Shocking Debt Illusion: Actuarial Pension Plan Adjustments and House Price Capitalization *

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Preliminary: Comments Welcome

Abstract

This paper investigates the extent to which information shocks to a city's local debt burden are capitalized into house prices. The shocks we focus on are changes to actuarial accounting assumptions in cities' pension plans. One focus of the paper is on the timing of the transmission of these shocks: we differentiate between when pension boards decide on the changes, when actuarial accountants publish the resulting changes to funding levels, and when city budgets adjust to these changes. A second focus is on which segments of a local housing markets are most affected: we differentiate across homes that price in more the public goods that get cut when city budgets are squeezed, and we differentiate across homes whose owners are better able to substitute those public goods privately.

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1 Introduction

The *Ricardian Equivalence Theorem* suggests that outcomes are independent of whether or not a public program is financed by current taxes or by bond issues (Barro, 1974; Seater, 1993) At the local level, this equivalence of tax and debt finance arises as long as residents and home buyers are 'fiscally aware', so that future taxes are priced into local property values today (Daly, 1969; Akai, 1994). Tiebout sorting, i.e. voting with your feet, reinforces this prediction (Tiebout, 1956). *Debt illusion* (or *fiscal illusion*) refers to a failure of Ricardian equivalence, whereby citizens may prefer debt finance over tax finance because they are not 'fiscally aware' (in the words of Banzhaf and Oates 2013).

Because declining house prices today are more salient than higher taxes tomorrow, many view the *local* version of Ricardian Equivalence as a more compelling empirical proposition than its *national* equivalent (Daly, 1969; Dollery and Worthington, 1996; Fishel, 2001; Banzhaf and Oates, 2013; Brinkman, Coen-Pirani, and Sieg, 2018). In other words, debt illusion is viewed as less likely at the local level. This view, however, requires believing that future taxes (property taxes or other local taxes) are indeed capitalized into house prices today, and there is not a lot of evidence to support this belief.

In fact, debt illusion may very well exist at the local level because the biggest source of local debt is unfunded pension obligations, which are what Glaeser and Ponzetto (2014) call '*shrouded*,' i.e. difficult to understand and quantify for local homeowners and voters.[1] The main reason for this shroudedness is that the calculation of under-funding hinges critically on actuarial assumptions (primarily, this is the *actuarially assumed return* (AAR) on a plans' assets). Whether actuarial assumptions are overly optimistic is difficult for homeowners and voters to assess, although this issue is widely recognized as a big source of cities' future funding problems (Mitchell and Smith 1994, footnote1, 282, Greenhut 2009, 43, Novy-Marx and Rauh 2011, Anzia and Moe 2019, 9, Kelley 2014, 24). For instance, Novy-Marx and Rauh (2009) estimate that the "true" level of unfunded liabilities is about three times higher than the official level.

Debt illusion due to the shroudedness of pension under-funding does not imply that home-

[1] Unfunded pension obligations are the biggest source of local/municipal debt in the U.S. Novy-Marx and Rauh (2014b). This is that because "in the United States the use of the municipal bond market is restricted to capital outlays; the only way for local governments to finance current expenditures with future taxes is through pension underfunding" (Inman, 1982, p52).

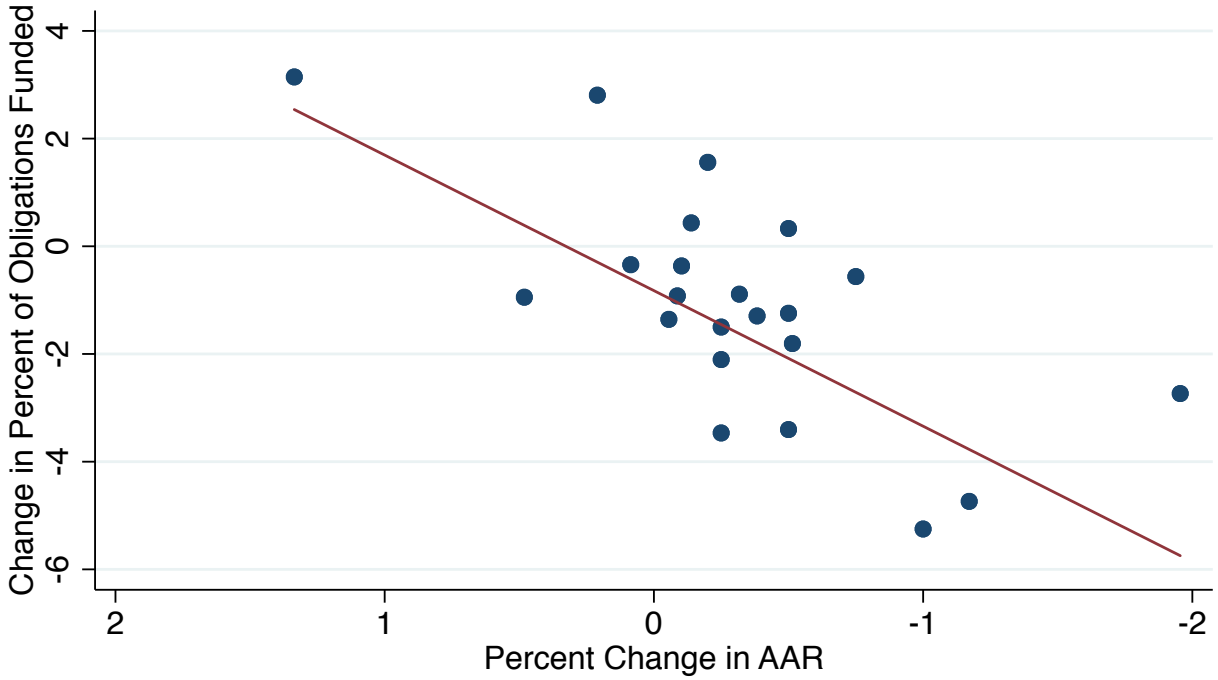

Figure 1: Binned Scatter: Δ in Funding-Ratio against ΔAAR

owners are irrational or short-sighted. Instead, it is more nefarious because even informed homeowners and voters find it difficult to gauge their city's true exposure to pension under-funding if it diverges from the officially reported actuarial level.

This discussion implies that the biggest shocks to residents' information about public debt occur when municipal plans have to adjust their actuarial assumptions, and in particular their AAR. The *National Association of State Retirement Administrators* estimates that cutting the AAR by 0.25 percentage points immediately increases the required contributions into a pension plan by two to three percentage points, so that "it is in no one's interest to make more realistic assumptions about returns" (The Economist, 2017). However, "pretend and extend' cannot be sustained forever: when the AAR exceeds the actual returns for long enough, the actuarial assumptions do eventually have to be brought in line with reality, sometimes by state law or gubernatorial executive order (Anzia and Moe, 2019).

This paper investigates the effect of shocks to municipalities official public debt levels, using as the primary source of variation the 294 occurrences of pension plans' AAR adjustments that have occurred in U.S. cities since 2000. Figure 1 shows a binned scatter of these ΔAAR against

resulting (fiscal year to fiscal year) changes in the official funding ratio of cities' pension plans. The negative relationship is obvious: When a plan's AAR is adjusted downward, future obligations are discounted at a lower rate, and plans' funding ratios drop. In the raw data, a one-percent decrease in the AAR is associated with a concurrent three-percent decrease in the official funding-ratio of pension obligations.

We link these 294 ΔAAR events to a monthly city-level panel of Zillow house price data to investigate the speed with which (and extent to which) their implied shocks to cities' official pension under-funding obligations were capitalized into house prices.

Our paper is focused on two particular questions: First, we ask how quickly information about funding shocks diffuses into house prices. We distinguish for each event between three different dates at which ΔAAR information is revealed or increases in salience: the date of the plan's internal *Board Meeting Decision* (BMD), the plan's *Actuarial Report*'s date of publication (ARD) when the transmission from ΔAAR into a plan's funding level is first publicized, and the date of a city's *Fiscal Year End* (FYE), when a city's budget first responds to ΔAAR and resulting changes in city contributions.

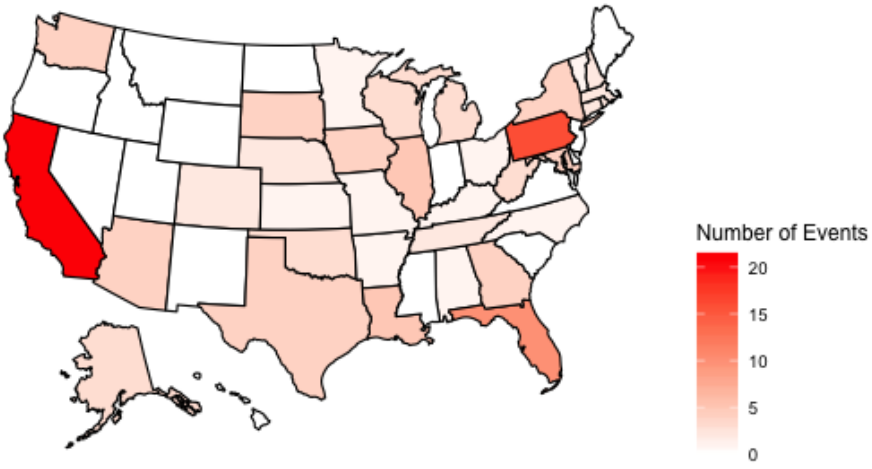

Figure 2: The Spatial Distribution of ΔAAR Changes

Second, we explicitly consider that cities may be quite constrained in their ability to raise taxes, in which case increased pension obligations start to crowd out public good provision in cities' budgets. This constraint is particularly important in states like California, where Proposition 13

constrains local property taxes (Brunner and Sonstelie, 2006). Figure 2 shows that ΔAAR adjustments are particularly frequent in California. Cutting public goods and services may then be the only option. This in turn affects families with children much more than residents without children, because it directly affects the funding for public schools. We therefore consider separately the Zillow house price data for single family homes, relative to condos.

To identify AAR adjustments, we build on the Center for Retirement Research at Boston College's *Public Plans Data* (PPD). The PPD aggregates over 100 detailed measures of pension plan financial information on an annual basis from 2001 to 2019, including the AAR and key measures of funding status. It covers 190 of the largest state- and local-level public pension plans, of which 138 plans are administered by 89 unique local governments.[2] Over these 138 plans, we observe 294 instances of decreases in a plan's AAR. From the observed annual plan information in PPD, we collect more precise dates of AAR changes to match with monthly frequency housing data from Zillow.

The precise date of a pension board's AAR change approval, the BMD, was identified by combing through board meeting minutes available on individual plan websites. For meeting minutes unavailable online, Freedom of Information Act (FOIA) requests were submitted to request relevant documents. The publication date of the first Actuarial Valuation Report incorporating an AAR change, the ARD, was obtained by locating the report through source material on the PPD website, plan-specific websites, or via FOIA requests. To pinpoint transmission to local government budgets, we link the PPD pension plans to the U.S. Census of Governments and find the start of the fiscal year following the publication of the Acturial Valuation Report (i.e. the first year governments address updated plan financials in a budget). Using these three dates, we create alternative AAR paths that represent different scenarios of public information acquisition. In each alternative, a given AAR adjustment takes effect at a different date (BMD, ARD, or FYE), providing a way to test for housing market responses at different times depending on salience of AAR changes.

In equation (1), we regress the city-month (i, t) level Zillow house price index on adjustments

[2]State-run plans are excluded from our analysis.

to the actuarially assumed return (AAR) in a city's plan.

$$\text{HPI}_{iht} = \alpha + \beta \text{AAR}_{it} + \mu_i + \mu_h + \mu_{st} + \mu_{bt} + \epsilon_{iht} \tag{1}$$

We distinguish between single family homes, i.e. the house(hold)s most affected by cuts in public good provision, and condos, i.e. the house(hold)s least affected by cuts in public good provision.[3] This is indexed by h. In addition to μ_h, μ_i is a city fixed effect, μ_{st} is a state$\times$year fixed effect, and μ_{bt} is a separate big-city$\times$year fixed effect.

The following two sets of results are preliminary: while we already have the universe of city-plan AAR changes from 2001–2019, we have not yet pinned down the exact monthly dates of BMD, ARD, and FYE for some of these. The data we currently include in the regressions includes only the changes for which we have these dates, and only cities for which we have all events dated. Table 3 suggests that transmission is already strong after an event's BMD, strongest after an event's ARD (which occurs an average four months after the BMD), but fully capitalized by the time of the FYE (which on average occurs five months after an event's ARD, or nine months after the BMD). A one-percent decrease in the AAR at the BMD date leads to a three-percent decrease in the funding ratio (not shown) and a 0.68 percent decrease in house prices. If we push the event forward to the ARD date, a one-percent decrease in the AAR leads to a 0.73 percent decline in housing prices. If we push the event forward yet more to the FYE date, there is no associated change in housing prices. This suggests AAR change information diffuses relatively quickly, such that any housing capitalization has fully occurred by the start of the time local government debt or spending actually starts to change.

Table 4 suggests that transmission does in fact appear stronger in single-family homes, i.e. the house(hold)s more negatively affected by cuts in public goods provision that might arise from municipal budget cuts. As shown in columns 2 and 4, housing capitalization is driven by price responses in the market for single-family homes, while the market condos does not significantly change. These results suggest that, using the BMD, a 1 percent decline in AAR is associated with an approximately 0.88 percent decline in single family home prices.

[3] We use the awkward term 'house(hold)s' because our prediction rests on the public-goods demand of different types of households, but what we measure is different types of housing.

Figure 3: ΔAAR_{it} at 3 Information-Revelation Markers

	(1)	(2)	(3)	(4)	(5)	(6)
	Board Meeting Date		**Actuarial Report Publication Date**		**Fiscal Year End for Admin. Govt.**	
VARIABLES	House Price (log)	House Price (log)	House Price (log)	House Price (log)	House Price (log)	House Price (log)
Actuarially Assumed Return (AAR)	0.678**	0.704***	0.736***	0.734***	0.243	0.232
	(0.272)	(0.260)	(0.249)	(0.241)	(0.255)	(0.249)
I(Single Family Home)	0.160***	0.160***	0.160***	0.160***	0.160***	0.160***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
City FE	✓	✓	✓	✓	✓	✓
State-Year FE	✓	✓	✓	✓	✓	✓
Big City-Year FE		✓		✓		✓
Number of Events	294	294	287	287	269	269
Number of Event Cities	85	85	82	82	82	82
Number of Total Cities	89	89	89	89	89	89
R-squared	0.911	0.913	0.911	0.913	0.911	0.913
Observations	36,104	36,104	36,150	36,150	36,140	36,140

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Figure 4: Transmission into Housing Types by 'Public Good Provision Demand'

	(1)	(2)	(3)	(4)	(5)	(6)
	Board Meeting Date		**Actuarial Report Publication Date**		**Fiscal Year End for Admin. Govt.**	
VARIABLES	House Price (log)	House Price (log)	House Price (log)	House Price (log)	House Price (log)	House Price (log)
Actuarially Assumed Return (AAR)	0.704***		0.734***		0.232	
	(0.260)		(0.241)		(0.249)	
x I(Condo)		0.529		0.535		0.072
		(0.460)		(0.458)		(0.472)
x I(Single Family Home)		0.878**		0.937**		0.393
		(0.408)		(0.425)		(0.428)
I(Single Family Home)	0.160***	0.133**	0.160***	0.129**	0.160***	0.135**
	(0.010)	(0.053)	(0.010)	(0.056)	(0.010)	(0.057)
City FE	✓	✓	✓	✓	✓	✓
State-Year FE	✓	✓	✓	✓	✓	✓
Big City-Year FE	✓	✓	✓	✓	✓	✓
Number of Events	294	294	287	287	269	269
Number of Event Cities	85	85	82	82	82	82
Number of Total Cities	89	89	89	89	89	89
R-squared	0.913	0.913	0.913	0.913	0.913	0.913
Observations	36,104	36,104	36,150	36,150	36,140	36,140

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

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Appendix A Unfunded Liabilities

In Defined Contribution (DC) plans, benefits payments are directly tied to the return on past contributions so that there cannot be a funding gap. However, almost all municipal pensions in the U.S. are *Defined Benefit* (DB) plans, where future benefits are legally binding obligations, irrespective of a plan's funding level, so that pension under-funding can occur. The basic metric of a DB pension's funding gap is the difference between its assets and its discounted future benefit obligations committed to its pensioners and active members. This gap is referred to as a plan's *Unfunded Actuarially Accrued Liabilities* (UAAL). The actuarial accounting that goes into calculating a plan's UAAL is complicated, but it can be broadly summarized (at time τ) by the following expression

$$\text{UAAL}_{i\tau} = \text{Assets}_{i\tau} - \sum_{t>\tau}^{\infty} \frac{\text{Benefits}_{it}}{(1+AAR_i)^{t-\tau}}. \tag{2}$$

The AAR is the *actuarially assumed return* on a plan's assets; at a higher AAR future benefit obligations are discounted more steeply. It is worth noting that past contributions by employers and employee do not appear in expression (2), because they (and the return that was earned on them) are what makes up the plan's current asset base. Future contributions are by default actuarially determined to cover obligations accrued in the future so that neither appears in expression (2).

Funding gaps are often caused at least in part by unrealistic actuarial assumptions; in particular AAR that are too high, or *actuarially required contributions* (ARC) that are in reality too low. Actuarially required contributions are by definition 'actuarially adequate' under a set actuarial assumptions. These actuarial assumptions are, however, determined by pension boards and are heavily politicized choices (Greenhut 2009, 43, Anzia and Moe 2019, 9). One important set of actuarial assumptions pertains to modeling retirement choices: Many employees will in practice retire earlier than the models assume, which reduces a member's years of contributions (and thus lowers the expected asset base) and increases that member's years of drawing benefits. Actuarial models often do not adequately account for changes in expected retirement ages, thus creating blind spots in the ARC calculations (Mitchell and Smith, 1994, 282). A second important actuarial assumption is the AAR: pension boards have been known to neutralize the transmission from benefit expansion to the ARC by simultaneously increasing their AAR (Mitchell and Smith 1994, footnote1, Kelley 2014, 24, Novy-Marx and Rauh 2011). The AAR in most plans is between 7 and

8 percent, and it is almost always higher than actual returns have been over the last decade (Wall Street Journal, 2016).[4] It is important to be clear that unrealistic actuarial assumptions do not impact a plan's official funding levels in the short run because the UAAL in expression (2) is then calculated based on the same unrealistic actuarial assumptions. In the long run, however, unrealistic assumptions have to be adjusted, and the resulting changes can lead to fairly sudden jumps in funding calculations. As a result, efforts to lower plans' AAR have resulted in particularly acrimonious political conflicts in recent years, typically fought out between union representatives and treasury representatives on a plan's board. Lowering the AAR is consequential because it immediately opens up a gap in expression (2), which then immediately results in higher ARC for both employers and employees (Gillers, 2016). The Economist (2017) reports that the *National Association of State Retirement Administrators* estimates that cutting the AAR by 0.25 percentage points increases the required contribution rate of plans' active members (as a proportion of payroll) by two to three percentage points, so that "it is in no one's interest to make more realistic assumptions about returns." Anzia and Moe (2019) provide an illustrative account of the bruising political battles surrounding efforts to reduce the state pensions' AAR in Rhode Island in 2011 and California in 2015.

[4] A related issue is whether the practice of discounting future obligations at the expected rate of return on assets is appropriate. Logically, it is inconsistent to discount a stream of effectively 'risk-free obligations' at the rate of return of a risky portfolio of assets (Novy-Marx and Rauh, 2009, 2011, 2014a,b; Brown and Wilcox, 2009). Yet, state laws sanction public-sector plans to do precisely this (while simultaneously prohibiting private-sector 401(k) plans from doing the same).