

MISSOURI CHARTER SCHOOLS
AND TEACHER PENSION PLANS:
How Well Do Existing Pension Plans
Serve Charter and Urban Teachers?

February 2014

Ewing Marion
KAUFFMAN
Foundation

MISSOURI CHARTER SCHOOLS
AND TEACHER PENSION PLANS:
How Well Do Existing Pension Plans
Serve Charter and Urban Teachers?

February 2014

*Note: An erratum to this report was published August 27, 2014.
The initial report was inaccurate in stating that there is not reciprocity
between the Missouri Public School Retirement System (PSRS) and the
Kansas City Public School Retirement System (KC). The correction also
examines rigidities in the transfer agreement that cause educators to face
significant pension penalties in moving districts.*

Cory Koedel
Shawn Ni
Michael Podgursky
P. Brett Xiang

Ewing Marion
KAUFFMAN
Foundation

This report has been prepared for the Ewing Marion Kauffman Foundation. The authors are in the economics department at the University of Missouri-Columbia. The views in this report reflect those of the authors. The usual disclaimers apply.

© 2014 by the Ewing Marion Kauffman Foundation. All rights reserved.

FOREWORD

By Aaron North, vice president of Education, and Dane Stangler, vice president of Research and Policy, Ewing Marion Kauffman Foundation

For decades, education has been a political football. From differing opinions over funding levels and diversity, to arguments over what to teach and how to teach it, education debates are often proxies for ideological disputes. While these arguments still rage, there is an emerging consensus that the central actor in improving educational outcomes is the teacher. And, therefore, the locus of change and reform is the teacher.

To some, this may sound rather obvious: haven't teachers always been central to education? Yes, but ongoing education debates often treat teachers as incidental. With teachers at the center, we can focus on public policies that support the entire system of teaching—from new teacher training to working conditions to ongoing professional development to a facilitative labor market. Organizations across the political spectrum are working on these issues, and all recognize that there is no “one solution” that will address the challenges at once. Each dimension is nuanced and embedded in years of institutional tradition.

The Ewing Marion Kauffman Foundation focuses much of its education work on urban school districts, where the general challenges of American education are especially acute. Urban districts are a crucible of many teacher-related issues. Our experience with the salient characteristics of urban education systems—frequent teacher turnover in the early years, difficulties recruiting teachers and leaders, performance gaps, funding constraints, and so on—led us to identify the teacher labor market as a potential point of change in enhancing support for teachers.

One important dimension of the teacher labor market is pensions; this, too, has sometimes been a source of contention among teachers, administrators, and policymakers. But those arguments (usually concerning money) miss broader points. How do we design teacher pension plans that align with labor market realities and the interests of all teachers? Can alternative designs help address challenges of recruitment and retention, especially for urban districts? These are the questions that Podgursky, Koedel, Ni, and Xiang explore in this paper with respect to Missouri.

It turns out that Missouri is a good place to examine these questions because of its tripartite educator retirement system. Uniquely, the state has three separate pension systems: the Kansas City Public School Retirement System (KC), the Public School Retirement System of the City of Saint Louis (STL), and the Missouri Public School Retirement System (PSRS). The KC and STL retirement systems cover employees of district and charter schools only in the two respective city school districts. The statewide system, PSRS, covers everyone else.

Because of this fragmented structure, with the two urban districts carved out separately, Missouri is a microcosm of larger national issues concerning teacher pension systems—particularly the ability of teachers to move between systems. A well-

functioning labor market improves the “match quality” between teachers and schools, which helps teachers be more effective and improves school quality. But, a well-functioning labor market also requires, among other things, transportability and reciprocity, which are absent between the three Missouri systems. This and other features of the urban district pension systems are burdens on teachers and schools.

The inability to move without a pension penalty among the systems exacerbates the challenges already facing the KC and STL urban districts. For example, state data show that, within eight years of starting employment in either the KC or STL systems, between 80 percent and 90 percent of teachers have left the systems. Only a small fraction of teachers make up the “pension wealth mountain” that the authors describe. The urban districts also face pension-related challenges in recruiting school leaders. The rising share of charter schools in KC and STL (now between 30 percent and 40 percent of educators) underscores the importance of exploring issues related to pension systems and ways to design systems that ensure retirement security for teachers and buttress the ability of urban districts to recruit and retain teachers and leaders.

At the heart of this research paper and the Kauffman Foundation’s support for it is the question regarding how well Missouri’s system of retirement plans serves the educators working within those plans. We also are interested to know if there are ways those plans, or different plans, could serve as a more effective tool to recruit and retain teachers in the state’s two urban centers.

Teachers deserve supports that make the fruits of their labors as secure and robust as possible, while also allowing them to work in different locations without fear of losing benefits for which they have worked so diligently. Students deserve the best possible education professionals in their schools, and we hope this research provides insight into ways Missouri can better make that possible.

MISSOURI CHARTER SCHOOLS AND TEACHER PENSION PLANS: How Well Do Existing Pension Plans Serve Charter and Urban Teachers?

EXECUTIVE SUMMARY

This report examines teacher pension plans in Missouri, with a particular focus on the Kansas City and Saint Louis school districts. Missouri is unusual in that public educators are divided among three pension systems: the Kansas City Public School Retirement System (KC), which covers 3 percent of Missouri teachers; the Public School Retirement System of the City of St. Louis (STL), which covers 4 percent; and the state Public Service Retirement System (PSRS), which covers the remaining 93 percent of teachers. Kansas City and Saint Louis teachers are enrolled in Social Security, while teachers in the larger state system are not. There is no reciprocity between the systems, which means that teachers lose employer contributions if they change systems. Costs have risen sharply over the last decade in the STL and PSRS plans. They will begin rising in the KC plan in 2014. Other notable features of the pension landscape for public educators in Missouri include:

- The strong back-loading of benefits in all three pension plans. Educators who teach for less than a full career suffer disproportionately large losses in pension wealth because they exit prior to becoming eligible for retirement benefits.
- The “pull” and “push” incentives typical of final-average-salary defined benefit pension plans are present in all three Missouri pension plans. Strong retention incentives for mid-career teachers (“pull”) are followed by similarly strong “push” incentives that induce teachers to retire at relatively early ages.
- The charter sector in both city districts has grown rapidly in the past decade. Charters schools now account for 41 percent and 30 percent, respectively, of teacher employment in KC and STL. Charter schools are currently not represented on the pension board in either city district.
- The long-term retention rates for new cohorts of teachers in KC and STL, whether employed at charter schools or not, are low. This means that very few of these teachers remain in their pension plans long enough to collect full benefits. Retention rates in both cities are far below retention rates for PSRS teachers.
- In addition to the general problems associated with using a heavily back-loaded pension structure to compensate teachers in high-attrition environments, urban schools (both charter and traditional) in Missouri also are disadvantaged in recruiting mid-career teachers or school leaders from neighboring districts because of the lack of reciprocity between the city plans and PSRS.

For these reasons, we find that the maintenance of separate pension plans for Kansas City and Saint Louis teachers represents a costly barrier to school improvement that needlessly balkanizes the market for educators in the two metropolitan areas. A reform agenda for the pension plans should include the following elements:

- Increased transparency in all plans. This would include “what if” projections of future costs under alternative economic scenarios. It also would include greater transparency regarding contributions versus benefits for educators with different spells of employment in the three plans.
- Given the increasing charter-school presence in Kansas City and Saint Louis, charter schools should be represented on both the KC and STL pension boards.
- Data on school and teacher quality should be linked to pension data at the state and district levels. This would produce greater transparency regarding how resources are distributed to schools through the pension plans and allow for evaluations of the school staffing effects of various pension plan characteristics.
- Alternative plans for new teachers that would be less expensive and provide mobile retirement benefits should be considered, particularly in the city districts. Benefit mobility can be increased by reducing the back-loading of benefits. Switching plans would entail closing the current plans to new members.
- Charter schools in PSRS districts should be allowed to partially or totally opt out of PSRS if they have an adequate retirement plan in place that provides mobile benefits. All new teachers in PSRS districts should participate in Social Security, which offers a basic and transparent mobile retirement benefit.

INTRODUCTION

Researchers consistently have identified teacher quality as one of the most important determinants of student success in schools. A recent summary of research on teacher effectiveness finds that the learning growth of a typical student in the classroom of a seventy-fifth-percentile teacher will exceed that of a similar student with a twenty-fifth-percentile teacher by one half of a school year.¹ This effect size is on par with the effect of a ten-student reduction in class size, and is large relative to race- and income-based achievement gaps. A recent long-term study of several million New York City students demonstrates that exposure to high-quality teachers in K-12 schools has effects on matriculation to college, early-career labor market earnings, teen pregnancy, and related consequential outcomes (Chetty et al., 2011).

The crucial role that teacher quality plays in determining student achievement elevates the importance of effective compensation and human resource policies in public schools. States and districts have launched experiments in performance pay and other compensation reforms designed to improve teacher performance, attract and retain the best teachers, and put teachers where they are needed most. Some of these reforms have been stimulated U.S. Department of Education grants from programs such as Race to the Top and the Teacher Incentive Fund (TIF). Locally, the Kansas City School District and Hogan Preparatory Academy were awarded five-year TIF grants in 2010 to incorporate teacher performance into current compensation structures.²

However, one part of teacher compensation—retirement benefits—has received very little attention. Direct consideration of retirement benefits is important for two reasons. First, the costs of providing retirement benefits for public school teachers represent a large and growing share of total payroll costs. Second, research shows that the retirement timing of teachers is highly responsive to their pension incentives, which suggests that the pension incentive structure may play an important role in influencing the quality of late-career teachers.³

Figure 1 documents the total costs of retirement benefits for educators in 2014 as a percent of teacher salaries for the three Missouri teacher plans: KC, STL, and PSRS. Costs are first divided between the system and Social Security (PSRS teachers are not covered by Social Security), with system costs further divided by employer and worker contributions.⁴ The costs are substantial in all three systems. For example, the figure

¹ The reported percentiles are for the distribution of teacher quality, for which available estimates are summarized by Hanushek and Rivkin (2010). We apply their numbers to MAP statistics to arrive at the estimated years of learning growth in Missouri associated with the change in teacher quality (see also Aaronson et al., 2007; Koedel and Betts, 2011; Nye et al., 2004; Rivkin et al., 2005; and Rockoff, 2004).

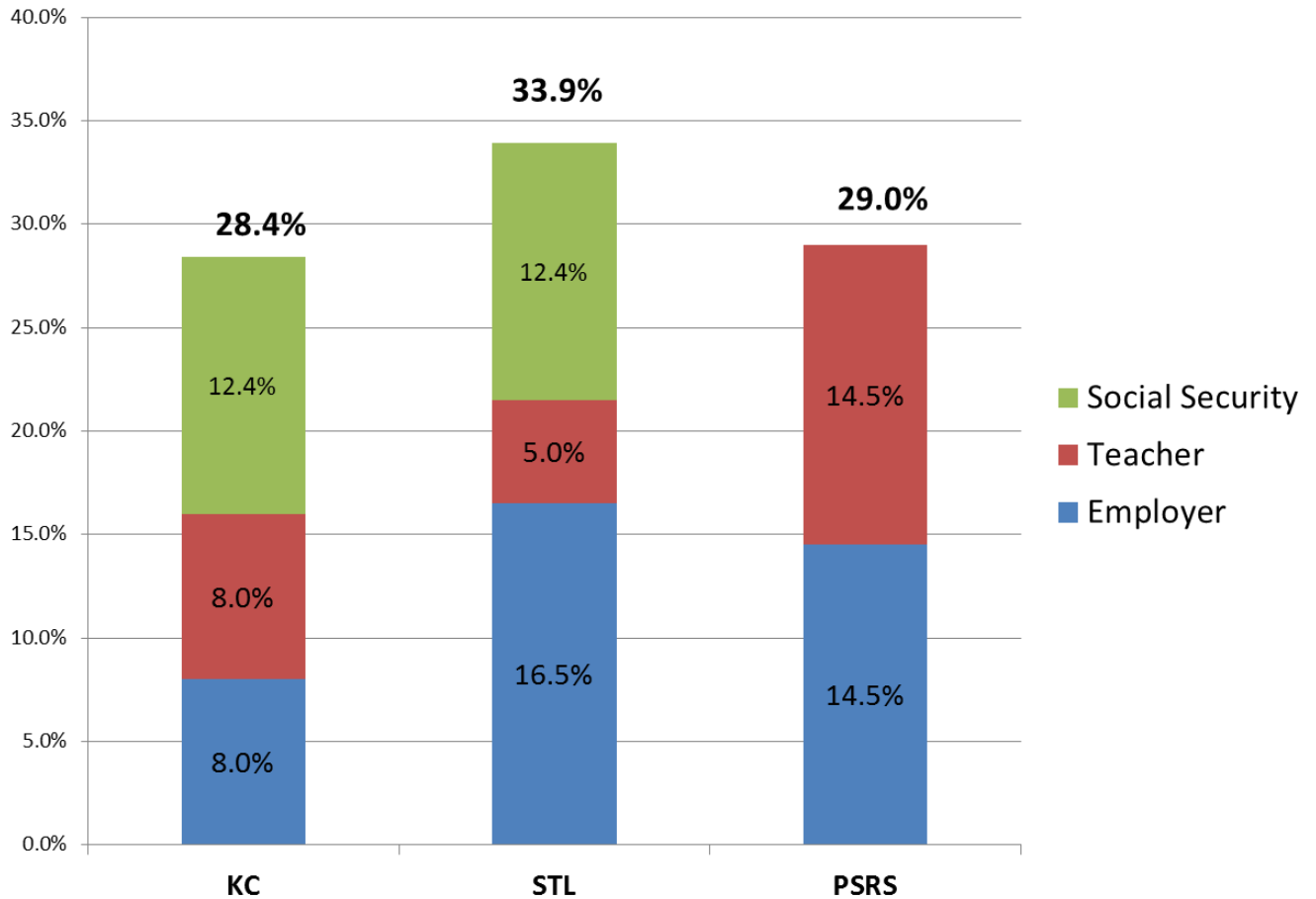
² <http://cecr.ed.gov/TIFgrantees/granteeProfiles/>

³ For evidence on teacher responses to their retirement incentives, see Brown (2009), Costrell and McGee (2010), and Friedberg and Turner (2010). Fitzpatrick and Lovenheim (2013) and Koedel, Podgursky, and Shi (2013) examine the link between pension incentives and teacher quality. The latter article provides a general discussion of the possible mechanisms by which the pension incentive structure may affect teacher quality, some of which have yet to be empirically tested.

⁴ The combined employee and employer contribution for Social Security (FICA) is 12.4 percent of salaries. These calculations do not include Medicare contributions.

shows that in KC, STL, and PSRS, the employer contribution rate to fund teacher pension benefits is 8.0 percent, 16.5 percent, and 14.5 percent of teacher salaries, respectively. In KC and STL, employers also make Social Security payments on behalf of teachers.⁵

Figure 1. Current Pension Contribution Rates in the Three Missouri Teacher Pensions Plans



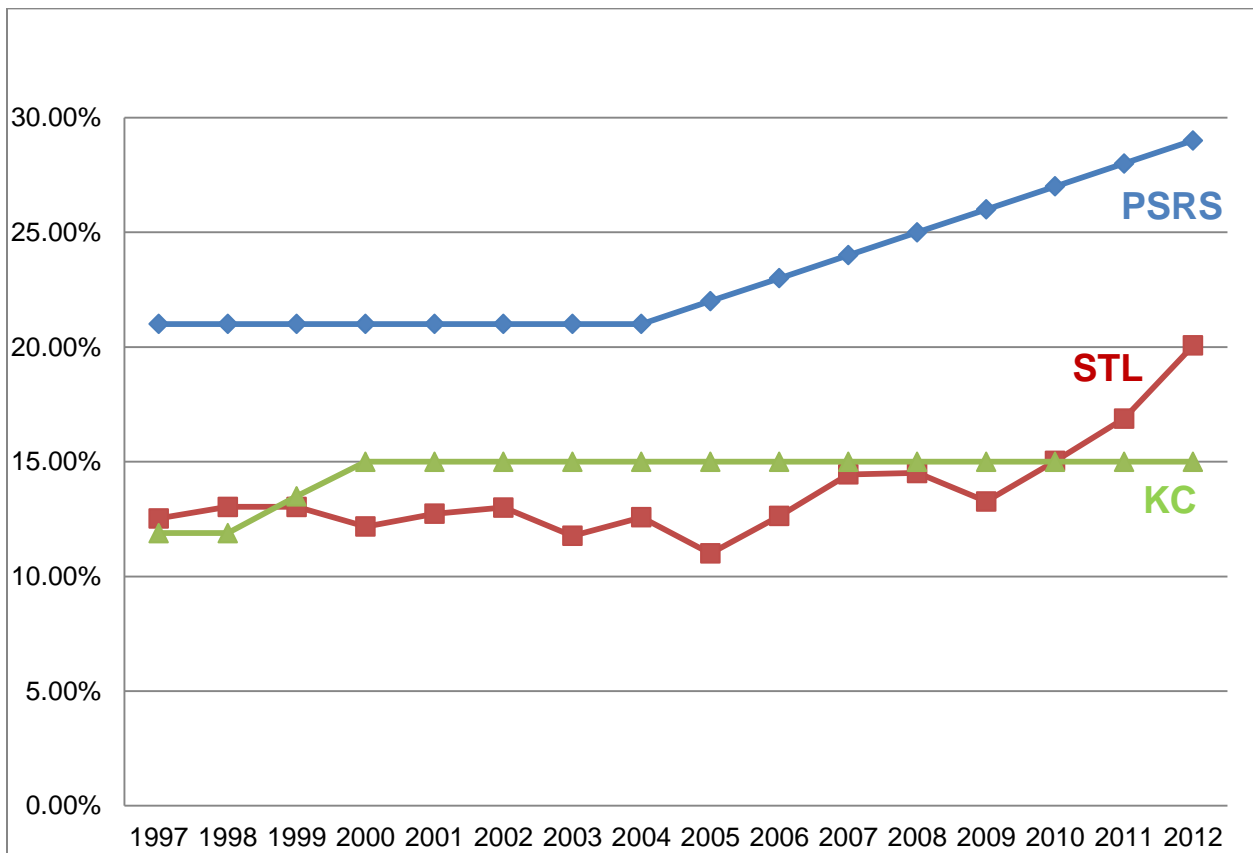
Source: Annual Reports of Pension Plans.

Figure 2 shows that costs have risen sharply over the last decade in PSRS and STL. Due to recent legislative changes, they will start rising in Kansas City in 2014, as well. The increasing costs of retirement benefits for Missouri teachers are consistent with the national trend. Data from the U.S. Department of Labor show that employer costs for teacher pension benefits have risen sharply over the last decade—from 10.5 percent of salaries in 2004 to 17.1 percent today, as illustrated in Figure 3. By contrast, employer

⁵ The KC and STL plans analyzed in this report apply to all employees in the public schools in these two districts. Membership in both plans primarily consists of public school employees. In KC, public library employees are covered, as well. In STL, some older employees of Harris-Stowe State University are included. The state PSRS plan covers the professional staff in public schools holding teaching certificates. Non-professional staff members are in a different, less-generous plan and are covered by Social Security.

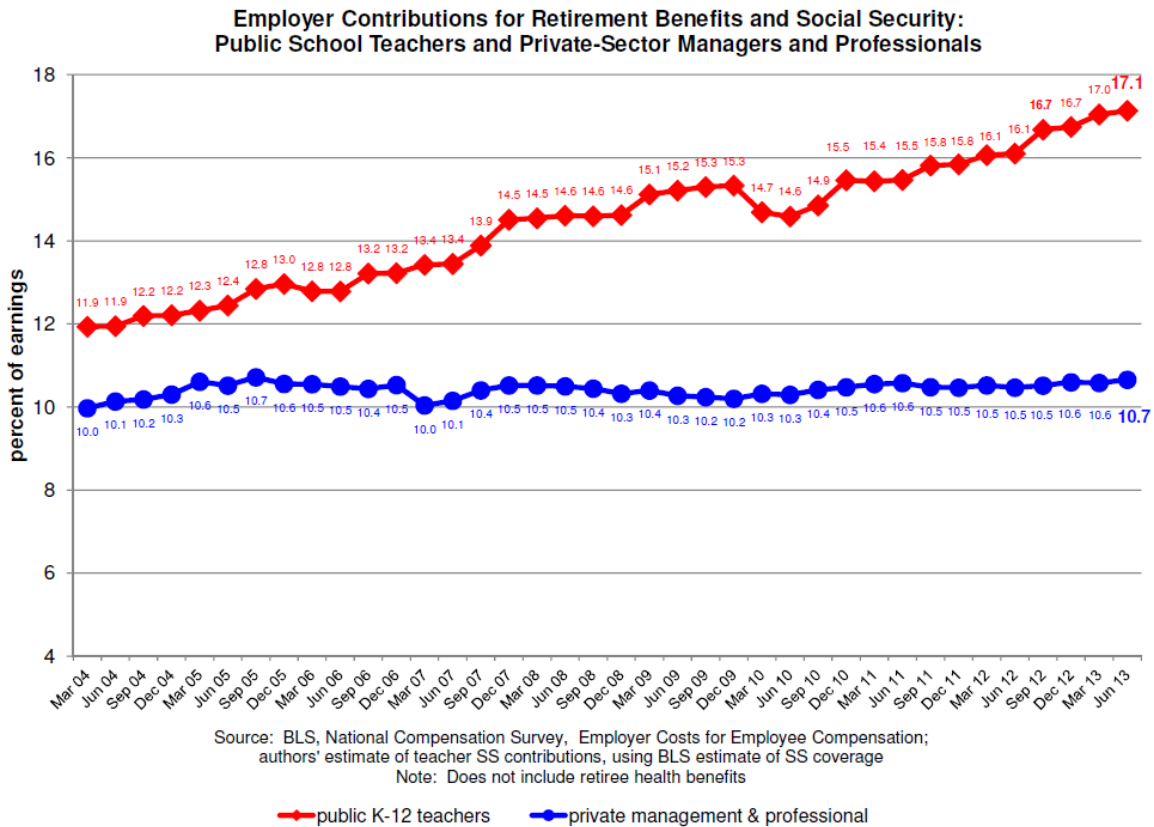
retirement-benefit costs for private-sector professionals over the same time period have been nearly flat at about 10.5 percent of salaries. Figure 3 does not include worker contributions, nor does it include retiree health insurance costs, which are substantial in the education sector, given that most teachers retire prior to becoming eligible for Medicare (typically at age sixty-five).

Figure 2. Trends in Missouri Teacher Pension Contribution Rates



Source: Annual reports of pension plans. Unpublished statistics provided by plan administrators.

Figure 3.



Source: Costrell and Podgursky (2009), updated at: <http://www.uaedreform.org/wp-content/uploads/2000/01/Employer-contribution-chart.pdf>.

The primary driver of these rising costs is the large, unfunded liabilities of the pension plans. The annual contribution rates for employers have two parts. The first is a payment to cover the accrual of future benefits for current teachers over the course of the year (“normal costs”). The second is a payment to pay down previously accrued unfunded liabilities. Pension fund assets were negatively shocked in 2008. It is also the case that the generosity of most teacher pension plans nationally, including the three Missouri plans, increased substantially during the 1990s, which increased long-term liabilities (Koedel et al., forthcoming).⁶ Both of these factors have contributed to present-day unfunded liabilities in the Missouri plans.

⁶ According to the most recent available actuarial reports, the unfunded actuarial liabilities (UAL) of the three plans are: KC (\$132m), Saint Louis (\$122m), and PSRS (\$6.6b). The increase in contribution rates reflects a policy designed to pay down or amortize these costs over thirty years in line with Government Accounting Standard Board (GASB) recommendations. UAL estimates are taken from valuation studies and annual reports on the websites of the three systems.

The fundamental question that must be asked is whether the funds devoted to support educator pension plans represent the best use of public resources targeted to educate children. With this question in mind, we examine how the pension plans operate. We first show how pension wealth accrues over a teacher work life, illustrating the powerful “pull” and “push” incentives for teacher retention and then retirement. Next, we document the actual retention and turnover behavior of charter and non-charter teachers in the two urban districts, along with teachers in the rest of the state, and compute estimates of the expected pension returns for variously situated teachers. We then discuss the large mobility penalties that arise for teachers and school administrators who cross one of the pension boundaries in the middle of a career. We conclude by considering options for policymakers.

HOW TEACHER PENSION PLANS WORK

Nearly all traditional public school teachers belong to a state or municipal teacher pension plan. In sixteen states, charter schools can opt out of the public pension plans, and many do (Olberg and Podgursky, 2010). However, in Missouri, charter as well as traditional public school teachers must participate in the public plans. The teacher pension landscape in Missouri is more complicated than in most other states because of the three pension systems and the lack of reciprocity between them. The KC system covers 3 percent of Missouri teachers, the STL system covers 4 percent, and PSRS covers the remaining 93 percent. As noted above, KC and STL teachers also are enrolled in Social Security, whereas PSRS teachers are not. The benefit formulas for the city plans are less generous than the PSRS benefit formula is because of the Social Security difference.⁷

All of the Missouri plans, and most teacher plans nationally, are *final-average-salary defined benefit plans*. There are two parts to this definition. First, the “defined benefit” (DB) part means that workers receive an employer-guaranteed pension payment (annuity) upon retirement, based on their earnings over some part of the career. For example, Social Security is a DB plan.

Next, the “final-average-salary” part of the definition relates to the segment of the career over which the annuity payment depends on earnings. The Social Security Administration uses a formula based on an individual’s thirty-five-year earnings history to determine the retirement annuity. By contrast, teacher pension plans base the retirement annuity on the average of just the highest several years of earnings. In PSRS and STL, the final-average-salary calculation depends on the highest three years of earnings; in KC it depends on the highest four years.

⁷ The pension plans in Saint Louis and Kansas City cover all public school employees (e.g., teachers and classified staff such as janitors and secretaries). PSRS, by contrast, only covers certified staff (e.g., teachers, counselors, and administrators). Classified staff are in a separate plan (PEERS) and also are covered by Social Security.

Teacher pension plans use a formula of the following form to determine the retirement annuity:

$$A = F \times YOS \times FAS$$

In the equation, *A* represents the annual benefit at retirement, *F* is a formula factor, which ranges between 2 percent and 2.55 percent in the Missouri plans, *YOS* indicates years of service in the system, and *FAS* is the teacher's final average salary calculated as the average of the highest few years of earnings. In many plans, the annuity payments are increased over time using cost of living adjustments (COLAs), which are meant to maintain the annuity's spending power in the face of inflation. In PSRS, there are automatic COLA increases. In KC and STL, COLA increases are *ad hoc* and depend on the fiscal situation of the fund.

Table 1 describes the key parameters of the three Missouri systems. Returning to the equation above, we see that the formula factor (*F*) is 2 percent in the KC and STL plans. Thus, a teacher who works thirty years in either plan will collect an annuity equal to 60 percent of his or her final average salary. The formula factor in PSRS is a bit more complicated. It is 2.5 percent on all years up to and including thirty. Thus, a teacher who works thirty years would collect an annuity equal to 75 percent of earnings. However, a teacher who works thirty-one or more years has a formula factor of 2.55 percent applied to all service years.⁸

Table 1. Key Plan Parameters of the Three Missouri Teacher Pension Plans

	KC	Missouri PSRS	STL
Number of Teachers	1896	64124	2778
Share of MO Teachers (%)	2.7%	93.4%	3.9%
In Social Security	Yes	No	Yes
Vesting (years)	5	5	5
Retirement Eligibility	60/5, Rule of 75	60/5, any/30, Rule of 80	65/5, Rule of 85
Contribution Rates	Teacher 7.5%, District 7.5%	Teacher 14.5%, District 14.5%	Teacher 5.0%, District 16.5%
Formula Factor	2.00%	2.5% 1-30 yrs., 2.55% 31+ yrs.	2.00%
Annuity Cap (% of FAS)	60%	100%	60%
Early Retirement	55/5	55/5, any/25	60/5
COLA	ad hoc	CPI, compounded, up to 80%	ad hoc

Source: Annual pension plan reports. Number and percent of Missouri teachers in each plan (2012–13 school year) computed separately by authors using DESE administrative data.

⁸ This creates a strong incentive for teachers to work a thirty-first year and then retire. A teacher who has worked thirty years will see a jump in her annuity of 4.05 percent if she works for the thirty-first year. This is because the teacher will get 2.55 percent on the thirty-first year and .05 percent on years one to thirty. Thus, the marginal return from additional years of work is: year twenty-nine = 2.5 percent, year thirty = 2.5 percent, year thirty-one = 4.05 percent, year thirty-two = 2.55 percent, etc. Teachers have been responsive to this incentive and other incentives in these plans. See Ni, Podgursky, and Ehlert (2009).

A key feature of any retirement plan is retirement eligibility. Once a teacher becomes eligible for retirement, he or she can begin collecting pension benefits. Eligibility is based on some combination of age and/or years of system service. The eligibility rules are important in assessing the generosity of a plan. There is a very big difference in total benefits between a plan that pays \$50,000 annually starting at age sixty-five versus one that makes the same payment starting at age fifty-five.

In Kansas City, for example, a teacher can collect a full pension if she meets one of three conditions: (1) she has thirty years of service, (2) she has reached age sixty with at least five years of service, or (3) the summation of her age and service years meets or exceeds seventy-five – i.e., the “Rule of 75.” PSRS and STL have the analogous “Rule of 80” and “Rule of 85,” respectively. Many states also have rules that permit teachers to retire with reduced benefits at younger ages or with fewer service years. All three Missouri plans have such options.

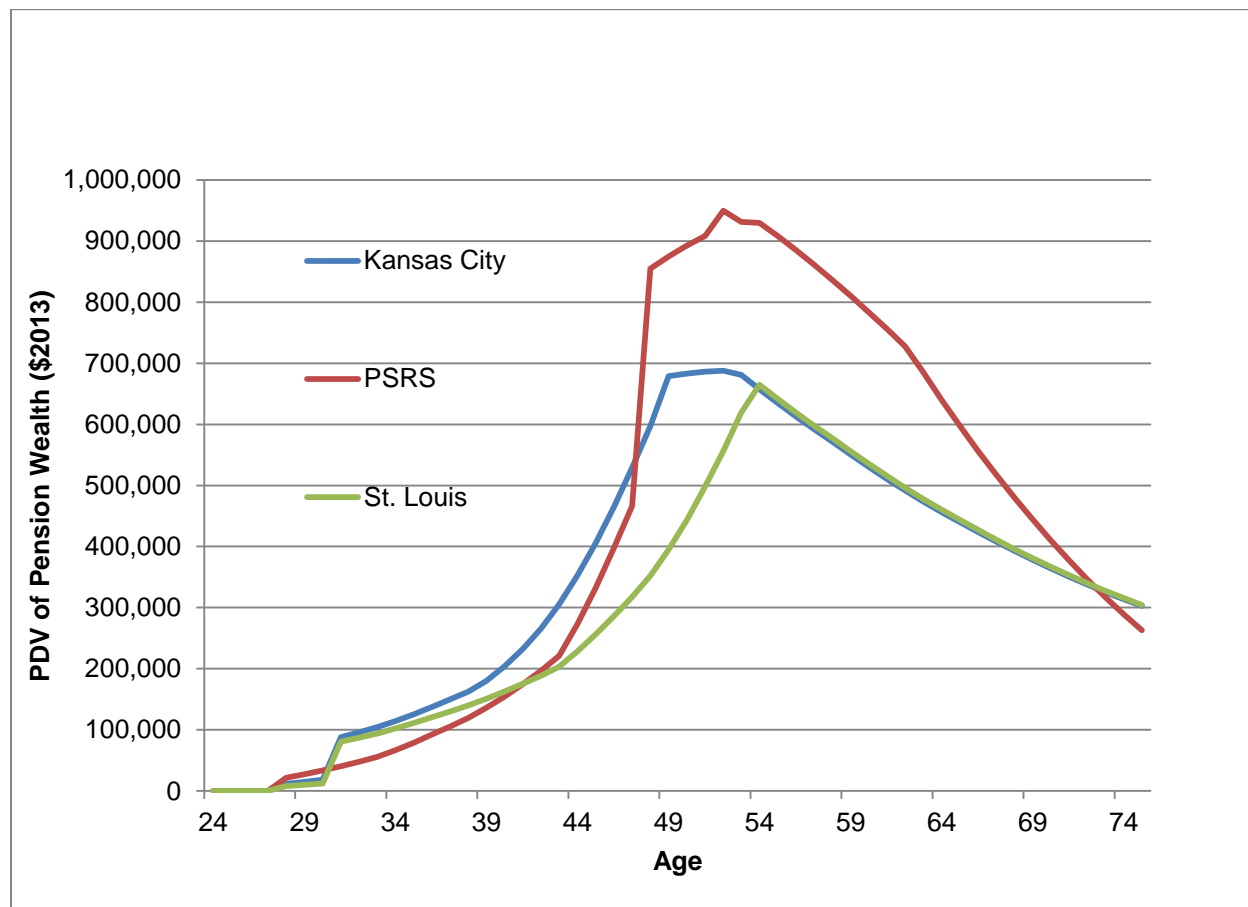
Teachers typically are not vested in their pension plans immediately. Rather, it takes three to five years for pension eligibility (“vesting”), although Doherty et al. (2013) report that thirteen states now require ten years of service for new teachers to be vested—up from nine states in 2008. KC, STL, and PSRS require five years of service for vesting.

All of these complicated rules regarding calculation of the annuity, eligibility, vesting, COLA adjustments, and so forth vary from plan to plan and make cross-plan comparisons of benefit generosity difficult. However, tools from the larger financial economics literature allow us to compute comparable measures of the value of retirement benefits as they accrue over a teacher’s work life in different plans. *Pension wealth* is a simple measure of the cash value of a pension at any point in a worker’s career, in *present discounted value* (discounted to a particular point in time). Discounting is an important concept when one considers the value of pension benefits, because benefit collection occurs in the future, and income in the future is less valuable than income today.

Figure 4 shows the evolution of pension-wealth accrual over time for a representative Kansas City teacher who began her career at age 24—the modal age for beginning teachers in the state. Pension-wealth accrual over the career cycle is mapped out for the teacher in each of the three Missouri systems. The figure shows the pension wealth that she would have if she left the pension system at different points in her career in each plan. Note that the KC and STL profiles combine system and Social Security pension wealth.⁹

⁹ The teacher’s earnings profile is based on the 2012–2013 Kansas City salary schedule in the figure. However, the substance of the figure does not depend on reasonable adjustments to the career-cycle earnings profile. The profile is held constant across all three systems to isolate the differences in wealth accrual driven by differences in pension rules.

Figure 4. Pension Wealth Accrual for a Representative Kansas City Teacher in Three Missouri Pension Systems



Source: Author calculations based on Kansas City salary schedule.

Economists describe the payoff structure shown in Figure 4 as *back-loaded*. It reflects the powerful “pull” and “push” incentives that are built into these plans. In the middle years of a teaching career, the plan exerts a strong retention effect because the teacher approaches the steeply rising part of the pension wealth curve. This encourages teachers to stay on the job until they are eligible to collect a pension. Past this retirement date, however, pension wealth declines. This is due to the fact that, if the teacher does not retire, the benefits are lost—put differently, pension benefits cannot be collected while working. Studies show that the highly back-loaded structure of pension-wealth accrual shown in Figure 4 for Missouri is typical of plans in other states and municipalities (Costrell and Podgursky, 2009). Indeed, it is a direct mathematical consequence of the rules that determine pension payments in these plans.

In addition to encouraging retirements within a narrow window of the career cycle, another consequence of pension-wealth back-loading is that it creates severe penalties for mobility, even within teaching. This is because the benefit formula and retirement rules depend on *system* service, not teaching service. Educators who switch plans over

a career will have much less pension wealth than educators who work an entire career in a single plan, all else equal. The harsh penalties for mobility built into these plans have raised concern as the educated labor force, including teachers, has become more mobile over time (Groes, Kircher, and Manovskii, 2010; Kambourov and Manovskii, 2009). We examine the mobility issue in detail in Section IV.

CHARTER AND URBAN SCHOOLS

The Missouri teacher pension plans reward longevity and punish mobility and early exit. Therefore, given that all plan members pay the same fixed percent of salary for membership, the winners in a DB system are teachers who have the greatest longevity and the schools that employ them, while the losers are shorter-spell teachers and the schools that employ them. In this section, we show that the typical new teacher in KC and STL does not benefit from the DB pension structure. This is the case regardless of whether the teacher works in a charter or traditional public school.

Table 2 provides some background information on teacher employment in the Saint Louis and Kansas City school districts, along with the rest of the state (PSRS). As noted earlier, KC and STL teachers account for approximately 7 percent of total teacher employment in Missouri. The table shows that this share has been falling over time. For example, by 2012, teacher employment in KC and STL had fallen to just 73.9 percent and 84.7 percent of 2002 levels, respectively. By contrast, teacher employment in PSRS has grown by 5 percent over the same decade (with a slight dip since 2007). While overall teacher employment declined in STL and KC, the number and share of teachers employed in charter schools has increased sharply. By 2012, charter schools accounted for 41 percent and 30 percent of teacher employment in the KC and STL districts, respectively.

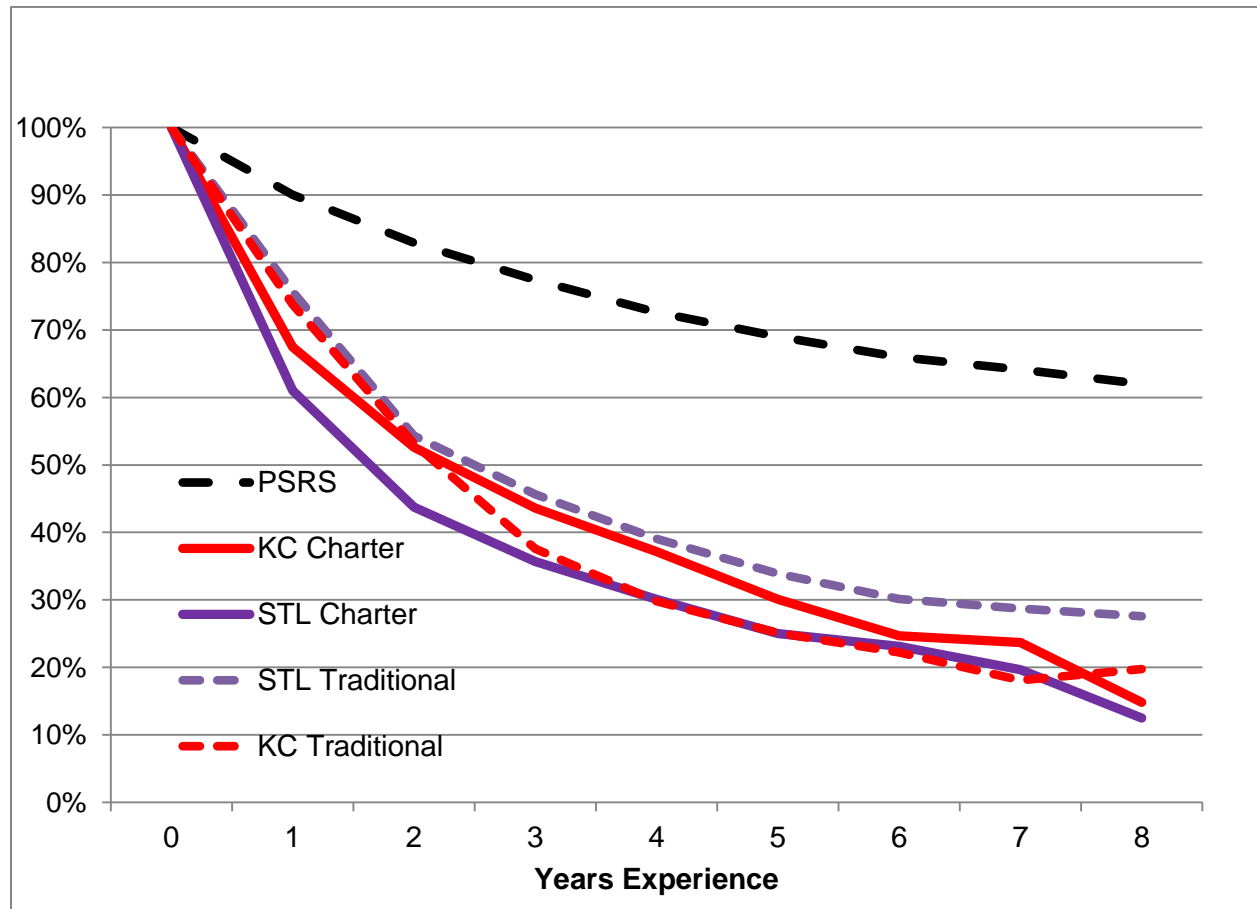
Table 2. Teacher Employment by Year

	2002	2007	2012
KC Traditional	2,213	2,118	1,125
KC Charter	353	445	771
KC Total	2,566	2,563	1,896
Index	100.0	99.9	73.9
Charter Share	13.8%	17.4%	40.7%
STL Traditional	3,155	2,502	1,934
STL Charter	115	282	835
STL Total	3,270	2,784	2,769
Index	100.0	85.1	84.7
Charter Share	3.5%	10.1%	30.2%
PSRS Total	61,008	64,218	64,124
Index	100.0	105.3	105.1

Source: DESE administrative data.

Given the back-loaded pension structure shown in Figure 4, a key factor in determining the expected benefit of such a plan for a prospective new teacher is the likelihood that she will get to the peak of the pension-wealth “mountain.” Available data suggest that, for teachers in KC and STL, getting to the mountain is unlikely. Figure 5 reports survival rates over the first eight years of employment for new cohorts of teachers between Fall 2005 and Fall 2012.¹⁰ Note that these are survival rates in the retirement plans, which are the relevant rates for examining pension benefits per the preceding discussion. The upper dashed line is the survival rate for PSRS. After eight years, roughly 70 percent of teachers remain on the job. The eight-year survival rates in STL and KC are far lower, ranging from 10 percent to 30 percent. Our first observation, then, is that the DB pension plans do not seem well suited for either charter or traditional public school teachers in the urban districts in Missouri.

Figure 5. Retention of New Teachers: Cohorts of New Teachers Hired 2005–2012

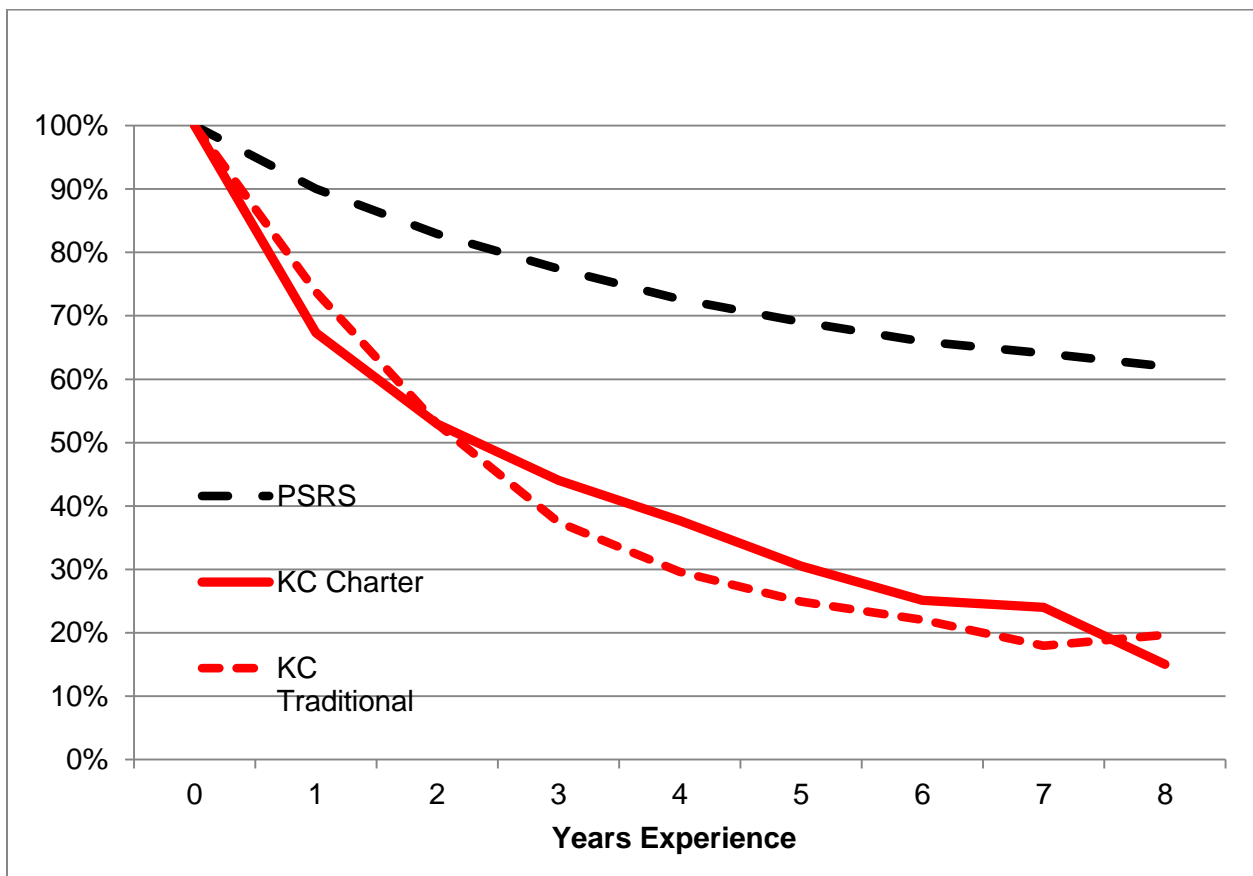


Source: DESE administrative data.

¹⁰ There are too few charter school teachers to reliably report survival rates prior to the 2005 cohort of teachers.

In order to bring more clarity, Figures 6 and 7 break out teachers in KC and STL separately. Figure 6 shows that the patterns of early-career retention are equally poor in both traditional and charter schools in Kansas City. Only about one in five teachers survives to year eight in either group. Turning to Figure 7, a somewhat different pattern emerges in STL. Here, we see a roughly ten percentage-point gap in the eight-year survival rate between teachers at traditional and charter schools. At the end of eight years, just over one in ten charter school teachers is still teaching in STL.¹¹ The difference in the KC and STL experience may reflect greater layoffs of new teachers in the KC district associated with the more aggressive downsizing shown in Table 2.

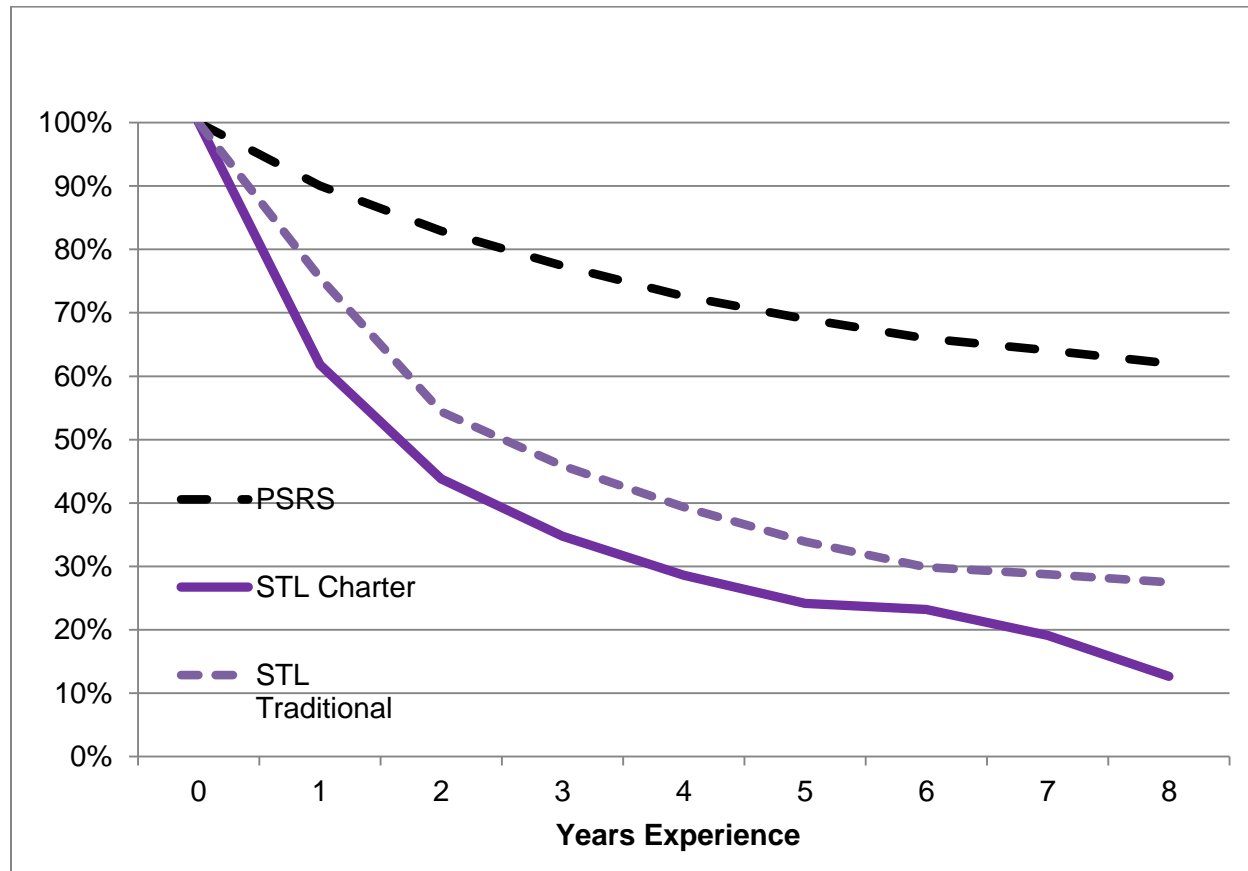
Figure 6. Retention of New Teachers: Cohorts of New Teachers Hired 2005–2012



Source: DESE Administrative data.

¹¹ Interestingly, the actuarial report for the STL plan explicitly assumes lower retention rate for charters school teachers. This favorably affects long-term system liabilities, but charter teachers in STL are required to pay in at the same rate as teachers in traditional schools. No such assumption is made in the KC plan.

Figure 7. Retention of New Teachers: Cohorts of New Teachers Hired Fall 2005–2012



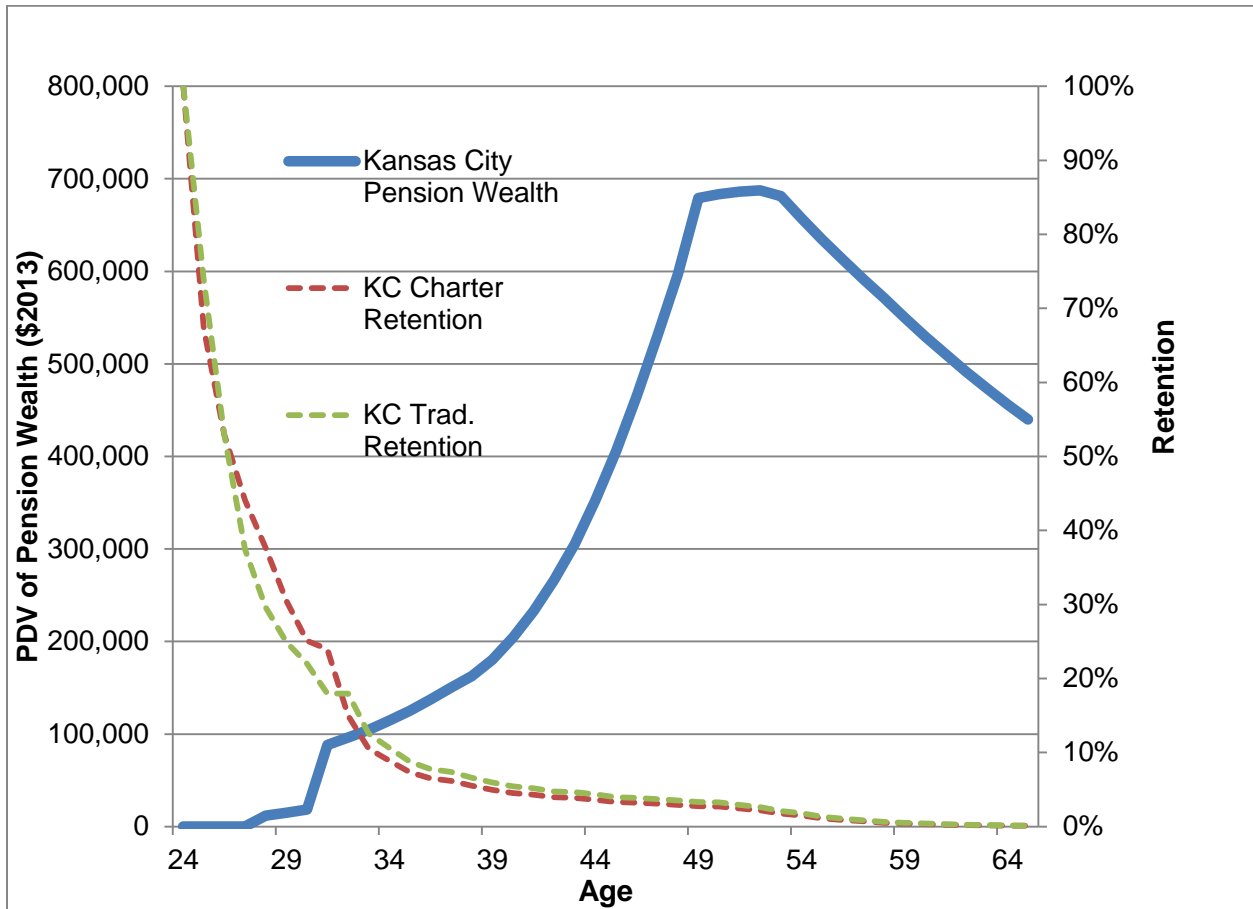
Source: DESE Administrative data.

Figures 8 and 9 provide some insight on the likelihood of a payoff in the heavily back-loaded KC and STL teacher pension plans for young, new teachers. In the figures, we reproduce the pension wealth accrual profiles for each city (from Figure 4) and plot them against the shares of young teachers in an incoming cohort who are likely to make it to the top of the pension-wealth “mountain.” In KC, we estimate the likelihood that a traditional or charter teacher stays in the profession up to the peak is roughly 3 percent. In other words, 97 percent of teachers have exited the plan prior to reaching the maximum payoff. A similar pattern holds in STL, where roughly 4 percent of traditional public school teachers can be expected to survive to the peak, versus about 2 percent of charter teachers.¹² For comparison, approximately 40 percent of young, new teachers

¹² The full-career survival rates in Figures 8 and 9 are constructed using the early-career survival rates shown in Figures 5–7, augmented by later-career survival rates that we estimate conditional on teaching experience for each system. We add a correction to the experience-conditional survival rates to account for the fact that, for a fixed level of experience during the mid- and late career, younger teachers are less likely to exit (the correction we implement is based on survival rates as computed in Koedel, Ni, and Podgursky, forthcoming). We use the same corrected later-career survival rate for charter and traditional teachers in each city, building off of the baseline survival rates after year eight as shown above.

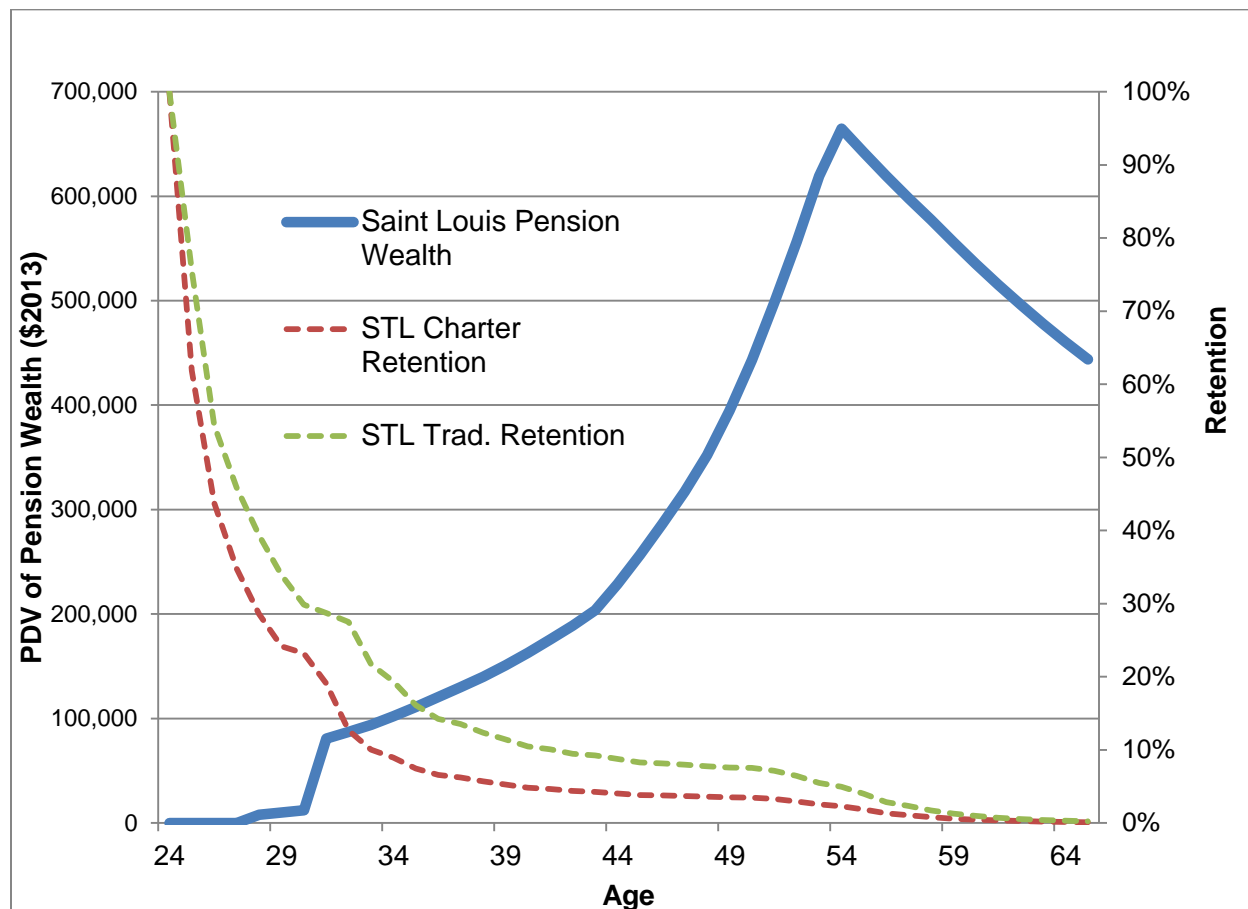
entering PSRS work long enough within the PSRS system to reach the pension-wealth mountain.

Figure 8. Pension Wealth Accrual and Estimated Probability of Retention to a Given Age: Kansas City Teachers



Source: Author calculations.

Figure 9. Pension Wealth Accrual and Estimated Probability of Retention to a Given Age: Saint Louis Teachers

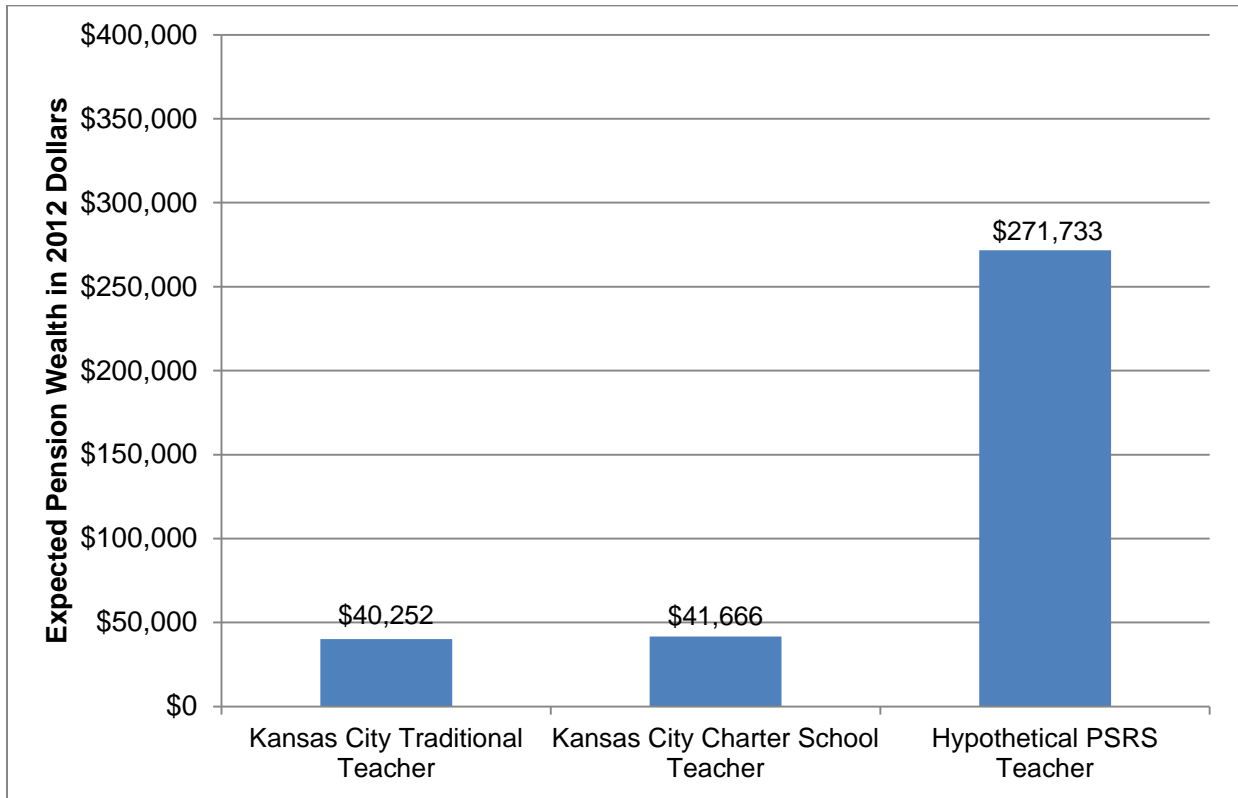


Source: Author calculations.

In Figures 10 and 11, we compute *expected pension wealth* at age fifty-five for entering teachers in KC and STL. Expected pension wealth combines the wealth-accrual profiles with the survival rates in the previous charts to come up with a measure of how much pension wealth a typical teacher can expect to accrue during a teaching career after accounting for her likelihood of surviving to each point in the career cycle as a teacher (for more information about this calculation, see Koedel, Ni, and Podgursky, forthcoming).¹³

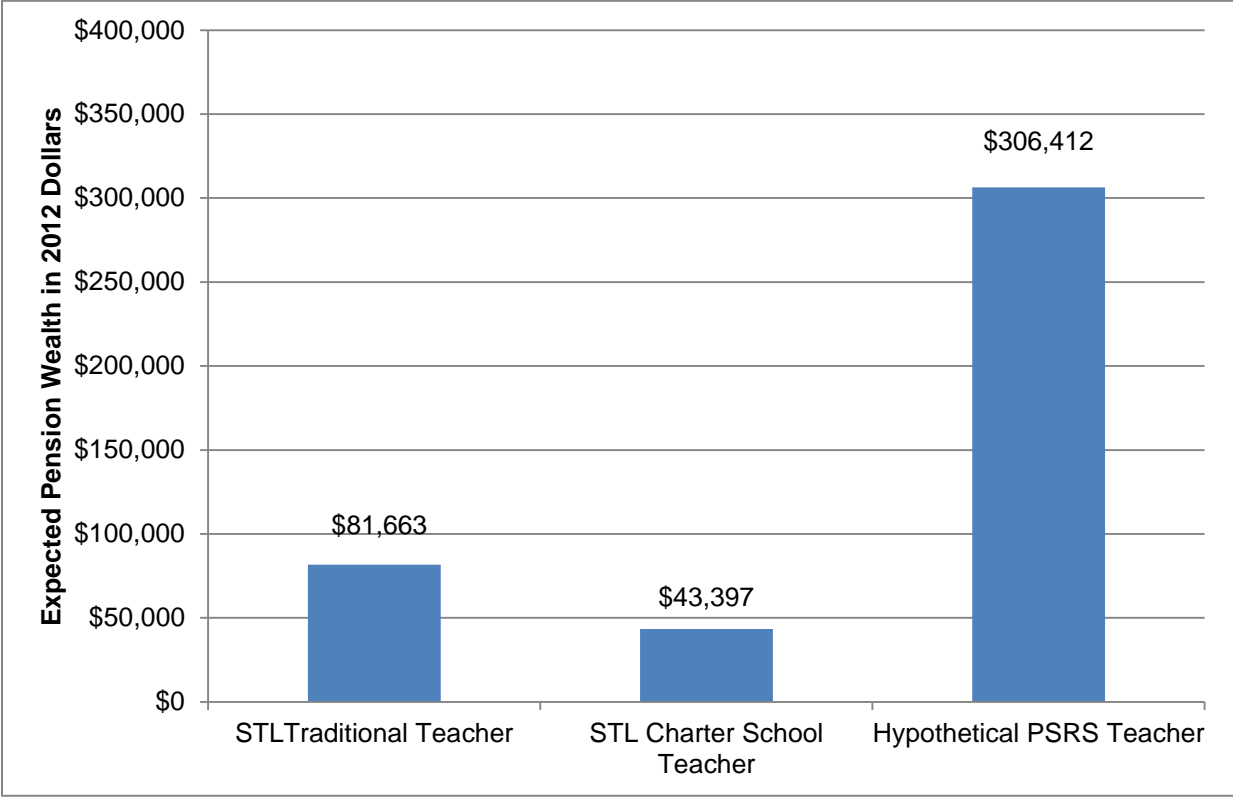
¹³ Figures 10 and 11 use the same career survival rates as Figures 8 and 9. See footnote 12 for details.

Figure 10. Expected Pension Wealth in Kansas City, Discounted to Age 55, for Teachers with Different Expected Survival Rates



Source: Author calculations.

Figure 11: Expected Pension Wealth in Saint Louis, Discounted to Age 55, for Teachers with Different Expected Survival Rates



Source: Author calculations.

The first two bars in each figure report expected pension wealth for teachers who follow the turnover patterns observed in the charter and non-charter sectors in each city district. The right-most bar shows expected pension wealth for a hypothetical teacher whose turnover pattern matches that of a typical PSRS teacher, but who works in KC or STL. The difference in expected pension wealth is striking and driven entirely by the large gap in survival rates across the different segments of the teaching workforce. An entering teacher with the retention pattern of a typical PSRS teacher could expect to have six times the pension wealth of a typical KC teacher, charter or otherwise.

The high attrition rates for KC and STL teachers likely stem from a combination of factors. For one, urban schools, charter or not, generally have higher attrition rates (also see Gross and DeArmond, 2010). The KC and STL pension systems are also much smaller than PSRS; hence, changing schools more likely means leaving the system. For teachers who are uncertain about spending a full career in KC or STL, starting in either city district will be less appealing because of the pension costs of mobility (see below for further discussion).

In Kansas City and Saint Louis, teacher attrition rates are so high that the number of teachers reaching the pension peak is negligible. While the costs of the pension systems are financed by what amounts to a flat tax on payroll for all teachers, the benefits are highly concentrated among a very small number of teachers. The compensation structure seems particularly ill-suited for the workforces in the city districts.

MOBILITY COSTS

Consider two teachers who work thirty-year careers in the profession. The first teacher works all of her thirty years in a single plan. The second teacher works fifteen years in one plan and then fifteen years in another. Because of the way pension wealth accrues in these plans, the latter teacher will have less than half the pension wealth of the former teacher at age fifty-five. This amounts to a several-hundred-thousand-dollar mobility cost based on typical salary schedules (Costrell and Podgursky, 2010). The reason for these massive costs can be seen by the shape of the curves in Figure 4. A teacher who splits up her career over two or more systems will never climb the steep part of the wealth-accrual curve. DB plans are designed to punish mobility and they do so very effectively.

One area in which these mobility penalties have been particularly costly for the KC and STL school districts concerns the recruitment of school leaders.¹⁴ Both urban districts, struggling with accreditation, would benefit from a strong applicant pool for leadership positions. However, administrative data (Table 3) point to a weaker pool of school leaders in the two urban districts as compared to the suburbs. Average licensing exam scores are significantly lower in the city districts, as is the share of leaders matriculating from more selective colleges and universities.

¹⁴ This section draws on Koedel, Grissom, Ni, and Podgursky (2012). Details are available in that study.

Table 3. Licensure Exam Scores and College Quality for School Leaders: PSRS, KC, STL, and PSRS Neighboring Districts

	PSRS All	Kansas City Region		St. Louis Region	
		KC Schools	Neighbor (PSRS)	STL Schools	Neighbor (PSRS)
<u>Licensure Exam Scores</u>					
Average Score	178.2 (7.4) ^{a,b}	172.8 (7.2)	179.8 (7.0) ^a	175.1 (7.1)	178.8 (7.3) ^b
N (leaders)	4,099	163	261	222	322
<u>College Quality: All</u>					
High Quality	0.174 (0.379) ^{a,b}	0.112 (0.316)	0.184 (0.388) ^a	0.077 (0.267)	0.233 (0.423) ^b
N (leaders)	8,873	339	803	377	1101
<u>College Quality: MO Specific</u>					
High Quality	0.187 (0.390) ^{a,b}	0.083 (0.276)	0.177 (0.382) ^a	0.078 (0.269)	0.262 (0.440) ^b
Low Quality (Public)	0.064 (0.245) ^{a,b}	0.223 (0.417)	0.056 (0.229) ^a	0.566 (0.496)	0.162 (0.369) ^b
N (leaders)	7,089	193	575	295	809
Avg. % Free/Reduced Lunch	31.7	59.9	23.9	70.8	29.6
Avg. % Disadv. Minority Districts	7.1 539	70.9 1	27.1 11	83.3 1	45.0 21

Notes: The neighboring districts are within a commutable distance to the city in each region. Licensure exam scores are available for school leaders from 2000-2009. College quality is available throughout the data panel and is coded based on the institutions where leaders obtained their initial bachelor's degrees. Standard deviations are in parentheses. Superscripts indicate statistically significant differences ($p < 0.01$) from Kansas City (a) and Saint Louis (b), respectively (test results are reported within region and for each city district relative to PSRS).

Source: Koedel, Grissom, Ni, and Podgursky (2012).

Nearly all principals come from the ranks of the teaching workforce. Teachers typically make the transition to school leadership in the middle of the career (age thirty-eight is the median age for the transition to leadership in Missouri). If a new or experienced mid-career principal were to make a move from one of the PSRS suburban districts into Kansas City or Saint Louis, she would suffer large losses in pension wealth.

An international trade analogy seems apt. Rather than promoting free trade and labor mobility, the pension plans effectively are imposing a tariff on the import or export of human capital between the city districts and the other districts in Missouri. This tariff is becoming more important over time with the broader labor-market trend of increased worker mobility, particularly among skilled workers (Groes, Kircher, and Manovskii, 2010; Kambourov and Manovskii, 2009).

These DB plans generally will not be attractive to young, mobile, well-educated professionals or, by extension, the employers seeking to hire them. That is why the private sector, as well as much of higher education, has adopted retirement plans that do not punish mobility. Broadly speaking, defined contribution (DC) plans (including IRAs, 403b, 4001k, and similar accounts) provide a mobile benefit for employees. If the employee quits, the funds travel with the employee. In the standard Teachers Insurance and Annuity Association (TIAA-CREF) annuity plan, which is the norm in private higher education institutions, many research nonprofits, and public research universities, pension wealth accrues at a smooth rate and can be annuitized at retirement. TIAA-CREF is the primary retirement instrument for several hundred thousand professors in higher education.

It also should be noted that the high mobility costs seen in teacher pension plans are not inherent in DB plans. One source of back-loading is the fact that the retirement annuity is based on final average salaries and not on career earnings, as in Social Security. A DB plan designed along the lines of Social Security would not have the severe mobility penalties. A “cash balance” DB plan, which has become popular with private-sector employers that have retained DB plans, operates like TIAA-CREF. Under a cash balance plan, the employer and the employee make annual contributions to the retirement fund. These individual funds are pooled just as with a traditional DB plan. Employees do not make investment decisions. The plan guarantees an annual return to the teacher (e.g., 4 percent, with possible bonuses in good years). Thus, pension wealth accrues smoothly over a work life. In addition, if the teacher quits and leaves his or her funds in the plan, they will continue to accrue interest at the guaranteed rate. The balance in the account can be annuitized at retirement.

Several states have implemented cash balance plans. California has one for part-time teachers and adjunct faculty.¹⁵ State and local employees in Nebraska (excluding teachers) are in a cash balance plan.¹⁶ Perhaps most relevant, Kansas public school teachers hired after January 1, 2015, will be enrolled in a cash balance plan.¹⁷ Unlike Missouri, where there are separate pension plans for public school employees, Kansas teachers are part of a statewide plan that includes other local and state employees (KPERs). The KPERs system is severely underfunded. A deal to put the plan on a path to fiscal solvency involved increased state contributions, increased worker and employer contributions, and some cuts in COLA benefits for incumbents. As part of this deal, effective January 1, 2015, most new members (including teachers) will be enrolled in a cash balance plan.

DOES THE DB PENSION STRUCTURE IN MISSOURI BENEFIT URBAN SCHOOLS?

Advocates for back-loading may argue that it is good for retaining teachers and that, without the DB pension system, the high turnover rates in STL and KC would be even

¹⁵ <http://www.calstrs.com/cash-balance-benefit-program>.

¹⁶ <http://www.nasra.org/ne>.

¹⁷ See <http://www.kpers.org/pdf/Tier3Plan.pdf> and <http://www.kpers.org/valuationreport123112.pdf>.

higher. However, empirical patterns of teacher turnover in a number of locales suggest that young teachers greatly discount their future pension benefits. Consequently, DB pension plans are ineffective for retaining young teachers. For example, during the late 1990s, PSRS instituted a series of enhancements to educator pension benefits that increased the value to teachers of remaining in the workforce (Koedel, Ni, and Podgursky, forthcoming). These enhancements, while costly to implement, had no observable impact on the retention rates of young teachers. Extrapolating from the empirical evidence, we conclude that the DB pension benefit needed for substantially raising the young teacher retention rate at STL or KC is much higher than the current level. On the other hand, there was no need to enhance the DB pension to keep late-career teachers. For teachers later in their careers working in the range leading up to the pension-wealth mountain—the ones with the strongest retention incentives—available evidence suggests that they would be relatively unlikely to move even in the absence of strong DB pension incentives (Harris and Adams, 2007).¹⁸ Enhancement of DB benefits induces predictable changes in teachers' retirement timing, but they do not necessarily help in retaining late-career teachers. It is also important to recognize that the claim that public schools generally suffer from excessive teacher turnover is empirically problematic.¹⁹ College-educated young people are highly mobile, and increasingly so, and the more academically talented individuals are the most mobile. These people are unlikely to be attracted to a system that trades off up-front salary for distant, and highly uncertain, retirement benefits. Private-sector employers have all but eliminated DB plans for young professionals in favor of mobile benefits. Given the mobility expectations for young people generally, including teachers, it should come as no surprise that teachers value a dollar set-aside to fund future pension benefits at significantly less than a dollar of current salary.²⁰ Because the KC and STL systems are much smaller than the PSRS, the balkanized DB plans in Missouri penalize mobility across plans and are an additional obstacle for urban schools to recruit bright young teachers.

Another problem with the DB pension structure is that, even to the extent that it does help retain some teachers who otherwise would leave, it is not clear that this benefits students. Put differently, it may do more harm than good to use pecuniary incentives to retain teachers who do not otherwise wish to remain in the classroom. Indeed, if anything, available research suggests that mid-career teachers who are held in the profession by the pension structure are less effective than other teachers. For example, Fitzpatrick and Lovenheim (2013) study a voluntary early-retirement incentive program in Illinois that greatly reduced the pension penalties associated with early exit for mid-career teachers. They found that the teachers who chose to participate in the plan—all of whom had significant teaching experience—were less effective on average than the teachers who replaced them in the workforce.²¹

¹⁸ We do not mean to suggest that there is no retention effect in these systems—merely that the retention effect is not as large as some might expect. The reason is that labor mobility rates already are declining for a number of factors unrelated to the pension system leading up to retirement eligibility.

¹⁹ For example, see Harris and Adams (2007), who show that the early- and mid-career turnover of teachers is no higher than that in comparable careers with similar levels of college education.

²⁰ Fitzpatrick (2011).

²¹ Also see Koedel, Podgursky, and Shi (2013).

Locking employees into a particular firm or industry generally is recognized as an inefficient policy in the economics literature. The labor market works best when employees with heterogeneous skills and preferences are able to match with employers with heterogeneous workplaces and needs. This job-matching process is one reason young people “shop around” among a variety of employers early in their careers. Recent research suggests that this process is also important in the context of teachers and schools, where improved teacher-school matches correspond to higher student achievement.²² The pension boundaries that bisect Missouri schools in the urban areas likely inhibit productivity-improving matches between teachers and schools.

A strong case can be made for greater front-loading of teacher compensation, particularly for urban schools. A cheaper and more mobile retirement benefit would mean higher starting pay (with lower withholding for retirement benefits). This is likely to widen and improve the applicant pool and, thus, give charter and traditional public schools a greater opportunity to recruit better teachers. At a minimum, given the weak rationale for the current systems, charter and urban schools should be given sufficient “regulatory space” to experiment with alternative compensation structures.

CONCLUSION AND POLICY RECOMMENDATIONS

We have examined the three teacher pension plans in Missouri. The costs of maintaining all three plans are substantial. Costs in STL and PSRS have risen sharply over the last decade, and costs in KC are set to rise beginning in 2014. High turnover rates for teachers in KC and STL raise serious questions as to whether the DB pension structure is well-suited for the typical new teacher entering these systems—whether employed at a charter or traditional public school. The lack of reciprocity and sharp penalties for mobility put KC and STL schools at a severe disadvantage in terms of their ability to recruit talented teachers and school leaders from neighboring suburban districts. In light of these findings, we believe that policymakers should consider the following recommendations for reform. Most of these recommendations amount to collecting information and developing a menu of options for teachers and schools in the urban areas. This is based on our belief that the status quo is neither desirable nor sustainable, and it is thus important to begin a serious discussion about alternatives.

1. Increase Transparency

All three pension plans would benefit from greater transparency. Increased transparency is particularly important in educating policymakers and stakeholders about the costs and benefits of the existing and alternative plans. We highlight several key dimensions along which transparency is particularly important moving forward:

²² See Jackson (forthcoming).

- *Report “What If” Contribution-Rate Scenarios.*

Forecasting funding requirements in DB systems under the best of circumstances is challenging. Forecasts depend on projecting payroll growth, labor turnover, and asset returns well into the future, among other things. Nonetheless, it would be possible for all three Missouri plans to produce forecasts of future contribution rates under different sets of assumptions regarding the key variables noted above. This would give school administrators—both charter and district—the opportunity to realistically plan future budgets. It also would show how sensitive actuarial funding estimates are to underlying behavioral and economic variables. The Saint Louis plan is particularly vexing in this regard. Both Kansas City and PSRS have caps on year-to-year changes in teacher and employer contribution rates. No such cap exists for the Saint Louis plan, which exposes employers to potentially severe “rate shock” risk from one year to the next. As noted earlier, Saint Louis charter schools have experienced an increase in their contribution rates from 8.27 percent of teacher salaries in 2010 to 16.7 percent in 2014. Funding shocks of this magnitude make rational budgeting a challenge for schools.

- *Report Net Benefits for Teachers with Varying Employment Spells in the District, and Provide Information on Mobility Costs.*

The pension fund should provide estimates comparing contributions to returns for teachers with varying tenure in the pension plan. Providing all members, as well as the general public, with pension wealth calculations can bring much-needed transparency as to the net benefits of the plan for individual teachers. It would be a simple matter for actuaries to produce personalized estimates showing the accrual of pension wealth and pension wealth net of contributions for teachers with various years of experience. All three plans should make information available on pension wealth losses that occur as a result of mobility between plans.

- *Link State Teacher and School Data to Pension Data.*

To help spur school improvement, states have developed extensive data systems to track the level and growth of student performance, as well as information on teachers and schools. As a condition of its NCLB waiver, the Missouri Department of Elementary and Secondary Education (DESE) has agreed to develop a system of teacher performance evaluation that will include measures of student achievement growth. Yet, none of this extensive data on teacher quality and school performance is linked to pension system data at present. Creating a linked system would facilitate statistical analyses of pension plan effects on teacher quality and staffing. For example, what is the average retirement age for STEM teachers? What about STEM teachers in low-performing schools? What share of teachers in low-performing schools takes early retirement? Are these above- or below-average teachers? These are fundamental questions that must be asked about the effects of the pension structure. Moreover, they can serve as a first step toward using pension-system retirement incentives in a more proactive way to improve school performance and workforce quality.

- *Assure Charter School Representation on Pension Boards.*

Despite the fact that 41 percent of teachers in Kansas City and 30 percent of teachers in Saint Louis work in charter schools, there is not a single charter school representative on the eleven-member board of either plan. Some board representatives are elected and some are appointed by the school district. Given the increasing role of charter schools in educating children in both urban districts in Missouri, charter-school representation on these boards is appropriate.

2. Explore Alternatives to the Current Plans

The pension systems in Kansas City and Saint Louis have become serious impediments to school improvement. Given the critical importance to the public of providing opportunities for a high-quality education for urban youth, the legislature should begin exploring alternatives to the existing plans. We do not think it our role to provide detailed alternatives to the existing plans here. Rather, these details should emerge from discussions between school leaders and educators, including those from charter schools, and plan administrators. Some useful general principles should be kept in mind in considering new plans.

- *Retirement Benefits can be made Less Expensive and More Mobile.*

The public schools in Kansas City and Saint Louis are competing for academically talented young workers, just like many other employers. We suspect that most young workers would prefer higher upfront salaries as opposed to generous end-of-career retirement benefits.²³ Employer retirement-benefit costs, as a percent of salary, are much lower for managers and professionals in the private sector than for teachers (Figure 3). Given the relatively small share of new teachers in Kansas City or Saint Louis who can expect to complete an entire career in either district, as a strategic recruiting tool it makes more sense to raise front-end salaries.²⁴

Whatever policymakers decide is the proper value of the retirement benefit, it should be mobile. Mobility can be built into the benefit formula in various ways, and there are many examples from non-profit firms and higher education. In whatever alternative plan emerges, employer contributions should travel with the educator.

- *Charter Schools should have Flexibility.*

The new charter school law enacted in 2013 permits charter schools to open in PSRS districts. None as yet have opened, but it can be expected that, by 2015, charters will begin to expand outside of the city districts. While PSRS provides very generous

²³ Turnover of young teachers falls if relative wages are higher (Hanushek, et al. 2004; Podgursky, et al. 2004). In addition, Fitzpatrick (2012) finds that teachers value a dollar of pension wealth at much less than a dollar of salary. This suggests that a revenue-neutral shift of compensation from retirement pensions to up-front pay would expand the applicant pool and increase retention of young teachers.

²⁴ McGee and Winters (2013) show how much starting teacher salaries could be increased if retirement benefit costs were more closely aligned to private-sector standards.

retirement benefits for full-career teachers (Figure 4), there is every reason to expect that charter teachers in PSRS districts will exhibit higher exit rates. This will lead to lower expected values of pension wealth for new entrants. We recommend that charter school participation in PSRS districts be voluntary. Charter schools should be in Social Security, and allowed to develop their own retirement benefit plans, if they so choose. If it does not run afoul of federal government regulations, PSRS charter schools that hire PSRS-vested teachers should be allowed to maintain membership in PSRS for these teachers in order to facilitate mobility within teaching in Missouri.

REFERENCES

- Aaronson, Daniel, Lisa Barrow, and William Sander. (2007). Teachers and Student Achievement in the Chicago Public High Schools. *Journal of Labor Economics* 25(1), 95–135.
- Brown, Kristine. (2009). “The Link Between Pensions and Retirement Timing: Lessons from California Teachers.” National Center on Performance Incentives. Vanderbilt University.
- Costrell, R., & J. McGee. (2010). Teacher Pension Incentives, Retirement Behavior, and Potential for Reform in Arkansas. *Education Finance and Policy* 5, 492–518.
- Costrell, R., and M. Podgursky. (2009). Peaks, Cliffs and Valleys: The Peculiar Incentives in Teacher Retirement Systems and Their Consequences for School Staffing. *Education Next* 4, 175–211.
- Costrell, R., and M. Podgursky. (2009). Peaks, Cliffs and Valleys: The Peculiar Incentives in Teacher Retirement Systems and Their Consequences for School Staffing. *Education Finance and Policy* 4, 175–211.
- Costrell, R., and M. Podgursky. (2010). Distribution of Benefits in Teacher Retirement Systems and Their Implications for Mobility. *Education Finance and Policy* 5, 519–557.
- Doherty, K., S. Jacob, and T. Madden. (2012). *No One Benefits: How Teacher Benefit Systems are Failing Both Teachers and Taxpayers*. Washington, D.C.: National Council on Teacher Quality.
- Fitzpatrick, Maria, and Michael Lovenheim. (2013). “Early Retirement Incentives and Student Achievement.” Working Paper 19281. Cambridge, Mass.: NBER.
- Furgeson, Joshua, Robert Strauss, and William Vogt. (2006). “The Effects of Defined Benefit Pension Incentives and Working Conditions on Teacher Retirement Decisions.” *Education Finance and Policy* 1(3), 316–348.
- Friedberg, L., and S. Turner. (2010). Labor Market Effects of Pensions and Implications for Teachers. *Education Finance and Policy* 5, 463–491.
- Groes, Fane, Philipp Kircher, and Iouri Manovskii. (2010). The U-Shapes of Occupational Mobility. Unpublished manuscript, University of Pennsylvania.
- Gross, Betheny, and Michael DeArmond. (2010). Teacher Attrition in Charter vs. District Schools. Policy Brief, Center on Reinventing Public Education.
- Hanushek, Eric, John Kain, and Steven Rivkin. (2004). Why Public Schools Lose Teachers. *Journal of Human Resources* 39, 326–354.
- Hansen, J. (2010). An Introduction to Teacher Retirement Benefits. *Education Finance and Policy* 5, 402–437.
- Hanushek, Eric, and Steven Rivkin. (2010). “Generalizations About Using Value-Added Measures of Teacher Quality.” *American Economic Review Papers and Proceedings*. (May), 267–271.

- Fitzpatrick, Maria. (2012). "How Much Do Teachers Value Their Retirement Benefits?" Stanford Institute for Economic Research.
- Harris, Douglas N., and Scott J. Adams. (2007). Understanding the Level and Causes of Teacher Turnover: A Comparison with Other Professions. *Economics of Education Review* 26(4), 325–337.
- Jackson, Kirabo (forthcoming). Match Quality, Worker Productivity, and Worker Mobility: Direct Evidence from Teachers. *Review of Economics and Statistics*.
- Kambourov, Gueorgui, and Iouri Manovskii. (2009.) Occupational Mobility and Wage Inequality. *Review of Economic Studies* 76(2), 731–759.
- Koedel, Cory, and Julian R. Betts (2011). Does Student Sorting Invalidate Value-Added Models of Teacher Effectiveness? An Extended Analysis of the Rothstein Critique. *Education Finance and Policy* 6(1): 18–42.
- Koedel, Cory, Jason Grissom, Shawn Ni, and Michael Podgursky (2012). "Pension Induced Rigidities in the Market for School Leaders." WP-67. CALDER. Washington, D.C.
- Koedel, Cory, Jason Grissom, Shawn Ni, and Michael Podgursky (2013). "Defined Benefit Pension Plans and Job Lock: Evidence from the Education Sector." Department of Economics Working Paper 13-10. University of Missouri-Columbia.
- Koedel, Cory, Michael Podgursky, and Shishan Shi. (2013) "Teacher Pension Systems, the Composition of the Teaching Workforce, and Teacher Quality" *Journal of Policy Analysis and Management*. Forthcoming.
- Koedel, Cory, Shawn Ni, and Michael Podgursky. (2013). Who Benefits from Pension Enhancements? *Education Finance and Policy*. Forthcoming.
- McGee, Josh, and Marcus Winters. (2013) *Better Pay, Fairer Pensions: Reforming Teacher Compensation*. Civic Report No. 79. New York: Manhattan Institute (September).
- Ni, Shawn, Mark Ehlert, and Michael Podgursky. (2009) "Teacher Pension Incentives and Labor Market Behavior: Evidence from State Administrative Data." National Center on Performance Incentives. Vanderbilt University. (February).
https://my.vanderbilt.edu/performanceincentives/files/2012/10/200911_Ni_EtAl_IncentivesLaborMkt.pdf.
- Nye, Barbara, Spyros Konstantopoulos, and Larry V. Hedges. (2004.) How Large are Teacher Effects? *Educational Evaluation and Policy Analysis* 26(3), 237–257.
- Olberg, Amanda, and Michael Podgursky. (2011). *Charting a New Course to Retirement: How Charter Schools Handle Teacher Pensions*. Washington, D.C: Fordham Institute.
- Podgursky, Michael, Ryan Monroe, and Donald Watson. (2004) "Teacher Pay, Mobility, and Academic Quality." *Economics of Education Review* 23, 507–518.
- Rivkin, Steven G., Eric A. Hanushek, and John F. Kain. (2005). Teachers, Schools and Academic Achievement. *Econometrica* 73(2), 417–458.

Rockoff, Jonah. (2004.) The Impact of Individual Teachers on Student Achievement: Evidence from Panel Data. *American Economic Review (P&P)* 94(2), 247–252.

Tennessee Department of Education. Office of Research and Policy (2013). *Recent Retirement Trends of Tennessee Teachers*. (February).

http://www.tn.gov/education/research/doc/RecentRetirementTrendsofTennesseeTeachers_FINAL.pdf.

Zeehandelar, Dara, and Amber Winkler. (2013). *The Big Squeeze: Retirement Costs and School District Budgets*. Washington, D.C: Fordham Foundation.