

# Teacher Pension Workshop: Connecting Evidence-Based Research to Pension Reform

## Are Teacher Pensions “Hazardous” for Schools?

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# Are Teacher Pensions “Hazardous” for Schools?

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The findings of this research are attributable only to the author.



# Motivation

Will pension reforms affect quality of instruction?

Teachers differ on job satisfaction, outside wages

Implications for student learning, school staffing



# Take-aways

	“Pull”	“Push”
Higher quality	Stay	
Younger	Stay	Stay
Higher paid	Stay	Stay
M.A. degree (B.A.)	Go	
Nonwhite (white)	Stay	Stay
More competitive college	Go	
Less competitive college (competitive college)	Go	Stay
Higher % black	Go	Stay
Higher % econ disadvantaged	Go	Go
Middle school High school (Elementary school)	Go	

# Contribution

Data: 15 years, linked students & teachers

Model: Cox proportional hazard model

# Data: North Carolina teachers, 1994-2009

Females

Started teaching before age 35

20+ years of experience

Quality for 12% of sample (4<sup>th</sup> & 5<sup>th</sup> grades)

# Teacher Quality (Value-added)

Relative growth in her students' achievement

$$TestScore_{jit} = ValueAdded_i + Y_{jt}\boldsymbol{\rho} + v_{jit}$$



Student j's previous test score  
Student, class, school attributes  
Grade, year fixed effects



# Teacher Quality (Value-added)

Relative growth in her students' achievement

$$TestScore_{jit} = ValueAdded_i + Y_{jt}\boldsymbol{\rho} + v_{jit}$$

Not included:

Teacher experience (limit sample)

School fixed effects

# Value-added Regression

	Math	Reading
Previous score	0.74 ***	0.70 ***
Female	-0.01 ***	0.02 ***
Black	-0.10 ***	-0.13 ***
LEP	-0.02 ***	-0.06 ***
Economically disadvantaged	-0.07 ***	-0.10 ***
(kitchen sink)	X	X
N (student test scores)	778,734	783,572
R-squared	0.75	0.69



# Teacher Quality (Value-added)

Relative growth in her students' achievement

$$TestScore_{jit} = ValueAdded_i + Y_{jt}\boldsymbol{\rho} + v_{jit}$$

Average math & reading  
“Shrink” (Bayes shrinkage)  
Standardize (mean 0, s.d. 1)

# Value-added Measure

Each teacher had 10-252 student scores, average 72

	Math	Reading	Average
S.D. (before shrinkage)	0.22	0.15	0.17
S.D. (after shrinkage)	0.19	0.10	0.13

Standardized value-added = 1: Teachers whose students' test scores grew 13 percentile points more than the average

# Teacher Retention and Value-added

Clotfelter, Ladd & Vigdor (2006); Boyd et al. (2007); Goldhaber, Gross & Player (2011); others: early-career effects, sorting across schools

Koedel, Podgursky & Shi (2013): include retirement timing as covariate in value-added regression, no effect

Fitzpatrick & Lovenheim (2014): early retirement incentives have little effect on student test scores, perhaps positive

# Sample Statistics: Teachers (full sample)

	1995-96	2008-09
N	14,359	12,034
Experience	24	26
Age (imputed, college grad date)	48	50
9-month salary	\$31,050	\$45,630
White	79%	83%
Nonwhite	21%	17%
Attended more competitive college	5%	8%
Attended competitive college	51%	51%
Attended less competitive college	44%	41%
B.A. degree	59%	58%
M.A. degree or above	42%	43%

# Sample Statistics: School Characteristics

	1995-96	2008-09
Elementary school	57%	57%
Middle school	19%	21%
High school	24%	23%
% Black students		
Mean	30%	27%
S.D.	22%	23%
% Econ disadvantaged students		
Mean	30%	37%
S.D.	18%	19%

Standardize student demographics by school level

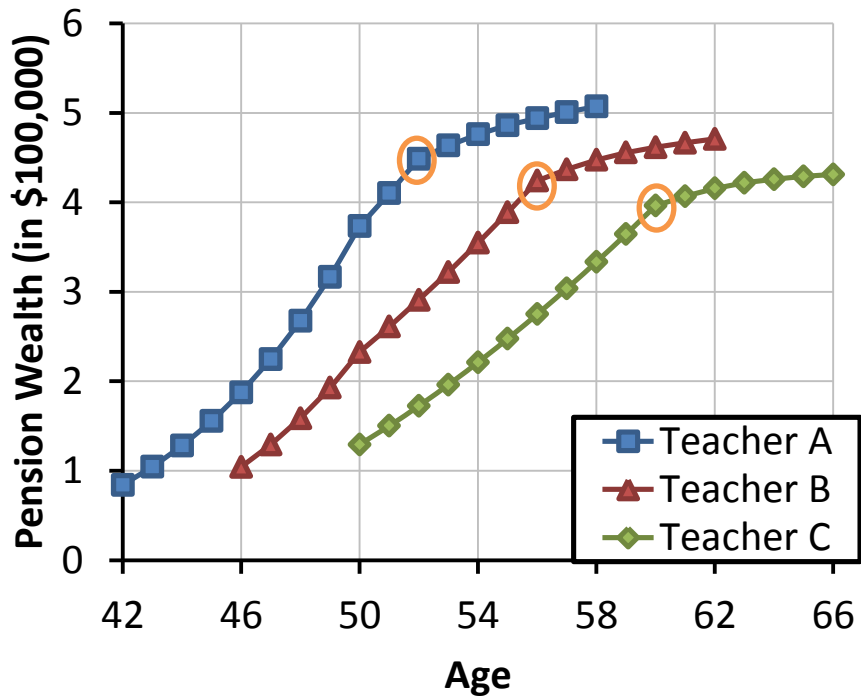
# Modeling Retirement

Rust (1989), Berkovec & Stern (1991):  
dynamic structural model

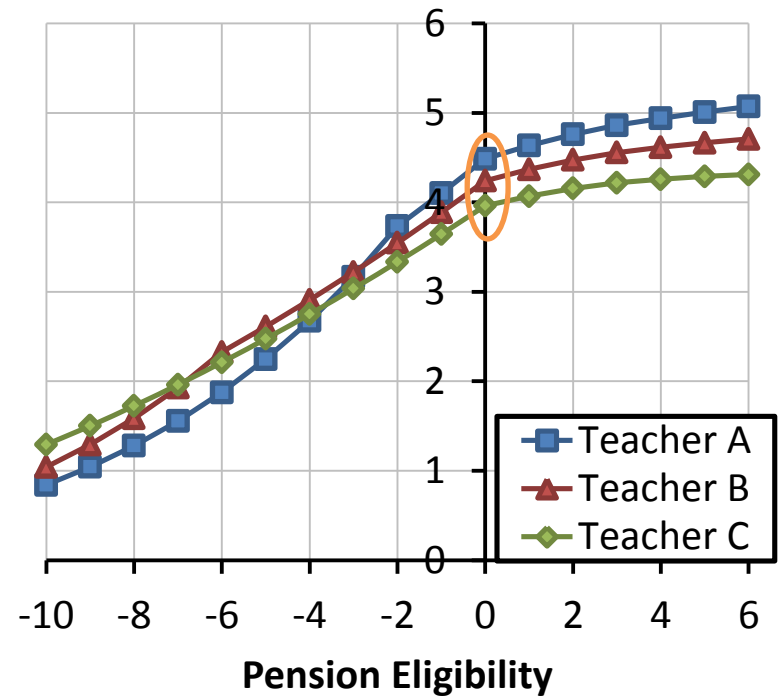
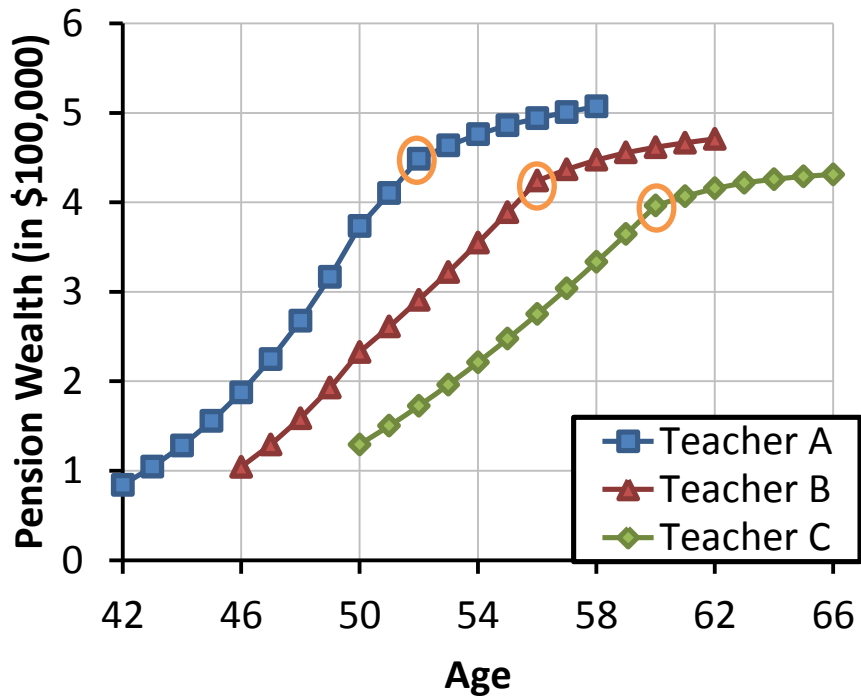
Stock & Wise (1990): Option value, continue  
to work to keep option open

Coile & Gruber (2007): Peak value, present-  
discounted value of continuing to work





Teacher	Started teaching at age
A	21
B	25
C	29



Teacher	Started teaching at age
A	21
B	25
C	29

# Hazard Model

Stock & Wise (1988): hazard is simplification of option value

Hausman & Wise (1985): hazard model to study Social Security



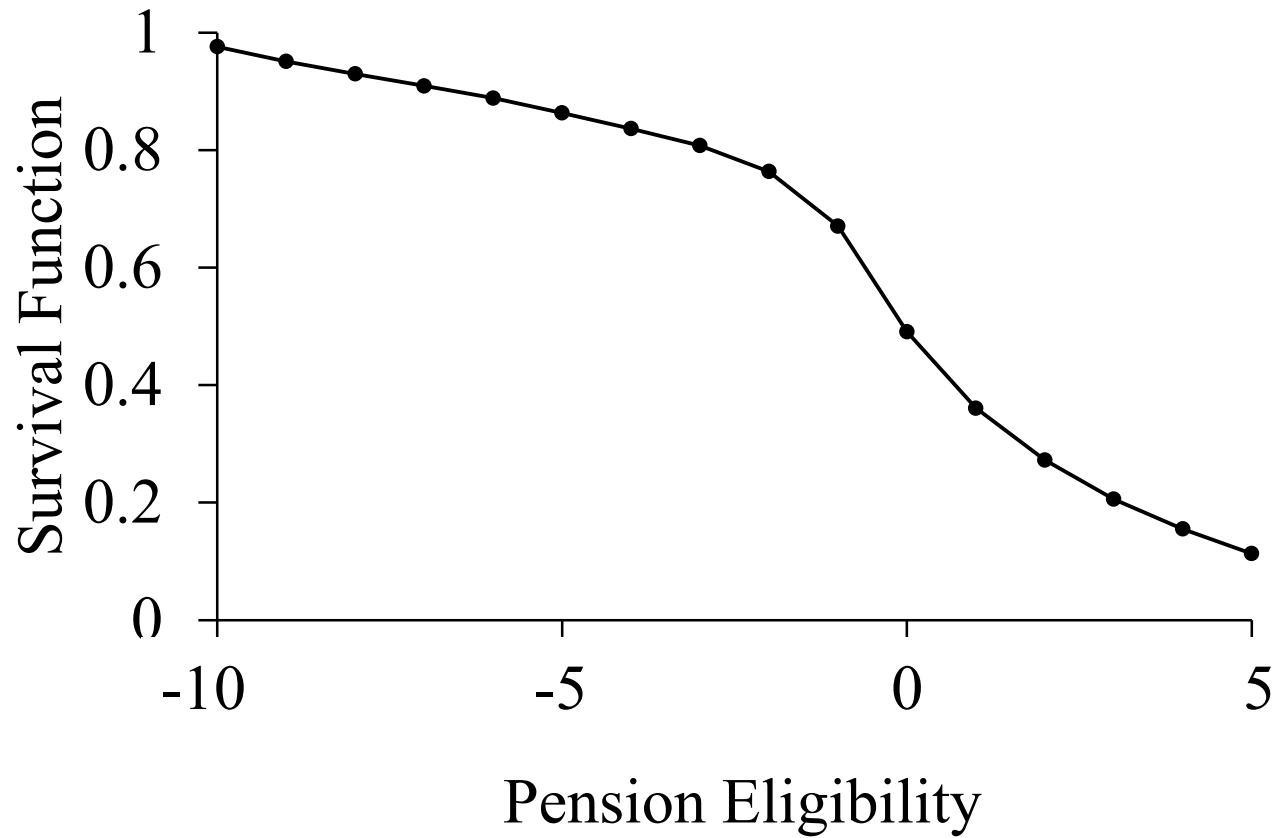
# Hazard Model

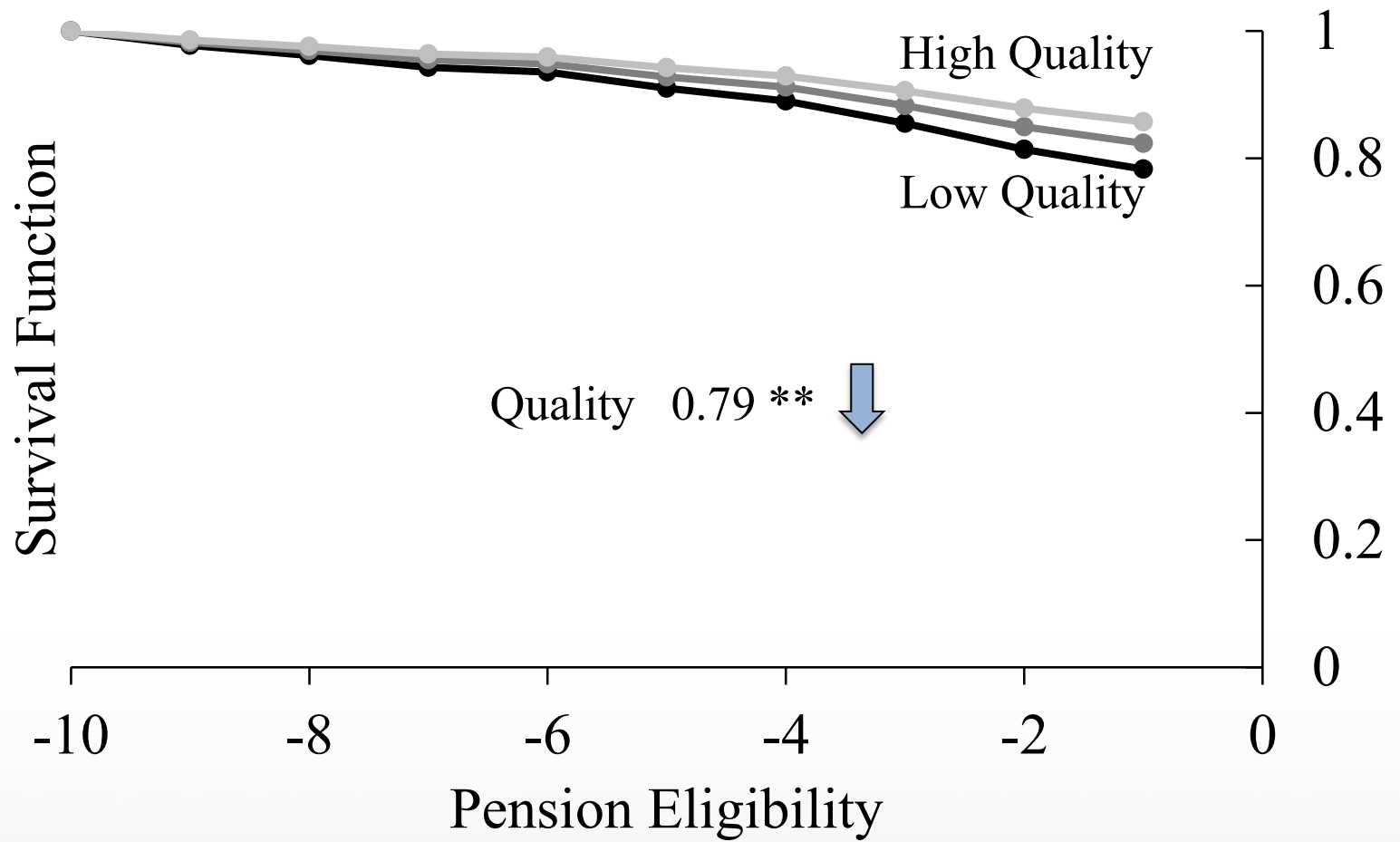
Common “risk” of retiring at each value of pension eligibility

$$\lambda(t|X_{it}) = \lambda_0(t) \cdot \exp(X_{it}\beta)$$

People with different characteristics have an overall higher/lower “risk” of retiring







# Pension Eligibility -10 to -1

	Hazard Ratio	
Age	1.09 ***	↑
Salary	0.95 ***	↓
Compared to B.A. only M.A. degree and above	1.27 ***	↑
Nonwhite	0.79 ***	↓
Compared to competitive college more competitive	1.11 **	↑
less competitive	1.13 **	↑
1 S.D. higher % black	1.09 **	↑
1 S.D. higher % econ disadvantaged	1.09 **	↑
Compared to elementary school middle school	1.15 ***	↑
high school	1.02	

# Pension Eligibility 0 to 5

	Hazard Ratio	
Age, Age <sup>2</sup>		↑
Salary	0.97 ***	↓
Compared to B.A. only M.A. degree and above	0.97	
Nonwhite	0.89 ***	↓
Compared to competitive college more competitive	0.99	
less competitive	0.93 **	↓
1 S.D. higher % black	0.96 *	↓
1 S.D. higher % econ disadvantaged	1.03 *	↑
Compared to elementary school middle school	0.97	
high school	0.97	



# Take-aways

	“Pull”	“Push”
Higher quality	Stay	
Younger	Stay	Stay
Higher paid	Stay	Stay
M.A. degree (B.A.)	Go	
Nonwhite (white)	Stay	Stay
More competitive college	Go	
Less competitive college (competitive college)	Go	Stay
Higher % black	Go	Stay
Higher % econ disadvantaged	Go	Go
Middle school High school (Elementary school)	Go	

# Conclusion

Pension incentives have (slightly) different effects on different workers

Be cognizant of how changing those incentives affects who stays and who goes

For full paper:

[http://research.upjohn.org/up\\_workingpapers/281/](http://research.upjohn.org/up_workingpapers/281/)

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