full Period (2012-2016)	Full Period (2012-2016)
	(1)	(2)	(3)	(4)
VARIABLES	lnpercapNHP	lnpercapNHP	lnpercapNHP	lnpercapNHP
lnLoanlimit	-1.781**	-1.457*	-1.655**	-1.653**
	(-2.29)	(-1.71)	(-2.19)	(-2.18)
PropTaxRate	0.319***	0.353	0.322**	0.315**
	(2.91)	(1.45)	(2.52)	(2.43)
PerCapInc	0.254	0.036	0.184	0.182
	(0.91)	(0.07)	(0.55)	(0.54)
lnRevenue	-0.008	0.021	0.005	0.003
	(-0.10)	(0.26)	(0.06)	(0.04)
EduQuality	0.061**	0.027	0.050*	0.050*
	(2.45)	(0.79)	(1.96)	(1.92)
IncTaxRate	-0.039	-0.049*	-0.044*	-0.044*
	(-1.39)	(-1.98)	(-1.77)	(-1.77)
Coindex	0.002	0.001	0.002	0.002
	(0.66)	(0.25)	(0.52)	(0.54)
Foreclosure	0.107	0.086	0.097	0.095
	(1.03)	(0.57)	(0.89)	(0.88)
Constraint	-0.154**	-0.171*	-0.157**	-0.160**
	(-2.30)	(-1.92)	(-2.32)	(-2.34)
Debtratio	0.556*	0.928**	0.662**	0.672**
	(1.81)	(2.31)	(2.12)	(2.15)
pctUnion	-0.024	-0.047**	-0.032**	-0.032**
	(-1.65)	(-2.43)	(-2.17)	(-2.16)
lagMedianPrice	1.359***	1.353***	1.342***	1.349***
	(6.58)	(4.62)	(6.02)	(6.05)
County-pair FE	Y	N	N	N
Year FE	Y	N	N	N
County-pair * Year FE	N	Y	Y	Y
Observations	3,196	1,618	4,814	4,814
R-squared	0.721	0.721	0.723	0.723
Adj. R-squared	0.438	0.434	0.443	0.442

Table 5 Cross-sectional Analysis of Pension Underfunding and Housing Price Growth in Adjacent counties

This table presents the regression results of the effect of debt reliance, Union presence, political constraint and news exposure on the relation between pension underfunding and housing price growth from the year 2012 to the year 2017. The dependent variable is HPG, which is the annual growth rate of the housing price index (HPI) of the county; $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014, $Debtratio$ is total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union; $Constraint$ is a categorical variable that ranges from 0 to 3 depending on the level of political constraint the state face to renegotiate pension benefits, $NEWS$ is the product of the number of news articles and news sentiments on the states' pension-related issues. Control variables are the same groups of variables as in Table 3 and 4. See Appendix I for their definition. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

VARIABLES	(1) HPG	(2) HPG	(3) HPG	(4) HPG
Underfunding×DebtRatio×POST	-0.012			
	(-0.75)			
Underfunding×pctUnion×POST		-0.003**		
		(-2.03)		
Underfunding×Constraint×POST			-0.226	
			(-1.12)	
Underfunding×NEWS×POST				-0.020**
				(-2.22)
Underfunding×DebtRatio	-0.033***			
	(-3.09)			
Underfunding×pctUnion		-0.001		
		(-1.08)		
Underfunding×Constraint			-0.007**	
			(-2.67)	
Underfunding×NEWS				0.006***
				(2.70)
Underfunding×POST	-0.155	-0.219	-0.429	-0.008**
	(-0.41)	(-0.47)	(-1.20)	(-2.07)
Underfunding	0.007	0.002	-0.004	-0.002
	(1.34)	(0.51)	(-1.48)	(-0.60)
FACTORS × POST	Y	Y	Y	Y
FACTORS	Y	Y	Y	Y
Controls	Y	Y	Y	Y
County-pair ×Year FE	Y	Y	Y	Y
Observations	10,400	10,400	10,400	10,400
R-squared	0.750	0.750	0.750	0.730
Adj. R-squared	0.499	0.498	0.498	0.456

Table 6 Pension Underfunding and Future Government Actions

This table presents the regression results of the effect of pension underfunding on future government spending and taxes from the year 2012 to the year 2017. The dependent variable include $lnEducation$, the natural log of one plus total spending on education at the county level, $lnPolice$, the natural log of one plus total spending on the police departments at the county level, $lnHealth$, the natural log of one plus total spending on healthcare, and $lnPropTax$, the natural log of one plus total property taxes at the county level. $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014. Selected control variables as in Table 3 and 4 are included. See Appendix I for their definition. Standard errors are clustered at the state-border level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

VARIABLES	(1) lnEducation	(2) lnPolice	(3) lnHealth	(4) lnPropTax
Underfunding×POST	-0.015	-0.103*	-0.258***	0.106
	(-0.75)	(-1.77)	(-5.20)	(0.13)
Underfunding	-0.000	0.002	0.000	0.043**
	(-0.89)	(1.36)	(0.11)	(2.52)
PropTaxRate	0.137***	-0.055	-0.556***	4.471***
	(3.36)	(-0.49)	(-2.98)	(2.70)
lnPerCapInc	-0.041	0.104	0.021	1.978
	(-1.03)	(1.09)	(0.21)	(1.44)
lnRevenue	0.956***	0.995***	1.061***	-1.582**
	(40.35)	(17.01)	(17.60)	(-2.00)
EduQuality	0.008*	0.015	-0.015	-0.331***
	(1.97)	(1.50)	(-1.51)	(-2.65)
IncTaxRate	0.001	-0.006	-0.037*	0.545*
	(0.13)	(-0.31)	(-1.76)	(1.74)
Coindex	0.001	0.000	-0.004	-0.049
	(0.51)	(0.11)	(-1.45)	(-1.28)
Constraint	-0.052**	-0.107***	0.032	0.386
	(-2.31)	(-3.23)	(0.57)	(0.59)
Debtratio	-0.145	0.377*	0.418	-0.372
	(-1.51)	(1.69)	(1.34)	(-0.12)
pctUnion	-0.000	-0.016	0.000	0.286
	(-0.07)	(-0.90)	(0.01)	(1.03)
Countypair × Year FE	Y	Y	Y	Y
Observations	5,228	5,228	5,228	5,228
R-squared	0.981	0.932	0.913	0.606
Adj. R-squared	0.979	0.865	0.826	0.210

Table 7 Pension Underfunding and Housing Price Growth: California

This table presents the regression results of the relation between local housing price growth and pension burden of the cities in California from the year 2012 to the year 2017. $SalestoListYoY$ is the year-to-year change in the average number of sales divided by total listings in the city. $InventoryYoY$ is the total year-to-year change in the city's total housing inventories. $MedSalePriceYoY$ is the year-to-year change in the median sales price of the houses in the city. $lnPensionBurden$ is the natural log of the total pension liabilities per household at the city level in California, $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014, $lnCityRevenue$ is the natural log of the per capita revenues of the city, and $CalPropTaxRate$ is the city-level property tax rates. The standard errors are clustered at the county-level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

VARIABLES	(1) Salesto ListYoY	(2) Saleto ListYoY	(3) InvYoY	(4) InvYoY	(5) MedSale PriceYoY	(6) MedSale PriceYoY
lnPensionBurden × POST		-0.002***		0.075**		-0.006***
		(-3.15)		(2.75)		(-3.05)
lnPensionBurden	0.000*	0.001***	-0.018*	-0.045***	0.002	0.004**
	(1.71)	(3.02)	(-1.83)	(-4.41)	(1.08)	(2.36)
lnCityRevenue	-0.000	0.000	0.014	0.003	-0.007	-0.007
	(-0.26)	(0.45)	(0.71)	(0.13)	(-1.41)	(-1.25)
CalPropTaxRate	-0.000	-0.000	0.007	0.005	-0.002	-0.002
	(-1.40)	(-1.18)	(0.46)	(0.30)	(-0.67)	(-0.60)
Year FE	Y	Y	Y	Y	Y	Y
County FE	Y	Y	Y	Y	Y	Y
Observations	1,545	1,545	1,545	1,545	1,545	1,545
R-squared	0.230	0.233	0.347	0.352	0.209	0.210
Adj.R-squared	0.210	0.212	0.330	0.334	0.188	0.188

Table 8 Pension Underfunding and Housing Price Growth in Neighbouring Zip Codes in Los Angeles County

This table presents the regression results of the relation between housing price growth in neighbouring zip codes and city-level pension burden. $CalHPG$ is the zip code-level housing price index annual growth rate in Los Angeles county, $lnPensionBurden$ is the natural log of the total pension liabilities per household at the city level in California, $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014, $lnCityRevenue$ is the natural log of one plus the per capita revenues of the city, $CalProTaxRate$ is the secured property tax rate of the city. All standard errors are clustered at the city level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

Panel A Distance between two zip codes <10 miles

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CalHPG	CalHPG	CalHPG	CalHPG	CalHPG	CalHPG
lnPensionBurden× POST				-0.877***	-1.476***	-1.319*
				(-9.73)	(-3.57)	(-1.86)
lnPensionBurden	-2.304***	-1.017**	-0.471***	-0.542***	-1.483***	-1.365***
	(-5.05)	(-2.08)	(-3.80)	(-6.00)	(-15.13)	(-7.42)
lnCityRevenue	0.841*	0.918	0.768	1.426***	0.778***	0.655***
	(1.96)	(1.58)	(0.83)	(14.98)	(7.89)	(6.38)
POST				4.221***		
				(5.01)		
CalProTaxRate	4.661**	3.058*	3.431	4.162***	2.785***	3.043***
	(2.10)	(2.01)	(1.29)	(6.25)	(4.55)	(5.37)
Zipcode-pair FE	Y	Y	N	Y	Y	N
Year FE	N	Y	N	N	Y	N
Zipcode-pair × Year FE	N	N	Y	N	N	Y
Observations	18,519	18,519	10,893	18,519	18,519	10,893
R-squared	0.374	0.587	0.835	0.471	0.591	0.836

Panel B Distance between two zip codes <5 miles

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	CalHPG	CalHPG	CalHPG	CalHPG	CalHPG	CalHPG
lnPensionBurden× POST				-0.809	-1.862***	-1.661*
				(-1.36)	(-4.26)	(-1.91)
lnPensionBurden	-2.788***	-1.673***	-0.438	-0.844	0.817	1.619
	(-7.05)	(-3.19)	(-1.61)	(-1.13)	(0.89)	(1.67)
lnCityRevenue	1.128***	1.295**	0.790***	1.536***	1.066	0.717
	(2.92)	(2.32)	(4.38)	(5.43)	(1.51)	(0.81)
POST				4.147		
				(0.56)		
CalProTaxRate	6.49***	3.78**	3.63***	3.71**	2.91*	3.39***
	(4.86)	(2.09)	(3.60)	(2.65)	(2.16)	(3.38)
Zipcode-Pair FE	Y	Y	N	Y	Y	N
Year FE	N	Y	N	N	Y	N
Zipcode-Pair × Year FE	N	N	Y	N	N	Y
Observations	3,741	3,741	2,393	3,741	3,741	2,393
R-squared	0.369	0.581	0.904	0.453	0.584	0.905

Table 9 Pension Underfunding and Public Employment Outcomes in Adjacent Counties

This table presents the results of the relation between public employment outcomes and pension underfunding in adjacent counties. $lnPayroll$ is the natural log of total payrolls to public employees in a given county. $lnFTEE$ is the natural log of the number of full-time equivalent public employees at the county level. $Underfunding$ is the disclosed difference of the state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1. $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014, $lnPerCapInc$ is the natural log of per-capita income of the county, $lnRevenue$ is the natural log of total revenues of the county, $lnPopulation$ is the natural log of the total population in a county. $Coindex$ is the coincident index of the state, $IncTaxRate$ is the total wage tax rate of the state, $Debtratio$ is total debt outstanding as a percentage of total revenue at the state level, $pctUnion\ i$s the percentage of employees in the state that are part of a public Union, $Constraint$ is a categorical variable that ranges from 0 to 3 depending on the level of political constraint the state face to renegotiate pension benefits. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

	(1)	(2)
VARIABLES	lnPayroll	lnFTEE
Underfunding×POST	-0.003*	-0.064*
	(-1.74)	(-1.96)
Underfunding	0.000**	0.001
	(2.21)	(1.08)
lnPerCapInc	-0.003	-0.079**
	(-1.17)	(-2.35)
lnRevenue	0.045***	0.828***
	(46.95)	(43.96)
lnPopulation	0.015**	0.337***
	(2.66)	(3.15)
IncTaxRate	0.000	0.006
	(1.01)	(0.63)
Coindex	-0.000	-0.002
	(-0.89)	(-1.64)
Constraint	-0.002*	-0.031
	(-1.72)	(-1.45)
Debtratio	0.008	0.210***
	(1.60)	(2.79)
pctUnion	-0.000	-0.010
	(-0.42)	(-1.36)
Observations	10,220	10,220
R-squared	0.982	0.981
Adj.R-squared	0.964	0.961

Table 10 Pension Underfunding and Business Activities in Adjacent Counties

This table presents the regression result of the impact of pension funding status on the number total establishments in adjacent counties. $lnNumEST$ is the natural log of the number of total business establishments in the county, $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 if for the year 2015-2016, and 0 for the year 2012-2014, $PropTaxRate$ is the county level property tax rate, $lnPerCapInc$ is the natural log of per-capita income of the county, $lnRevenue$ is the natural log of the county's total revenues, $lnPopulation$ is the natural log of county-level population, $IncTaxRate$ is the marginal income tax rate of the state, $Coindex$ is the coincident index of the state, $Debtratio$ is the total debt outstanding as a percentage of total revenue at the state level. All standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

VARIABLES	(1) lnNumEST	(2) lnNumEST
Underfunding×POST	-0.003**	-0.003**
	(-2.09)	(-2.09)
Underfunding	-0.071	-0.126
	(-1.21)	(-1.46)
PropTaxRate	-0.277*	-0.285*
	(-1.83)	(-1.99)
lnRevenue	0.093	0.064
	(0.33)	(0.22)
lnPerCapInc	1.979***	2.120***
	(5.45)	(5.30)
lnPopulation	-0.129	-0.112
	(-0.49)	(-0.41)
IncTaxRate	-0.022	-0.017
	(-0.83)	(-0.63)
Coindex	0.004	0.005*
	(1.63)	(1.85)
Constraint	0.135**	0.140***
	(2.67)	(2.81)
Debtratio	0.138	0.165
	(0.53)	(0.61)
pctUnion	0.033**	0.038***
	(2.60)	(2.79)
County-pair FE	Y	N
Year FE	Y	N
County-pair×Year FE	N	Y
Observations	7,544	7,544
R-squared	0.774	0.757
Adj. R-squared	0.743	0.512

Online Appendices for

"Economic Consequences of Public Pension Underfunding Transparency:

Evidence from Housing Markets and Local Economies"

The Online Appendices reports the results of supplementary and robustness tests as described below:

Table A1: Pension Underfunding and News

Table A2: Federal Reserve Pension Underfunding and Housing Price Growth

Table A3: Pension Underfunding and Housing Price Level

Table A4: Alternative Housing Price Index-Zillow

Table B1: Robustness Test on Subsample Analysis-Part 1 –excluding California

Table B2: Robustness Test on Subsample Analysis-Part 2 –excluding states in the west region

Table A1 Pension Underfunding and News

This table presents the regression results of the relation between news-related variables and state-level pension underfunding from the year 2012 to the year 2017. $NewsCoverage$ is the number of unique news articles that contain "government pension", "state pension", "pension crisis", or "pension underfunding" in the headlines, $Sentiment$ is the annual average of the sentiments of pension-related news (measured by CSS from Ravenpack), $NEWS$ is the product of $Sentiment$ and $NewsCoverage$, which measure the combined effect of media coverage and sentiment. $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 for the year 2015-2017, and 0 for the year 2012-2014, $lnPerCapInc$ is the natural log of income per capita at the county level, $lnRevenue$ is the natural log of total revenues of the county, $Coindex$ is the coincident index of the state, $Debtratio$ is the total debt outstanding as a percentage of total revenue at the state level, $pctUnion$ is the percentage of employees in the state that are part of a public Union. T-statistics are in parentheses, and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

VARIABLES	(1) NewsCoverage	(2) Sentiment	(3) NEWS
Underfunding×POST	0.239*	-0.007	-0.063*
	(1.78)	(-0.67)	(-1.91)
Underfunding	0.004*	-0.000	0.029
	(1.80)	(-0.37)	(0.46)
lnPerCapInc	-0.662	-0.032	-81.443
	(-0.61)	(-0.37)	(-0.97)
lnRevenue	1.815***	0.051	48.236
	(13.03)	(1.24)	(0.91)
Coindex	-0.001	-0.000	0.105
	(-0.37)	(-0.19)	(0.68)
DebtRatio	-0.229	-0.023	10.649
	(-0.34)	(-1.30)	(0.58)
pctUnion	0.028	-0.003	-0.880
	(0.75)	(-0.95)	(-1.09)
State FE	Y	Y	Y
Year FE	Y	Y	Y
Observations	272	272	272
R-squared	0.834	0.354	0.377
Adj. R-squared	0.794	0.200	0.228

Table A2

Federal Reserve Pension Underfunding and Housing Price Growth

This table presents the regression results of the relation between housing price growth and pension underfunding when using the Federal Reserve pension underfunding measure from the year 2012 to the year 2017. HPG is the annual growth rate in FHFA Housing Price Index (HPI); $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, data collected from the Federal Reserve, $PPOST$ is an indicator variable that equals 1 for the year 2015-2017, and 0 for the year 2012-2014, $lnPerCapInc$ is the natural log of income per capita at the county level; $lnRevenue$ is the natural log of total revenues of the county; $EduQuality$ is the pupil-to-teacher ratio of the county; $IncTaxRate$ is the marginal income tax rate at the state level; $Coindex$ is the coincident index of the state; $lnPerCapInc$ is the natural log of per-capita income of the county; $Debtratio$ is total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union; $lagMedianPrice$ is the natural log of the median home prices in the county in year t-1. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
Underfunding×POST			-0.016*	
			(-1.91)	
Underfunding	-0.010	-0.022*	-0.008	-0.012
	(-0.89)	(-1.69)	(-0.70)	(-0.65)
Underfunding × Year2012				0.003
				(0.16)
Underfunding × Year2013				0.002
				(0.11)
Underfunding × Year2014				-0.006
				(-0.25)
Underfunding × Year2015				-0.007
				(-0.32)
Underfunding × Year2016				-0.015
				(-0.59)
Underfunding × Year2017				-0.030*
				(-1.79)

Table A2 (Continued)

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
lnLoanlimit	2.785*	-0.941	0.913	0.910
	(1.98)	(-0.66)	(1.00)	(1.00)
PropertyTax	0.161	-0.793	-0.191	-0.189
	(0.53)	(-1.07)	(-0.50)	(-0.50)
lnPerCapInc	2.496***	2.430***	2.590***	2.595***
	(5.64)	(2.93)	(5.72)	(5.72)
lnRevenue	-0.249*	0.095	-0.164	-0.167
	(-1.88)	(0.44)	(-1.41)	(-1.44)
EduQuality	0.124**	0.129**	0.095***	0.095***
	(2.21)	(2.63)	(2.70)	(2.71)
IncTaxRate	-0.113**	-0.024	-0.030	-0.029
	(-2.44)	(-0.29)	(-0.73)	(-0.72)
Coindex	-0.005	0.021**	0.011*	0.011*
	(-0.78)	(2.48)	(1.82)	(1.83)
Foreclosure	0.278*	-0.357	0.117	0.115
	(1.75)	(-1.07)	(0.68)	(0.66)
Constraint	0.041	-0.260	-0.032	-0.033
	(0.34)	(-1.64)	(-0.31)	(-0.32)
Debtratio	-0.776	-0.213	-0.423	-0.429
	(-1.65)	(-0.20)	(-1.39)	(-1.41)
pctUnion	0.015	0.020	0.053*	0.054*
	(0.52)	(0.42)	(1.80)	(1.82)
lagMedianPrice	-1.132***	-1.090*	-1.376***	-1.376***
	(-2.91)	(-1.91)	(-4.09)	(-4.09)
County-pair × Year FE	Y	Y	Y	Y
Observations	5,292	5,196	10,440	10,440
R-squared	0.711	0.572	0.731	0.731
Adj. R-squared	0.421	0.139	0.461	0.461

Table A3 Pension Underfunding and Housing Price Level

This table presents the regression results of the relation between the level of county-level median housing price and pension underfunding from the year 2012 to the year 2017. As a result, the county-level control variables that are time-invariant are excluded. $lnMedianPrice$ is the natural log of the median home prices in the county. $Underfunding$ is the state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 for the year 2015-2017, and 0 for the year 2012-2014, $lnPerCapInc$ is the natural log of income per capita at the county level; $lnRevenue$ is the natural log of total revenues of the county; $EduQuality$ is the pupil-to-teacher ratio of the county; $IncTaxRate$ is the marginal income tax rate at the state level; $Coindex$ is the coincident index of the state; $Debtratio$ is the total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

VARIABLES	(1) lnMedianPrice	(2) lnMedianPrice
Underfunding×POST	-0.020**	-0.014**
	(-2.08)	(-2.42)
Underfunding	-0.000	-0.000
	(-1.04)	(-1.52)
lnPerCapInc	-0.087	0.012
	(-1.66)	(0.47)
lnRevenue	0.049	-0.048*
	(0.85)	(-1.76)
EduQuality	-0.000	-0.000
	(-0.39)	(-0.58)
IncTaxRate	0.019	0.007
	(1.62)	(1.32)
Coindex	0.001	0.001
	(1.18)	(1.28)
Debtratio	-0.082	-0.095**
	(-1.29)	(-2.61)
pctUnion	-0.001	0.001
	(-0.59)	(0.64)
County FE	Y	Y
County-pair FE	Y	N
Year FE	Y	N
County-pair × Year FE	N	Y
Observations	10,440	10,440
R-squared	0.991	0.997
Adj. R-squared	0.989	0.994

Table A4 Alternative Housing Price Index-Zillow

This table presents the regression results of the relation between alternative measures of housing price growth and pension underfunding from the year 2012 to the year 2017. $ZillowYOY$ is the annual Zillow Home Price growth rate. $Underfunding$ is the state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 for the year 2015-2017, and 0 for the year 2012-2014, $lnPerCapInc$ is the natural log of income per capita at the county level; $lnRevenue$ is the natural log of total revenues of the county; $EduQuality$ is the pupil-to-teacher ratio of the county; $IncTaxRate$ is the marginal income tax rate at the state level; $Coindex$ is the coincident index for the state; $lnPerCapInc$ is the natural log of per-capita income of the county; $Debtratio$ is the total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union; $lagMedianPrice$ is the natural log of the median home prices in the county in year t-1. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

	(1)	(2)
	Zillow	Zillow
VARIABLES	YOY	YOY
Underfunding×POST	-0.000**	-0.000**
	(-2.59)	(-2.90)
Underfunding	0.000**	0.000**
	(2.64)	(2.33)
lnLoanLimit	0.118***	0.107***
	(3.00)	(3.17)
PropTaxRate	0.041	0.017
	(1.24)	(1.35)
lnPerCapInc	0.001	-0.055***
	(0.02)	(-4.27)
lnRevenue	0.000	-0.000
	(0.05)	(-0.08)
EduQuality	0.005**	0.002
	(2.42)	(0.76)
IncTaxRate	-0.003	-0.005***
	(-1.31)	(-3.17)
Coindex	-0.001*	-0.000
	(-1.75)	(-0.45)
Foreclosure	-0.037	-0.003
	(-1.69)	(-0.36)
Constraint	-0.002	-0.003
	(-0.33)	(-0.61)
Debtratio	-0.014	0.003
	(-0.48)	(0.13)

Table A4 (Continued)

VARIABLES	(1) Zillow YOY	(2) Zillow YOY
pctUnion	0.001	-0.001**
	(0.49)	(-2.18)
lagMedianPrice	-0.061	0.003
	(-1.40)	(0.19)
County-pair FE	Y	N
Year FE	Y	N
County-pair ×Year FE	N	Y
Observations	1,459	1,459
R-squared	0.535	0.792
Adj. R-squared	0.455	0.560

Table B1

Robustness Test Using Subsample Analysis-Part 1

This table presents the regression results of the relation between housing price growth and pension underfunding when excluding the state of California from the year 2012 to the year 2017. HPG is the annual growth rate in FHFA Housing Price Index (HPI); $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 for the year 2015-2017, and 0 for the year 2012-2014, $lnPerCapInc$ is the natural log of income per capita at the county level; $lnRevenue$ is the natural log of total revenues of the county; $EduQuality$ is the pupil-to-teacher ratio of the county; $IncTaxRate$ is the marginal income tax rate at the state level; $Coindex$ is the coincident index for the state; $lnPerCapInc$ is the natural log of per-capita income of the county; $Debtratio$ is total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union; $lagMedianPrice$ is the natural log of the median home prices in the county in year t-1.Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
Underfunding×POST			-0.006*	
			(-1.95)	
Underfunding	-0.009**	-0.009**	-0.002	0.002
	(-2.21)	(-2.20)	(-0.52)	(0.29)
Underfunding × Year2012				0.005
				(0.92)
Underfunding × Year2013				0.002
				(0.60)
Underfunding × Year2014				-0.001
				(-0.21)
Underfunding × Year2015				-0.001
				(-0.13)
Underfunding × Year2016				-0.007
				(-1.04)
Underfunding × Year2017				-0.020***
				(-3.61)

Table B1 (Continued)

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
lnLoanlimit	2.660**	-0.132	1.431*	1.433*
	(2.31)	(-0.11)	(1.82)	(1.82)
PropertyTax	0.069	-0.821	-0.158	-0.179
	(0.15)	(-1.30)	(-0.45)	(-0.51)
lnPerCapInc	6.337***	2.878***	2.827***	2.821***
	(6.62)	(3.38)	(6.26)	(6.23)
lnRevenue	-0.322	0.282*	-0.162	-0.173*
	(-1.34)	(1.73)	(-1.60)	(-1.73)
EduQuality	0.111**	0.107**	0.077**	0.076**
	(2.25)	(2.10)	(2.21)	(2.18)
IncTaxRate	0.378***	0.066	-0.014	-0.016
	(10.13)	(0.98)	(-0.38)	(-0.43)
Coindex	0.059***	0.018**	0.011*	0.011*
	(3.49)	(2.36)	(1.95)	(2.00)
Foreclosure	0.793**	-0.284	0.187	0.175
	(2.18)	(-0.89)	(1.12)	(1.06)
Constraint	0.408*	-0.292**	-0.032	-0.043
	(2.00)	(-2.05)	(-0.35)	(-0.46)
Debtratio	-0.781**	1.078	-0.235	-0.217
	(-2.18)	(0.91)	(-0.85)	(-0.79)
pctUnion	0.098	-0.016	0.040	0.040
	(1.31)	(-0.37)	(1.56)	(1.56)
lagMedianPrice	-5.380***	-1.272*	-1.661***	-1.658***
	(-10.66)	(-2.01)	(-5.42)	(-5.38)
County-pair × Year FE	Y	Y	Y	Y
Observations	6,225	5,020	10,200	10,200
R-squared	0.368	0.562	0.630	0.630
Adj. R-squared	0.212	0.120	0.257	0.258

Table B2

Robustness Test Using Subsample Analysis-Part 2

This table presents the regression results of the relation between housing price growth and pension underfunding excluding states in the west region (including the state of Arizona, Colorado, Idaho, Montana, Nevada, New Mexico, Utah, Wyoming, California, Oregon, and Washington), from the year 2012 to the year 2017. HPG is the annual growth rate in FHFA Housing Price Index (HPI); $Underfunding$ is the disclosed state-level net pension liabilities (total pension liabilities – total pension assets) as a percentage of total state revenues in year t-1, $POST$ is an indicator variable that equals 1 for the year 2015-2017, and 0 for the year 2012-2014, $lnPerCapInc$ is the natural log of income per capita at the county level; $lnRevenue$ is the natural log of total revenues of the county; $EduQuality$ is the pupil-to-teacher ratio of the county; $IncTaxRate$ is the marginal income tax rate at the state level; $Coindex$ is the coincident index for the state; $lnPerCapInc$ is the natural log of per-capita income of the county; $Debtratio$ is the total debt outstanding as a percentage of total revenue at the state level; $pctUnion$ is the percentage of employees in the state that are part of a public Union; $lagMedianPrice$ is the natural log of the median home prices in the county in year t-1. Standard errors are clustered at the state-border level and individual state level. T-statistics are in parentheses and *** denotes significance at the 1% level, ** at 5% level, and * at 10% level.

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
Underfunding×POST			-0.007***	
			(-2.79)	
Underfunding	-0.009**	-0.009**	-0.002	0.006
	(-2.19)	(-2.29)	(-0.55)	(0.89)
Underfunding × Year2012				0.003
				(0.63)
Underfunding × Year2013				-0.008
				(-1.03)
Underfunding × Year2014				-0.012
				(-1.46)
Underfunding × Year2015				-0.011
				(-1.61)
Underfunding × Year2016				-0.012
				(-1.48)
Underfunding × Year2017				-0.024***
				(-4.01)

Table B2 (Continued)

	Pre-GASB (2012-2014)	Post-GASB (2015-2017)	Full Period (2012-2017)	Full Period (2012-2017)
	(1)	(2)	(4)	(5)
VARIABLES	HPG	HPG	HPG	HPG
lnLoanlimit	4.346***	-0.177	2.089***	2.078***
	(4.24)	(-0.16)	(2.72)	(2.72)
PropertyTax	-0.040	-0.769	-0.374	-0.395
	(-0.10)	(-1.08)	(-1.07)	(-1.14)
lnPerCapInc	4.223***	3.077***	2.933***	2.947***
	(4.17)	(3.13)	(4.81)	(4.81)
lnRevenue	-0.134	0.240	0.027	0.014
	(-0.59)	(1.39)	(0.23)	(0.13)
EduQuality	0.175	0.050	0.084*	0.083*
	(1.66)	(0.84)	(1.75)	(1.73)
IncTaxRate	0.335***	0.027	-0.026	-0.025
	(10.25)	(0.38)	(-0.55)	(-0.54)
Coindex	0.033***	0.014*	0.010	0.010*
	(2.83)	(1.76)	(1.67)	(1.77)
Foreclosure	0.372	-0.225	-0.050	-0.064
	(1.01)	(-0.66)	(-0.22)	(-0.28)
Constraint	0.160	-0.258*	-0.178*	-0.194**
	(1.02)	(-1.89)	(-1.93)	(-2.14)
Debtratio	-0.357	-0.413	-0.493	-0.431
	(-0.49)	(-0.33)	(-1.05)	(-0.91)
pctUnion	-0.018	-0.015	-0.011	-0.011
	(-0.38)	(-0.37)	(-0.39)	(-0.37)
lagMedianPrice	-3.463***	-1.593**	-1.536***	-1.535***
	(-6.68)	(-2.49)	(-4.02)	(-4.02)
County-pair × Year FE	Y	Y	Y	Y
Observations	5,354	4,318	8,860	8,860
R-squared	0.328	0.539	0.616	0.617
Adj. R-squared	0.166	0.0730	0.229	0.231