

REWARDING EXPERIENCED TEACHERS

How Much Do Schools Really Pay?

Josh B. McGee
Senior Fellow, Manhattan Institute

Marcus A. Winters
Senior Fellow, Manhattan Institute

EXECUTIVE SUMMARY

U.S. public school districts pay a far larger premium for teacher experience than is typically acknowledged: the relationship between a teacher's experience and take-home salary is widely reported; the relationship between a teacher's experience and pension—another important element of total compensation—is not. Current compensation practices persist despite a wide body of research demonstrating that quality differences between teachers plateau after five to seven years.

This paper calculates true total compensation, including salary *and* pension, for teachers at varying years of experience in the ten largest U.S. public school districts: New York City, the largest, followed by Los Angeles, Chicago, Dade County (FL), Clark County (NV), Broward County (FL), Houston, Hillsborough County (FL), Hawaii, and Philadelphia. It finds that these districts' "final-average-salary-defined-benefit" (FAS-DB) pension plans backload retirement compensation in a way that substantially increases the total compensation premium paid to highly experienced teachers who remain in the same school district their entire careers.

The paper then models an alternative "cash-balance" (CB) pension plan, where teachers more smoothly accrue pension benefits across their careers; for the aforementioned school districts, the paper calculates changes to the teacher-experience premium if a district switched from its current heavily backloaded (FAS-DB) plan to a smooth-accrual (CB) plan of equivalent value—and thus, of equal cost to taxpayers. It finds that transitioning to the latter would substantially reduce the teacher-experience premium without reducing a teacher's total expected career compensation. At present, the true value of total compensation for most U.S. public school teachers is poorly understood. It is also poorly aligned with teacher performance: the compensation gap between a teacher with, say, 35 years of experience and one with ten years is far greater than the gap in their teaching abilities. Smooth-accrual plans, the paper concludes, better align teacher compensation with teacher quality by raising compensation for teachers in their early years—a time when teachers improve most dramatically.

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ABOUT THE AUTHORS

JOSH B. MCGEE is a senior fellow at the Manhattan Institute and vice president of public accountability at the Laura and John Arnold Foundation. His research interests include retirement policy, K–12 education, and economic development. His work has been published in various scholarly journals, including *Education Finance and Policy*, *Journal of Development Economics*, and *Education Next*, and in popular media, including *National Affairs*, *Dallas Morning News*, *Philadelphia Inquirer*, *Atlanta Journal Constitution*, and *Houston Chronicle*. McGee has provided expert testimony and technical assistance in more than 50 jurisdictions and routinely speaks to the media on retirement and K–12 issues.

McGee holds a B.S. and M.S. in industrial engineering and a Ph.D. in economics from the University of Arkansas.

MARCUS A. WINTERS is a senior fellow at the Manhattan Institute and an assistant professor at the University of Colorado Colorado Springs. His research focuses on education policy, especially school choice, accountability, and teacher quality. His papers have been published in the *Journal of Policy Analysis and Management*, *Educational Researcher*, *Educational Evaluation and Policy Analysis*, *Education Finance and Policy*, *Educational Finance*, *Economics of Education Review*, and *Teachers College Record*. His op-ed articles have appeared in numerous newspapers, including the *Wall Street Journal*, *Washington Post*, and *USA Today*, and he is often quoted in the media on education issues.

Winters holds a B.A. in political science from Ohio University and a Ph.D. in economics from the University of Arkansas.

REWARDING EXPERIENCED TEACHERS HOW MUCH DO SCHOOLS REALLY PAY?

Josh B. McGee INTRODUCTION

Marcus A. Winters

Any compensation plan that pays a premium to employees for factors not systematically related to performance is far from ideal. At present, the vast majority of U.S. public school districts compensate teachers according to a salary schedule based explicitly on years served in the classroom and advanced degrees held. Such compensation practices persist despite a wide body of research demonstrating that quality differences between more and less experienced teachers typically plateau after five to seven years.

Despite disagreement on how best to reform America's flawed public school teachers' compensation plans, numerous researchers have argued in favor of decoupling the relationship between salaries and years in the classroom (see, for instance, Hanushek 2007; Podgursky and Springer 2007; Winters 2011; and Rice 2013). This paper demonstrates that such arguments understate the magnitude of the problem: U.S. public school districts pay a far larger premium for teacher experience than is currently reported in the academic literature and policy debate.

To date, researchers and other commentators have focused on the relationship between a teacher's experience and his take-home salary, largely ignoring his deferred retirement benefits, another important element of total compensation. Final-average-salary-defined-benefit (FAS-DB) pension plans—which cover retirements for about 89 percent of U.S. public school teachers—heavily backload retirement compensation late into teachers' careers, when such compensation often constitutes a large share of total compensation.¹

This paper calculates total compensation, including salary and pensions, for teachers at each year of experience in the ten largest U.S. public school districts. The paper finds that all pension plans examined backload retirement compensation in a way that substantially increases the total compensation premium paid for highly experienced teachers. In late career years, more of this premium occasionally derives from pension-benefits accrual than from salary.

The paper then considers this teacher-experience premium under an alternative cash-balance (CB) retirement plan, where teachers more smoothly accrue pension benefits across their careers. The CB structure offers teachers a guaranteed investment return and is distributed as an annuity. For each of the aforementioned school districts, the paper calculates changes to the teacher-experience premium if a district switched from its current plan to a CB plan of equivalent value—and thus, of equal cost to taxpayers: moving to a CB plan, the paper finds, would substantially reduce the teacher-experience premium without reducing a teacher’s total expected career compensation.

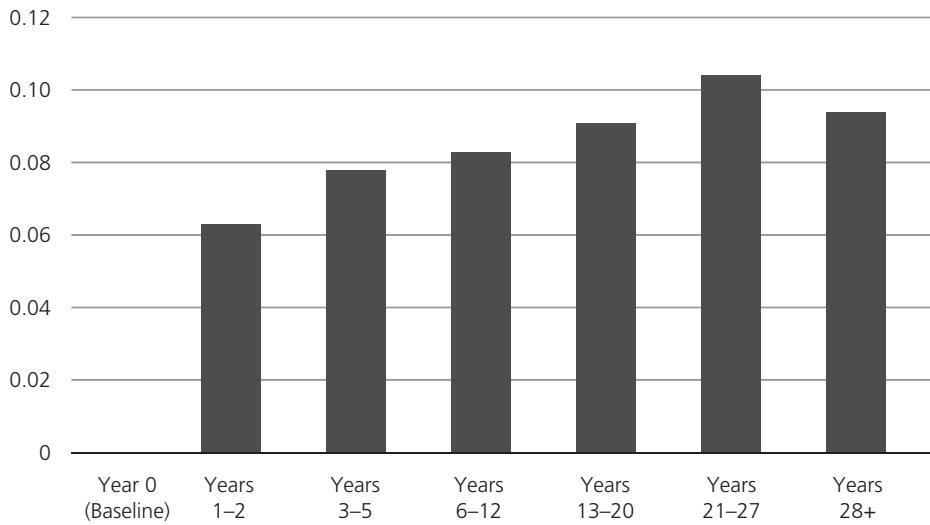
I. EXPERIENCE AND QUALITY

A wide body of research finds that more experienced teachers are substantially more effective in the classroom than early-career teachers. Such research also finds that the magnitude and structure of experience-related quality differences are not well aligned with current teacher-compensation patterns.

The link between experience and teacher quality is among the most widely studied relationships within educational research. Hanushek (1997, 2003), surveying 206 findings published before 2003, found consistently large returns to experience early in a teacher’s career—with returns plateauing after five to seven years of classroom experience. Other researchers report similar findings (Rivkin, Hanushek, and Kain 2005; Hanushek et al. 2005; Gordon, Kane, and Staiger 2006; Clotfelter, Ladd, and Vigdor 2007).

Some recent research has identified substantial quality returns to classroom experience gained beyond five to seven years (Harris and Sass 2011; Wiswall

Figure I. Estimated Returns to Experience, Relative to Novice, in Standard Deviation Units



Source: Clotfelter, Ladd, and Vigdor (2007), table 2, column 2

2013; Papay and Kraft 2014). Such papers demonstrate that the gains to experience from later years are disguised by selection bias, whereby more effective experienced teachers are more likely to exit the classroom than less effective teachers. While such papers offer evidence of quality returns to late-career experience for teachers who remain in the classroom, the papers do not dispute the assertion that quality differences, between more and less experienced teachers in the same school district, essentially plateau after five to seven years.

Figure 1 illustrates the average difference in the quality of teachers with varying levels of experience relative to novice teachers (i.e., teachers with no experience) (Clotfelter, Ladd, and Vigdor 2007). Though broadly representative of the research literature, such results—reported in standard deviation units for the teacher’s independent impact on student test-score performance—attach greater weight to the link between teacher experience and quality than do most previous studies.

Figure 2. Salary Tables, NYC and Philadelphia Teachers with Master’s Degrees

Years of Service	NYC	Philadelphia	Years of Service	NYC	Philadelphia
0	\$57,320	\$46,694	26	\$100,049	\$76,462
1	\$60,224	\$48,945	27	\$100,049	\$76,462
2	\$60,626	\$53,531	28	\$100,049	\$76,462
3	\$61,333	\$56,531	29	\$100,049	\$76,462
4	\$61,943	\$59,532	30	\$100,049	\$76,462
5	\$63,602	\$62,368	31	\$100,049	\$76,462
6	\$65,918	\$65,121	32	\$100,049	\$76,462
7	\$72,194	\$67,788	33	\$100,049	\$76,462
8	\$72,194	\$70,565	34	\$100,049	\$76,462
9	\$72,194	\$73,454	35	\$100,049	\$76,462
10	\$78,885	\$76,462	36	\$100,049	\$76,462
11	\$78,885	\$76,462	37	\$100,049	\$76,462
12	\$78,885	\$76,462	38	\$100,049	\$76,462
13	\$80,987	\$76,462	39	\$100,049	\$76,462
14	\$80,987	\$76,462	40	\$100,049	\$76,462
15	\$85,426	\$76,462	41	\$100,049	\$76,462
16	\$85,426	\$76,462	42	\$100,049	\$76,462
17	\$85,426	\$76,462	43	\$100,049	\$76,462
18	\$86,590	\$76,462	44	\$100,049	\$76,462
19	\$86,590	\$76,462	45	\$100,049	\$76,462
20	\$95,202	\$76,462	46	\$100,049	\$76,462
21	\$95,202	\$76,462	47	\$100,049	\$76,462
22	\$100,049	\$76,462	48	\$100,049	\$76,462
23	\$100,049	\$76,462	49	\$100,049	\$76,462
24	\$100,049	\$76,462	50	\$100,049	\$76,462
25	\$100,049	\$76,462			

Source: NYC Department of Education and the School District of Philadelphia

Figure 1 suggests that most meaningful differences in teacher quality develop during teachers' first two years in the classroom. Teachers with additional years of experience show far more modest increases in effectiveness: the quality difference between a teacher with two years' experience and a novice teacher is about 0.063 standard deviations; for a teacher with 27 years of experience and a teacher with two years of experience, only 0.041 standard deviations.

II. SINGLE-SALARY SCHEDULES

Most U.S. public school teachers earn salaries according to "step-and-lane" single-salary schedules, which depend entirely on teachers' years in the classroom and the number of advanced degrees held. Such schedules typically appear in collective bargaining agreements between school districts and teachers' unions. Single-salary schedules have long been dominant: by 1950, 97 percent of public schools had adopted them (Sharpes 1987).

Figure 2 reports single-salary schedules for New York City² and Philadelphia³ teachers with master's degrees: teachers' salaries automatically increase as they gain additional years of experience.⁴ Compensation based on experience and credentials—popular among teachers and rigorously protected by union representatives—is frequently criticized by researchers and policymakers because of the aforementioned relationship between experience and performance.

III. BACKLOADING

The teacher-experience premium, via the single-salary schedule, is well documented. Less well publicized is the teacher-experience premium paid for deferred retirement compensation, a sizable component of employees' total compensation packages. The great majority of U.S. public school teachers earn retirement benefits under FAS-DB pension plans, where teachers earn a lifetime annuity that can be accessed only after they reach their plan's retirement thresholds (typically, a combination of age and years of service). The size of a teacher's starting annuity increases as he accrues more years of service in the same plan and as his salary rises.

The dollar value of an employee's starting annual annuity for a given age at separation, a_s , and age at retirement, a_r , is given by **Equation 1**. Annuity payments are assumed to commence at the beginning of retirement. B represents the starting annual annuity beginning at retirement age a_r ; given age of separation, a_s , M is the benefit multiplier, R is an indicator for retirement eligibility, E is the percent reduction for early retirement, YOS is the number of years worked for the sponsor, and FAS is the final average salary.⁵

The present value of an employee's retirement benefit, PVB , can be calculated at various ages of separation, a_s , using standard actuarial techniques.⁶ Retirement rules may allow the employee to begin receiving an annuity immediately or require him to defer until meeting retirement eligibility thresholds. **Equation 2** offers the present value of the employee's retirement benefit at any given age. The equation calculates maximum pension benefits that an employee may realize at each age, a_s .

$B(a_r|a_s)$ represents the starting annuity that an employee would begin receiving at the age of retirement, a_r , given that the employee separated at age a_s ; AF is the annuity factor and represents the value of a dollar of annuity beginning at a_r ; $f(a_r|a_s)$ is the conditional probability of survival from a_s to a_r , and r is the interest rate used to discount future cash flows. PVB_{a_s} represents the cash value of the annuity that an employee has earned at age a_s .⁷ An employee should be indifferent between receiving the lump sum PVB_{a_s} and the annuity $B(a_r|a_s)$.

Equation 3 shows how the present value of an employee's retirement benefit can also be calculated net of employee contributions (i.e., isolating the portion of the benefit funded by the employer), PVB^{net} . $TotCont$ represents cumulative employee contributions up to a specified age.⁸ While workers will be interested in the total benefit provided under the plan, netting out the value of worker contributions provides a measurement of the employer-funded benefit or retirement compensation. Examining benefits net of worker contributions offers a better understanding of how retirement benefits fit into workers' total compensation packages—and whether workers might

$$\text{Equation 1: } B(a_r|a_s) = YOS_{a_s} * M_{a_r,YOS} * R_{a_r,YOS} * (1 - E_{a_r,YOS}) * FAS_{a_s}$$

$$\text{Equation 2: } PVB_{a_s} = \max_{\{a_r \in A | a_r \geq a_s\}} [B(a_r|a_s) * AF_{a_r} * f(a_r|a_s) * (1 + r)^{-(a_r - a_s)}]$$

$$\text{Equation 3: } PVB_{a_s}^{net} = PVB_{a_s} - TotCont_{a_s}$$

prefer a different pattern of compensation. The remainder of this paper uses PVB^{net} , or retirement compensation, as the primary variable of interest.

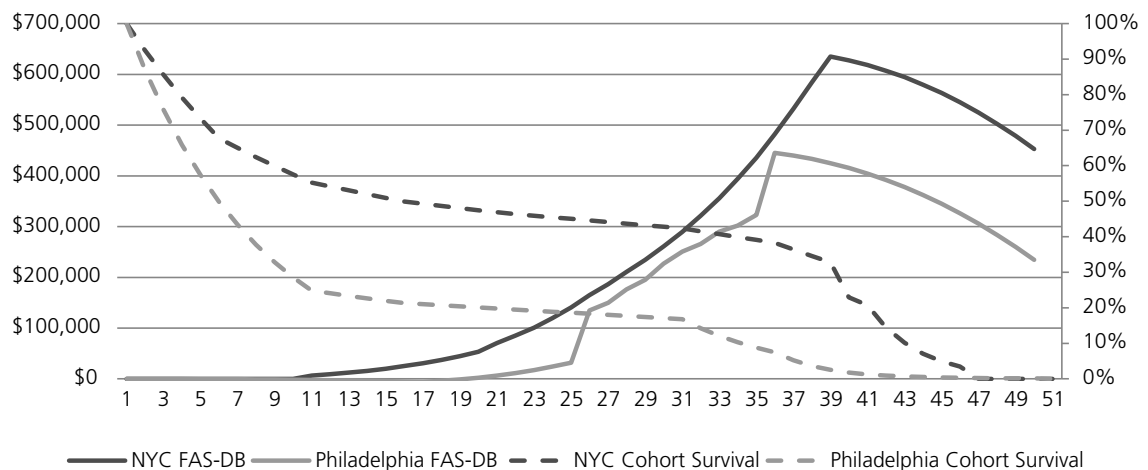
FAS-DB plans often backload retirement benefits late into an employee's career. The magnitude of the backloading varies substantially across plans and is often considerable. **Figure 3** illustrates the annual net present value of retirement benefits, under FAS-DB plans, for a 25-year-old teacher entering Philadelphia's and NYC's public schools. Both cities' plans exhibit a similar backloaded curve that is broadly reflective of plans used in most other U.S. school districts.

This paper models benefits accrual according to the current benefits tier for new employees. In recent

years, several states have adopted changes to their benefit plans that affect this new benefit tier but not the benefit tiers of previously hired teachers.⁹ These changes have generally led to plans that are less generous and peak later in a teacher's career. Teachers under these new plans generally experience less backloading of compensation than do previously hired teachers still working within the district. This paper's results are thus conservative for the relationships considered.

The basic structure of pension benefits in Philadelphia and NYC is one of "peaks and valleys" (Costrell and Podgursky 2008). In both cities, teachers do not vest in their retirement plan—and therefore do not earn retirement benefits—until they have

Figure 3. Employer-Sponsored Retirement Benefits (Constant USD)



Source: Authors' calculations

been employed for ten years in the district. After ten years, teachers see gradual increases in their pension benefits; at around 25 years, teachers rapidly acquire far more valuable retirement benefits. In NYC, a teacher earns an average of about \$1,031 in retirement compensation during each of his first 15 years of service; in each of his 15 ensuing years, he earns \$16,908, on average.

In Philadelphia and NYC, a teacher's retirement benefits decline rapidly after 40 years of service: at this point, the teacher's salary no longer meaningfully increases; he has reached the maximum percentage of his salary that the plan will pay during retirement years; for each additional year in the classroom, his retirement compensation loses value because it is paid as an annuity; and each year spent teaching is one year fewer that the teacher receives a retirement payment.

For a teacher certain to remain in the same school district for 30–40 years, backloading of deferred retirement compensation is a nonissue: actual pension benefits are not distributed until the teacher retires; and the amount earmarked for him, in the net present value of retirement benefits, is inconsequential until retirement, when the value is maximized.

Backloading is an issue, however, for the large majority of public school teachers who leave before acquiring sufficient years of service to land on the steep portion of the retirement benefits-accumulation curve. In Figure 3, dashed lines illustrate the percentage of teachers who are expected by their respective pension plans to remain within the system for a given number of years. Among teachers who begin their careers in Philadelphia, about 25 percent will participate in the pension plan for the ten years required to vest; only 7 percent of teachers will reach 35 years of service—the point at which their retirement benefits would be maximized.

IV. BACKLOADING AND THE TEACHER-EXPERIENCE PREMIUM

A neglected consequence of the backloaded nature of FAS-DB pension plans is to substantially increase the premium for experience that public

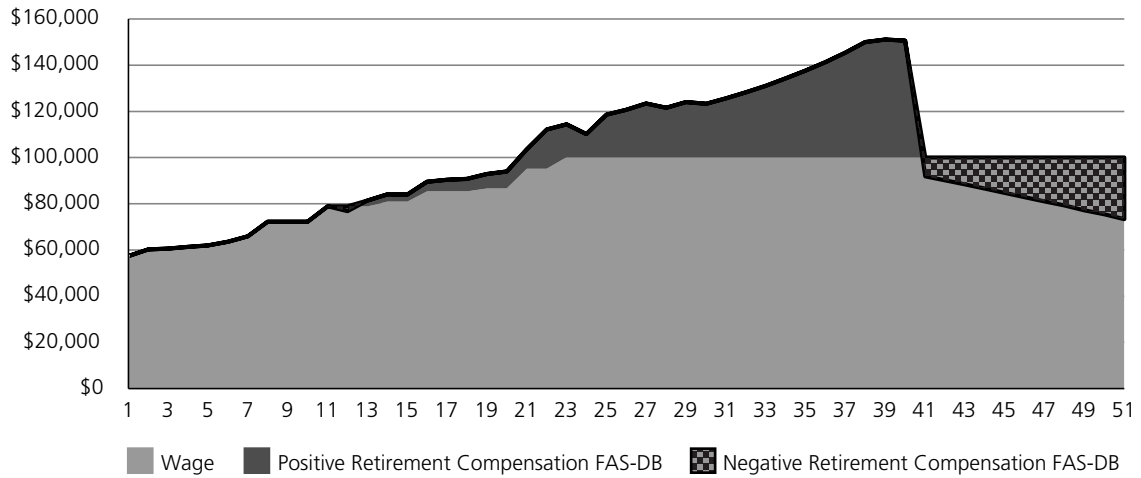
schools pay teachers in total compensation. Section IV describes the total compensation teacher-experience premium offered annually to public school teachers in NYC and Philadelphia, including the extent to which the premium derives from salary or deferred retirement compensation. (For similar analysis of the remaining eight largest U.S. school districts, see **Appendix**.)

Teacher compensation, in the form of salary, derives from the school district's single-salary schedule. This paper restricts its analyses to teachers with master's degrees. A teacher's retirement compensation during a year is calculated by subtracting the net present value of retirement benefits held by the teacher the previous year from the net present value of retirement benefits held by the teacher after a given year of service. Calculations describe a female teacher entering the school district at age 25.

Figure 4 illustrates total compensation for a NYC public school teacher for each year of service.¹⁰ Areas in the figure are cumulative: the light-gray area represents compensation in the form of salary, according to the single-salary schedule; the dark-gray area accounts for the net present value of retirement benefits; total compensation is the sum of the aforementioned areas; and the checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation. At 20 years of service, a NYC teacher earns a salary of \$95,202 (light-gray area) and experiences a \$16,892 increase in pension benefits (dark-gray area), for a total compensation of \$112,094.

Early in a NYC public school teacher's career, increased compensation over time derives entirely from upward movement on the salary ladder—teachers, as mentioned, do not vest into the pension plan for ten years and thereafter do not become eligible for meaningful retirement compensation for years. In a NYC teacher's third decade of teaching, retirement compensation rises rapidly. After year 22, NYC teachers no longer see increases in their take-home salary according to the single-salary schedule—at this time, teachers have reached the steep portion of the retirement compensation curve

Figure 4. Total Compensation, NYC*



*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation.

Source: Authors' calculations

(Figure 3) and begin to rapidly accrue retirement benefits. NYC teachers in year 36 earn \$100,049 in salary and experience a \$49,936 increase in the net present value of their retirement benefits.

Figure 5 shows that Philadelphia public school teachers reach the maximum rung on the salary ladder after ten years of service. They earn no positive retirement compensation until year 17, when they suddenly accrue significant pension benefits in a few particular years. In year 24, a teacher earns an additional \$7,716 of deferred retirement compensation; in year 25, \$102,975.

In Philadelphia, NYC, and elsewhere, pension plans reduce total teacher compensation after about year 40: negative accrual occurs when the increase in the present value of the benefit, for an additional year worked, is less than the amount lost due to the lost year of collecting a pension during retirement. For instance, once a teacher has taught enough years to maximize the percentage of her final average salary to be paid during retirement years, she will no

longer increase her yearly retirement payment by working another year. Because the teacher does not receive retirement payments until retirement, that additional year worked means one year fewer collecting a percentage of her final average salary as retirement income. The teacher-experience premium then declines.

In the FAS-DB plan, teachers who remain in the classroom after the specified retirement age teach for pennies on the dollar: such teachers would therefore do better financially to leave their public school district and either retire or pursue outside opportunities (Costrell and Podgursky 2008). Previous research suggests that teachers typically leave to avoid this dramatic pay cut (Costrell and McGee 2010).

Figure 6 and **Figure 7** reveal the extent to which the total compensation teacher-experience premium paid relative to compensation for a novice teacher, for each fifth year of service, derives from salary or pension. In a teacher's early years, the teacher-experience

premium is primarily due to differences in take-home salary. Beginning in year 20 (New York) and year 25 (Philadelphia), deferred retirement benefits become a significant share of the total compensation teacher-experience premium. In NYC, a teacher in year 35 earns \$42,729 more in take-home salary than a novice teacher (\$100,049 – \$57,320) and \$45,419 more than the \$0 in retirement compensation received by a not-yet-vested novice teacher. Under Philadelphia’s even more backloaded retirement plan, the aforementioned gaps are larger still.

V. A BETTER ALTERNATIVE?

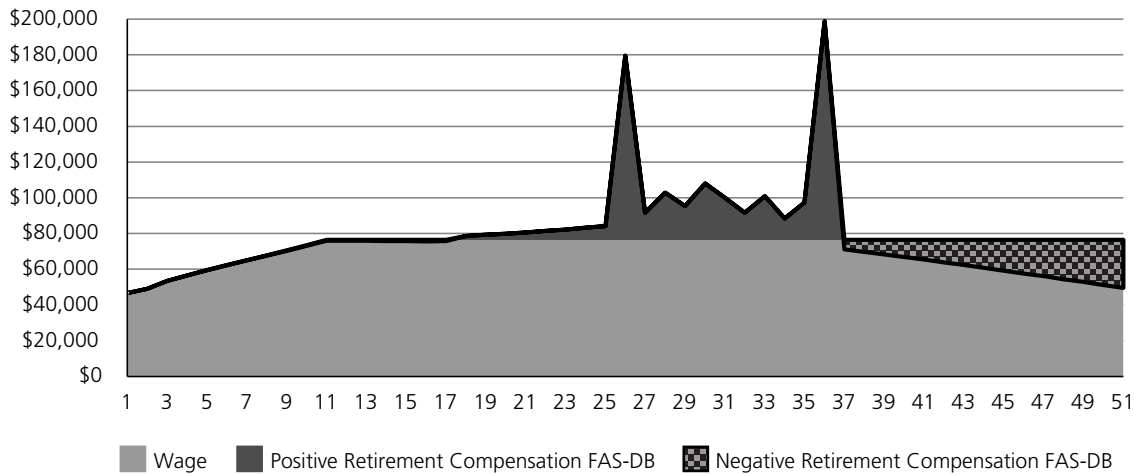
This paper has explained how the backloaded nature of FAS-DB plans dramatically increases the teacher-experience premium. Section V considers the teacher-experience premium under an alternative cash-balance (CB) pension plan of equivalent cost to taxpayers and expected value for entering teachers. The CB plan does not seek to link teacher compensation to measurable performance; nor is it a defined-contribution plan similar to a 401(k) plan. The CB plan

simply redistributes teachers’ deferred retirement compensation while staying within the current defined benefit, annuitized structure.

Section V compares retirement compensation under the FAS-DB plan, described in Section IV, with a smooth-accrual CB plan, where annual retirement compensation equals a constant percentage of cumulative earnings.¹¹ For each of the ten largest U.S. school districts, this paper calculates the average expected benefit for an entering teacher under an FAS-DB plan, and then uses that value to determine the accrual rate for a cost-equivalent CB plan.¹² The employer-contribution percentage equals the expected value of future retirement benefits, at age of workforce entry, divided by expected cumulative wages. Under the CB plan, employer contributions equal the employer-contribution percentage; annual guaranteed interest on such contributions equals the interest rate used to discount liabilities (5 percent, in this case).

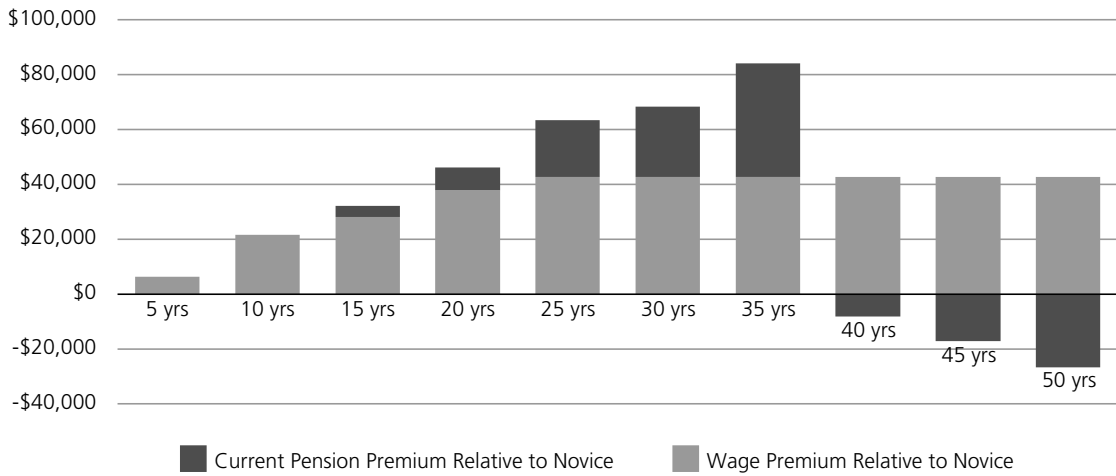
Equation 4—equal to the numerator of the employer-contribution percentage formula—calculates

Figure 5. Total Compensation, Philadelphia*



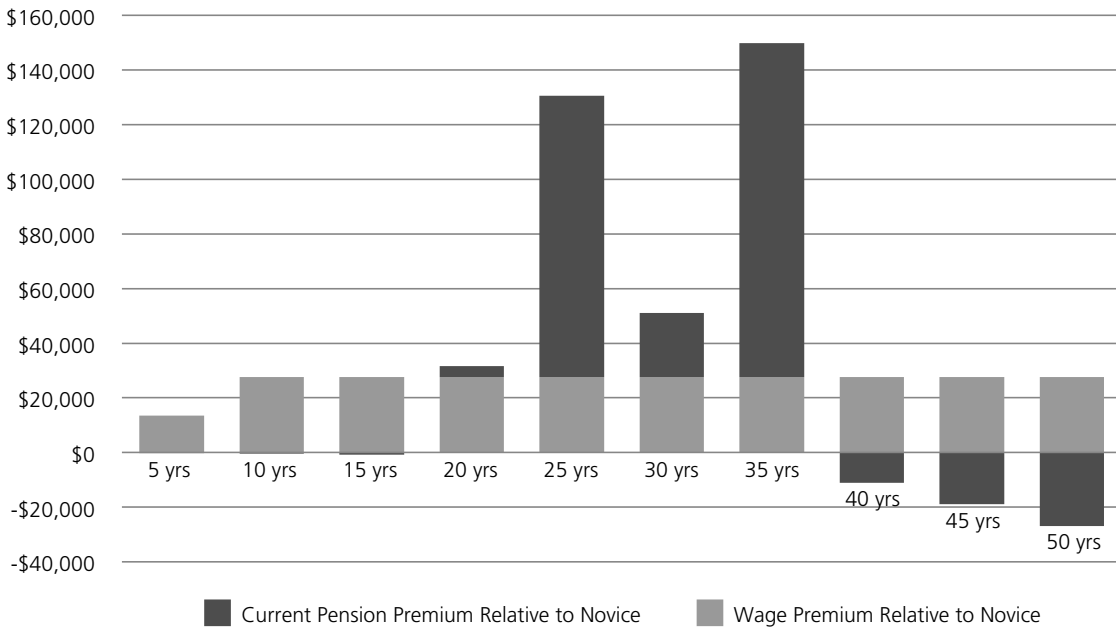
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation. Source: Authors’ calculations

**Figure 6. Deconstructing Compensation
Premium Relative to Novice—Current System, NYC**



Source: Authors' calculations

**Figure 7. Deconstructing Compensation
Premium Relative to Novice—Current System, Philadelphia**



Source: Authors' calculations

$$\text{Equation 4: } E_{a_e}[PVB^{net}] = \sum_{a=a_e}^{a_z} PVB_a^{net} (1+r)^{-(a-a_e)} * g_{a_e}(a)$$

$$\text{Equation 5: } E_{a_e}[CCW_e] = \sum_{a=a_e}^{a_z} CW_a * (1+r)^{-(a-a_e)} * g_{a_e}(a)$$

$$\text{Equation 6: } EC_{a_e} = \frac{E_{a_e}(PVB^{net})}{E_{a_e}(CCW_e)}$$

the expected value of retirement benefits at entry age, a_e , where $g(a_s)$ represents the separation-probability distribution for a given entry age.¹³ (The summation extends to the last possible age at which an employee might separate from employment, a_z .)

Equation 5—equal to the denominator of the employer-contribution percentage formula—calculates expected cumulative wages for a worker entering employment at age a_e .

Equation 6—equal to the quotient of Equation 4 and Equation 5—represents the employer-contribution percentage: the constant-percentage cumulative wages that result in a smooth-accrual pattern that is cost-equivalent to the backloaded FAS-DB accrual pattern, given a particular separation-probability distribution. The employer-contribution percentage is specific to a particular entry age.

Figure 8 compares the present value of retirement benefits under FAS-DB plans in NYC and Philadelphia with cost-equivalent CB plans. Under the former, pension benefits are distributed as a percentage of final average salary; under the latter, teachers smoothly accrue pension benefits across their careers because retirement compensation is determined as a constant percentage of salary. Under CB plans, in other words, teachers earn far more pension benefits earlier in their careers and substantially less later in their careers. Why?

FAS-DB plans can provide a higher return to teachers who remain in the same school district for four decades only by dramatically reducing the retirement compensation of teachers who do not stay in the same

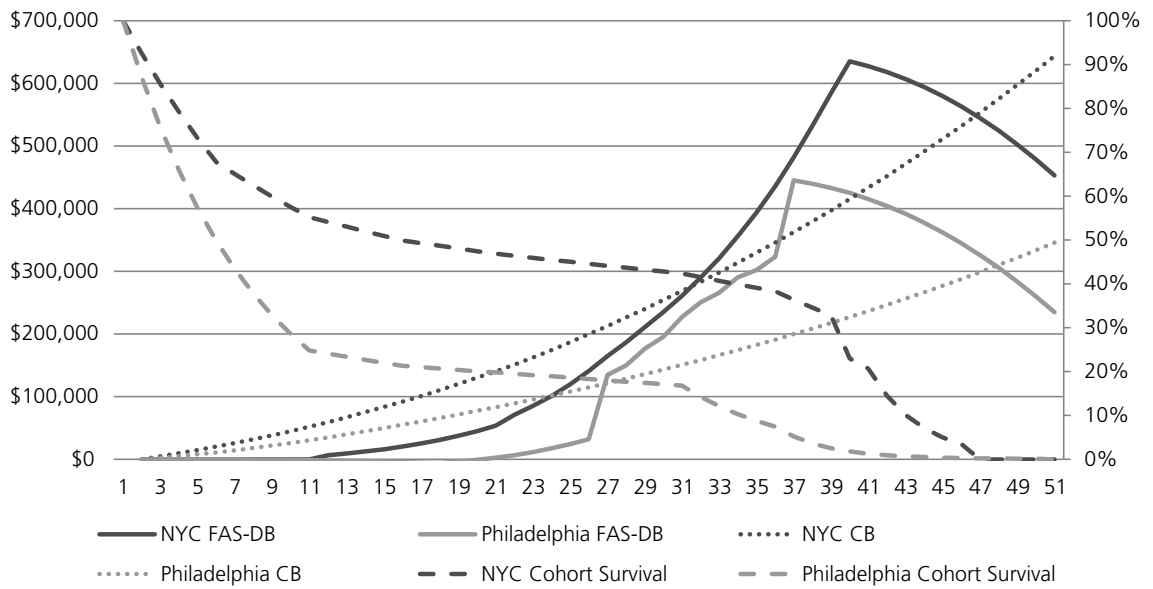
district. Entering teachers—of whom the vast majority will not teach in the same district for 40 years—should thus strongly prefer the smooth distribution of a CB plan over the uneven distribution of a cost-equivalent FAS-DB plan (McGee and Winters 2014).

VI. TEACHER-EXPERIENCE PREMIUM UNDER A CB PLAN

Section VI analyzes the teacher-experience premium under a CB plan with the same expected value as an FAS-DB plan (i.e., one with no additional taxpayer costs or savings, as well as the same average compensation throughout a teacher’s career). The CB plan would, however, offer more retirement benefits to teachers who leave their school districts earlier—at the expense of teachers who remain in the same district their entire careers.

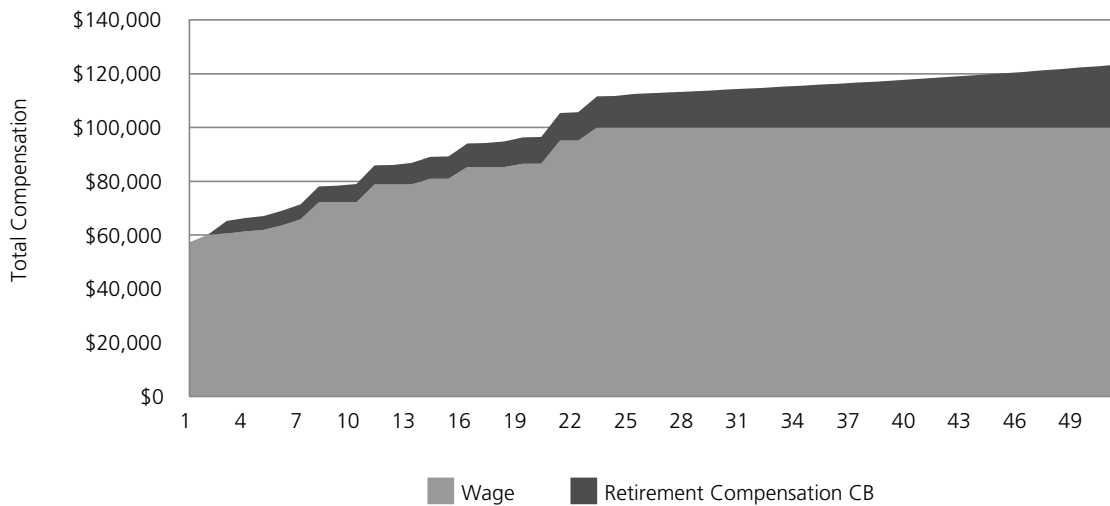
Figure 9 and **Figure 10** illustrate the annual distribution of salary and retirement compensation under a CB plan: unlike the extreme backloading of pension benefits experienced under an FAS-DB plan, pension benefits under a CB plan rise evenly as a teacher’s salary rises. **Figure 11** and **Figure 12** reveal the extent to which, under a CB plan, the total compensation premium paid for each fifth year of service, relative to compensation for a novice teacher, derives from salary or pension. (Figure 11 and Figure 12 use the same scale as Figure 6 and Figure 7.) Because it spreads retirement benefits more evenly across a teacher’s career, a CB plan in NYC and Philadelphia would substantially reduce the premium paid for experience, in the form of deferred retirement compensation, relative to current FAS-DB plans.

Figure 8. Employer-Sponsored Retirement Benefits (Constant USD)



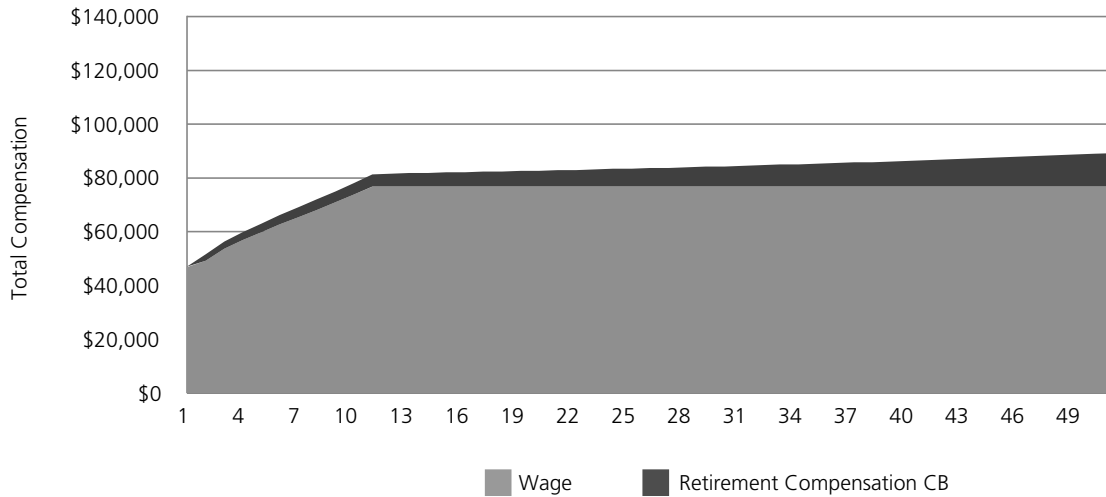
Source: Authors' calculations

Figure 9. Total Compensation Under a CB Plan, NYC



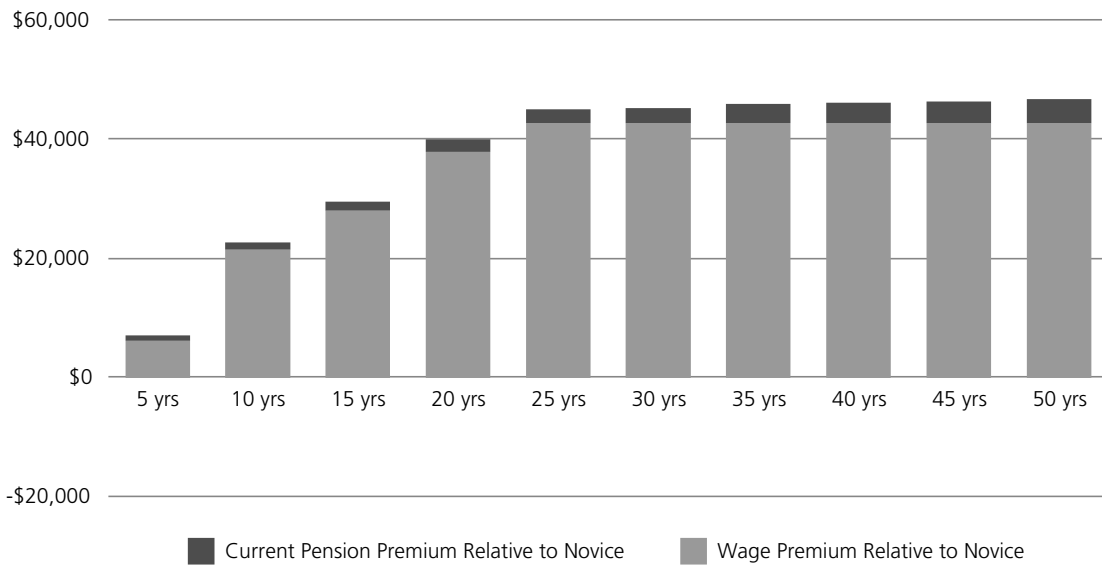
Source: Authors' calculations

Figure 10. Total Compensation Under a CB Plan, Philadelphia



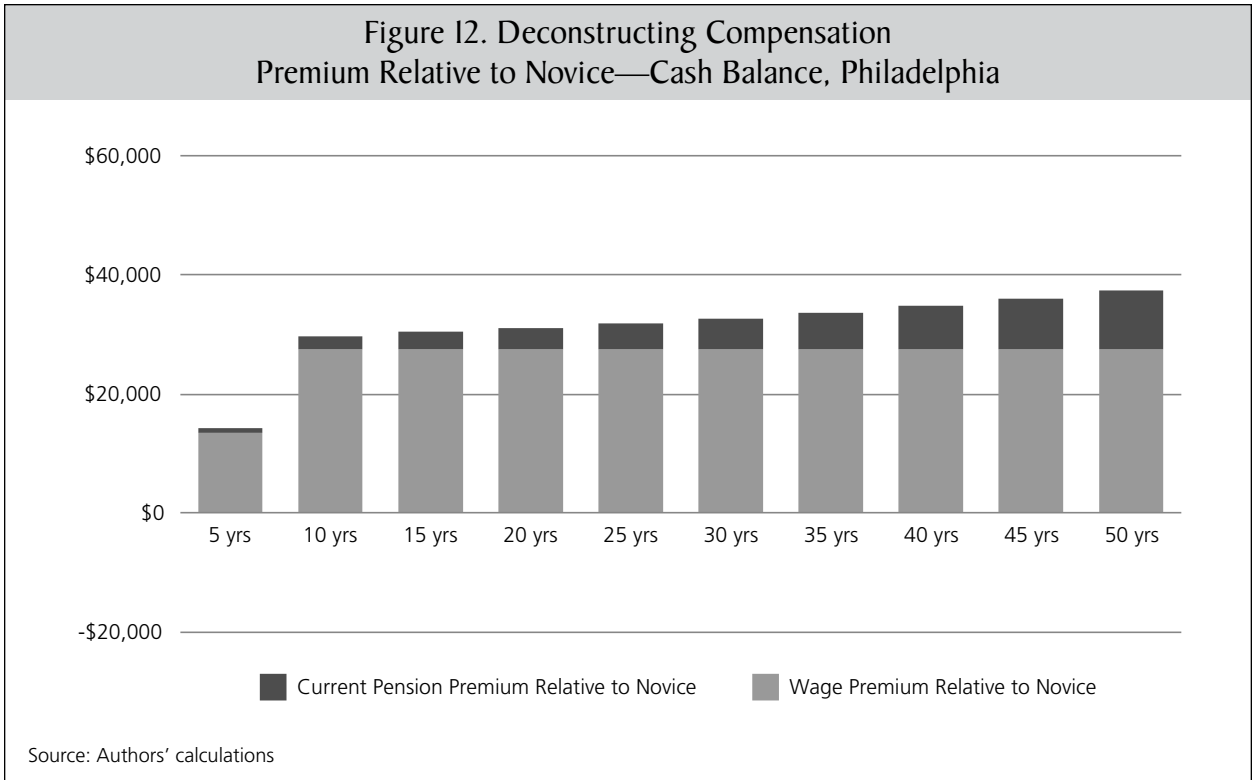
Source: Authors' calculations

Figure 11. Deconstructing Compensation Premium Relative to Novice—Cash Balance, NYC



Source: Authors' calculations

Figure 12. Deconstructing Compensation
Premium Relative to Novice—Cash Balance, Philadelphia



CONCLUSION

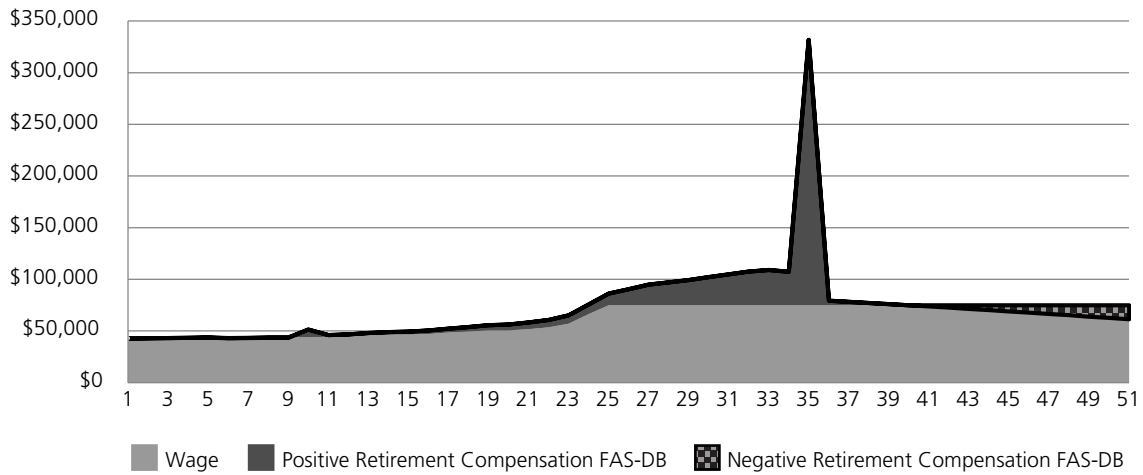
This paper examines the distribution of compensation across a teacher's career in the ten largest U.S. public school districts. It demonstrates that accounting for deferred retirement compensation substantially increases the premium that school districts pay for more experienced teachers—a premium far larger than typically acknowledged in policy discussions. The paper then considers an alternative retirement-benefits design, with the same cost and investment protection as current plans, which would, nevertheless, substantially reduce the late-career teacher-experience premium of current plans.

The authors' results indicate that current FAS-DB pension plans backload compensation in a way

that poorly aligns with relative quality differences between teachers of varying experience—thereby exacerbating the weak link between teacher compensation and effectiveness. One way to reduce the premium paid for experience is to adopt a retirement-benefits structure under which teachers more smoothly accrue pension benefits across their careers.

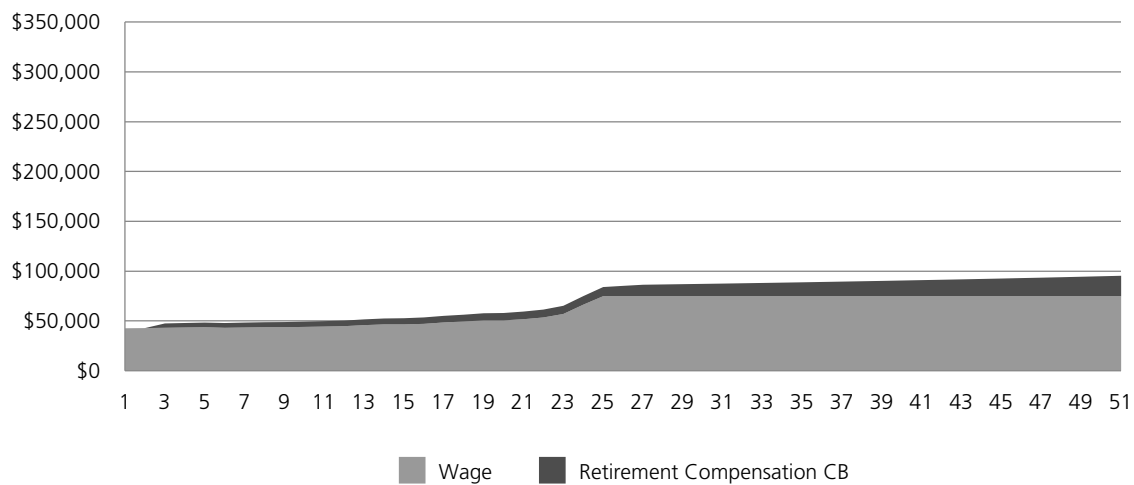
This paper demonstrates that adopting a cost-equivalent CB plan would substantially reduce the premium paid to experienced teachers while continuing to offer a guaranteed defined-benefit structure. Transitioning to CB pension plans would better align teacher compensation with teacher quality by boosting teachers' compensation in their early years—a time when teachers improve most dramatically.

Figure 13. Deconstructing Total Compensation—Current System, Broward County



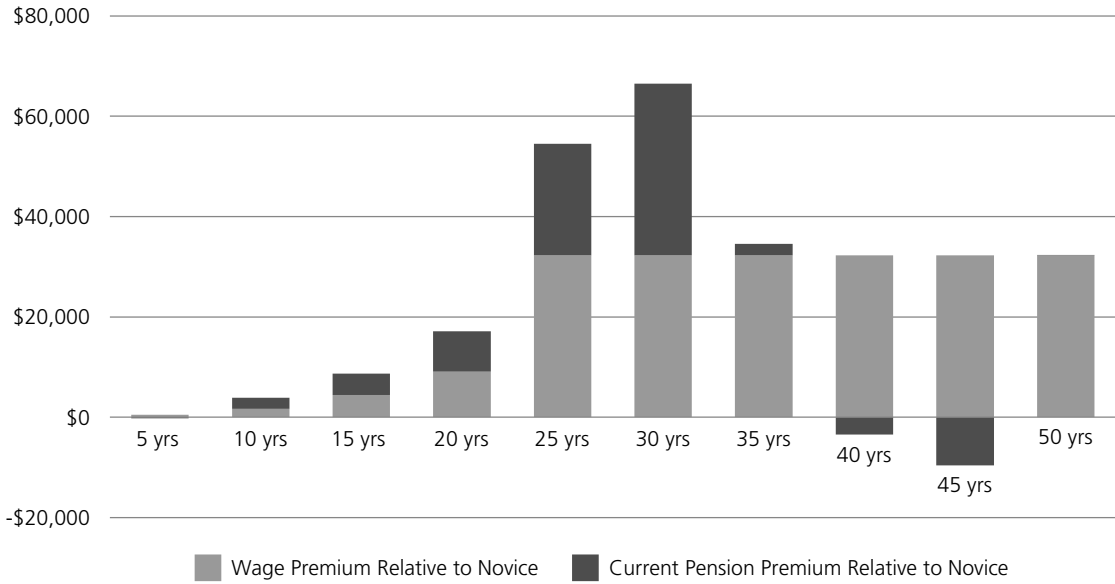
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation.
Source: Authors' calculations

Figure 14. Total Compensation Under CB, Broward County



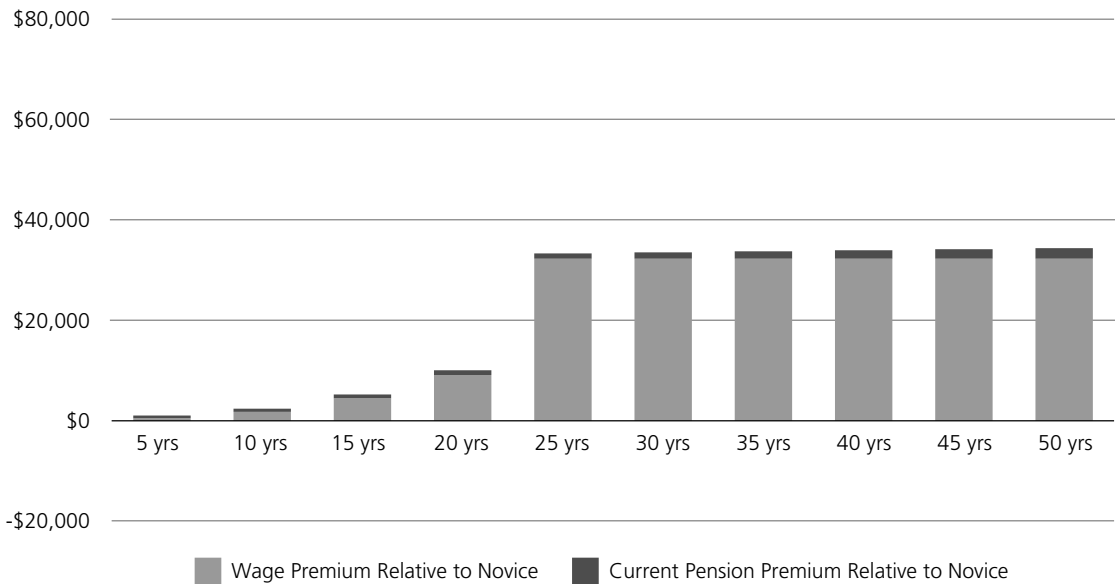
Source: Authors' calculations

Figure 15. Deconstructing Compensation Premium Relative to Novice—Current System, Broward County



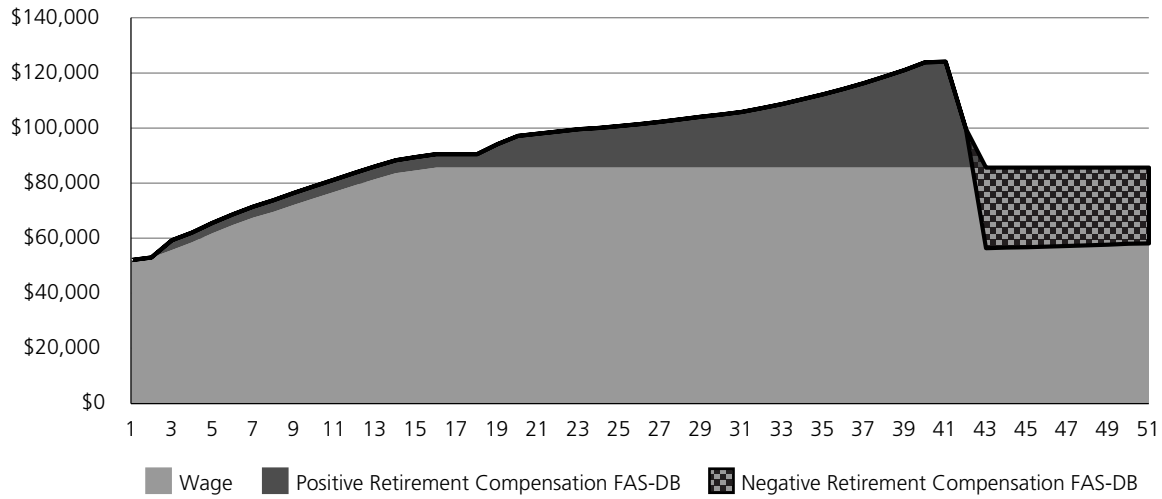
Source: Authors' calculations

Figure 16. Deconstructing Compensation Premium Relative to Novice—Cash Balance, Broward County



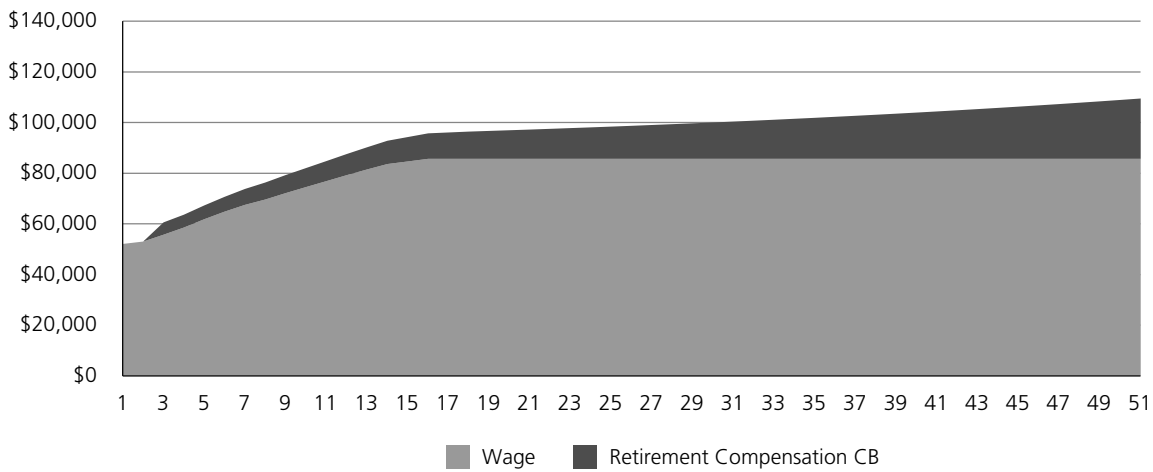
Source: Authors' calculations

Figure 17. Deconstructing Total Compensation—Current System, Chicago



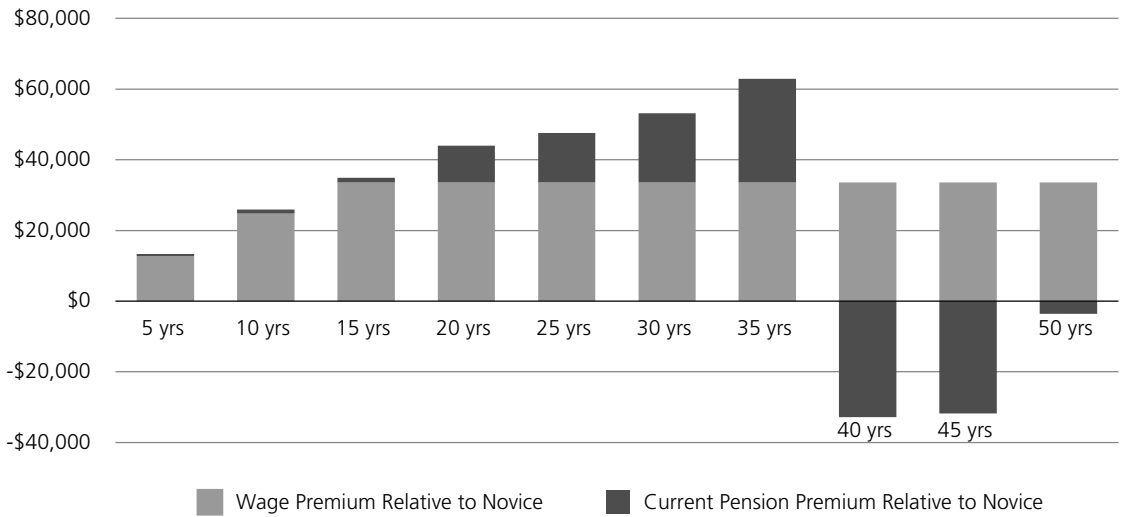
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation. Source: Authors' calculations

Figure 18. Total Compensation Under CB, Chicago



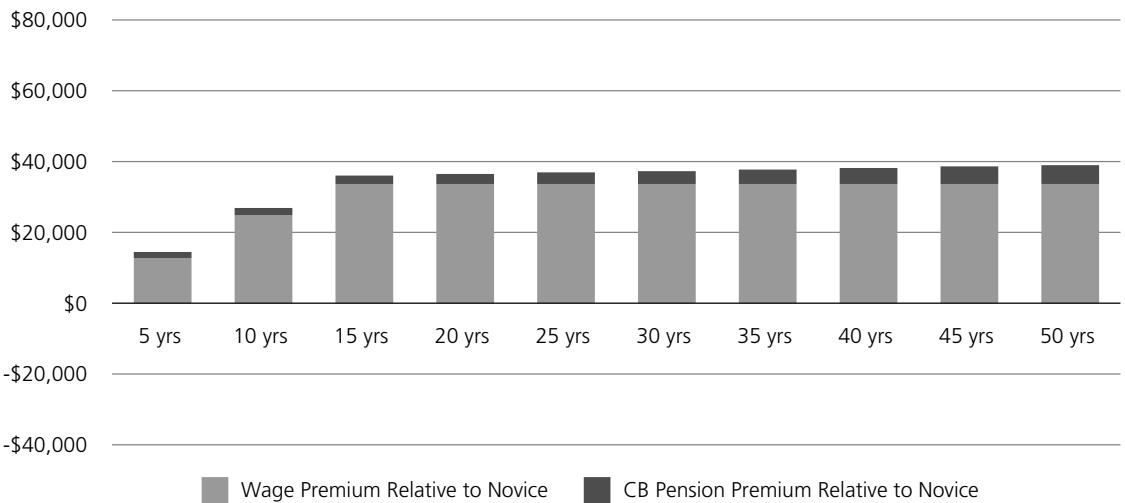
Source: Authors' calculations

Figure 19. Deconstructing Compensation Premium Relative to Novice—Current System, Chicago



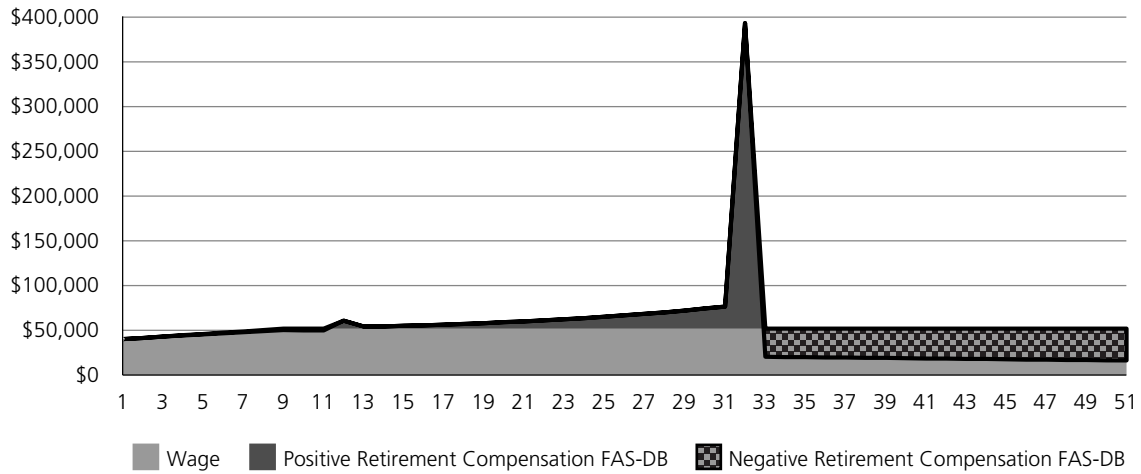
Source: Authors' calculations

Figure 20. Deconstructing Compensation Premium Relative to Novice—Cash Balance, Chicago



Source: Authors' calculations

Figure 21. Deconstructing Total Compensation—Current System, Clark County



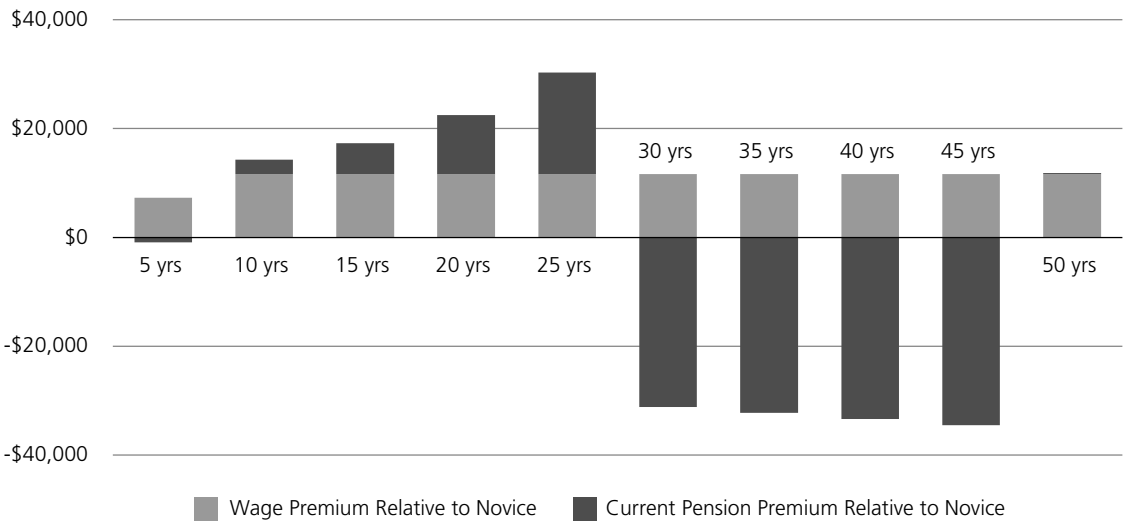
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation.
Source: Authors' calculations

Figure 22. Total Compensation Under CB, Clark County



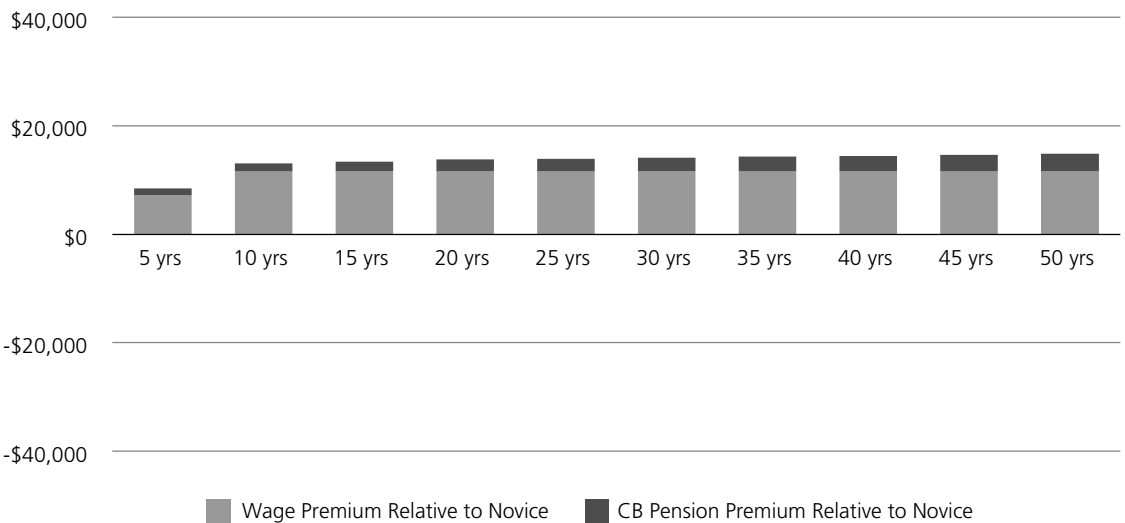
Source: Authors' calculations

Figure 23. Deconstructing Compensation Premium Relative to Novice—Current System, Clark County



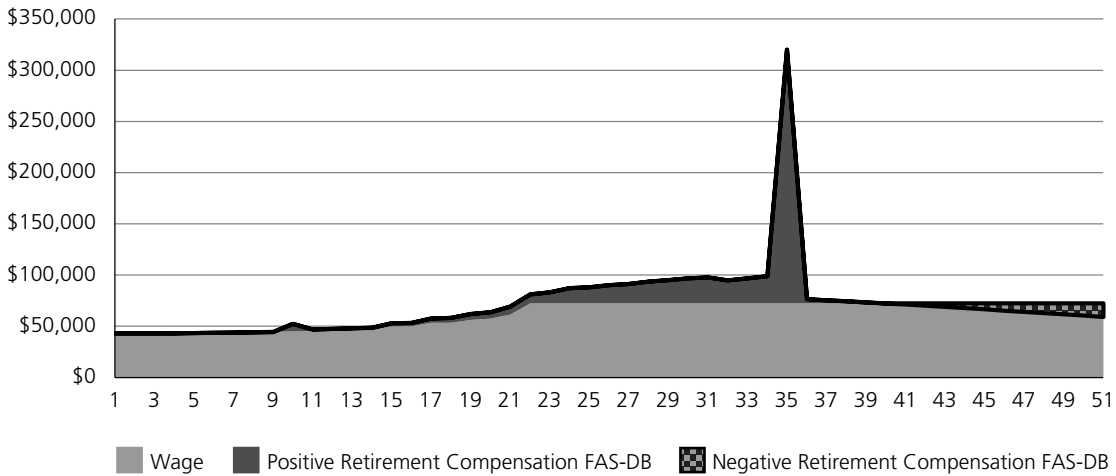
Source: Authors' calculations

Figure 24. Deconstructing Compensation Premium Relative to Novice—Cash Balance, Clark County



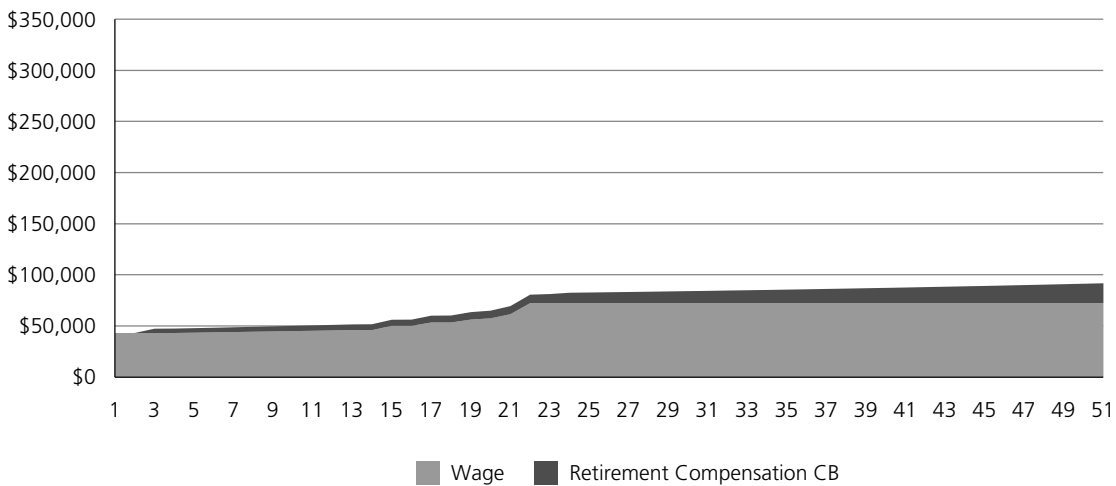
Source: Authors' calculations

Figure 25. Deconstructing Total Compensation—Current System, Dade County



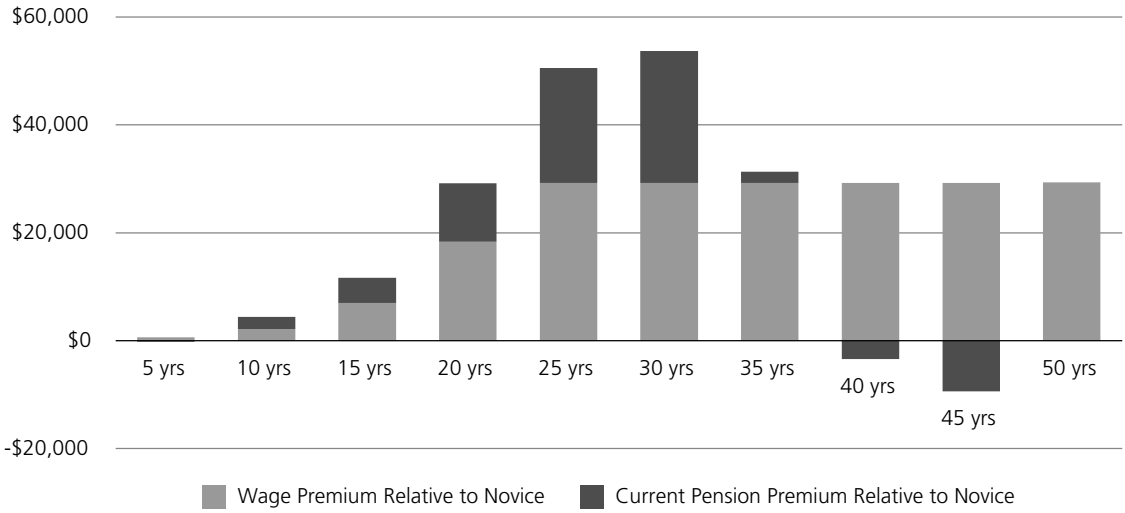
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation. Source: Authors' calculations

Figure 26. Total Compensation Under CB, Dade County



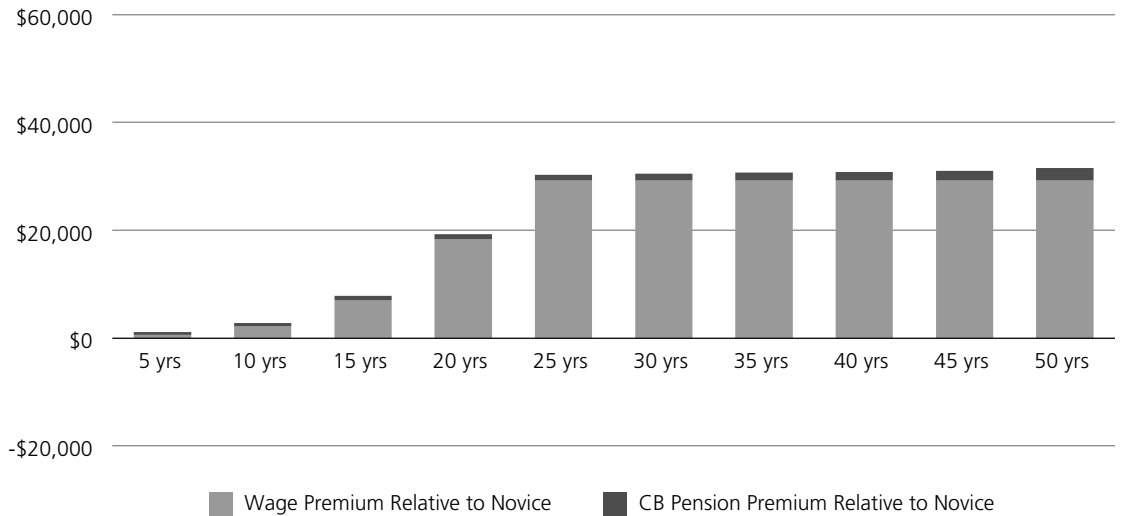
Source: Authors' calculations

Figure 27. Deconstructing Compensation Premium Relative to Novice—Current System, Dade County



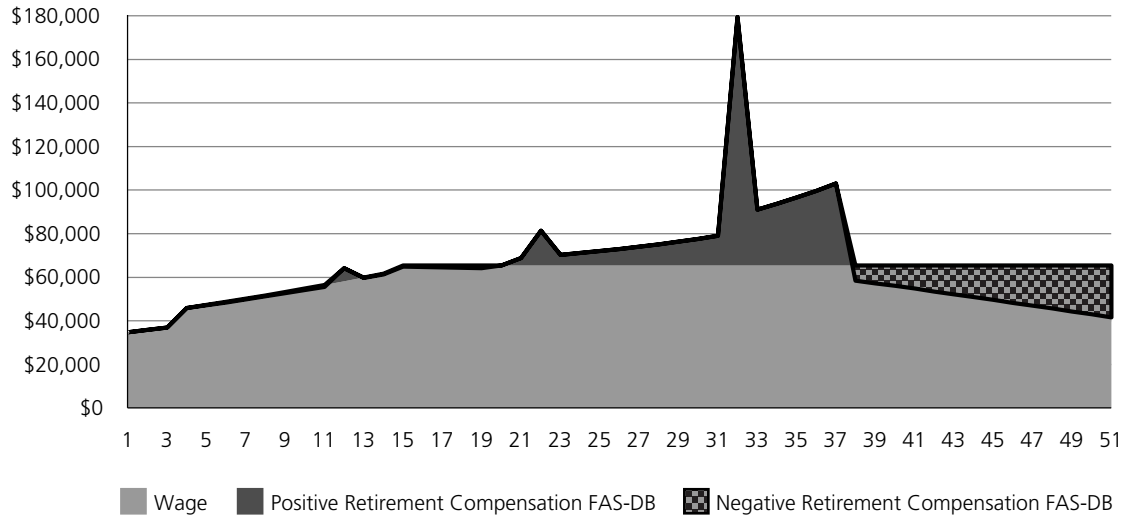
Source: Authors' calculations

Figure 28. Deconstructing Compensation Premium Relative to Novice—Cash Balance, Dade County



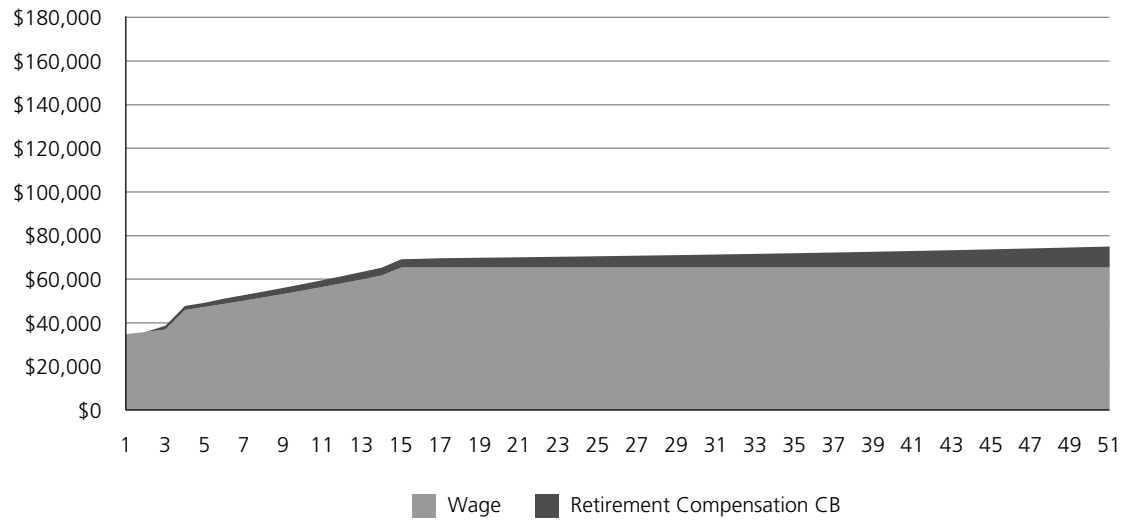
Source: Authors' calculations

Figure 29. Deconstructing Total Compensation—Current System, Hawaii



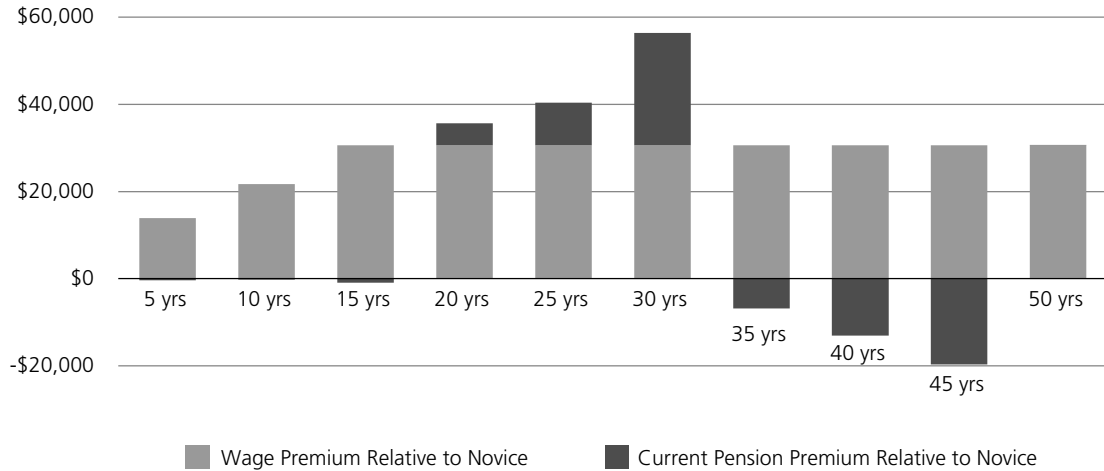
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation. Source: Authors' calculations

Figure 30. Total Compensation Under CB, Hawaii



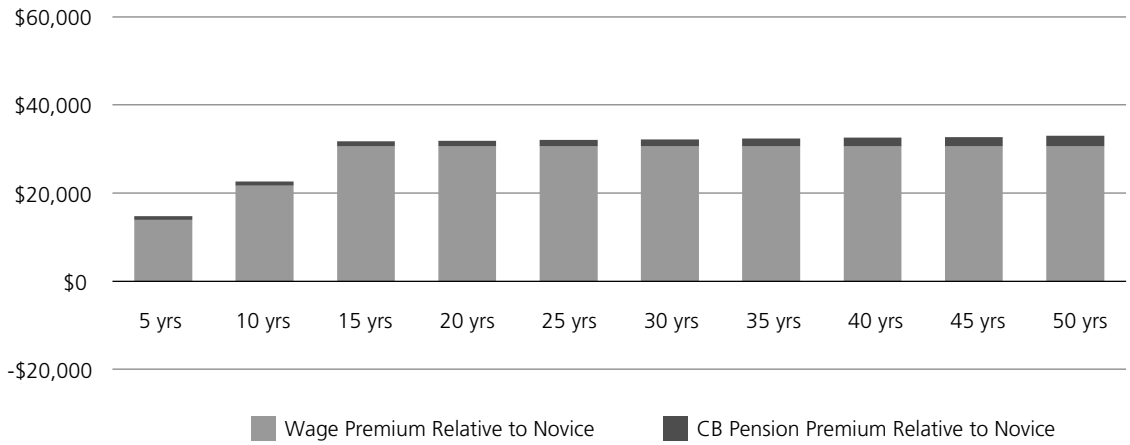
Source: Authors' calculations

Figure 31. Deconstructing Compensation Premium Relative to Novice—Current System, Hawaii



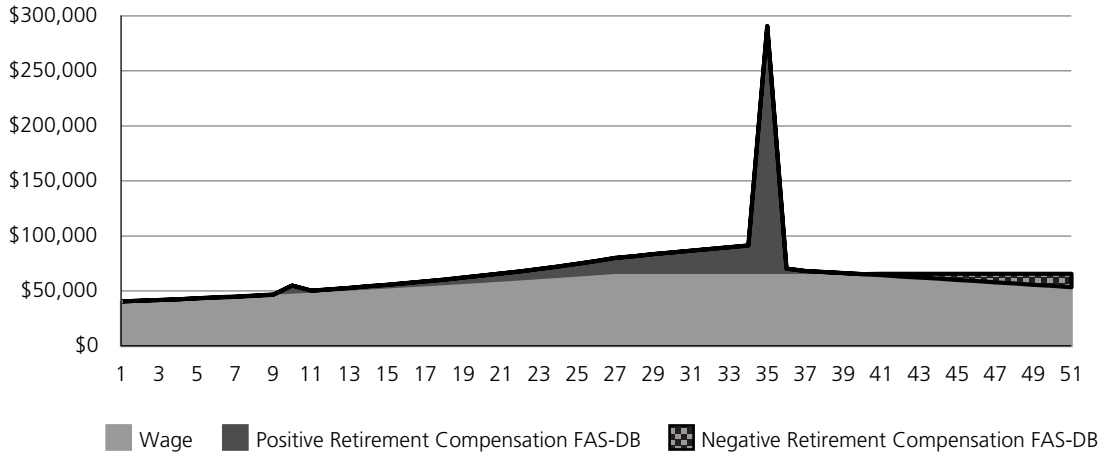
Source: Authors' calculations

Figure 32. Deconstructing Compensation Premium Relative to Novice—Cash Balance, Hawaii



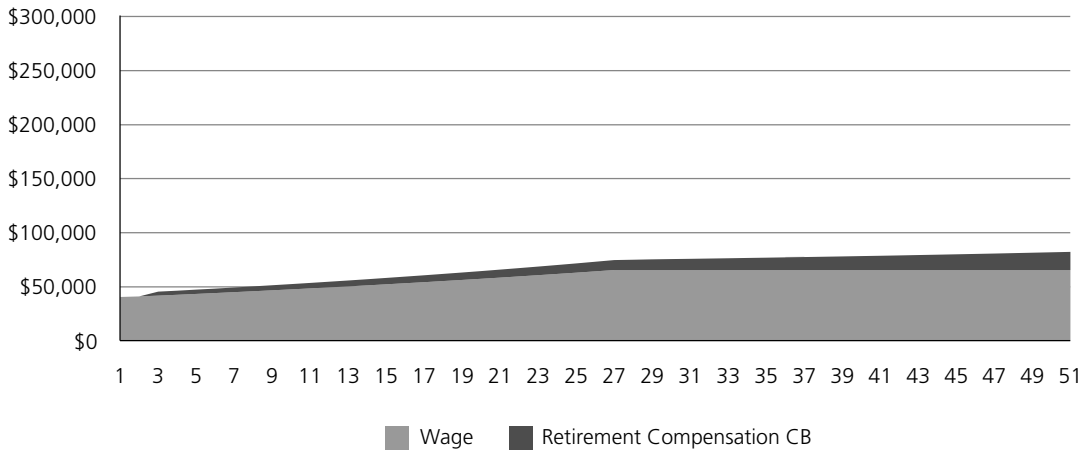
Source: Authors' calculations

Figure 33. Deconstructing Total Compensation—Current System, Hillsborough County



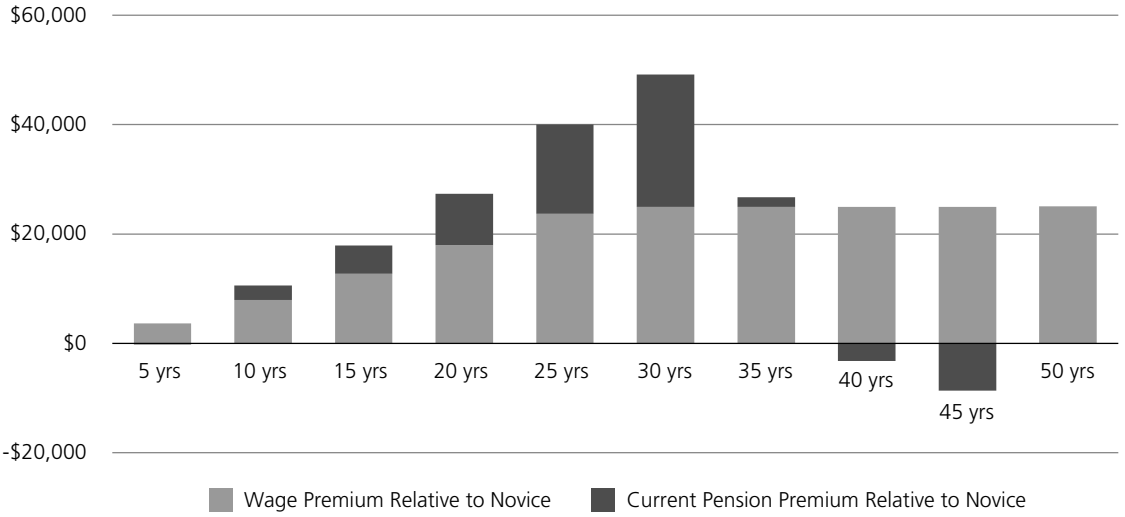
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation.
Source: Authors' calculations

Figure 34. Total Compensation Under CB, Hillsborough County



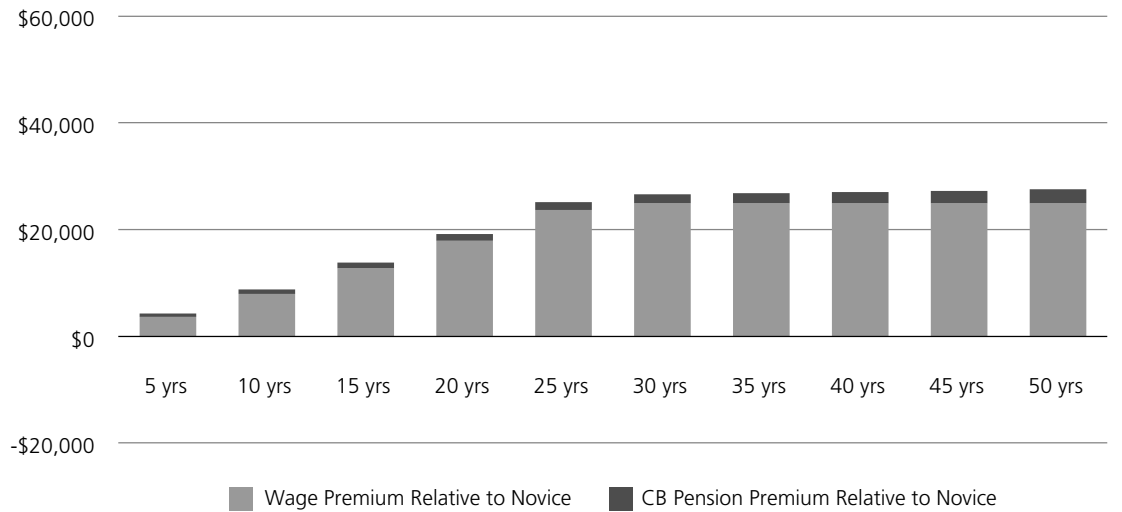
Source: Authors' calculations

**Figure 35. Deconstructing Compensation
Premium Relative to Novice—Current System, Hillsborough County**



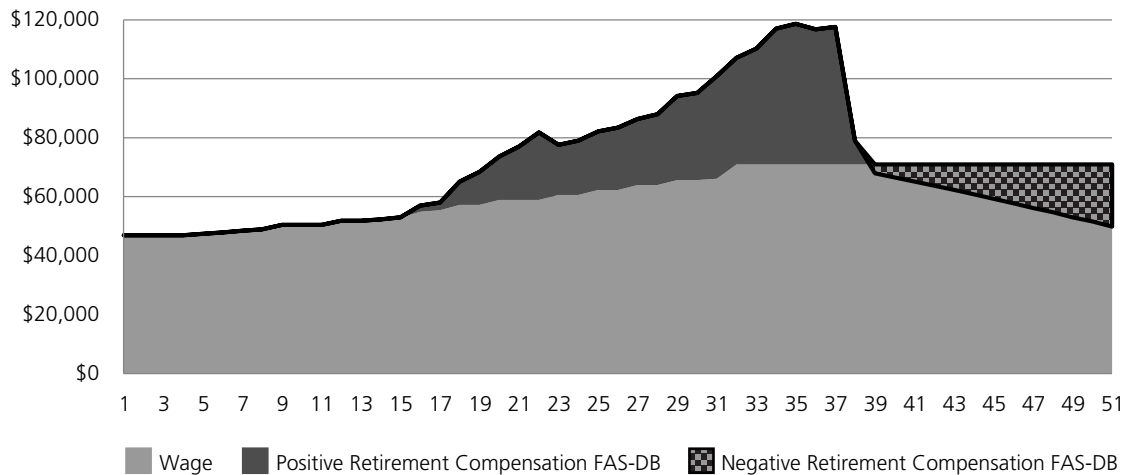
Source: Authors' calculations

**Figure 36. Deconstructing Compensation
Premium Relative to Novice—Cash Balance, Hillsborough County**



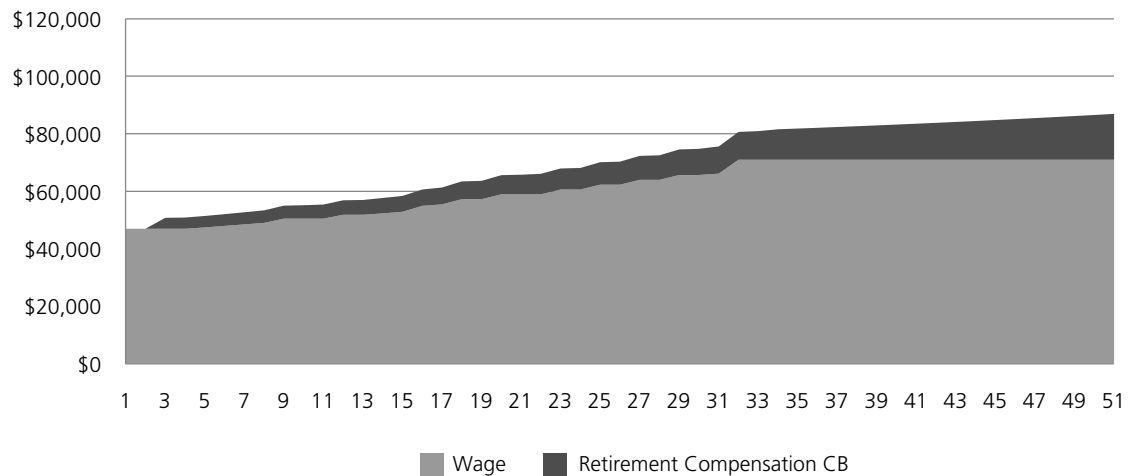
Source: Authors' calculations

Figure 37. Deconstructing Total Compensation—Current System, Houston



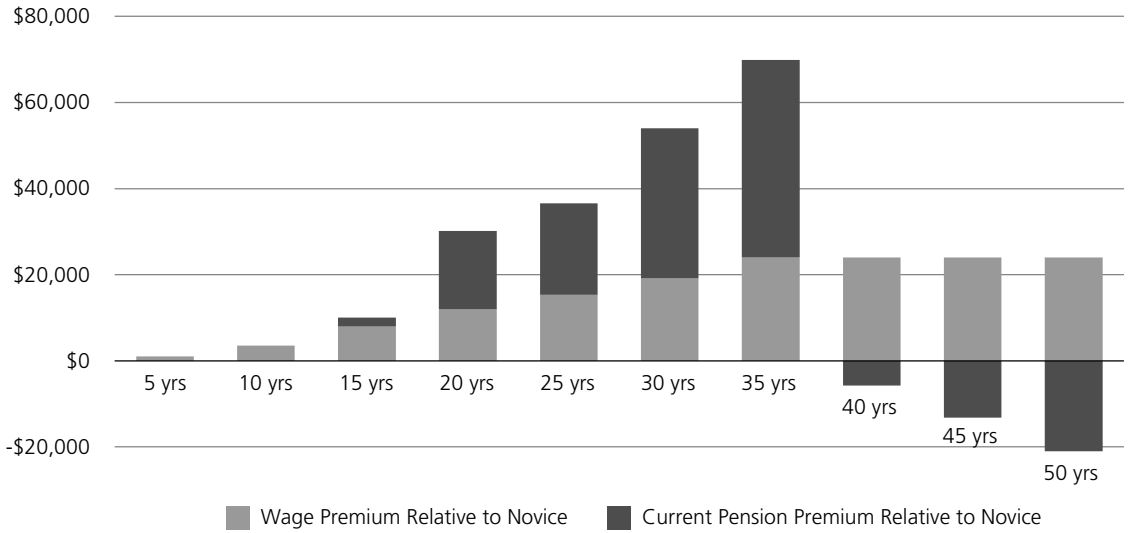
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation. Source: Authors' calculations

Figure 38. Total Compensation Under CB, Houston



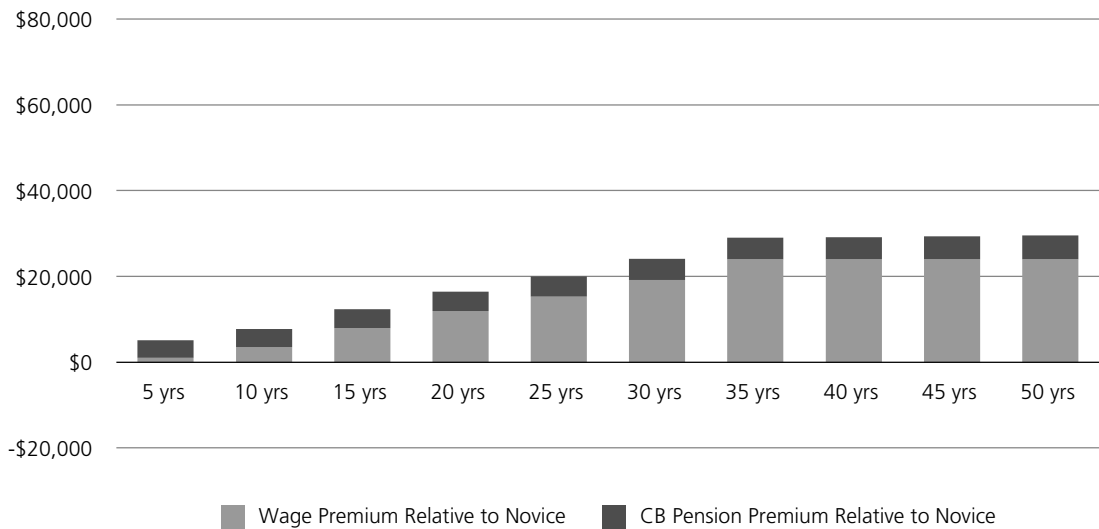
Source: Authors' calculations

Figure 39. Deconstructing Compensation Premium Relative to Novice—Current System, Houston



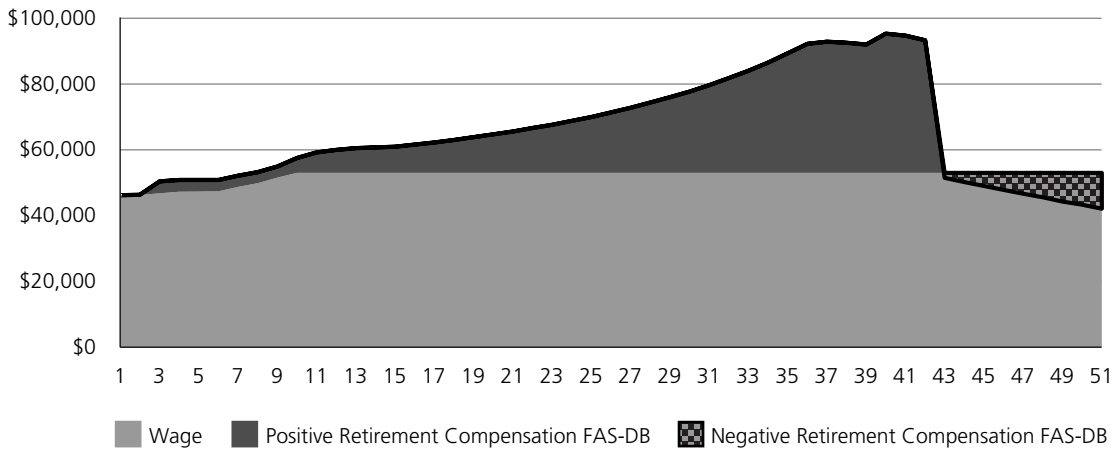
Source: Authors' calculations

Figure 40. Deconstructing Compensation Premium Relative to Novice—Cash Balance, Houston



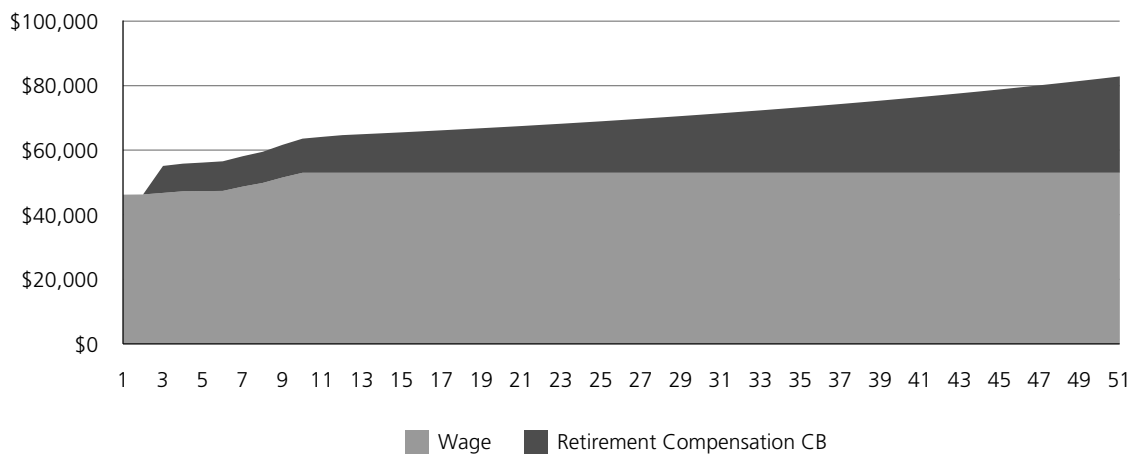
Source: Authors' calculations

Figure 41. Deconstructing Total Compensation—Current System, Los Angeles



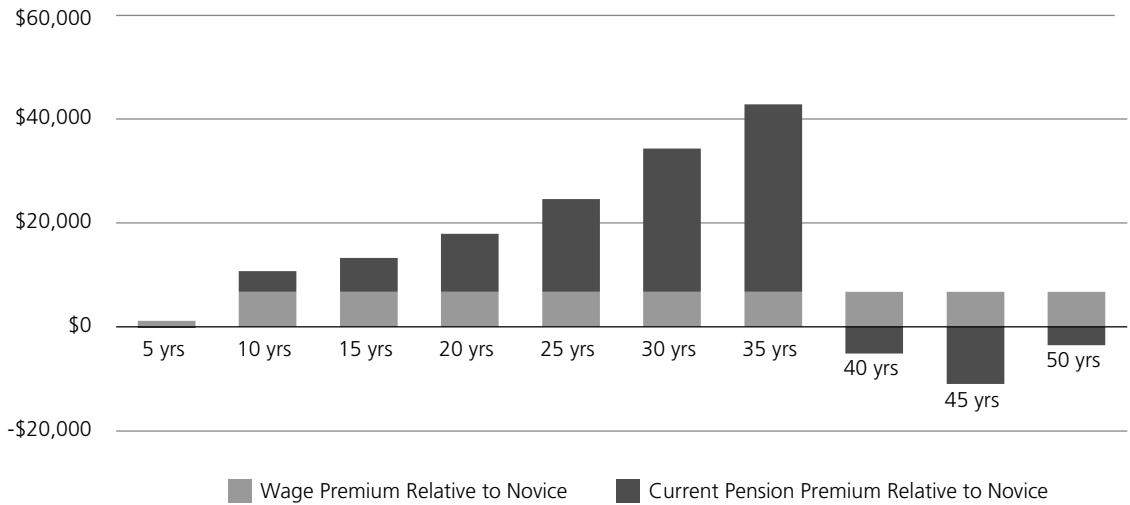
*Figure illustrates independent contribution of wage and present-value of dollars accrued in retirement compensation, during each year of service. The light-gray portion represents wages. The dark-gray portion represents the difference in present-value of retirement wealth from previous year. The checkered area represents the portion where retirement wealth accrual is negative, and thus decreases total compensation. Source: Authors' calculations

Figure 42. Total Compensation Under CB, Los Angeles



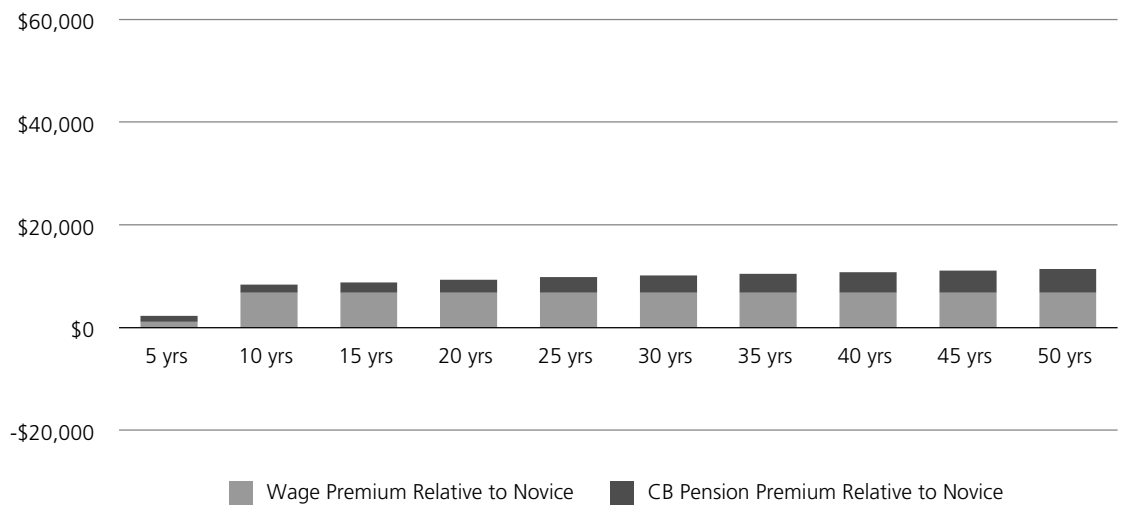
Source: Authors' calculations

Figure 43. Deconstructing Compensation Premium Relative to Novice—Current System, Los Angeles



Source: Authors' calculations

Figure 44. Deconstructing Compensation Premium Relative to Novice—Cash Balance, Los Angeles



Source: Authors' calculations

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ENDNOTES

1. Defined benefit coverage taken from the Bureau of Labor Statistics National Compensation Survey, March 2014, <http://www.bls.gov/ncs/ebs/benefits/2014/ownership/govt/table02a.htm>.
2. See <http://schools.nyc.gov/Offices/DHR/TeacherPrincipalSchoolProfessionals/Salary/Salary+Step+and+Differentia+I+Schedules.htm>.
3. See <http://webgui.phila.k12.pa.us/offices/e/ee/information-center/offices/e/ee/resources/information-center/salary-schedule2>.
4. Though not shown in Figure 2, teachers' salaries can also increase by earning additional degrees.
5. To obtain teachers' salaries, the paper uses the master's degree lane from the relevant district's teacher salary schedule.
6. The methods used here follow Costrell and Podgursky (2008), Costrell and McGee (2010), and McGee and Winters (2014).
7. For all present-value calculations, the paper uses a nominal interest rate of 5 percent and an inflation rate of 2.5 percent. The paper uses mortality tables dictated for use under ERISA and compiled and updated by the IRS. Specifically, the paper uses the 2013 static mortality table, based on the RP-2000 Mortality Tables Report adjusted for mortality improvement using Projection Scale AA. See <http://www.irs.gov/pub/irs-drop/n-08-85.pdf>.
8. Cumulative employee contributions were accumulated at the same nominal 5 percent interest rate used in present-value calculations.
9. See National Conference of State Legislatures (NCSL) Pension and Retirement State Legislation Database, <http://www.ncsl.org/research/fiscal-policy/pension-legislation-database.aspx>; and National Council on Teacher Quality (NCTQ) report "No One Benefits," http://www.nctq.org/dmsView/No_One_Benefits_Teacher_Pension_Systems_NCTQ_Report.
10. Total compensation also includes health care benefits. However, health care benefits are the same for teachers at any year of service and thus do not affect the compensation premium that a teacher earns.
11. In practice, the CB plan modeled is equivalent to a plan where cumulative retirement compensation equals accumulated employer contributions and interest (in this case, 5 percent).
12. The employer-contribution percentage in this paper's cost-equivalent CB plan equals the normal cost of benefits calculated using the Entry Age Normal method.
13. The separation-probability function, $g()$, is estimated using decrement tables reported by each plan in its plan documents, such as actuarial valuations and comprehensive annual financial reports. Retirement-plan actuaries worry about accurately predicting plan costs—these decrement tables thus represent separation-hazard rates based on historical plan experiences.

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