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When the Walls Come Down: Evidence on Charter Schools' Ability to Keep Their Best Teachers Without Unions and Certification Rules

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Abstract: Theories of market-based school reform suggest that teacher labor markets may be inefficient, and perhaps inequitable, because union contracts, tenure protections, and government regulation limit school autonomy over hiring, evaluation, compensation, and working conditions. In a less restrictive setting, schools could incentivize performance by selectively retaining and rewarding better-performing teachers. We test this empirically by comparing teacher exits in the deregulated market of New Orleans with exits in neighboring traditional public school districts. Our results suggest that the relationship between teacher performance and retention is stronger in the New Orleans market setting than in similar traditional school districts. We also find positive associations between annual salary increases and performance, but only when teachers transfer from one charter school to another. While teacher retention is more closely tied to performance in New Orleans, this did not yield a net gain in teacher quality, relative to neighbors. New Orleans had much higher teacher turnover, and we find the large numbers of teachers who had to be hired annually in the city had lower value-added than the entrants in comparison districts.

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1. Introduction

Over the past decade, policies governing teacher labor markets have changed markedly. Many states and districts have implemented teacher evaluation systems, eliminated traditional job protections, and experimented with compensation strategies that depart from traditional step-and-ladder salary schedules (e.g., Kraft, 2018). With increasing evidence that teachers are critical to student outcomes (e.g. Chetty, Friedman, and Rockoff, 2014; Hanushek and Rivkin, 2010; Rivkin, Hanushek, and Kain, 2005; Rockoff, 2004), these policy changes seek to improve the quality of teaching by providing school and district leaders with authority to make staffing and compensation decisions based on performance—a strategy that is restricted under many union contracts and state tenure and certification laws.

At the same time, a number of districts across the country have also transitioned to more market-based school governance models. In these districts, the traditional top-down district structure was transitioned to a system of autonomous schools—often referred to as a "portfolio" system—that relies on private organizations to run schools and advance a larger goal of introducing market forces into the education system (Hill, Campbell, and Gross, 2013). A key tenet of the portfolio strategy, and market-based education systems more generally, is that the government should hold school operators responsible for school performance and, in turn, grant operators autonomy to make decisions regarding curriculum, scheduling, budgeting, and services. Autonomy over personnel decisions, such as recruiting, hiring, training, compensation, and dismissal, may be particularly important (Chubb and Moe, 1990).

Many cities making the transition to a portfolio system rely heavily on charter schools, which are operated by private organizations under contracts with government agencies or other state-approved authorizers. In some cities, the share of charter schools is large enough to justify a "portfolio manager" (Hill, Campbell, and Gross, 2013; Hill and Jochim, 2014). Rather than

directly managing most schools, the portfolio manager is primarily responsible for creating the menu of schooling options available to families, overseeing contracts with charter organizations, and managing the system as a whole (e.g., enrollment and school buildings). As private employers, charter schools are typically free from union contracts and district and state rules governing teacher employment. Thus, a transition to a portfolio of charter schools is a de facto deregulation of a substantial portion of the teacher labor market. Charter schools must attract students and reach authorizer performance goals to survive, so charter operators will, in theory, work to staff their classrooms with highly effective teachers. Theoretically, this combination of choice, competition, contracting, and autonomy could result in an improved teacher workforce. Whether these reforms actually produce any meaningful change in the distribution of teacher quality, however, relies on assumptions about teacher labor supply and school management that might not be met in practice.

New Orleans provides the most extreme case of market-based school reform in the U.S. Since reopening in 2006 after Hurricane Katrina, the city's schools have evolved into a portfolio model where virtually all schools are charter schools with considerable autonomy over the terms of teacher employment.[1] These policy conditions make New Orleans an ideal setting for analyzing the effects of a relatively unregulated environment surrounding teacher employment, combined with strong performance incentives for school managers. In this paper, we leverage this setting to examine how market-based, portfolio management shapes the distribution of teacher quality. Specifically, we test the theory that schools operating in market-

[1] A few New Orleans charter schools have re-unionized, but during the period of analysis in this study, no schools operated with CBAs. Charter school teachers were also not subject to the state's tenure law, which was effectively eliminated for all teachers in publicly-funded schools in 2012. In the years we analyze, a small number of schools were also directly operated by Orleans Parish School Board (OPSB) or the state Recovery School District (RSD). These schools also had substantial autonomy in teacher hiring, but adherence to salary schedules and state pension contributions were required. Some charter schools were required to participate in the state pension system, while others could opt in or out.

based portfolio settings are more likely to recruit and retain effective teachers and to exit ineffective ones, relative to schools subject to greater constraints on teacher employment.

Based on analysis of seven years of teacher employment and salary data, we find that the New Orleans teacher labor market has been more responsive to teacher value-added measures—a proxy for performance—than similar schools in neighboring districts traditional school governance. We find evidence that, relative to traditional schools, lower-performing teachers in market settings are more likely to exit teaching while high-performing teachers in market settings are less likely to exit. For example, we estimate that a one standard deviation increase in teacher value-added decreases the likelihood of exiting a school by about 9.5 percentage points in New Orleans, compared to 2.8 percentage points in neighboring traditional settings, controlling for school and teacher characteristics. These results occur both at charter schools and autonomous district schools in Orleans Parish. While we cannot identify whether teacher exits are voluntary or involuntary, our findings do not appear to be driven by forced job loss due to school closure or takeover, which frequently occurred in New Orleans during this period (Bross, Harris, and Liu, 2016; Harris, Liu, Gerry, and Arce-Trigatti 2019). These findings are also highly robust to multiple definitions of "portfolio" or "market" schools, multiple measure of teacher value-added, disaggregation by race and performance level, and comparison to other Louisiana school districts outside of the regional labor market.

One potential reason that high-performing teachers might be more likely to stay in New Orleans is that they are rewarded with higher pay. We find some evidence that charter schools link teacher raises to performance, but only when teachers switch from one charter school to another; we find no evidence that salaries of returning charter school teachers vary according to their value-added.

Retention of high-performing teachers, is, of course, only one element of improving teacher quality. We also examined the relative quality of exiting teachers versus replacements teachers in each setting over time. Despite being more responsive to teacher value-added in exit decisions, we find that the teachers who replace exiting teachers have lower value-added than in the neighboring districts, and that these countervailing forces seem to roughly cancel out over time. In other words, the fact that New Orleans schools are better able to retain quality teachers does not seem to translate into increased average teacher quality. Rothstein (2015) had previously suggested this type of trade-off where a risk of dismissal due to poor performance might discourage new teachers from entering. While we can only present descriptive evidence, the close proximity and fairly similar demographics of New Orleans and the comparison districts, suggests that this trade-off might be real. At the very least, this additional descriptive analysis is important for highlighting the potential trade-offs involved.

While the main contribution of the paper to test the theory of school improvement through autonomy over human resources in a setting where the teacher labor market is both highly competitive and highly decentralized, we also make several methodological contributions. First, we show that difference-in-difference estimates are likely to provide a misleading comparison of the role that market forces play in linking teacher quality and turnover, especially when the more market-oriented school systems (e.g., New Orleans) have higher overall rates of turnover. We propose and implement a hazard model in response to this problem. Second, we propose methods to compare exiting and entering teacher to estimate system-wide effects on teacher quality.

We proceed by first providing background and context for our analysis, situating our work within the literatures on market-based approaches to education, teacher quality, and

teacher recruitment and retention. We then outline the data that serve as the basis for our analyses and describe the empirical strategy we use to analyze how reshaping the teacher labor market within a governance model that promotes choice and competition affects the distribution of teacher quality. We present the results of our analysis before closing the paper with a discussion of their implications for policies like those implemented in New Orleans, as well as for research on those initiatives.

2. Choice & Competition, School Autonomy, and Teacher Effectiveness

The theoretical argument that greater levels of school autonomy could increase educational quality can be traced back at least to Friedman (1955) and, more recently, Chubb and Moe (1990) who argued that the institutional arrangements governing public education in the United States—school districts subject to direct democratic control—were the root cause of persistently poor educational outcomes. The theory that simply providing schools with a greater degree of autonomy will produce the better outcomes, however, relies on a number of potentially problematic assumptions.

First, for the market-driven model to improve student outcomes, schools must have the capacity to identify effective teachers and, equally important, be willing to actively remove ineffective ones. In an analysis of New York City public schools, Rockoff, Staiger, Kane, and Taylor (2012) demonstrate that providing principals with teacher performance information increased the probability that low-performing teachers leave their positions. In Chicago, Jacob (2011) similarly found that lower valued-added probationary teachers were more likely to be dismissed. However, qualitative evidence on the teacher hiring practices of school leaders in New Orleans—the vast majority of whom led charter schools—suggests that the ability to improve student learning outcomes was just one of many factors taken into consideration when

making hiring decisions. Leaders also valued teacher experience, community connections, and the willingness to go the proverbial "extra mile" (Jabbar, 2018). Thus, it remains an open question whether school leaders will prioritize the ability to raise achievement in the teacher hiring process and, if they do, whether they can obtain the information needed to identify effective teachers and use that information to make potentially difficult personnel decisions.

Second, for personnel flexibility to increase the quality of the teaching force, the supply of teachers must give school leaders access to teachers of higher quality than those who depart. For example, the option to offer higher salaries might induce higher-performing teachers to enter the market. On the other hand, teacher employment protections might be necessary to attract and retain the best teachers in the profession. Through simulations, Rothstein (2015) illustrates that a loss of employment protections that currently make teaching a relatively low-risk, lifelong profession would need to be offset with substantial pay increases in order to fill existing positions without loss of quality.

Third, Chubb and Moe's (1990) theory assumes that schools in a market setting have incentives to hire, develop, compensate, and dismiss teachers based on performance. With intense performance-based school contracting, this seems likely in New Orleans. More than 40 schools have been closed or taken over for low performance or mismanagement since the initial state takeover (Bross, Harris, and Liu, 2016). However, with regard to market competition, parents have relatively few high-quality schooling choices and limited information about school quality; also, schools have incentives to focus their efforts on recruiting and selecting students, which may distract from genuine school improvement (Jabbar, 2015; Harris, forthcoming). Lincove, Valant, and Cowen (2018) illustrate that supply constraints allow most New Orleans schools to maintain adequate enrollment to operate even with low performance and low demand

among parents. The accountability incentives and pressures facing schools are therefore complex and ambiguous.

Ultimately, whether increased school autonomy will result in a more effective system-level teacher workforce is an empirical question. A handful of studies provide inconsistent evidence from settings where charter schools represent a small portion of public schools. Two studies in North Carolina find that charter schools have high turnover rates and disproportionately hire less-effective teachers than traditional public schools, as measured by estimated value-added (Carruthers 2012; Jackson 2012). Such a pattern could reduce the quality of education provided by the North Carolina charter sector and, perhaps more importantly, casts at least some doubt on claims that school autonomy will generate higher-quality teaching.

Cowen and Winters (2013) use data from Florida to study the exit patterns of charter teachers compared to traditional school teachers. They find that charter school teachers are more likely to exit the profession than their district school peers, but that, on average, there are no cross-sector differences in the relationship between quality and exit probabilities. In both sectors, less-effective teachers exit the profession at greater rates than their more-effective peers, but these rates are similar across sectors. Bruhn, Cowen, Imberman, and Winters (2019) studied the teacher labor market in Massachusetts, comparing the charter sector to traditional public schools. They also find mixed evidence on whether charter schools are more effective at exiting low-performing teachers. They find an almost U-shaped relationship between performance and turnover; relative to average-performers, both low- and high-performing teachers were more likely to exit. A comment by Cowen and Winters (2013) sums up both studies well: “Whatever administrative or organizational differences may exist in charter schools, they do not necessarily translate into a discernible difference in the ability to dismiss poorly performing teachers.”

This limited existing empirical evidence calls into question the presumption that a greater degree of school autonomy will lead to increased quality of the teaching force. But no prior study has been conducted in a context like New Orleans, where hiring is substantially decentralized with many competing employers, most schools have teacher performance data, and there are strong incentives for schools to improve, due to performance-based contracts with the government. Prior studies in the New Orleans context do show that, during the immediate post-Katrina period, New Orleans saw accelerated exit among experienced teachers (Lincove, Barrett, and Strunk, 2018), a demographic shift from a majority black, highly experienced labor market to younger, white teachers (Barrett and Harris, 2015), elevated teacher turnover rates (Barrett and Harris, 2015), and school closures disrupting the teacher labor market (Lincove, Carlson, and Barrett, 2017). Such findings provide important context for considering how portfolio management and market forces more generally shape the distribution of teacher quality.

3. Data and Measures

Our analyses primarily draw on elements from the Louisiana Department of Education's (LDOE) administrative records, including the Profile of Educational Personnel (PEP) and the Student Information System (SIS). The PEP table includes annual, de-identified records for all teachers employed in Louisiana public school systems, including all traditional public schools and charter schools. It contains information on teacher demographics, teaching certificates, college degrees, salary, teaching experience, school assignments, and district hire dates. These records allow us to observe teachers as they move across public schools within the state. When teacher exit the data, we cannot distinguish between those who exit teaching from those who have moved out of state (or into private schools). We are able to measure performance, which we operationalize as value-added, for teachers employed from fall 2009 to fall 2015, and to observe

exits at the end of each academic year.

We use information in the SIS records to construct several school-level measures that might be associated with both teacher retention and performance. The SIS records contain annual, individual-level information on the standard set of student demographics and educational needs, such as race/ethnicity and free/reduced price lunch eligibility. To construct the school-level measures we use in our analyses below, we simply aggregate the student-level information. From other published state records, we also identify whether schools are charter or district-run and each school's status (passing or failing) in LDOE's annual accountability reporting.

In addition to turnover and salary, the key measure in our analysis is teacher performance. We estimate this using the two-step value-added modeling approach described in Appendix A. The data allow us to generate annual estimates of teacher effectiveness for teachers of the four tested subjects (reading, math, science, and social studies) in grades 4-8. Many teachers in these grades teach more than one subject. For each year, we create a single effectiveness measure for each teacher by averaging scores across all available subjects.[2] Because we are interested in performance-related teacher exit, we omit teachers who begin a school year with 24 or more years of experience. Teachers who have accrued 25 years of state pension participation are eligible to retire with full benefits.

We use multiple teacher value-added measures in our analyses, reflecting the various possible decision processes and outcomes of interest. In our main specifications, we use measures that we standardize using the regional mean and standard deviation, where we define

[2] Value-added scores can be estimated for approximately 30% of all teacher-by-year observations. Appendix B includes estimation of the effect of *having* a value-added score (vs. not having a score) on exit probabilities for all teachers. We do find significantly different rates of exits between those who do and do not have value-added scores—teachers without value-added scores are more likely to exit than their peers in tested subjects. This result holds across both market and non-market settings.

the region as the three school districts we draw upon in our empirical analysis below. This has the advantage of allowing us to easily compare the estimates across schools and districts, as they are on the same scale. On the other hand, school leaders might be most likely to dismiss the teachers who are lowest performing within their own schools. This calls for within-school standardization of teacher value-added measures, which we accomplish by adding school fixed effects to the value-added models. We use within-school value-added as a robustness check and report in the text any substantive differences between these and the main specifications. Finally, we test a value-added estimate that is based on up to three years of information on student performance. All three value-added models are described in Appendix A.[3]

Our value-added estimates proxy for information teachers and their employers would likely discern from internal assessment of annual exams and benchmark assessments. Louisiana passed a statewide teacher evaluation policy in 2010 that included teacher value-added. Beginning in fall 2013, tested teachers and their principals at both traditional and charter schools should have received value-added measures based on a similar model calculated by LDOE. This information was meant to guide human capital decisions but carried no enforceable high-stakes consequences during the time of our study.[4] The only substantive difference between our calculation and that of LDOE is that ours omits student attendance from the model; however, prior research suggests that the specific covariates used has limited influence, especially once

[3]Bruhn et al. (2019) estimate the teacher and school value-added measures simultaneously within a single model. This is because their study has a different purpose: to study whether high-quality teachers are more likely to leave high-quality schools, where the latter is implicitly defined as the contribution schools make separately from their teachers.

[4] It is possible that getting a value-added measure from the state changed the underlying relationship between our researcher-estimated valued added score and teacher exit decisions by making the information more transparent. Empirical tests of effects before and after the state provided value-added scores show no effect of the policy on the relationships estimated in our models.

prior achievement and other student demographics have been accounted for (Harris and Sass, 2006).

4. Empirical Method

We design our analysis to test the hypothesis that schools operating in a competitive labor market like New Orleans will be better able to retain effective teachers and dismiss ineffective teachers than schools operating in traditional district settings. We selected comparison districts with two key properties: first, in our main specification, we restricted the comparison group to districts within the same metropolitan area to account for shared labor market conditions. Second, we looked for districts with similar student demographics, which are also correlated with teacher labor market outcomes. We also focused on districts with traditional governance models (collective bargaining, tenure, school attendance zones, district management) and low charter market share. Based on these criteria, we selected two adjacent school districts to Orleans Parish: Jefferson Parish and St. Bernard Parish.

Jefferson Parish includes mostly traditional district-run schools and a small number of charter schools, and St. Bernard Parish has only district-run schools. Consequently, a full 100 percent of teachers in St. Bernard Parish and more than 97 percent of teachers in Jefferson Parish were employed by a school district. In Orleans Parish, a majority of teachers (74 percent) were employed by charter management organizations (CMOs), and the remaining teachers were employed by one of the two school districts in the parish, the state Recovery School District (RSD) or the Orleans Parish School Board (OPSB). In the immediate wake of the hurricane, the Louisiana Board of Elementary and Secondary Education (BESE) took over more than 100 OPSB schools and shifted control to the RSD to either contract out to CMOs or run directly. By 2009, the year our study begins, RSD had contracted out a large majority of schools to CMOs,

but it still directly operated a small number of schools in Orleans Parish. OPSB also operated a handful of schools in the district. Together, these two school districts employed about a quarter of teachers in New Orleans over the time period we study.

Like prior studies, we consider the distinction between charter and district schools in our definition of market setting. The New Orleans setting is more complex than this simply dichotomy, because it is not just some school types that face deregulation, but the entire market, and all schools enjoyed a greater degree of autonomy over human resources than neighboring district schools. Thus, our first and preferred definition of "market" includes all schools located in Orleans Parish (charter, RSD-run, and OPSB-run) with Jefferson Parish and St. Bernard Parish traditional schools serving as a comparison group.

In addition to the above preferred definition, we also tested two secondary definitions of market schools. The first of these alternative definitions includes only New Orleans charter schools, shifting New Orleans schools district-run schools into the comparison group. Finally, our third definition considers the market to include all charter schools in the three districts, which adds a small number of charter schools in Jefferson Parish to the set of schools operating in market settings (there are no charter schools in St. Bernard Parish). Under this definition, our analysis compares the outcomes of teachers employed in charter schools to those of teachers employed in a district setting across the region. Our results are generally robust across all three market definitions with any exceptions noted in the discussion below.

Table 1 illustrates the differences between teachers and their students in market and traditional settings based on our three definitions of the market term. The table reports means and standard deviations for teacher-by-year observations. When we define the market setting as all Orleans Parish schools (columns 1 and 2), our sample includes 1,445 unique teachers in the

market setting, and 1,240 unique teachers in neighboring district settings. As a first indication of differential turnover and retention, with this primary market definition, in the market setting more than 21 percent of teacher-by-year observations end in exit from the parish, compared to only 12 percent in the non-market setting. Without controlling for experience, average teacher pay is very similar in both settings. Similar differences in exit rates are reported in Table 1 for our two alternative definitions of markets.

[Insert Table 1 about here]

Importantly, Table 1 also shows that teacher and school characteristics vary across settings. Reflecting segregation patterns in the region, the proportion of black students and teachers is substantially higher in Orleans Parish than neighboring districts, although rates of student economic disadvantage (measured through eligibility for free or reduced-price lunch) are approximately 80 percent in both settings. In terms of teacher qualifications, teachers in the market setting are more likely to have attended college out-of-state and to be trained by Teach for America or The New Teacher Project (TFA/TNTP) than their peers in non-market settings. However, overall rates of alternative certification and specialty certification in STEM are similar across the groups.

There are also substantial differences in estimated school and teacher performance across settings. Schools in the market setting of New Orleans are more likely to be identified as failing in the Louisiana school accountability system, which is based primarily on student performance levels. But estimated teacher value-added contributions to student growth are substantially higher at schools operating in the market settings than those in non-market settings. These patterns exist across all three definitions of market schools but are somewhat smaller when we include district-run schools in Orleans Parish in our market definition. In short, teachers and schools in our

defined market settings are generating greater test score growth than teachers and schools in traditional settings, but measured through student performance levels, market schools perform worse on average.

A plausible comparison across settings requires that teachers are selected from overlapping ability distributions (i.e., common support). Prior research cited above suggests that charter teachers in some settings reflect a lower-quality region of the distribution relative to district teachers. Figure 1 illustrates the full distribution of teacher quality, relative to all teachers in the state, for Orleans Parish teachers (solid line) and Jefferson Parish-St. Bernard Parish combined (dotted line). We see substantial overlap suggesting that even in this unique regional labor market, with a substantial number of positions in deregulated schools, we can estimate effects for similar teachers across settings.

[Insert Figure 1 about here]

Given the above differences between New Orleans and the traditional districts, we also re-estimated our main specifications using a different approach to identify the comparison districts. Instead of looking for districts in the same local labor market, we looked for a district that was outside the labor market and similar student demographics. East Baton Rouge is most similar to New Orleans in this regard. The results for this additional comparison lead to similar conclusions and are included in the appendix.

Difference-in-Differences Model

We first compare employment outcomes of teachers in market versus traditional school districts by estimating several variants of the following difference-in-differences (DD) model:

$$Y_{ijz,t+1} = \beta_0 + \beta_1 market_z + \beta_2 performance_{izt} + \beta_3 (performance_{iz,t} \cdot market_z) + \delta_t + e_{ijzt} \quad (1)$$

where $Y_{ijz,t+1}$ indicates continued employment in the next school year for teacher *i* with experience level *j* who worked for school *z* in year *t*. In this model, $performance_{izt}$ is the value-added measure of teacher productivity in year *t* estimated using the approach described in Appendix A, and $market_z$ is a binary sector indicator equal to one if the teacher is employed in a school in a market setting and equal to zero if the teacher is employed in non-market setting.[5] The coefficient of greatest interest is β_3, which estimates the difference in the relationship between teacher performance and employment for the market setting, relative to more regulated district settings. We include δ_t, academic year fixed effects, to account for other state policy changes and economic conditions that affected teachers across sectors. Finally, e_{ijzt} is a random error clustered at the individual teacher level.

Our DD model differs in both form and intention from the DD approaches most commonly seen in the literature. The typical DD approach intends to estimate the causal effect of a policy or intervention, addressing selection into treatment by comparing the pre- and post-policy difference for the treatment and comparison group. Our approach, in contrast, compares schools operating in market and non-market settings (first difference) in their retention of low versus high value-added teachers (second difference). In doing so, our analysis is not intended to estimate a causal effect of the market setting, but rather to describe whether schools operating in that setting retain high value-added teachers at greater rates than schools operating in traditional districts.

With this in mind, we direct attention to β_3, which may reflect actions on both the demand side (schools making efforts to retain their best teachers) or the supply side (e.g.,

[5] We are unable to include school fixed effects due to their perfect collinearity with market status. If a teacher switches schools, then, in our model, she might also switch from market to non-market (or vice versa).

teachers in market and non-market settings differing in their willingness to stay in teaching when they are low-performing). Unfortunately, as in most labor data, we are unable to distinguish voluntary and involuntary separations. In an effort to gain at least some insight into whether these patterns are driven by the supply or demand sides, we estimate two additional specifications. The first includes fixed effects for teacher experience to account for employment outcomes for teachers who would be treated differently in district salary schedules. The second includes both fixed effects for teacher experience and measures of observable teacher qualifications (preparation programs, certificates, education level) and demographics (race, gender, and college graduation year), as well as observable school characteristics that reflect teacher working conditions (poverty rate, percent minority students, and school accountability status).

We examine the role that teacher performance, employment in a market setting, and the interaction of the two play in shaping three binary outcomes: (a) exit from the current school, (b) exit from the current employer, and (c) exit from the parish school system. Teachers in traditional district settings with monopsony-like hiring can switch schools but must stay within the same employer. The portfolio model, however, creates more employers and more labor market competition. In our data, New Orleans teachers can switch across over 40 independent employers (RSD, OPSB, and many CMOs) without exiting the parish, while teachers in St. Bernard are all employed by a single local school district (in addition to private schools). Testing these three outcomes provides insight into whether market settings generate additional internal teacher churn, as well as system-wide responses to teacher quality.

The period we study was characterized by frequent school transitions in Orleans Parish. Many schools were closed, turned into charter schools, or turned over to new charter operators

(Bross, Harris, & Liu, 2016; Harris, Liu, Gerry, & Arce-Trigatti, 2019). These transitions triggered the exit of many teachers, suggesting that closure and management changes are a mechanism for teacher transitions in the district (Lincove, Carlson, and Barrett 2019). We tested the role of school closures and takeovers as an intervening factor in the relationship between performance and employment by estimating equation (1) both with and without teachers whose schools were closed, chartered, or re-chartered at the end of the school year. We present results from a sample excluding closure- and takeover-affected teachers in the appendix. The results are strikingly similar regardless of this exclusion, suggesting that accountability-based closure is not the driver of estimated relationships between teacher value-added and exit.

We also examine whether market systems link performance and pay by estimating a variant of equation (1) where we specify the outcome as annual teacher salaries, as reported in the PEP data. All outcomes are measured through observed employment in the following school year. In the case of turnover, this means comparing teacher value-added in year *t* with an indicator for whether teachers changed employment (according to each of the turnover definitions) in *t+1*. To estimate salary effects, we add salary at time *t* to all three specifications of equation (1) predicting salary at time *t+1;* these estimates are necessarily restricted to teachers who are still employed in the following year.

Hazard Models

Following Cowen and Winters (2013), equation (1) models employment outcomes as a linearly separable function of market conditions and teacher performance. Such a model is appropriate when the comparison groups have the same average rate of turnover but might not be otherwise. Since it is well known that charter schools, particularly those in market settings, have

higher rates of turnover, it is possible, for example, that the difference β_3 in equation (1) will be positive only because the overall rate of turnover is higher among schools in the market setting.

The following example illustrates the problem. First, note that equation (1) is a DD model that is approximately equal to the following: $(Y_M^{LVA} - Y_M^{HVA}) - (Y_{NM}^{LVA} - Y_{NM}^{HVA})$ where *LVA* refers to low value-added teachers, and *HVA* refers to high value-added teachers, *M* refers to schools operating in a market setting, and *NM* refers to schools in non-market settings. Now, suppose the *LVA* teachers exit at twice the rate of *HVA* teachers, and that this is true in both the market and non-market setting; this implies that the market system has no effect on the performance-exit relationship. Yet, the estimates from equation (1) would still show such effects. Here is a concrete example; suppose that we insert into the above simple DD model numbers that align with the above scenario: (0.12-0.06)-(0.08-0.04)=0.02. Here, the positive result (0.02) implies that the market setting does a better job keeping its best teachers, but the higher overall turnover rate makes this misleading, If we instead divide (i.e., Y_M^{LVA}/Y_M^{HVA}), then the results show no difference between the two sectors relative to performance.[6] The hazard model ensures that the results are not driven by the between-sector average turnover rate in this way.

To address this potential issue, we also estimate a proportional hazard model:

$$h(t+1,\, \boldsymbol{x_i}(t)) = h_0 \exp\{\boldsymbol{x_i}(t)'\beta(t)\} \quad (2)$$

where *h(t+1)* is the probability of the hazard (teacher exit) following year *t* conditioned on a vector of teacher-level covariates $\boldsymbol{x}$. $h_0(t)$ is the baseline hazard probability (i.e. $\boldsymbol{x}$ is vector of 0's). In our case, the basic proportional hazards model assumes the ratio between the probability of teacher exit and the vector of teacher-level covariates is constant over time employed (t). Such an assumption would not hold if exit probabilities are influenced by a time-varying covariate,

[6] Specifically, the calculation is: (0.12/0.06)-(0.08/0.04)=0.5-0.5=0. This yields a substantively different conclusion than the DD model.

such as a teacher's annual value-added score. Thus, to estimate the effects of a performance measure that can change each year, we estimate a hazard model that interacts the time-varying *x*'s—including annual value-added—with time indicators, which has the effect of allowing the impact of the time-varying performance measure to vary over time.[7] Put differently, the model allows the employment response to value-added to vary with how long teachers have been employed at the school.

The hazard analysis is added to account for the likely possibility that baseline hazards are substantively different in market and non-market settings. Therefore, instead of an interaction term for market and performance like that contained in eq (1), we estimate eq (2) separately for the market and non-market samples. In our analysis the teacher performance measure is time-varying. Thus, our baseline hazard is the group-specific probability of exit for teachers with a standardized value-added score equal to zero (exactly average performance), and the model allows time employed to influence the role of teacher performance in shaping exit probabilities. We assume a Weibull distribution which, descriptively, is the best match for the patterns in teacher turnover in our data.[8]

To parallel the results for eq (1), we estimate eq (2) with academic year fixed effects, controls for teacher experience, and full teacher and school covariates. In the hazard models, experience is represented by the fixed level of experience a teacher had upon entering her current employment setting.[9] Thus, we set *t=0* in the first year the teacher is observed as employed by

[7] There are several options for the function form of the hazard estimation. We report results for the Weibull estimation: $h(t+1,\ \boldsymbol{x_i}(t)) = p \cdot\ [h_0 \exp\{\boldsymbol{x_i}(t)'\beta(t)\}]\ \cdot t^{p-1}$, where p is a shape parameter estimated by the data. Our results are robust to alternate forms including Cox and basic exponential forms.

[8] This allows the hazard rate to be high for young teachers and then decline at a diminishing rate.

[9] Our employment data begin in 2002-2003, which creates left-censoring in *t*. We cannot observe when a teacher entered a specific school prior to 2002. However, we do have an uncensored measure of teaching experience that is recorded in personnel data. So, the experience fixed effect reflects total years of teaching experience in Louisiana public schools.

the school, employer, or parish. Finally, we compare estimates from the market and non-market settings, testing for statistically significant differences in coefficients after estimation. We perform these tests in a seemingly unrelated estimation framework, first combining the two estimations—those for the market and non-market settings—into a single parameter vector and variance/covariance matrix and then conducting a Chow test of the hypothesis of no difference in the coefficient estimates for the teacher performance measure for the market and non-market results.

5. Results

Teacher Exit, Retention, and Switching

We first analyze whether there is a relationship between teacher value-added and employment outcomes for teachers at schools in market and non-market settings. Table 2 presents results for the three specifications of equation (1) described above. These results are based on our first definition of "market" schools as all schools in Orleans Parish, and "non-market" schools as all district-run schools in neighboring parishes (results based on alternate definitions are provided in Appendix B). We estimate the probability of exiting the current parish, the employer, and current school, respectively.[10] For each type of exit, we estimate three specifications: academic year fixed effects only, academic year and experience fixed effects, and both sets of fixed effects along with the full covariates (with teacher and school characteristics). We estimate each specification as a linear probability model, so coefficients reflect marginal effects on the probability of exiting the school, employer, or parish, respectively, with robust standard errors clustered at the teacher level. Teacher value-added is standardized using the

[10] Many New Orleans charter schools are management by organizations that run multiple schools, while others are stand-alone, single-school operators. This means that many charter teachers can exit a school and still be employed by same managing organization on a different campus.

regional labor market mean and standard deviation (results based on within-school teacher value-added estimates are in the appendix).

[Insert Table 2 about here]

In our baseline specification for school exit (Table 2, column 1), we estimate that teachers employed by schools operating in market settings are 17.7 percentage points more likely to exit their school than teachers employed by schools operating in a traditional district setting. We estimate that a one standard deviation increase in teacher value-added decreases the likelihood of exit by 4.6 percentage points in non-market settings. However, columns 2 and 3 show that estimated coefficients for the market indicator (β_1) and the standardized value-added score (β_2) decline in size and significance when we add the fixed effect for teacher experience and teacher and school characteristics. This pattern of results suggests that much of the *absolute* difference in turnover between market and non-market settings is driven by the characteristics of students and teachers in the two settings. We do not consider any one of these to be a preferred model; they are estimating somewhat different parameters and the comparison is meant to tell us to what degree labor market outcomes are driven by the various factors.

We are primarily interested in the interaction between our indicator for market context and teacher value-added scores (β_3), and here estimates are consistent in size and significance across the three specifications/columns. We find negative, significant coefficients on the interaction term in all nine specifications reported in Table 2, suggesting that schools operating in market settings are more responsive to value-added scores than schools in non-market settings when it comes to teacher exit. For example, the results in column 3 indicate that, combining β_2 and β_3, a one standard deviation increase in a market teacher's estimated value-added

decreases the likelihood of exiting a school by 9.5 percentage points, compared to about 2.8 percentage points in the non-market setting.

We draw the same general conclusion across exit from school and exit from employer. However, the turnover-performance relationship is noticeably weaker with exit from the parish. A one-standard deviation increase in the value-added score is estimated to reduce the probability of exit from the non-market context by 1.9 percentage points, compared to 4.2 percentage points in the market setting. Results for the two additional definitions of market schools—the first based on school sector and the second based on sector and setting—are substantively similar to those presented in Table 2 (results in Appendix B).

The above conclusions are nearly identical when we switch from regional standardization of teacher value-added to within-school standardization. Coefficient estimates for the interaction terms are smaller (in absolute value) in the within-school estimates for the exit from school and exit from employer outcomes, but larger for exit from parish. The results for exit from school might seem surprising as they seem to imply that schools push teachers out based more on their performance relative to the average teacher in the region, rather than the school. But this logic neglects the supply side of the model (teacher decisions), and which types of schools are losing teachers. The switch to within-school estimates makes high-value-added teachers in low-value-added schools look even better than they did with regional standardization, but the opposite is true with high-value-added schools. The pattern of results therefore suggests that high-value-added schools are more likely to retain their best teachers, which of course might be how they became high-value-added schools to start with. (This cannot explain why the results reverse with exits-from-parish, but these appear to be based less on performance and market settings in all the specifications.) The results are also similar when we replace the linear value-added variable with

an indicator for teachers in the top-quartile and when we switch from annual teacher value-added to three-year rolling averages, e.g., to reduce statistical noise (see Appendix B).

In addition to estimating equation (1) for the full sample of teachers, we also estimate it over a sample consisting only of black teachers employed at schools in market and non-market settings (Table 3). The exit of black teachers is a particular concern in New Orleans, where a large majority of students are black, and the proportion of black teachers fell considerably after the post-Katrina school reform initiatives (Barrett and Harris, 2015; Lincove, Barrett, and Strunk, 2018). The proportion of black teachers is also one of the largest differences between Orleans Parish and neighboring school systems.

The results for exiting schools and exiting employers suggest that black teachers follow similar patterns as the full sample. In some specifications, the coefficients are smaller in absolute value and in other cases they are larger, though they are all naturally less precise with the much smaller sample. The results reach significance when we use East Baton Rouge, which has a proportion of black teachers more similar to New Orleans, as the market comparison (Appendix B). On the whole, these results suggest that the market effect on the relationship between teacher performance and exit is similar for black teachers.

[Insert Table 3 about here]

The hazard results from estimating equation (2) are displayed in Table 4. We present exponentiated coefficients, so values greater than one reflect a positive association with the probability of exit, and values less than one reflect a negative association. The results confirm the linear probability estimates presented in Table 2. Once again, we find that value-added is negatively associated with hazard probabilities in both market and non-market settings, but effect sizes are larger and statistically significantly different in the market setting. The hazard results

are also consistent across models with and without covariates; similar to the results in Table 2, market-non-market differences are larger for school and employer exits than for parish exits.

[Insert Table 4 about here]

We display survival probabilities for teachers in the different settings in Figure 2. The figure compares two sets of New Orleans teachers—those with value-added scores in the top 5% statewide and those with scores in the bottom 5%—to the same two sets of teachers in neighboring traditional districts. The estimates for exit from schools and parish systems are quite similar. At both performance levels, New Orleans teachers are more likely to exit and, in both settings, low-performing teachers are more likely to exit. Regarding exit from employers, we see substantially larger gaps in survival probabilities between high- and low-performing teachers by market setting. This again suggests that, given the opportunity to switch employers after poor performance, New Orleans teachers are highly mobile within the school system, as well as being more mobile out of system.

[Figure 2 here]

A second mechanism of school reform in New Orleans is high-stakes accountability resulting in frequent school closure. Lincove, Carlson, and Barrett (2017) found that these closures substantially accelerate both teacher exit and school switching in New Orleans, but they find no evidence that closures selectively exit lower-performing teachers. To test whether differential exit of low value-added teachers in New Orleans is a product of closure of lower-performing schools, we also estimated all specifications predicting exit from parish school systems excluding observations in the year a school was closed. These results are displayed in

Appendix B. All results are robust to these exclusions. Thus, we rule out school closure as the primary reason why teachers with low value-added scores exit at higher rates in New Orleans.

Teacher Compensation

Our next analysis focuses on compensation for teachers who return to work in market and non-market settings. Without CBAs, market schools are not tied to salary schedules and could use salary to reward performance. Further, with competitive hiring, salary increases might be necessary to prevent teachers from exiting to positions in competing schools, and salary decreases might be experienced by low-performing teachers seeking employment following a dismissal. Using the three specifications of equation (1) described earlier and employing our preferred definition of market setting, we use OLS to estimate a teacher's next-year salary as a function of the value-added score, employment at a market school, and the interaction of the two. These estimates include controls for current-year salary and thus estimate market effects on *changes* in salary in the next year. All results have robust standard errors clustered at the teacher level. Because current and potential employers have different information about teachers, we report results in Table 5 separately for two sets of teachers: 1) teachers who returned to the same school from t to $t+1$ whose next-year salary is determined by the current manager, and 2) teachers who switched to a new school whose next-year salary is determined by the new manager.

[Insert Table 5 about here]

Our first results (columns 1-6) use our preferred market definition and compare all New Orleans schools to neighboring traditional public schools. Results for the sample of teachers who returned to the same school (columns 1-3) suggest that, controlling only for value-added, prior salary, and school year, the average change in salary of teachers in market schools is not

significantly different from that of teachers in traditional schools (column 1). However, controlling for teacher experience, we find that teachers employed in market settings exhibit salary changes that are roughly $1,000 greater than the changes of teachers employed in traditional settings with similar experience levels (column 2), and similar demographic characteristics and schooling contexts (column 3). However, the very small and insignificant interaction coefficients between value-added and market suggest that any use of these financial incentives for retention purposes is unrelated to quality.

The results differ for teachers who stay in the same school compared with those who switch schools (columns 4-6). In the market setting, teachers who switched schools commanded a premium of up to $1,800 in additional salary, compared to their peers who switched schools in non-market settings. The estimate for the interaction term suggests an additional premium of between $500-1,000 for each standard deviation increase in value-added for teachers in market settings, but these estimates fail to reach statistical significance. We also provide results for an alternate definition of "market" comparing only New Orleans charter school teachers to neighboring traditional public schools. Here we see that charter teachers who switch schools command an estimated wage premium of approximately $1,000 for each standard deviation of value-added, although the result is only statistically significant at $p<0.10$. We see no significant interaction of value-added and market for charter school teachers who remain in the same school.

In summary, our estimates of teacher pay suggest that any connection between performance and pay in the market setting occur only when teachers move across charter schools, and even that relationship is somewhat tenuous. We see no evidence of selective pay increases within schools for current teachers with relatively better performance. This may be counter-intuitive because current schools have the most information about teacher performance,

but there are several potential explanations for this. First, value-added is one of the few measures that can be easily communicated by teachers to other schools, as a form of credential that can affect salary when switching schools. Also, charter schools might be flexible on the starting salary even if they do not have explicit performance pay plans that yield raises after teachers start. Finally, it could be that teachers simply move from schools with low average salaries to those with higher salaries.

6. Does the Portfolio Model Lead to Systemwide Improvement Over Time?

Our results in Tables 2-4 and robustness checks in Appendix B provide evidence that schools operating in the market setting of New Orleans are more likely to exit teachers with low value-added scores, compared to schools operating in more traditional, non-market settings. As discussed earlier, this does not necessarily mean that teacher quality will improve over time; replacement teachers also have to be more effective than those who were dismissed. The higher absolute turnover rate calls this into question; high turnover signals a lack of willingness of teachers to supply labor to market schools, which means schools in the market might also have trouble attracting quality replacement teachers. Indeed, there is evidence that low job security and longer work hours in post-Katrina New Orleans have reduced teacher job satisfaction (Weixler, Barrett and Harris, 2018).

To gain some insight into whether teacher dismissal and hiring patterns have generated quality increases across the market of New Orleans relative to the non-market setting of its neighbors, we analyzed the distribution of value-added of exiting and *entering* teachers separately for the non-market and market setting for each exit and hiring cycle from 2011 to 2015. Across years, the exiting teachers in the traditional school districts had an average value-added of -0.223 s.d. (i.e., noticeably below the state average); the entering/replacement teachers

averaged -0.182 s.d., suggesting that the net effect was to increase teacher quality by 0.041 s.d. In New Orleans, by contrast, the analogous figures were -0.281 for exiting teachers and -0.269 for entering/replacement teachers—an improvement in value-added of 0.012 standard deviations. In other words, the replacement teachers were slightly better, but these personnel moves did less to improve average teacher quality than those in the comparison group.

To provide more detail on this analysis, Figure 3A shows kernel density distributions of teacher value-added for all teachers in New Orleans over our longitudinal period of study with snapshots in 2010, 2012, and 2015. Although New Orleans has slightly higher value-added across all three years, we do not see the market mechanism moving the teacher distribution to the right, relative to the traditional districts. In Figure 3B, we illustrate the value-added distribution of entering teachers in their first year. Here we see that the quality of new entrants is fairly similar, on average, in both settings, but more dispersed in New Orleans. In Figure 3C, we illustrate the distribution for exiting teachers only in their final year. Again, although New Orleans is exiting low-performing teachers more frequently, the overall distributions are not very different, nor are they separating over time. Finally, in Figure 3D we show differences in the distribution of teachers' years employed. Over time, we do see a growing difference with New Orleans teachers becoming relatively less experienced, which also contributes to stagnant average quality.

[Insert Figure 3 about here]

This analysis is only descriptive and imperfectly represents the dynamics of systemwide teacher quality across market and non-market settings. It does not account for teacher movement between tested and non-tested subjects, nor does it address experience-driven quality gains, nor does it account for factors other than policy and practice that might influence the quality of

teachers who enter the local market. What it does do, however, is illustrate why simply examining the relationship between performance and retention is insufficient to conclude that market model improves quality at the system level. The same policies influencing that relationship may also influence quality through the supply of replacement teachers, but in opposite directions.

7. Discussion

The theory of public school improvement through market-based reform relies on the argument that employment regulations, teacher contracts, and monopsony hiring create conditions that allow low-performing teachers to continue employment with little incentive to improve (Chubb & Moe, 1990). But previous studies of charter school employment have found little evidence that these schools with deregulated personnel practices were better able to retain high-quality and exit low-quality teachers than traditional school districts. Instead, most studies of charter school employment find that these teachers are, on average, less qualified than traditional public school teachers and more likely to exit regardless of performance (e.g., Carruthers 2012; Jackson 2012).

In contrast, we find that teacher exit and retention in New Orleans are more responsive to teacher value-added scores than neighboring traditional employment settings. The stronger performance-retention link in this setting is most likely because New Orleans is really the first place where all the elements were in place to encourage performance-based retention: Schools were being held strictly accountable for student performance and could measure teacher performance on those same student outcomes (i.e., teacher value-added to test scores). In addition to their performance contracts, schools were competing against one another to attract talent; and schools had complete autonomy over compensation and employment. It is therefore

perhaps not surprising that the results were different in New Orleans. The circumstances were uniquely arranged to yield links between performance and labor market outcomes.

Still, the market did not work in quite the way that Chubb & Moe (1990 predicted. Much of the teacher movement in the market setting is churn within the system, with teachers switching schools and employers. There appear to be substantial opportunities for reemployment after poor performance in the market setting. Similarly, Lincove, Carlson, and Barrett (2019) find that while the accountability mechanism of performance-based school closure caused an increase in teacher exit in New Orleans, the majority of teachers in closing schools were immediately rehired in other schools.

To better understand the dynamics of a deregulated teacher labor market, it is important to identify several mechanisms at work. First, as in most settings of urban education reform, turnover and exit in general are substantially higher in Orleans Parish than neighboring districts. This turnover is likely motivated in part by other components of market-based reform that change the nature of teaching, such as the lack of long-term employment security, longer school days and school years, reduced retirement benefits, and high-stakes accountability. Indeed, prior research suggests that turnover was much higher pre-Katrina (Barrett & Harris, 2015). Therefore, combined with the exit of low-quality teachers and the inability to substantially increase teacher pay, Orleans Parish, like many urban school districts, must rely on a large and consistent pipeline of new teachers. There is evidence that the system has been able to improve test performance (Harris and Larsen, 2018). This may be because New Orleans, in the period of reduced enrollment and citywide rebuilding after Katrina, had an unusually large supply of qualified teachers, which allowed schools to find large numbers of qualified replacements (Harris, forthcoming). Other cities with high turnover are more likely to struggle in maintaining a supply

of replacement teachers, so that the results of this type of analysis would be different.

A second mechanism is the dynamic performance of remaining teachers. The theory of improvement through exits of low-performing teachers also assumes that hiring a replacement is more efficient than professional development of current teachers. If teacher performance improves with experience, systems that frequently exit teachers are foregoing benefits of further investment in professional development for low-performing teachers who exit. The average experience of New Orleans teachers in our sample is only 5.6 years, compared to nearly 10 in neighboring parishes. Thus, New Orleans fails to realize performance advantages associated with experience.

A final issue generally left unaddressed in theories of market reforms is the potential reduction in the quality of information about teachers in contexts with multiple, competing employers. In traditional governance models, school districts are essentially the sole employers of teachers, so they have data with which to assess all current teachers, which mitigates the issue of adverse selection. This is not the case for charter school managers who are likely to only have access to evaluation data for their own teachers. This information asymmetry may make it more likely that low-performing teachers in market settings get rehired elsewhere. Thus, an increased degree of adverse selection in the teacher labor market is likely an unintended consequence of expanding a system's charter sector.

Overall, these results provide mixed support for the theory of school improvement through autonomy to hire and fire teachers. It does appear that in a fully-realized market setting, teacher quality is a greater factor in exit and retention. However, we do not see that New Orleans is able to improve teacher quality overall through this mechanism, as teacher performance relative to neighboring traditional districts is not improving over time. Performance differences

are rarely reflected in teacher pay, except when teachers switch schools, which likely exacerbates already-high turnover rates. Further investigation is needed to determine if downsides of human resource autonomy may outweigh the benefits of flexibility.

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Appendix A: Teacher Value-Added Model

For a given teacher j, student i, classroom c and school year t, we estimate a standard value-added model:

$$A_{it} = \mu + \alpha A_{it-1} + \beta X_{it} + \rho C_{ct} + \theta_{jt} + \varepsilon_{it}$$

- A_{it}: post-score
- A_{it-1}: pre-score
- X_{it}: student characteristics
- C_{it}: classroom characteristics
- θ_{jt}: value-added of teacher j in year t
- ε_{it}: error term for student i in year t

The model is estimated by year (2009-2015) and subject (math, ELA, science, social studies).

Following Guarino et al. (2015), the above value-added model can be re-written as:

$$y = X\gamma + Zb + u$$

X includes student demographics and prior test scores. Z includes course taking dummies. u contains the unobserved student-specific effects. b is the vector of teacher effects.

The shrunken value-added estimate for teacher j is then:

$$\hat{b}_j = \left(\frac{\sigma_b^2}{\sigma_b^2 + (\sigma_u^2/N_j)}\right)(\bar{y}_j - \bar{x}_j\hat{\gamma})$$

Let $c \equiv \frac{\sigma_b^2}{\sigma_b^2+(\sigma_u^2/N_j)}$. It represents the shrinkage factor. σ_b^2 is the variance of the teacher effects, b_j . σ_u^2 is the variance of the student-level error, u. N_j is the number of students taught by teacher j. $\bar{y}_j - \bar{x}_j\hat{\gamma}$ is the unshrunken estimate.

Appendix Table B1. Estimated Effects of Market Setting and Having a Value-Added Score on Teacher Exit Probabilities

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.183***	0.183***	0.183***	0.221***	0.221***	0.221***	0.102***	0.102***	0.102***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)
Has a vam	0.011	0.011	0.011	0.008	0.008	0.008	0.009	0.009	0.009
	(0.009)	(0.009)	(0.009)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)	(0.007)
Has a vam x market	-0.011	-0.011	-0.011	0.000	0.000	0.000	-0.015	-0.015	-0.015
	(0.014)	(0.014)	(0.014)	(0.013)	(0.013)	(0.013)	(0.011)	(0.011)	(0.011)
Constant	0.223***	0.214***	0.214***	0.095***	0.117***	0.117***	0.098***	0.115***	0.115***
	(0.008)	(0.005)	(0.005)	(0.006)	(0.004)	(0.004)	(0.006)	(0.004)	(0.004)
Observations	22662	22662	22662	22662	22662	22662	22662	22662	22662
Unique teachers	6583	6583	6583	6583	6583	6583	6583	6583	6583
Acad. year fixed effects	x	x	x	x	x	x	x	x	x
Experience fixed effects		x	x		x	x		x	x
Teacher and school covariates			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of all teachers not eligible for retirement between fall 2009 and spring 2015. Value-added scores (vam) are estimated for 4th to 8th grade teachers during years they taught in a tested subject. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. The reference group is a novice teacher in 2009-10 with no vam. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Appendix Table B2: Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities - Alternative Market Definitions

	Panel A: Market = New Orleans Charter Schools								
	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.142***	0.064***	-0.051***	0.188***	0.113***	0.008	0.090***	0.024**	-0.017
	(0.012)	(0.013)	(0.017)	(0.011)	(0.012)	(0.016)	(0.010)	(0.010)	(0.014)
Vam	-0.075***	-0.066***	-0.046***	-0.056***	-0.048***	-0.030***	-0.036***	-0.028***	-0.021***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
Vam x market	-0.028**	-0.025**	-0.033***	-0.044***	-0.040***	-0.048***	-0.020**	-0.018**	-0.021**
	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Constant	0.281***	0.348***	0.185***	0.156***	0.226***	0.144***	0.127***	0.173***	0.133***
	(0.013)	(0.022)	(0.036)	(0.011)	(0.021)	(0.035)	(0.010)	(0.018)	(0.032)
Observations	6923	6923	6923	6923	6923	6923	6923	6923	6923
Unique teachers	2600	2600	2600	2600	2600	2600	2600	2600	2600
Acad. year FEs	x	x	x	x	x	x	x	x	x
Experience FEs		x	x		x	x		x	x
Teacher/sch covariates			x			x			x
	Panel B: Market = Any Charter School								
	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.141***	0.064***	-0.051***	0.188***	0.113***	0.008	0.090***	0.025**	-0.015
	(0.012)	(0.013)	(0.017)	(0.011)	(0.012)	(0.016)	(0.010)	(0.010)	(0.013)
Vam	-0.075***	-0.067***	-0.046***	-0.056***	-0.048***	-0.030***	-0.036***	-0.028***	-0.021***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)
Vam x market	-0.027**	-0.025**	-0.033***	-0.042***	-0.040***	-0.047***	-0.021**	-0.020**	-0.023**
	(0.011)	(0.011)	(0.011)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)
Constant	0.281***	0.345***	0.181***	0.155***	0.223***	0.141***	0.127***	0.171***	0.131***
	(0.013)	(0.022)	(0.036)	(0.011)	(0.021)	(0.035)	(0.010)	(0.018)	(0.031)
Observations	6965	6965	6965	6965	6965	6965	6965	6965	6965
Unique teachers	2616	2616	2616	2616	2616	2616	2616	2616	2616
Year FEs	x	x	x	x	x	x	x	x	x
Experience FEs		x	x		x	x		x	x
Teacher/sch covariates			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of 4th to 8th grade teachers during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. In Panel A, the market indicator is equal to one for teachers in Orleans Parish charter schools. The comparison group (market =0) includes teachers employed by Jefferson, St. Bernard Parish, and Orleans Parish (including the local district and the state). Charter school teachers in the comparison districts are excluded. In Panel B, the market indicator is equal to one for teachers in Orleans Parish or Jefferson Parish charter schools. The comparison group (market =0) includes teachers employed by Jefferson, St. Bernard Parish, and Orleans Parish school districts and the State Recovery School district. Teacher value-added is standardized within the regional labor market (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Appendix Table B3: Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities - Omitting Closing Schools

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.159***	0.091***	-0.017	0.196***	0.132***	0.072***	0.089***	0.029***	-0.016
	(0.012)	(0.012)	(0.020)	(0.011)	(0.011)	(0.018)	(0.010)	(0.010)	(0.017)
Vam	-0.048***	-0.041***	-0.029***	-0.029***	-0.024***	-0.017***	-0.029***	-0.024***	-0.019***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Vam x market	-0.057***	-0.053***	-0.051***	-0.069***	-0.064***	-0.062***	-0.026***	-0.022**	-0.024***
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)	(0.009)	(0.009)	(0.009)
Constant	0.211***	0.262***	0.159***	0.110***	0.166***	0.101***	0.117***	0.171***	0.135***
	(0.013)	(0.023)	(0.038)	(0.011)	(0.021)	(0.035)	(0.011)	(0.019)	(0.033)
Observations	6667	6667	6667	6667	6667	6667	6667	6667	6667
Unique teachers	2547	2547	2547	2547	2547	2547	2547	2547	2547
Academic year fixed effects	x	x	x	x	x	x	x	x	x
Experience fixed effects		x	x		x	x		x	x
Teacher and school covariates			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of 4th to 8th grade teachers during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. Observations are omitted for teachers in schools that were closed or reconstituted at the end of the school year. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. Teacher value-added (vam) is standardized within the regional labor market (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Appendix Table B4. Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities - Within-School Value-Added

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.173***	0.107***	-0.009	0.222***	0.157***	0.092***	0.087***	0.027***	-0.023
	(0.012)	(0.013)	(0.020)	(0.011)	(0.011)	(0.018)	(0.009)	(0.010)	(0.016)
Has a vam	-0.017**	-0.012*	-0.015**	-0.011*	-0.007	-0.009*	-0.011*	-0.007	-0.009
	(0.007)	(0.007)	(0.007)	(0.006)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)
Has a vam x market	-0.037***	-0.035***	-0.033***	-0.043***	-0.040***	-0.038***	-0.024***	-0.021**	-0.019**
	(0.011)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)
Constant	0.246***	0.321***	0.116***	0.112***	0.188***	0.050	0.115***	0.171***	0.114***
	(0.014)	(0.023)	(0.038)	(0.011)	(0.021)	(0.036)	(0.011)	(0.019)	(0.033)
Observations	6923	6923	6923	6923	6923	6923	6923	6923	6923
Unique teachers	2600	2600	2600	2600	2600	2600	2600	2600	2600
Academic year fixed effects	x	x	x	x	x	x	x	x	x
Experience fixed effects		x	x		x	x		x	x
Teacher and school covariates			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of 4th to 8th grade teachers during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. Within-school teacher value added (within-school vam) is estimated with a school fixed effect and standardized within the regional labor market (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Appendix Table B5. Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities - Average Value-Added over 3 Years

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.168***	0.116***	0.007	0.214***	0.164***	0.106***	0.079***	0.030***	-0.014
	(0.011)	(0.012)	(0.020)	(0.010)	(0.011)	(0.018)	(0.009)	(0.010)	(0.016)
Has a vam	-0.043***	-0.038***	-0.025***	-0.026***	-0.022***	-0.014**	-0.025***	-0.022***	-0.016***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Has a vam x market	-0.062***	-0.064***	-0.063***	-0.067***	-0.067***	-0.066***	-0.017*	-0.017**	-0.019**
	(0.010)	(0.010)	(0.011)	(0.009)	(0.009)	(0.010)	(0.009)	(0.008)	(0.009)
Constant	0.244***	0.304***	0.165***	0.115***	0.161***	0.078**	0.118***	0.154***	0.124***
	(0.014)	(0.026)	(0.039)	(0.011)	(0.023)	(0.037)	(0.011)	(0.021)	(0.033)
Observations	6923	6923	6923	6923	6923	6923	6923	6923	6923
Unique teachers	2600	2600	2600	2600	2600	2600	2600	2600	2600
Acad. year FEs	x	x	x	x	x	x	x	x	x
Experience FEs		x	x		x	x		x	x
Teacher/sch covariates			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of 4th to 8th grade teachers during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. 3-year average teacher value added (3-year average vam) is estimated across observed vams in t=0, t=-1, and t=-2 and standardized within the regional labor market (see Appendix A). All specifications include a dummy indicator for the number of years included in the 3-year vam (1, 2, or 3 years). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Appendix Table B6. Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities - Teachers with Bottom Quartile Value-Added

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.265***	0.213***	0.015	0.392***	0.330***	0.240***	0.222***	0.164***	0.091
	(0.068)	(0.069)	(0.081)	(0.066)	(0.067)	(0.077)	(0.061)	(0.061)	(0.072)
Has a vam	-0.025	-0.021	-0.022	-0.024	-0.023	-0.020	-0.025	-0.028	-0.027
	(0.036)	(0.035)	(0.033)	(0.031)	(0.031)	(0.029)	(0.031)	(0.030)	(0.029)
Has a vam x market	-0.053	-0.056	-0.057	0.006	0.003	0.007	0.052	0.052	0.045
	(0.047)	(0.046)	(0.045)	(0.046)	(0.045)	(0.045)	(0.042)	(0.042)	(0.041)
Constant	0.218***	0.239***	0.266**	0.068	0.099	0.157	0.077	0.117*	0.104
	(0.053)	(0.067)	(0.109)	(0.048)	(0.063)	(0.107)	(0.047)	(0.060)	(0.101)
Observations	1268	1268	1268	1268	1268	1268	1268	1268	1268
Unique teachers	892	892	892	892	892	892	892	892	892
Academic year FEs	x	x	x	x	x	x	x	x	x
Experience FEs		x	x		x	x		x	x
Teacher/sch covariates			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of 4th to 8th grade teachers during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. Sample is restricted to teachers with a current-year vam in the bottom 25% statewide. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. Teacher value-added (vam) is standardized within the regional labor market (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Appendix Table B7. Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities - Comparison of Orleans Parish and East Baton Rouge

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.197***	0.165***	0.123***	0.230***	0.191***	0.161***	0.115***	0.083***	0.061***
	(0.011)	(0.011)	(0.012)	(0.010)	(0.010)	(0.011)	(0.009)	(0.009)	(0.009)
Has a vam	-0.041***	-0.036***	-0.017***	-0.030***	-0.025***	-0.015***	-0.021***	-0.016***	-0.014***
	(0.006)	(0.006)	(0.006)	(0.005)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)
Has a vam x market	-0.080***	-0.079***	-0.080***	-0.079***	-0.077***	-0.078***	-0.034***	-0.033***	-0.033***
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.008)	(0.008)	(0.008)
Constant	0.151***	0.183***	-0.040	0.076***	0.131***	0.020	0.064***	0.090***	0.043
	(0.011)	(0.020)	(0.032)	(0.009)	(0.019)	(0.030)	(0.008)	(0.017)	(0.027)
Observations	7690	7690	7690	7690	7690	7690	7690	7690	7690
Unique teachers	2803	2803	2803	2803	2803	2803	2803	2803	2803
Academic year FEs	x	x	x	x	x	x	x	x	x
Experience FEs		x	x		x	x		x	x
Teacher/sch. covariates			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of 4th to 8th grade teachers during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school district, state recovery district, or a CMO. The comparison group (market =0) includes teachers in East Baton Rouge employed by the local school district or state recovery district. East Baton Rouge charter school teachers are excluded. Teacher value-added (vam) is standardized within the combined Orleans and East Baton Rouge labor markets (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Figure 1. Baseline Teacher Value-Added Distribution of All Teachers by Setting

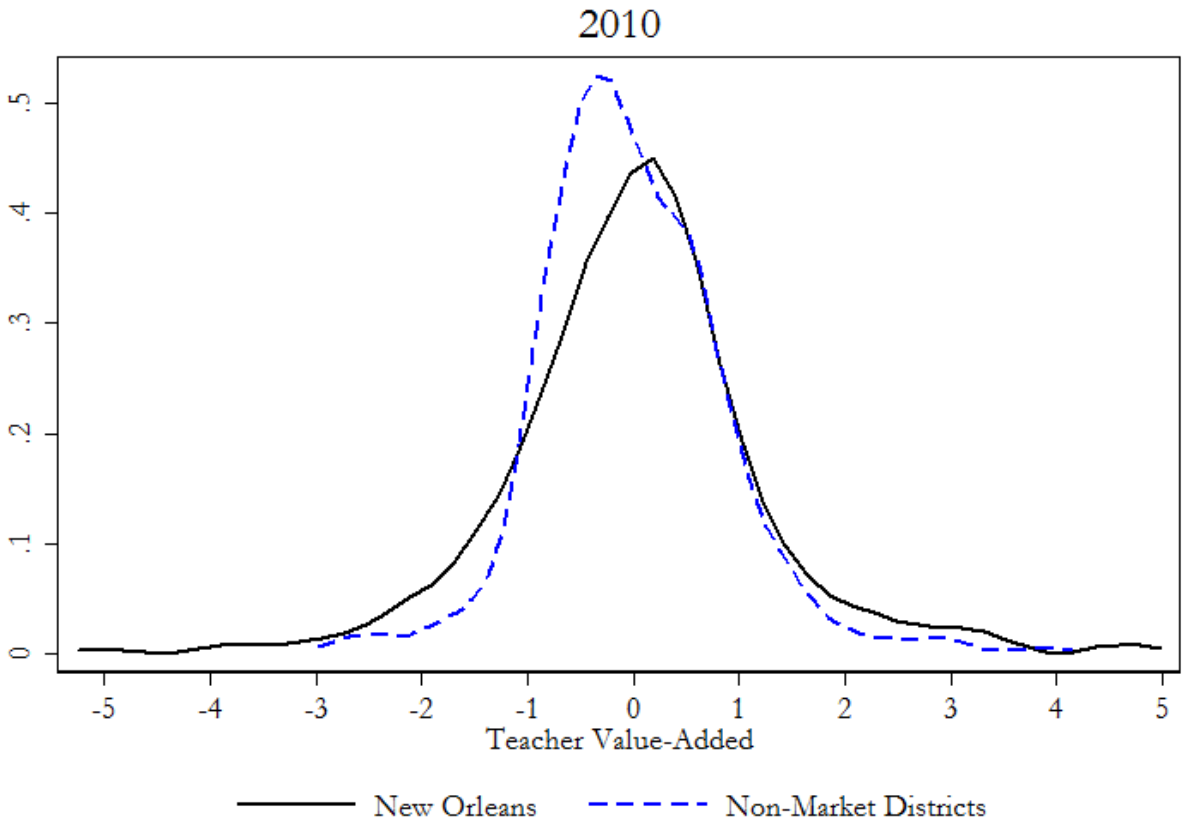
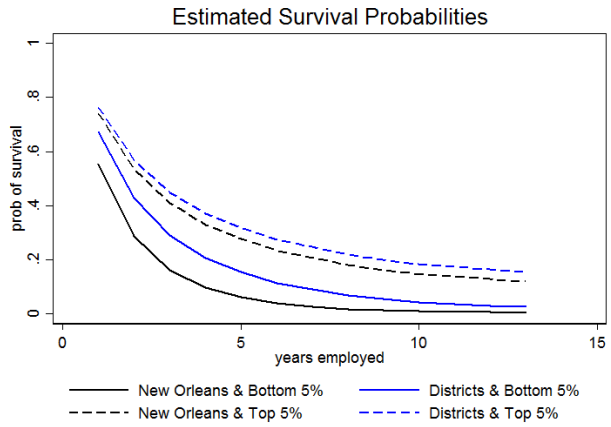
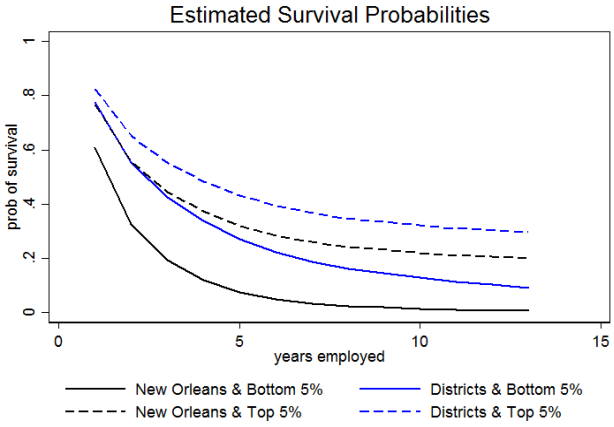


Figure 2. Estimated Survival Rates over Years Employed for Market and Non-Market Teachers

A. Exit from Current School



B. Exit from Current Employer (District or CMO)



C. Exit from Current Parish School System

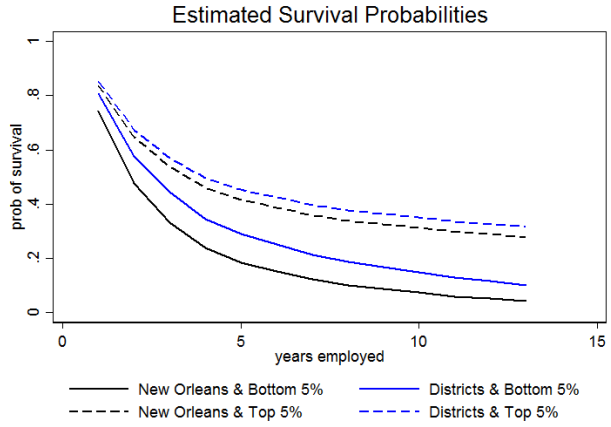
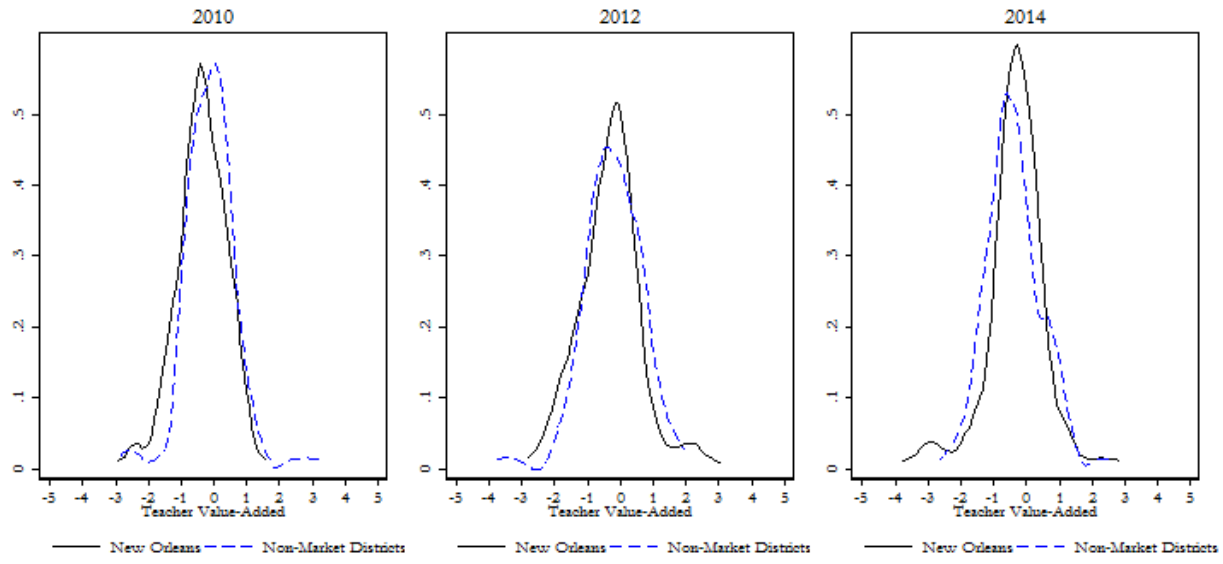
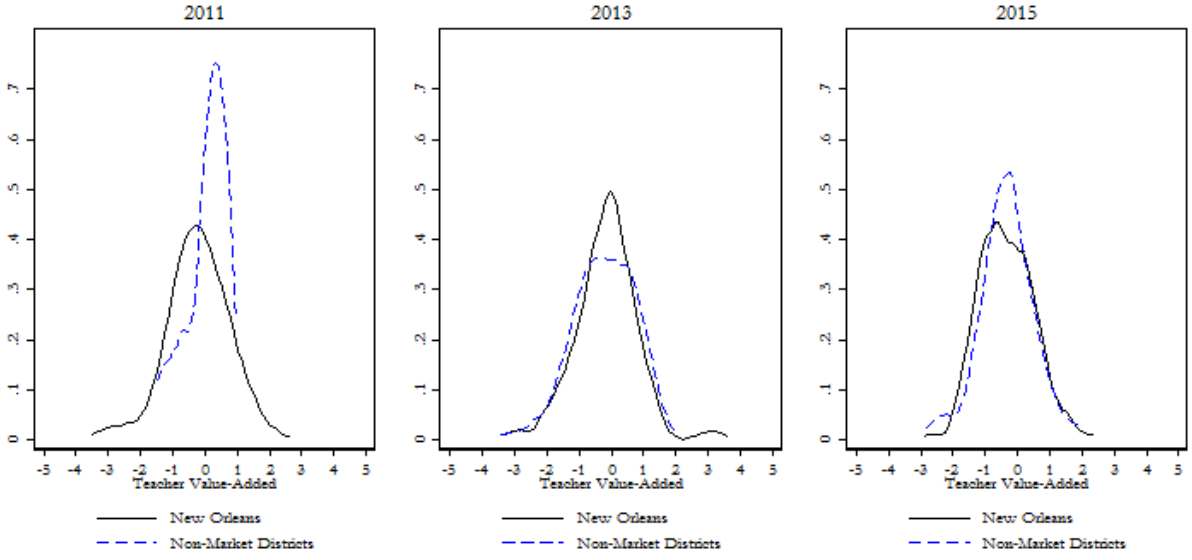


Figure 3. Performance Distributions Over Time by Setting

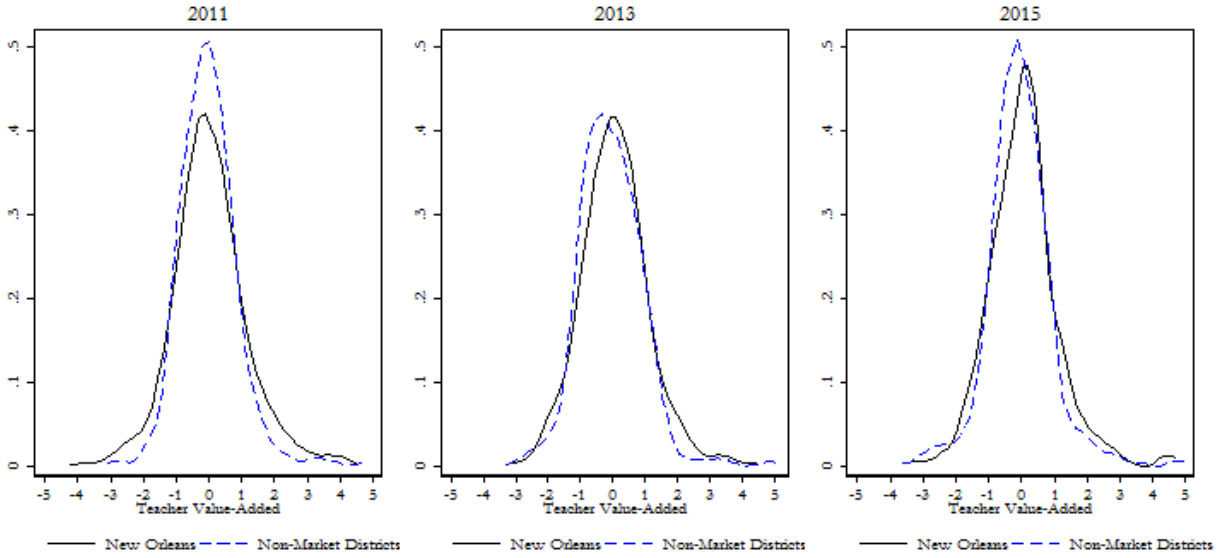
A. Exiting Teachers



B. Replacement Teachers (new entrants)



C. All Teachers



D. Teacher Experience

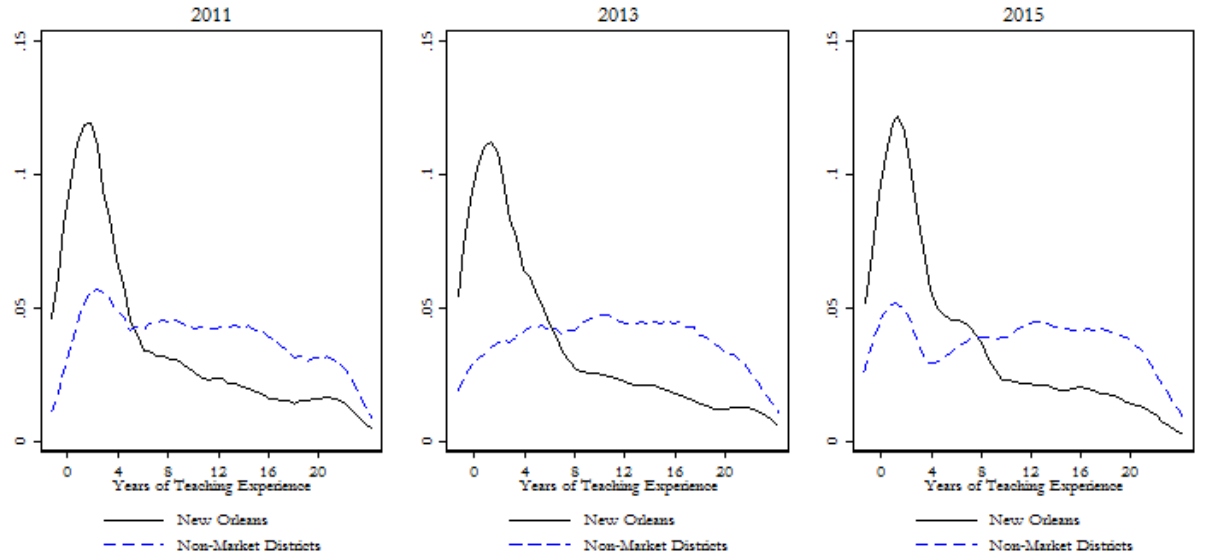


Table 1. Summary Statistics for Teachers in Market and District Settings

	Primary Market Definition		Alternative Market Definition 1		Alternative Market Definition 2	
	All Orleans Parish Schools	Jefferson & St. Bernard Parish District-Run Schools	Orleans Parish Charter Schools	Jefferson & St. Bernard Parish District-Run Schools	All Regional Charter Schools	All Regional District-Run Schools
	(1)	(2)	(3)	(4)	(5)	(6)
Employment outcomes						
Exit from school	0.397	0.225	0.378	0.259	0.377	0.259
Exit from employer	0.346	0.125	0.332	0.161	0.332	0.161
Exit from parish	0.211	0.124	0.214	0.133	0.214	0.133
Exit from teaching	0.174	0.069	0.176	0.080	0.175	0.080
Salary	$47,016	$46,911	$46,864	$47,016	$46,810	$47,016
	(7635)	(6519)	(7674)	(6620)	(7687)	(6620)
Teacher performance						
Value-added score	0.029	-0.025	0.115	-0.077	0.110	-0.077
	(1.071)	(0.930)	(1.052)	(0.955)	(1.051)	(0.955)
School performance						
Aggregate value-added score	0.053	0.045	0.085	0.025	0.084	0.025
	(0.200)	(0.146)	(0.183)	(0.162)	(0.183)	(0.162)
F-graded school	0.112	0.031	0.081	0.061	0.081	0.061
Closing school	0.057	0.019	0.026	0.045	0.026	0.045
Teacher characteristics						
Years of teaching experience	5.581	9.996	4.967	9.899	4.954	9.899
	(6.102)	(6.614)	(5.593)	(6.735)	(5.579)	(6.735)
Black	0.472	0.176	0.429	0.240	0.426	0.240
Female	0.765	0.891	0.761	0.879	0.759	0.879
TNTP or TFA participant	0.248	0.064	0.263	0.075	0.262	0.075
Louisiana college graduate	0.524	0.845	0.481	0.837	0.480	0.837
Alternative certification program	0.302	0.272	0.309	0.271	0.309	0.271
STEM certificate	0.220	0.137	0.223	0.145	0.223	0.145
Student characteristics						
Percent on free/reduced lunch	0.838	0.806	0.831	0.815	0.831	0.815
	(0.201)	(0.156)	(0.212)	(0.153)	(0.212)	(0.153)
Percent Black	0.876	0.441	0.861	0.502	0.858	0.502
	(0.198)	(0.209)	(0.210)	(0.259)	(0.213)	(0.259)
Teacher x year observations	3295	3628	2813	4110	2855	4110
Unique teachers	1445	1240	1266	1503	1284	1503

Notes: Mean values (standard deviations). Sample includes 4th to 8th grade teachers with up to 23 years of experience in the fall of each year who taught in a tested subject from fall 2009 to spring 2015. For columns 1-2, "market" teachers are employed by any Orleans Parish school, and "district" teachers are employed by Jefferson or St. Bernard Parish school districts. For columns 3-4, "market teachers are employed by Orleans Parish charter schools, and "district" teachers are employed by Orleans, Jefferson, and St. Bernard Parish school districts or the Louisiana Recovery School District. For columns 5-6, "market" teachers are employed by Orleans Parish or Jefferson Parish charter schools, and "district" teachers are employed by Orleans, Jefferson, and St. Bernard Parish school districts or the Louisiana Recovery School District.

Table 2. Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.178***	0.115***	0.011	0.226***	0.164***	0.108***	0.090***	0.030***	-0.012
	(0.011)	(0.012)	(0.020)	(0.010)	(0.011)	(0.018)	(0.009)	(0.010)	(0.016)
Vam	-0.045***	-0.040***	-0.028***	-0.030***	-0.025***	-0.017***	-0.029***	-0.025***	-0.019***
	(0.007)	(0.007)	(0.007)	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.005)
Vam x market	-0.070***	-0.068***	-0.067***	-0.075***	-0.072***	-0.071***	-0.023***	-0.021**	-0.023***
	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)	(0.009)	(0.009)	(0.008)	(0.009)
Constant	0.244***	0.301***	0.148***	0.111***	0.172***	0.080**	0.114***	0.164***	0.130***
	(0.013)	(0.022)	(0.037)	(0.011)	(0.021)	(0.035)	(0.011)	(0.019)	(0.032)
Observations	6923	6923	6923	6923	6923	6923	6923	6923	6923
Unique teachers	2600	2600	2600	2600	2600	2600	2600	2600	2600
Academic year FEs	x	x	x	x	x	x	x	x	x
Experience FEs		x	x		x	x		x	x
Teacher/sch. covariates			x			x			X

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of 4th to 8th grade teachers during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. Teacher value-added (vam) is standardized within the regional labor market (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Table 3. Estimated Effects of Market Setting and Value-Added on Teacher Exit Probabilities - Black Teachers Only

	Exit School			Exit Employer			Exit Parish		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Market	0.123***	0.079***	0.057	0.189***	0.143***	0.150***	0.020	-0.015	-0.034
	(0.023)	(0.024)	(0.040)	(0.019)	(0.020)	(0.037)	(0.017)	(0.017)	(0.029)
Vam	-0.036*	-0.033*	-0.028	-0.039**	-0.036**	-0.031**	-0.038**	-0.036**	-0.032**
	(0.020)	(0.020)	(0.020)	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)	(0.015)
Vam x market	-0.092***	-0.090***	-0.091***	-0.067***	-0.065***	-0.066***	-0.016	-0.014	-0.016
	(0.022)	(0.022)	(0.022)	(0.018)	(0.018)	(0.018)	(0.017)	(0.017)	(0.017)
Constant	0.207***	0.278***	0.125	0.067***	0.147***	0.088	0.091***	0.163***	0.181***
	(0.026)	(0.045)	(0.086)	(0.022)	(0.042)	(0.082)	(0.019)	(0.035)	(0.069)
Observations	2192	2192	2192	2192	2192	2192	2192	2192	2192
Unique teachers	821	821	821	821	821	821	821	821	821
Academic year FEs	x	x	x	x	x	x	x	x	X
Experience FEs		x	x		x	x		x	X
Teacher/sch. covariates			x			x			X

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from linear probability model estimation of teacher exit. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of black teachers assigned to 4th to 8th grade during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. The market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. Teacher value-added (vam) is standardized within the regional labor market (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.

Table 4. Hazard Model Estimates for Market and District Settings

	Exit from School				Exit from Employer				Exit from Parish			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Market teachers												
Failures/Observations	1309/3295				1141/3295				696/3295			
estimated effect of vam (odds ratio)	0.946*	0.938*	0.965*	0.971*	0.952*	0.946*	0.956*	0.968*	0.971*	0.968*	0.963*	0.975*
standard error	(0.005)	(0.005)	(0.008)	(0.005)	(0.005)	(0.005)	(0.008)	(0.005)	(0.005)	(0.005)	(0.009)	(0.005)
Comparison district teachers												
Failures/Observations	816/3628				452/3628				450/3628			
estimated effect of vam (odds ratio)	0.975*	0.975*	0.998	0.989*	0.975*	0.974*	0.995	0.989*	0.975*	0.973*	0.994	0.989*
standard error	(0.005)	(0.005)	(0.007)	(0.005)	(0.005)	(0.006)	(0.009)	(0.005)	(0.005)	(0.006)	(0.009)	(0.005)
Chi-square test of equivalence	18.51*	20.63*	9.86*	6.27*	10.12*	13.05*	10.04*	7.25*	0.23	0.42	5.52*	3.40*
Acad. year FEs	x	x	x	x	x	x	x	x	x	x	x	X
Baseline experience FEs		x	x			x	x			x	x	
Teacher/sch. covariates (time-varying)			x				x				x	
Within-school vam				x				x				X

* p<0.05

Notes: Odds ratios from parametric estimation of hazard models using Weibull distribution for the time-varying effect of teacher vam on exit probabilities. Standard errors in parentheses are clustered within teachers. Time is measured from the teacher's first year of employment in the school (columns 1-4), employer (columns 5-8), or parish (columns 9-12). Sample includes 4th to 8th grade teachers with up to 23 years of experience in the fall of each year who taught in a tested subject from fall 2009 to spring 2015. Employment outcomes are measured through fall 2016. Market definition includes all teachers in Orleans Parish who were employed by the local school district, state recovery district, or a CMO. Comparison district teachers includes teachers employed by Jefferson and St. Bernard Parish school districts. Jefferson Parish charter school teachers are excluded. Teacher value-added (vam) is standardized within the regional labor market and, for columns 4, 8, and 12 only, estimated with a school fixed effect (see Appendix A). Baseline hazard is for a novice teacher with average value-added score (z-score=0). Baseline experience measures the teacher's years of experience when she entered the school (columns 1-4), employer (columns 5-8), or parish (columns 9-12). School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate. School demographics are also modeled to vary over time. Equivalence of vam effects across groups was tested using seemingly unrelated estimation and Chow test. Chi-square test results are displayed with * if market and comparison groups effects are statistically significantly different at p<0.05.

Table 5. Estimated Effects of Market Setting and Value-Added on Teacher Pay

	Market = All Orleans Parish						Market = Orleans Parish Charter Schools Only					
	Returned to Same School			Changed Schools			Returned to Same School			Changed Schools		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Market	327**	686***	698***	538	1261*	1877*	451***	914***	954***	263	1015	765
	(139)	(151)	(266)	(614)	(678)	(1134)	(150)	(164)	(222)	(669)	(716)	(925)
Vam	154*	151*	169**	788*	916*	787	165**	150*	169**	600*	644*	557
	(83)	(85)	(85)	(461)	(473)	(513)	(79)	(80)	(80)	(328)	(360)	(407)
Vam x market	21	-24	-1	514	438	516	-35	-91	-55	1108*	1021*	1140*
	(128)	(132)	(131)	(581)	(594)	(658)	(132)	(137)	(135)	(578)	(611)	(659)
Constant	9932***	13005***	12845***	16347***	17130***	16519***	9816***	13052***	12772***	16868***	17513***	17188***
	(853)	(1149)	(1221)	(3135)	(3557)	(4768)	(863)	(1152)	(1225)	(3201)	(3635)	(4802)
Observations	4839	4839	4839	938	938	938	4839	4839	4839	938	938	938
Unique teachers	1926	1926	1926	800	800	800	1926	1926	1926	800	800	800
Academic year FEs	x	x	x	x	x	x	x	x	x	x	x	x
Experience FEs		x	x		x	x		x	x		x	x
Teacher/sch. covariates			x			x			x			x

*p<0.10, **p<0.05, ***p<0.01

Notes: Coefficients from OLS estimation of teacher's salary in the next year. All specifications include current year salary as an independent variable. Standard errors in parentheses are clustered within teachers. Estimates include annual observations of teachers assigned to 4th to 8th grade during years they taught in a tested subject and were not eligible for retirement between fall 2009 and spring 2015. In columns 1-6, the market indicator is equal to one for all teachers in Orleans Parish who were employed by the local school districts, state recovery district, or a CMO. The comparison group (market =0) includes teachers employed by Jefferson and St. Bernard Parish school districts. In columns 7-12, the market indicator is equal to one for all teachers in Orleans Parish charter schools only. The comparison group (market=0) includes teachers employed by Jefferson, St. Bernard, and Orleans Parish school districts and the State Recovery School District. Jefferson Parish charter school teachers are excluded. Teacher value-added (vam) is standardized within the regional labor market (see Appendix A). The reference group is a novice teacher in 2009-10. School covariates include failing state accountability, percent FRL, and percent black. Teacher covariates include race, gender, in-state college graduate, alternative certificate program, TFA participant, STEM certificate, and SPED certificate.