A Coming Crisis in Teaching?

Teacher Supply, Demand, and Shortages in the U.S.

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This report can be found online at https://learningpolicyinstitute.org/product/coming-crisis-teaching. And follow the conversation on Twitter at #SolvingTeacherShortages.

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Executive Summary

Widespread media reports of local teacher shortages have become a hot topic in education since the summer of 2015. After years of teacher layoffs, districts began hiring again as the economy recovered from the Great Recession. Many were surprised to find they had serious difficulty finding qualified teachers for their positions, especially in fields like mathematics, science, special education, and bilingual education/English language development. A number of states greatly expanded emergency permits to allow hiring of untrained teachers to meet these demands—which is the classic definition of a shortage. To date, however, there has not yet been a detailed national analysis of the sources and extent of these shortages, or a prognosis for the future.

This report details the outcomes of such a study, which analyzes evidence of teacher shortages, as well as national and regional trends in teacher supply and demand. Using several federal databases,[1] we examine the current context and model projections of future trends under several different assumptions about factors influencing supply and demand, including new entrants, re-entrants, projected hires, and attrition rates. We also investigate policy strategies that might mitigate these effects based on research about effective approaches to recruitment and retention.[2]

We define shortages as the inability to staff vacancies at current wages with individuals qualified to teach in the fields needed. We find strong evidence of a current national teacher shortage that could worsen by 2017–18, if current trends continue. Combining estimates of supply and demand, our modeling reveals an estimated teacher shortage of approximately 64,000 teachers in the 2015–16 school year. By 2020, an estimated 300,000 new teachers will be needed per year, and by 2025, that number will increase to 316,000 annually. Unless major changes in teacher supply or a reduction in demand for additional teachers occur over the coming years, annual teacher shortages could increase to as much as 112,000 teachers by 2018, and remain close to that level thereafter.

Based on the evidence available, the emerging teacher shortage is driven by four main factors:

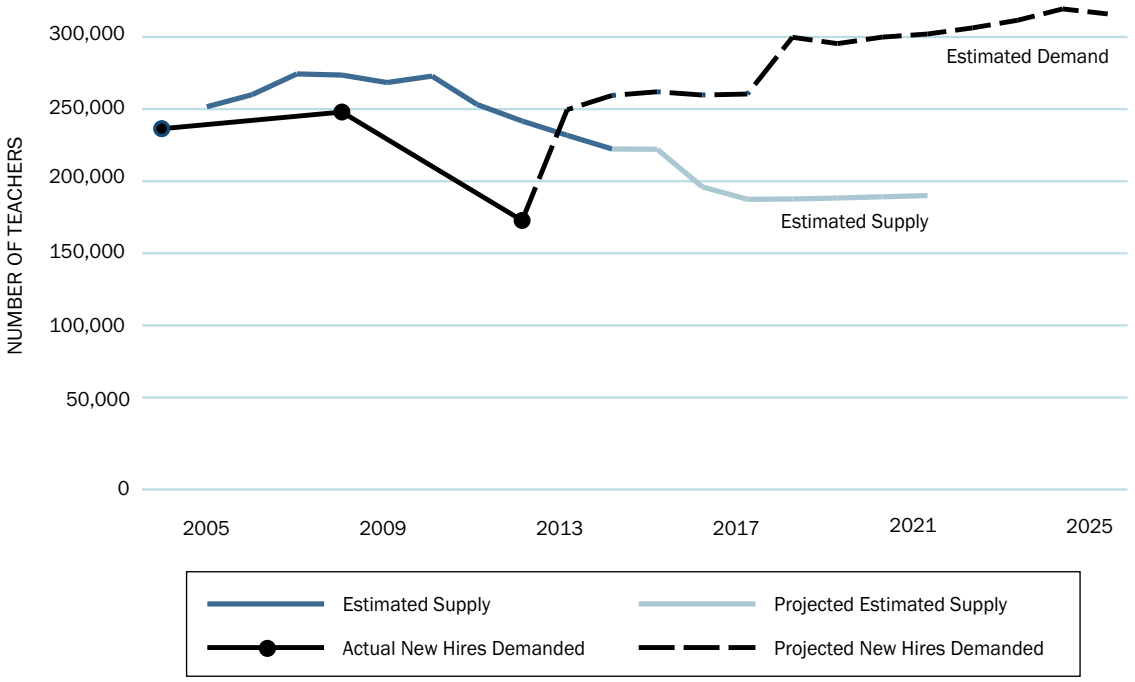
- A decline in teacher preparation enrollments,
- District efforts to return to pre-recession pupil-teacher ratios,
- Increasing student enrollment, and
- High teacher attrition.

The labor market should respond to the availability of jobs, so we can expect some increase in supply, but the extent of the increase and its distribution across subject fields and locations are likely to be uneven.

[1] We analyzed the federal Schools and Staffing Surveys and Teacher Follow-Up Survey databases from 2012 and 2013, along with Baccalaureate and Beyond 2008:2012 databases, and the Higher Education Act Title II data from 2005 through 2014, as well as more recent data from the State of California.

[2] A more complete review of the evidence regarding effective recruitment and retention is also available at Podolsky, A., Kini, T., Bishop, J., & Darling-Hammond, L. (2016). *Solving the Teacher Shortage: How to Attract and Retain Excellent Educators.* Palo Alto, CA: Learning Policy Institute.

Figure 1
Projected Teacher Supply and Demand



Note: The supply line represents the midpoints of our upper- and lower-bound teacher supply estimates (see Figure 10 for full analysis).

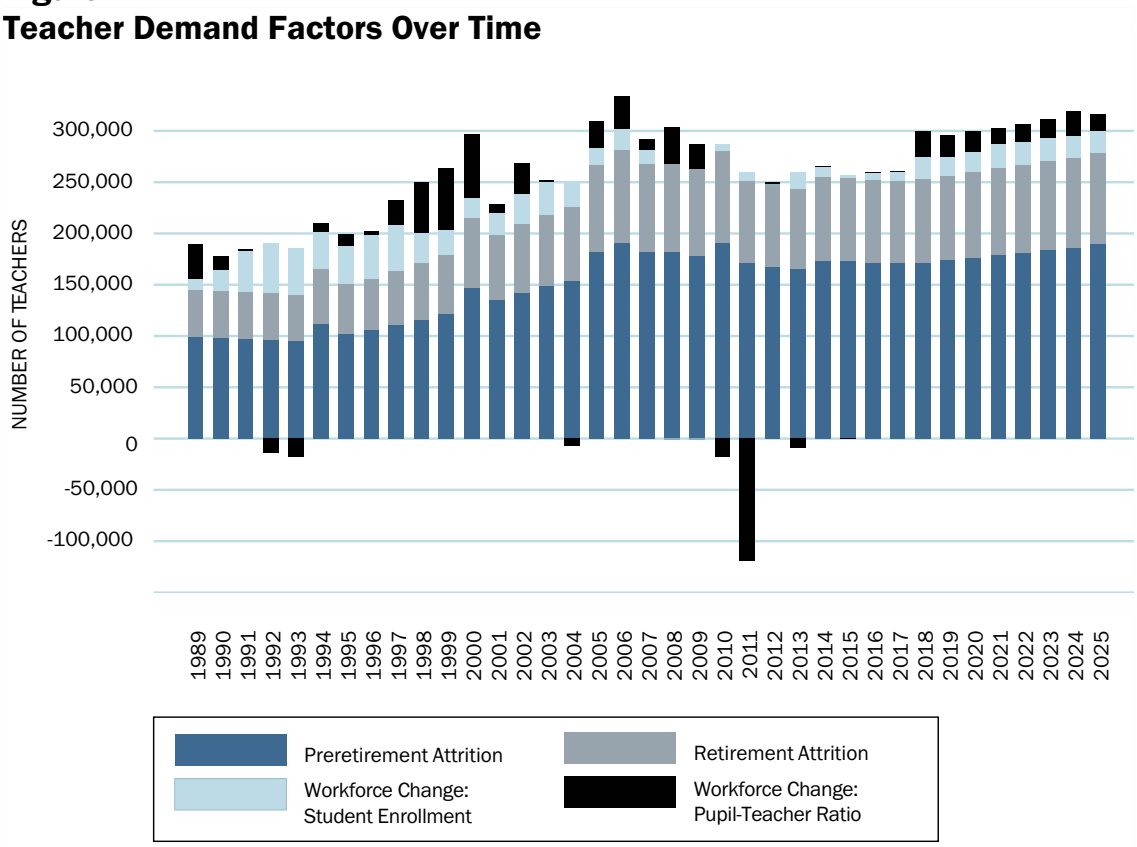
Source: U.S. Department of Education, multiple databases (see Appendix A).

Trends in Demand

Teacher demand is on the rise, as a function of changes in student enrollment, shifts in pupil-teacher ratios, and most significantly, high levels of teacher attrition. Based on the most recent data available, our modeling shows that teacher demand increased sharply after the Great Recession, leveling off at around 260,000 teacher hires annually by 2014. Projections show a large increase in 2017–18 and a projected plateau, bringing annual hires demanded to approximately 300,000 teachers a year.

- After relatively flat student enrollment growth for the past decade, the National Center for Education Statistics (NCES) predicts the school-going population will increase by roughly 3 million students in the next decade.
- Districts are looking to reinstate classes and programs that were cut or reduced during the Great Recession. It would require hiring an additional 145,000 teachers, on top of standard hiring needs, to reduce average pupil-teacher ratios from the current 16-to-1 to pre-recession ratios of 15.3-to-1.
- High levels of attrition, estimated to be nearly 8% of the workforce annually, are responsible for the largest share of annual demand. The teaching workforce continues to be a leaky bucket, losing hundreds of thousands of teachers each year—the majority of them before retirement age. Changing attrition would reduce the projected shortages more than any other single factor.

Figure 2
Teacher Demand Factors Over Time



Note: Negative number of teachers represents a decrease in the total number of teachers.

Source: U.S. Department of Education, multiple databases (see Appendix A).

Trends in Supply

Increased demand would not be an immediate reason for concern—if there were enough qualified teachers to enter the classroom, or if we could reduce the number of teachers leaving the classroom. Unfortunately, the supply of new teachers is atypically low and has been declining. The number of re-entrants (those who have stepped out of teaching) depends a great deal on whether policies make teaching an attractive and accessible possibility.

- Between 2009 and 2014, the most recent years of data available, teacher education enrollments dropped from 691,000 to 451,000, a 35% reduction. This amounts to a decrease of almost 240,000 professionals on their way to the classroom in the year 2014, as compared to 2009.
- Although teacher re-entrants make up one-third to one-half of each year's supply, depending on aspects of the economy that make teaching more or less attractive, securing teachers even at the high end of this range will not be enough to overcome shortages. In theory, the pool of former teachers is large, but estimates suggest only around a third of teachers who exit the profession ever return.

Projections incorporating historical data on the teacher pipeline and estimates of re-entrants show a steady decline in teacher supply. According to our model, 2016 will have the lowest number of available teachers in 10 years—between 180,000 and 212,000 teachers. This projection varies depending on the percentage of newly prepared teachers who actually enter the profession and the number of former teachers who return to the classroom as re-entrants.

The Significance of Attrition

In times of shortages, it is most common to focus attention on how to get more teachers into the profession. However, it is equally important to focus on how to keep the teachers we have in the classroom. In fact, as we show in this report, reducing attrition by half could virtually eliminate shortages. Compared to high-achieving jurisdictions like Finland, Singapore, and Ontario, Canada—where only about 3% to 4% of teachers leave in a given year—U.S. attrition rates are quite high, hovering near 8% over the last decade, and are much higher for beginners and teachers in high-poverty schools and districts. If attrition rates were reduced to the levels of those nations, the United States would eliminate overall teacher shortages.

In order to reduce attrition, we must know why people are leaving the profession, who is leaving the profession, where attrition is the greatest, and what factors are associated with different rates of attrition.

- **Why.** Contrary to common belief, retirements generally constitute less than one-third of those who leave teaching in a given year. Of those who leave teaching voluntarily, most teachers list some type of dissatisfaction as very important or extremely important in their decision to leave the profession. Areas of dissatisfaction include concerns with the administration, ranging from lack of support to lack of input and control over teaching decisions; testing and accountability pressures; dissatisfaction with the teaching career; or unhappiness with various working conditions. The next largest category of reasons (43%) is associated with family or personal factors, including parental leave.
- **Who.** Attrition varies by teacher subpopulations: Teachers with little preparation tend to leave at rates two to three times as high as those who have had a comprehensive preparation before they enter. Teachers in high-poverty, high-minority schools tend to have higher rates of attrition, as do teachers of color, who are disproportionately represented in these schools.
- **Where.** Teacher attrition rates also vary considerably across the country. The South has a particularly high turnover rate (movers and leavers) compared to the Northeast, Midwest, and West. For most regions, teacher turnover is higher in cities than in suburban or rural districts.
- **Associated Factors.** Administrative support is the factor most consistently associated with teachers' decisions to stay in or leave a school. Our study found that teachers who find their administrators to be unsupportive are more than twice as likely to leave as those who feel well-supported. Many other factors that emerge from research on attrition are also associated with the quality of school leadership, including professional learning opportunities, instructional leadership, time for collaboration and planning, collegial relationships, and decision-making input.

Variations in Shortages

Teacher shortages are not felt uniformly across all communities and classrooms, but instead affect some states, subject areas, and student populations more than others, based on differences in wages, working conditions, concentrations of teacher preparation institutions, as well as a wide range of policies that influence recruitment and retention.

State-Level Shortages

Currently reported shortages vary from state to state. California, for example, is experiencing severe shortages. The number of teachers on substandard credentials, an indicator that districts were unable to find fully-prepared teachers, increased by 63%, and comprised one-third of all credentials issued in 2015. Nearly half of all entering special education teachers were underprepared for the classroom. States like Arizona, Nevada, Oklahoma, and Washington also reported severe shortages. Meanwhile, higher-spending Massachusetts still reported an overall teacher surplus. Even there, however, schools are experiencing some shortages in special education and English learner education. Even though the teacher labor market might be balanced at the state level, subjects or regions within the state may be experiencing shortages.

The factors influencing shortages—wages, working conditions, and attrition rates—vary substantially from state to state, as we show in Appendix B. These disparities, which are related to policy differences, create very different labor markets from one state to the next. For example, wages are generally highest and attrition rates are lowest in the Northeast, while salaries are lower and turnover rates are higher in the South and some parts of the West.

Subject Area Shortages

States across the country are currently experiencing subject area teacher shortages. In the 2015–16 school year, 48 states and the District of Columbia reported shortages in special education; 42 states plus DC did so in mathematics; and 40 states and DC reported teacher shortages in science. In a 2014–15 educator supply and demand survey, all 10 special education subgroups were listed as severe shortage areas, comprising more than half of all severe shortage areas. Along with mathematics and science, this survey identified shortages in bilingual education/teachers of English learners.

Equity Concerns

Students in high-poverty and high-minority settings bear the brunt of teacher shortages. Considerable evidence shows that shortages historically have disproportionately impacted our most disadvantaged students and that those patterns persist today. Nationally, in 2013–14, on average, high-minority schools had four times as many uncertified teachers as low-minority schools. These inequities also exist between high-poverty and low-poverty schools. When there are not enough teachers to go around, the schools with the fewest resources and least desirable working conditions are the ones left with vacancies.

Policy Recommendations

There are many policy decisions that can be made to relieve teacher shortages. These are generally aimed either at increasing the attractions to teaching or lowering the standards to become a teacher. Short-term solutions may temporarily curb the fear of empty classrooms, but, as we found, they can often exacerbate the problem over the long haul. For example, if teachers are hired without having been fully prepared, the much higher turnover rates that result are costly in terms of both dollars spent on the replacement process and decreases in student achievement in high-turnover schools. Long-term solutions focusing on recruitment and retention can ease the shortage, while also prioritizing student learning and a strong teacher workforce.

Based on research we reviewed on what matters for recruiting and retaining teachers, policies should focus on:

1. **Creating competitive, equitable compensation packages** that allow teachers to make a reasonable living across all kinds of communities:
    - **Leverage more competitive and equitable salaries** so districts serving high-need students have a fair shot at recruiting well-qualified educators.
    - **Create incentives that make living as a teacher more affordable,** including housing supports, child care supports, and opportunities to teach or mentor after retirement to more effectively recruit and retain teachers.
2. **Enhancing the supply of qualified teachers for high-need fields and locations** through targeted training subsidies and high-retention pathways:
    - **Offer forgivable loans and service scholarships** to attract and retain teachers to high-need fields and locations.
    - **Create career pathways and "Grow Your Own" programs** to prepare committed individuals from urban and rural school districts.
    - **Establish teacher residency models for hard-to-staff districts** to recruit and retain talented and diverse candidates in high-need schools, while better preparing them for the challenges they will face.
3. **Improving teacher retention, especially in hard-to-staff schools,** through improved mentoring, induction, working conditions, and career development:
    - **Develop strong, universally available mentoring and induction programs** to increase retention and help slow the revolving door of beginning teacher turnover.
    - **Create productive school environments,** including supportive working conditions, administrative supports, and time for teachers' collaborative planning and professional development—all of which help attract and keep teachers in schools.
    - **Strengthen principal training programs** to develop principals and district leaders who can create productive teaching and learning environments that have a major impact on a teacher's decisions to stay or leave the classroom.

4. **Developing a national teacher supply market** that can facilitate getting and keeping teachers in the places they are needed over the course of their careers:

    - **Support teacher mobility** by removing unnecessary interstate barriers so states with teacher surpluses in particular fields can be connected to states with corresponding shortages.

Conclusion

The teacher shortage provides an opportunity for the United States to take a long-term approach, as was done in medicine more than half a century ago, to mitigating current shortages, while establishing a comprehensive and systematic set of strategies to build a strong teaching profession. At first, the price tag for these investments may seem substantial, but evidence suggests that these proposals would ultimately save far more in reduced costs for teacher turnover and student underachievement than they would cost. Preventing and solving teacher shortages so that all children receive high-quality instruction in every community every year is essential in a 21st century economy for the success of individuals as well as for society as a whole.

A Coming Crisis in Teaching?

Teacher Supply, Demand, and Shortages in the U.S.

As the 2015–16 school year got underway, headlines across the country broadcasted severe teacher shortages:

> "Nevada needs teachers, and it's shelling out $5 million to get them."[1]
>
> "First marking period in Philly ends with many teacher shortages."[2]
>
> "[San Francisco] Principals say state teacher shortage now a crisis."[3]
>
> "Why Oklahoma Is Racing to put Nearly 1,000 Uncertified Teachers in Its Classrooms."[4]

These examples are but the tip of a large iceberg indicating current and future imbalances in the U.S. teaching force. In the five months between June 22 and November 22, 2015, more than 300 newspaper articles appeared regarding teacher shortages.[5] Two years earlier, there were only 21 such articles during the same time period.[6]

Many of the advertised shortfalls have been in mathematics and science. Special education is seeing the greatest shortages of all. A National Public Radio report indicated that 48 states and the District of Columbia have identified a shortage of teachers in special education or related services: Half of all schools and 90% of high-poverty schools are struggling to find qualified special education teachers.[7] As these statistics suggest, teacher shortages often have a disproportionate effect on the most disadvantaged students. One *Washington Post* headline warned: "High-poverty schools often staffed by rotating cast of substitutes."[8]

These shortfalls mark a dramatic change from the years of teacher layoffs that occurred during the economic recession of 2008 and the several years that followed. In those years, tens of thousands of pink slips were handed out each spring informing teachers they would not be needed the following school year.[9] State austerity measures resulted in eliminating support staff, reducing the number of new teacher hires, and increasing class sizes.[10] The recession left the public accustomed to a surplus of teachers, with policies aligned to this reality.

However, as the economy improved and money began to come back into the system, districts have begun to hire again. Teacher demand has rapidly increased as schools begin to lower pupil-teacher ratios, and reinstate classes and programs that were reduced or eliminated in the Great Recession. This hiring increase comes at a time when teacher attrition is high, and teacher preparation program enrollments have fallen 35% nationwide in the last five years, a decrease of close to 240,000 teachers in total.[11]

Has the United States moved into an era of teacher shortages? If so, how large are the differences between supply and demand? Where and in what fields are they most severe? Will they persist? Most important, what can be done to prevent and mitigate the negative effects of such a teacher shortage?

This report examines current indicators of a national teacher shortage, analyzes the severity and persistence of the labor market imbalance, discusses the impact on students and schools, and

proposes evidenced-based policies that could help create a sustainable supply of well-prepared teachers in the subjects and states where they are needed.

Section I briefly reviews some of the current indicators of teacher shortages. Section II examines the factors that influence teacher demand, and then uses statistical techniques to model demand trends and project teacher demand into the future. Section III studies components of teacher supply, looking at current indicators and modeling supply trends. Section IV assesses supply and demand together to examine the current teacher labor market and implications for the U.S. education system, including factors influencing different states, regions, and types of communities. Section V highlights the role of teacher attrition in shortages, combining new evidence of trends with research on when and why teachers leave. Finally, section VI discusses policy opportunities to shift supply and demand to address both short-term teacher imbalances and long-term labor market stability in order to come to a better understanding of the current shortages, and provides evidence-based recommendations for future policy action.

I. Indicators of Shortages

Not all commentary on current signs of teacher shortages has been unanimous. Some articles have called the teacher shortage "a myth"[12] or "overblown."[13] Dissent about teacher shortages can be rooted in different labor market realities that operate across locations and teaching fields, as well as different uses of the term "shortage."

Often, the term *teacher shortage* is used to refer to an insufficient production of new teachers, given the size of student enrollments and teacher retirements. In this narrow definition, a teacher shortage is measured only by teacher production in relation to these factors associated with teacher demand. However, a large body of research indicates that teacher staffing problems are driven by a myriad of factors, including not only production of new teachers in various fields, but also teacher turnover, changes in educational programs and pupil-teacher ratios, and the attractiveness of teaching generally and in specific locations.

In this report, we use a theoretical framework of supply and demand that defines a teacher shortage as an inadequate quantity of qualified individuals willing to offer their services under prevailing wages and conditions. In other words, teacher shortages emerge in different fields and locations when there is an imbalance between the number of teachers demanded and the number of qualified teachers willing to offer their services to fill these demanded positions. This more robust definition allows for a more detailed diagnosis with clearer implications for policy analysis and recommendations. In this case, current data on the teacher labor market provide a compelling argument for teacher shortages, at least in some key teaching fields and locations.

One of the most widely used indicators of shortages is the difficulty employers have in filling vacancies. When school districts are having trouble finding fully qualified applicants to fill empty positions, it is a sign of labor market imbalances in those fields or locations. Each year, the American Association for Employment in Education (AAEE) surveys a sample of higher education institutions and districts across the country. In 2014–15, the survey found most districts reporting as "a big challenge" not having enough candidates for open positions (56%), and not finding candidates with the right credentials (53%). These proportions of districts were nearly double the rates from the previous year.[14]

> As states are scrambling to find special education teachers, many schools have no other choice but to hire unqualified teachers to fill these vacancies.

Indicators of Shortages by Teaching Field

As reported by the media, districts, teacher education institutions, and states have all identified special education as the number one field with severe shortages. In 2015–16, 48 states and DC identified special education as a shortage area in their reports to the U.S. Department of Education. Most states identified special education as the most severe shortage they face, appearing on their shortage reports for many grade levels and many subareas within special education.[15] Similarly, in the 2014–15 AAEE educator supply and demand report, "considerable" shortages—the most severe rating—were reported in all 10 special education subareas, from dual certification to cognitive

disabilities. Of the 18 areas in which school districts reported "considerable" shortages, 10 of the 18 were in special education.[16]

As states are scrambling to find special education teachers, many schools have no other choice but to hire unqualified teachers to fill these vacancies. In California, for example, one study found that almost half (48%) of entering special education teachers in 2015 lacked full preparation for teaching.[17] It is striking that the field that serves the most vulnerable students and, arguably, requires the most wide-ranging teacher knowledge—drawing on medical, psychological, and pedagogical fields—is increasingly populated by underprepared teachers.

Mathematics and science are close behind special education as shortage areas. In the 2015–16 school year, 42 states and DC reported teacher shortages in mathematics, as did 40 states and DC in science, a marginal increase from the previous year.[18] With greater job opportunities offering stronger compensation in the broader labor market for individuals who have trained in mathematics and science fields, these subjects are up against a particularly difficult recruitment challenge.

Along with special education, these fields have faced perennial staffing difficulties. Since 2000, over 10% of schools have reported serious difficulties filling mathematics and science vacancies.[19] One 2012 analysis suggested these problems are caused less by an underproduction of mathematics and science teachers than by high levels of attrition for these teachers.[20] Since that time, demand has rapidly increased, signaling a shift in the labor market. This shift could indicate that hiring for these already difficult-to-staff subject areas will only become more challenging.

In 2014–15, the AAEE survey found that teacher preparation programs as well as school districts reported "considerable" or "some" shortage in mathematics and every science subject listed (chemistry, biology, earth/physical science, physics).[21] The fact that both school districts and teacher preparation programs are reporting shortages in these fields is particularly concerning, because this evidence suggests immediate help from the pipeline is not coming, and we may no longer have adequate production of mathematics and science teachers.

In many states, bilingual education or teaching of English as a second language (ESL) is another subject area with intense shortages. In all, 31 states and DC report shortages in these fields.[22] The need for bilingual/ESL teachers clearly varies based on state demographics, so it makes sense that somewhat fewer states list shortages. However, the AAEE survey finds that the severity of the shortages is "considerable" for both teacher preparation programs and school districts.[23] World languages—including Chinese, Japanese, and classical languages—are also listed as showing considerable shortages.

Shortage Indicators by State

Each state experiences teacher supply and demand differently, because there are state-level labor markets created by different policies and contexts affecting teaching. These include funding levels and allocations, salary levels, teaching conditions, licensure and accreditation policies, concentration of preparation institutions, demographics of the teaching force, concentration or sparsity of the population, and topography, among others.

Regional, state, or local imbalances can lead to larger class sizes, cancellation of courses, or the assignment of underprepared or out-of-field teachers (those teaching subjects outside of their area of licensure or certification). National shortfalls can affect states that typically import many teachers from out of state more intensely than those that usually export teachers. States offering less competitive wages and working conditions will also typically feel shortages more acutely.

Even when the teacher labor market is balanced overall, teaching fields or regions within a state may be prone to shortages. As just some examples of the variable landscape across states:

- California's recent teacher shortages led to a tripling in the number of emergency and temporary permits in the last three years. In 2014–15, when demand outstripped supply by more than 25%, fully 7,700, or just over a third of the credentials and permits issued that year, went to teachers who were not fully prepared for their teaching assignments. The greatest increase was in permits issued to individuals without preparation who were not even in an internship pathway that would support their training. Permits to underprepared teachers were most plentiful in special education, mathematics, and science, and in schools serving concentrations of low-income and minority students.[24]

- Arizona's teacher shortage is having an intense impact on the school system. In 2013–14, 62% of school districts had unfilled teaching positions three months into the school year. In the same school year, close to 1,000 teachers were on substitute credentials—a 29% increase from the previous year. With one of the highest turnover rates of any state and 24% of the workforce eligible to retire by June 2018, the future outlook points to continued shortages.[25]

- Oklahoma's teacher demand projections over the next five years are only slightly greater than its annual supply, or about 320 vacancies each year. However, with imbalances by field and regional shortages in the southern half of the state,[26] there has been a sharp increase in emergency credentials issued to underprepared teachers by the Education Department, increasing from just 98 in 2010–11 to more than 900 by 2015–16.[27]

- By contrast, in high-spending Massachusetts, where there are many teacher preparing institutions, supply and demand projections show a current surplus. This varies by subject, though, with an expected surplus of more than 1,000 general education teachers (almost 2% of the teacher workforce) offset by shortages in special education (3% of the special education workforce) and English Language Learner (ELL) education (9% of the ELL workforce).[28]

We discuss the factors influencing state and regional variations in supply and demand further in Section IV.

Indicators of Shortages of Teachers of Color

Shortages of teachers of color are different from other shortages in that there are not positions intended exclusively for teachers of color. Rather, there is a noticeable discrepancy between the proportion of teachers of color in the workforce and the proportion of students of color. Meanwhile, many districts are seeking to hire a greater number of teachers of color than are available in the pool.[29] Despite the fact that students of color make up an increasing share of all students in the

United States and are currently estimated to be in the majority, teachers of color comprised less than 18% of the public school teacher workforce in 2012.[30] The number of teachers of color grew from about 12% to nearly 18% between 1987 and 2012. At the same time, however, the share of students of color increased by 75%: from 28% to 49% of students, leaving a very large differential.[31]

Although there have been increases in entry rates for teachers of color, successful minority teacher recruitment strategies are undone, in part, by high rates of teacher attrition, which we discuss in Section V of this report. While there are numerous theories touting the benefits of a racially diverse teacher workforce, research suggests benefits of two outcomes, in particular: (1) teachers of color enhance school experiences and academic outcomes for students of color, and (2) they are more likely to seek out difficult-to-staff teaching positions in low-income communities of color.[32] Both of these outcomes help combat acute teacher shortages and poor educational quality in the hardest-to-staff schools.

Shortage Indicators by Type of School and Student

Some of the largest variation in teacher shortages is not between states, but between schools, both within and across districts. Regardless of the state, students in high-poverty and high-minority schools typically feel the largest impact of teacher shortages. Historical patterns reveal a long-standing trend that has been a subject of many desegregation and school finance lawsuits: Students in high-poverty, high-minority schools are most likely to be taught by underprepared, inexperienced, and out-of-field teachers. These schools often experience difficulty hiring and high turnover on a regular basis, and they are the most severely affected when teacher shortages become widespread.[33] This happens, in part, because inequitable funding of schools leaves many low-wealth urban and rural communities with inadequate resources, so they must pay lower salaries and typically have poorer working conditions.[34]

The last time shortages were common, in the late 1990s to the early 2000s, the inequitable distribution of teachers was widespread across the country. The practice of lowering teacher quality standards to fill vacancies, particularly in high-poverty, high-minority schools, was seen in California, Florida, Massachusetts, New York, South Carolina, and Texas, among other states. For instance, in California, there were over 42,000 teachers on emergency credentials, and students in high-minority schools were five times as likely to have a teacher who was underprepared as students in low-minority schools.[35] In the 1990s, until the courts ordered a finance reform that raised salaries, New York City hired nearly half of its new teachers without full preparation. In 2002, students in high-minority schools in South Carolina and Texas were four times as likely—and in Massachusetts, they were five times as likely—to have an underprepared teacher as students in low-minority schools.[36]

The nationally representative Schools and Staffing Survey (SASS) reveals these patterns still existed in 2011-12, even in a time of relative teacher surpluses.[37] Across the country, teachers working on emergency credentials (the least qualified of the underprepared teachers), were three times more likely to serve in a high-poverty, high-minority school than in a low-poverty, low-minority school (4.0% vs. 1.4%). The combined categories of underprepared teachers were 61% more likely to be employed in a high-poverty, high-minority school than in low-poverty, low-minority schools (8.3% vs. 5.2%). These inequities were more intense in cities. Students in high-poverty, high-minority

schools in cities were nearly three times as likely to be taught by inexperienced teachers and by individuals who were not "highly qualified" by the federal law's definition.[38]

The Civil Rights Data Collection (CRDC), a universal survey of all public schools and districts, provides a more comprehensive overview of the distribution of teachers who lack certification. In 2013–14, on average, schools in the top quartile of minority student enrollment had four times as many uncertified teachers as schools in the bottom quartile of minority student enrollment. In Maryland, Louisiana, and Colorado, high-minority schools had, respectively, 12, eight, and five times as many uncertified teachers as their low-minority counterparts. In Colorado and DC, more than 20% of the teachers in high-minority schools were uncertified. Conversely, although there were still small equity gaps in states such as Idaho, Iowa, Kentucky, Nebraska, and North Carolina, both high-minority and low-minority schools employed fewer than 1% uncertified teachers. Nevada, South Dakota, and Vermont also had low levels of uncertified teachers (less than 1%) and no equity gap (see Appendix C).

In an effort to hold states accountable for the inequitable distributions of teachers, the U.S. Department of Education requires each state to create a state equity plan to address differential access to high-quality educators. The equity reports filed in 2015 reveal these same patterns across the nation, with unqualified, inexperienced, or out-of-field teachers disproportionately found in high-poverty and high-minority schools.[39] In Ohio, for example, high-poverty and high-minority schools had, respectively, 13 and 11 times as many unqualified teachers (teachers not licensed to teach that particular subject, student population, or grade level) as low-poverty and low-minority schools. In Arizona, high-poverty and high-minority schools had more than one in four of their teachers still in their first or second year of teaching, when they are typically much less effective than other teachers.[40] This meant that the odds of these students being taught by inexperienced teachers were about 70% greater than students in low-poverty and low-minority schools. Although each state uses slightly different definitions to report equity comparisons of underprepared and inexperienced teachers, all but a handful of states have a higher percentage of teachers not fully certified, inexperienced, or out of field in their high-poverty and high-minority schools than their low-poverty and low-minority schools.[41]

The equity reports filed in 2015 reveal these same patterns across the nation, with unqualified, inexperienced, or out-of-field teachers disproportionately found in high-poverty and high-minority schools.

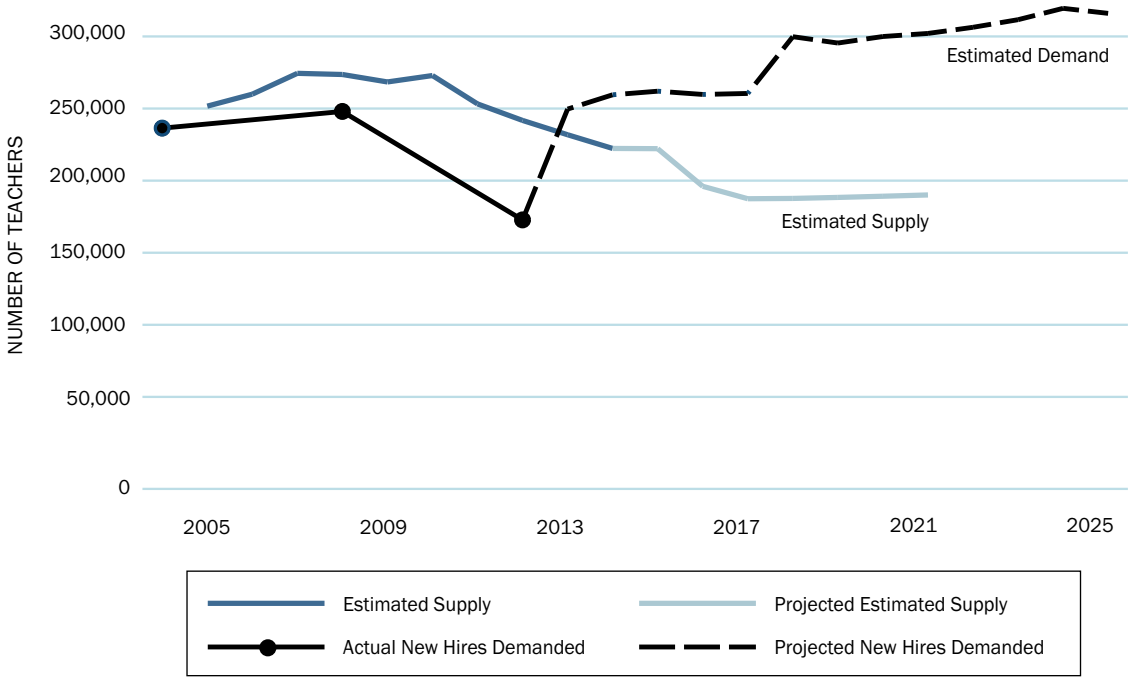
These data can be interpreted as shortages in high-minority and high-poverty schools and/or as distributional problems within the contexts of districts and states. Either way, the extent to which underprepared teachers are hired in these schools is a constant factor that grows greater during times of broader shortages.

As we describe in the last section of this report, states and districts that have addressed these problems with forceful policies have reduced these disparities in the past. Without the appropriate policy response, however, in times of shortage, both the overall number of underprepared teachers and the inequities between schools tend to increase.

National Indicators of Shortages

National data on the indicators of teacher supply and demand point to the potential for current and future shortages. The number of teachers entering the profession has significantly declined at the same time as more teachers are needed due to increasing student enrollments and districts' efforts to replace the teachers and programs reduced during the Great Recession, between 2008 and 2012. Looking beyond simple indicators of supply and demand, statistical projections incorporating the most recent data on the teacher labor market suggest the current shortages will persist into the future if current trends continue (see Figure 3).

Figure 3
Projected Teacher Supply and Demand



Note: The supply line represents the midpoints of our upper- and lower-bound teacher supply estimates (see Figure 10 for full analysis).

Source: U.S. Department of Education, multiple databases (see Appendix A).

As we describe in this report, teacher supply and demand modeling based on data regarding new entrants, potential re-entrants, and projected new hires reveals an estimated current teacher shortage of approximately 64,000 teachers in the 2015–16 school year. Of roughly 260,000 new teachers demanded, the number of qualified entrants available was approximately 196,000. This shortage reflects the difference between the number of qualified new or re-entering teachers available and the number of teachers districts would ideally hire. As we have noted, the shortages

can be met by hiring individuals who are not fully prepared for their teaching assignments, hiring temporary substitutes (who may or may not be prepared) while a search continues, maintaining class sizes and pupil loads that are greater than desired, or canceling courses or programs for which teachers cannot be found.

By 2020, an estimated 300,000 new teachers will be needed each year, and by 2025, that number will increase to 316,000. Unless major changes in teacher supply or a reduction in demand for additional teachers occurs over the coming years, annual teacher shortages could increase to as many as 112,000 teachers by 2018.

Based on current data and these projections, it appears that teacher shortages are occurring—at least in some fields and locations—and may grow. To understand the full extent and seriousness of potential shortages, we must dig more deeply into the factors influencing teacher supply and demand, as well as the policies that can make a difference in the teacher labor market. Short-sighted solutions may temporarily curb fears of empty classrooms, but only long-term solutions focusing on sound recruitment and retention strategies can ease the shortage, while also prioritizing student learning and a sustainable future.

II. Teacher Demand

The first component of the teacher labor market is teacher demand. Knowing how many teachers are needed is crucial to understanding labor market needs and thus ensuring that every community has access to a sufficient supply of well-qualified teachers.

Demand in the teacher labor market can be thought of in two ways. Total teacher demand represents the total number of teachers required to educate the nation's students. Next year, the total teacher demand will be roughly 3.1 million full-time-equivalent (FTE) public school teachers in classrooms across the United States.[42] Most of these positions are filled by teachers who remain in the workforce from the year before.[43] However, each year, about 250,000 positions[44] must be filled due to some combination of the increase in student population, changing pupil-teacher ratios, and teachers who leave the profession.[45] This second way of considering teacher demand—the annual need for teachers to fill vacant positions—is what we focus on here.

> Each year, about 250,000 positions must be filled due to some combination of the increase in student population, changing pupil-teacher ratios, and teachers who leave the profession.

One of the biggest challenges in estimating demand is navigating the difference between ideal demand and actual demand. Ideal demand requires defining the desired pupil-teacher ratio, geographic teacher distributions, and course requirements to determine the perfect number of teachers necessary each year. The actual demand represents reality—the need for teachers based on the number of teachers actually hired and employed. For example, in the Great Recession, actual demand for teachers dropped as budgets were cut, and schools could not afford to hire new teachers or even keep the teachers they already had. In this case, actual demand dropped, but ideal demand did not. In an ideal sense, schools would like, at a minimum, to be able to maintain the number of teachers and return to the class sizes and course offerings they had in place before the recession.

The projections in this paper, while mindful of ideal demand, attempt to estimate actual demand using NCES projections of student enrollments, pupil-teacher ratios, and the teacher workforce. These estimates are just that—estimates. Using historical data and indications of future trends, these projections paint a potential picture of the workforce in the future. We first examine the factors that determine the quantity of teachers needed in the classroom. Next, we look at indicators that speak to current trends in demand. Finally, in order to further understand the teacher labor market and pressing policy needs, we use current data to model teacher demand 10 years into the future.

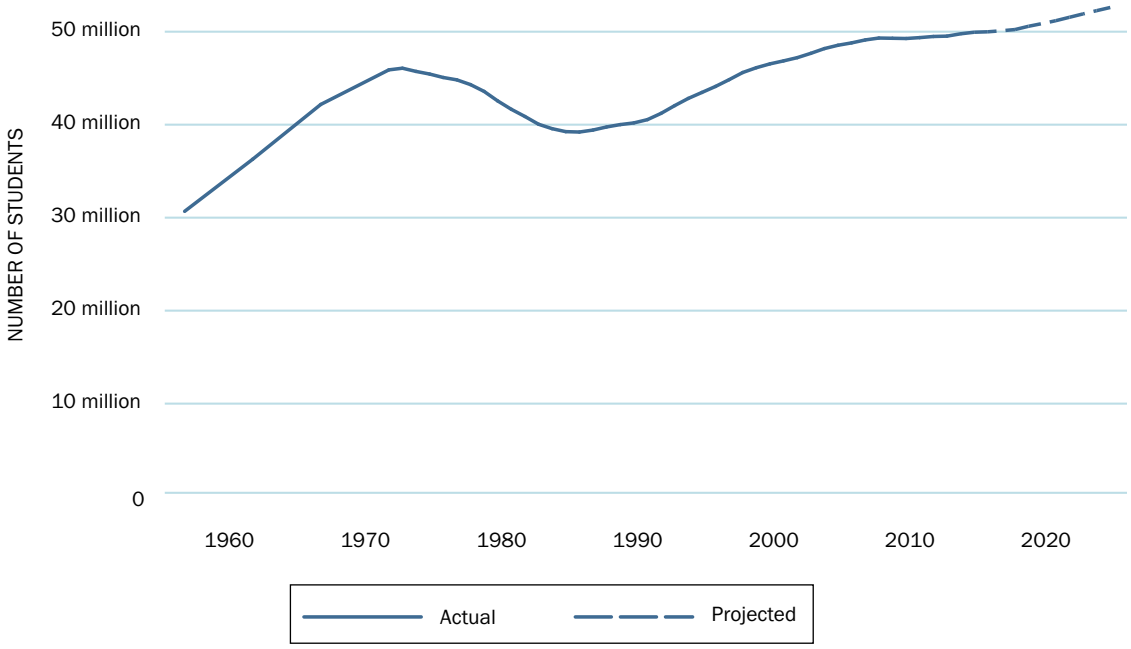
Demand Factors

Some elements of teacher demand, such as student enrollments, are predicted by trends not easily influenced by education policy. Others, such as pupil-teacher ratios and attrition rates, are very directly influenced by policy strategies. We discuss each of these in turn.

Student enrollment. Student enrollment directly influences teacher demand. An increase in the school-age population corresponds with an increase in the number of teachers needed in the education system, as long as pupil-teacher ratios remain constant. Future public school enrollment numbers can be estimated by looking at birth rates, public school attendance rates, and immigration and migration patterns.[46] These indicate how many school-age children will enter school. Once the number of students entering school is estimated, historical data can be used to model how many students will stay in school and for how long.

Public school enrollment increased substantially (by 26%) from 1986 to 2007, growing from 39 million students to 49 million students. From 2007 to 2015, student enrollment has remained relatively flat, hovering around 49 million public school students (see Figure 4). NCES estimates a steady increase in public school student enrollment starting in 2016, growing from 50 million to 53 million by 2025[47] (see Figure 4). Although NCES does not specify what will drive this increase, the enrollment rate of 5- to 17-year-olds has changed less than three percentage points over the last 30 years, suggesting the majority of this growth, if the enrollment rates continue to remain relatively constant, will come from an increase of school-age children due to population growth (higher birth rates and/or immigration), with teacher demand rising in response.[48]

Figure 4
Student Enrollment in Public Schools
1955–56 to 2024–25



Source: National Center for Education Statistics (2015). Digest of Education Statistics. Public and private elementary and secondary teachers, enrollment, pupil-teacher ratios, and new teacher hires: Selected years, fall 1955 through fall 2024. Washington, DC: U.S. Department of Education.

Pupil-teacher ratios. Pupil-teacher ratio is another component of teacher demand.[49] The number of additional teachers needed by a school district is dependent on the change in desired class

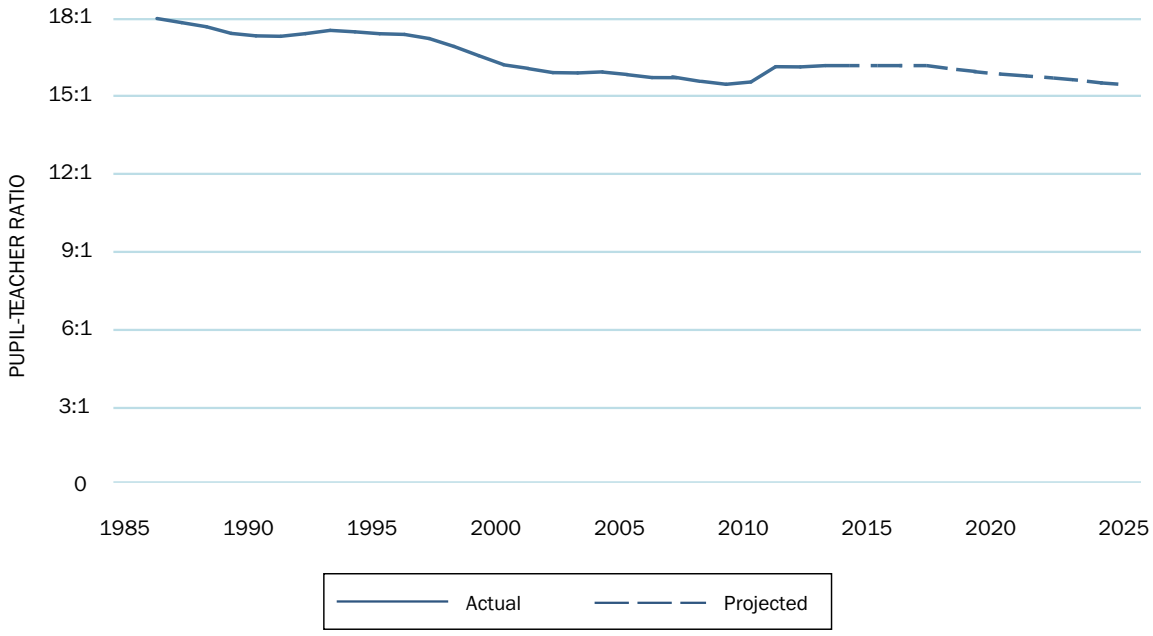
size, as well as any adjustments in how schools are staffed and how staff are used. To estimate pupil-teacher ratios, researchers first look at school budgets and economic conditions influencing a district's ability to hire more teachers.[50] Second, state and local policies may influence pupil-teacher ratios by requiring certain class sizes.

Current average public school pupil-teacher ratios are 16-to-1. Historically, pupil-teacher ratios have been slightly higher. In 1986, the average public school pupil-teacher ratio was just under 18-to-1. It remained over 17 until there was a large push in the late 1990s and early 2000s for smaller class sizes and increased staffing for special education.[51] By the 2008–09 school year, the national average pupil-teacher ratio was as low as 15.3-to-1. When the Great Recession hit and education budgets were slashed, average pupil-teacher ratios quickly increased to 16-to-1, and have remained there for some time (see Figure 5). These ratios vary across states, from a high of 24-to-1 in California to a low of 11-to-1 in Vermont[52] (see Appendix B).

Figure 5

Public School Pupil-Teacher Ratios

1985–86 to 2024–25



Source: National Center for Education Statistics (2015). Digest of Education Statistics. Public and private elementary and secondary teachers, enrollment, pupil-teacher ratios, and new teacher hires: Selected years, fall 1955 through fall 2024. Washington, DC: U.S. Department of Education.

Pupil-teacher ratios are incorporated into our analysis by using NCES pupil-teacher ratio projections. The NCES projections are produced by modeling both historical patterns and economic conditions, such as a teacher's relative wage compared to that of other workers and state education budgets, to determine the relationship between these factors, and current and future pupil-teacher ratios.[53] The NCES projects that pupil-teacher ratios will remain at 16-to-1 through 2016 and then slowly dip downward to 15.3-to-1 by 2025, slightly below pre-recession levels (see Figure 5). The effects of such a decrease on demand are significant: Reducing the pupil-teacher ratio from 16-to-1

to 15.3-to-1 would require hiring an additional 145,000 teachers.[54] Over a period of eight years, this reduction in the pupil-teacher ratio would increase annual demand by nearly 20,000 teachers a year.

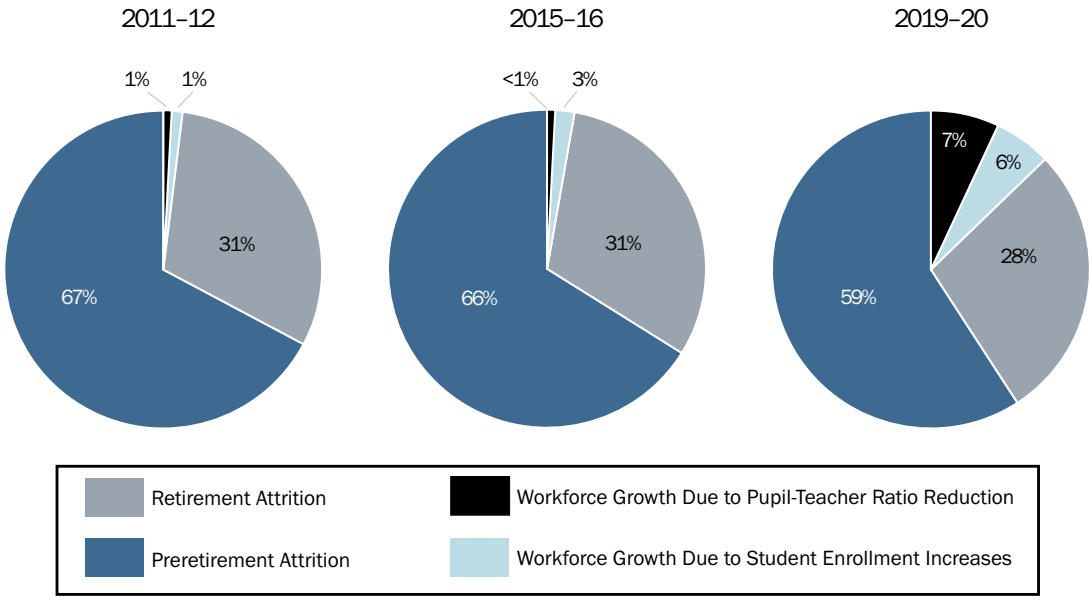
Attrition. The final component of demand for new hires is attrition. The number of new teachers demanded depends substantially on how many teachers leave the profession.[55] One form of departure is retirement. This accounts for about one-third of teachers who leave.[56] Preretirement attrition, due to school staffing decisions, life changes, or dissatisfactions with teaching, accounts for about two-thirds of all attrition and is estimated to have comprised around 66% of total new demand in the 2015–16 school year (see Figure 6). As we discuss in Section V, policies that change attrition rates can greatly influence demand and the extent of shortages.

> Preretirement attrition accounts . . . for about two-thirds of all attrition.

Based on the Schools and Staffing Surveys (SASS) from 2011–12 and the corresponding Teacher Follow-Up Survey (TFS) from 2012–13, the overall public school teacher attrition rate is calculated to be 7.68%.[57] To put this in perspective, of the 3.1 million FTE teachers in 2011, 238,310 teachers did not teach the following year.[58] In 1989, the attrition rate was below 6%; however, this rate climbed to 8.4% in 2004 and has remained near 8% since. The difference between a 6% and 8% attrition rate might seem trivial, but in 2015–16 alone, this would cut demand by nearly 25%, eliminating the need to replace approximately 63,000 teachers.

Each year, different factors contribute varying amounts to teacher demand. For example, in some years, student enrollment growth is responsible for a noticeable portion of increased demand, while in other years, demand is driven almost entirely by attrition. Figure 6 shows the estimated breakdown of the different components comprising demand in 2012, 2016, and 2020.[59] In each of these years, the largest portion of demand is driven by preretirement attrition.

Figure 6
Components of Teacher Demand



Source: U.S. Department of Education, multiple databases (see Appendix A).

Current Teacher Demand

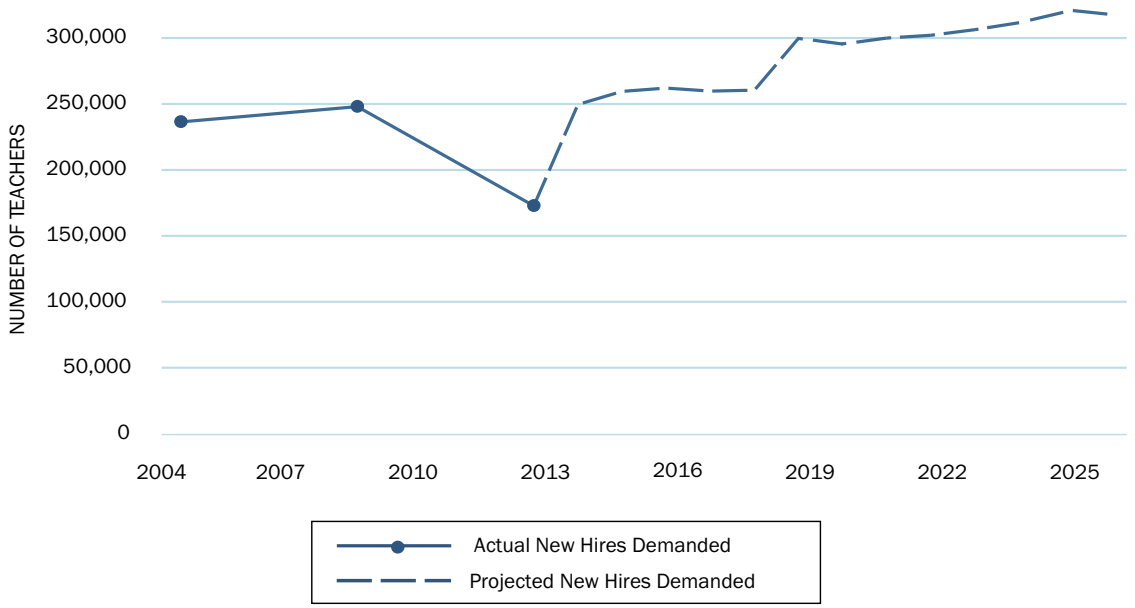
Currently, all of these factors play a role in boosting teacher demand. Student enrollment is on the rise, and if economic conditions hold firm, class sizes are predicted to decrease as districts move toward pre-recession class offerings and teacher workloads. Furthermore, attrition remains at relatively high rates with little indication of any change to come in the near future.

> The largest portion of demand is driven by preretirement attrition.

To model demand more precisely, we use the public school teacher projections from 2000 to 2025 produced by the NCES.[60] We refine these estimates using several nationally representative data sources that examine teachers and schools over time: the Schools and Staffing Survey (SASS) Teacher File 2011–12, the SASS Teacher Follow-Up Survey 2012–13, and Common Core of Data (CCD) years 1999–00 through 2012–13.[61] For a full description of the methodology, see the technical notes in Appendix A.

In Figure 7, the solid line represents observed demand, while the dashed line represents projected demand.[62] The impact of the Great Recession is evident by the sharp decrease in demand between 2008 and 2012 as a result of budget cuts and layoffs that occurred during these times of austerity. Teacher demand shows a sharp increase after 2012, leveling off at around 260,000 teacher hires by 2014. In 2017–18, there is a large projected increase, which brings annual demanded teacher hires to 300,000 a year. This model projects the largest demand increases are yet to come, eventually requiring over 300,000 public school teacher hires a year, the largest number of annual teacher hires in the last decade.

Figure 7
Estimated New Teacher Hires Demanded



Note: Data for teachers are expressed in full-time equivalents.

Source: U.S. Department of Education, multiple databases (see Appendix A).

This large increase in demand is not inherently a cause for alarm. After a period of austerity, it is no surprise that schools are attempting to return to pre-recession conditions. In fact, the downturn in the teacher workforce during the Great Recession was relatively modest compared to its considerable growth in the years before. Between the late 1980s and 2008, the teacher workforce grew at more than twice the rate of student enrollment growth, driven not only by declines in pupil-teacher ratios, but also by programmatic changes that called for more mathematics and science teachers when high school standards were raised, as well as more special education and bilingual/ESL teachers when services were expanded.[63] Other changes, like expansions of kindergartens from part- to full-day and increases in graduation rates that kept more high school students in school, also influenced the need for teachers.[64]

In the years ahead, a sizable demand is projected: New hires will fill positions that were lost during the Great Recession, as well as positions that are created to keep up with increased student enrollment and smaller class sizes.

In the years ahead, a sizable demand is projected: New hires will fill positions that were lost during the Great Recession, as well as positions that are created to keep up with increased student enrollment and smaller class sizes. The question is, as demand rapidly rises, can teacher supply expand to keep pace and provide all classrooms with well-qualified teachers? Alternatively, can we reduce attrition sufficiently to make the supply of teachers more adequate?

III. Teacher Supply

The second component of the teacher labor market is teacher supply. States and districts need accurate information about production and availability of future teachers to assess and plan for their workforce needs. To evaluate the current condition of teacher supply, we first identify indicators of teacher preparation program enrollments and completions. Next, we take a more complex methodological approach to model teacher supply over the last decade and to project supply into the next decade. To look further at labor market trends, we disaggregate national supply data by subject area. These analyses reveal a significant reduction in teacher supply over the last five years and shortages continuing over the next decade, if current teacher preparation enrollment trends continue. Given these sharp decreases, it is critical to understand the policy levers surrounding recruitment and retention that could support a high-quality, sustainable teacher workforce.

Like teacher demand, there are several different ways to think about teacher supply. One way to analyze supply-side dynamics is total teacher supply. Total activated teacher supply could be conceptualized as the entire teacher workforce, for example, the 3.1 million FTE public school teachers in classrooms across the United States.[65] The majority of these teachers remain in the workforce the following year; however, a substantial number of positions vacate and must be filled.

Examining the pool of teachers who will potentially be available to fill empty classrooms is a second way of looking at teacher supply and is most relevant to labor force analysis. This teacher supply can be thought of as the number of potential teacher entrants who were not teaching in the previous year, who are either new entrants to the profession or re-entrants who have stepped out from teaching for a period of time. At the local or state level, individuals who may be recruited from other schools or states are also considered a source of supply. The teacher supply that has the potential to meet the number of newly demanded employees is adjusted by two main influences: new entrants and re-entrants.[66] Individuals who hold valid teaching credentials, whether or not they are currently in the workforce, are thought of as the supply pool. Some of these individuals may enter or re-enter teaching under the right conditions. Understanding these conditions is important to policymakers, particularly in times when shortages emerge.

When fully credentialed teachers cannot be found, sometimes teachers are hired who are not fully prepared for the subjects they teach.

Supply Factors

New entrants. In most years, new entrants comprise over half of the annual teacher supply.[67] The potential supply of new entrants is often estimated as the number of recent fully credentialed teachers who have not yet taught. When fully credentialed teachers cannot be found, sometimes teachers are hired who are not fully prepared for the subjects they teach. State laws generally indicate that underprepared teachers cannot be hired when fully credentialed teachers are available. Thus, when underprepared teachers are hired, it typically indicates evidence of a shortage.

Estimating the number of new entrants into the workforce in a given year can be tricky. Universal data collected by the federal government on teacher preparation programs can be used to help deduce the number of candidates who enroll in and complete teacher preparation programs. However, these data do not reveal how many and how soon recent completers end up teaching in the classroom. Longitudinal studies conducted by institutions of higher education that follow college graduates in their educational and occupational pursuits can provide estimates of when and how many college graduates enter teaching. These sample sizes are relatively small and non-representative of all teachers. The federal government periodically conducts some surveys, like the Baccalaureate and Beyond survey, that follow college graduates into their careers, which can provide some information as well. A combination of these types of data—individuals who have completed teacher preparation programs and individuals who have accepted teaching jobs—is necessary to properly investigate patterns of entry into the teacher labor market.

Past estimates in the literature generally find between 70% and 90% of newly minted teachers end up in the classroom in the year following their teacher preparation, with higher rates of entry from postbaccalaureate programs than from undergraduate programs.[68] Historically, new teachers often came straight from undergraduate teacher preparation programs.[69] Today, it is increasingly common to obtain a teacher credential through a postgraduate program.[70] One survey in 2011 found that about one-third (34%) of respondents had entered the profession through a postbaccalaureate program.[71]

While some education graduates select occupations other than teaching, others enter teaching after a delay. The nature of this delay from preparation to practice adds delayed entrants as a sub-category of teachers that must be accounted for when examining new entrants.

Estimates of completer-to-teacher entrant rates are tied to labor market conditions. For instance, the comparative wage a teacher is paid relative to other jobs in the economy can affect the decision of a newly qualified teacher to enter the classroom.[72] Furthermore, the relative availability of teaching positions alters the likelihood that a newly qualified teacher who wants to enter the profession finds a job. In times of high demand, when there are more job openings, the percentage of hires coming straight from a teacher preparation program increases.[73]

Some evidence suggests delayed entry also varies by subject area. High rates of delayed entry are evident in some fields such as physical education and elementary education, but a recent study using national data found that almost all newly prepared mathematics and science teachers entered teaching within a year of graduating.[74]

We used survey responses from the 2008:2012 Baccalaureate and Beyond (B&B), a longitudinal study that follows college graduates after they receive their BA degree, to determine the percentage of students who were prepared to teach but did not end up in the classroom in a four-year period. The data provide an estimate that 75% of newly minted teachers ended up teaching within four years.[75] It is worth noting that the B&B sample includes only recent BA graduates; therefore, this estimate does incorporate many teachers coming from graduate-level pathways or nontraditional routes, which typically have higher entry rates.

The four-year average has the benefit of accounting for many delayed entrants. However, the years sampled were during the Great Recession in precisely the years that many beginning teachers were being laid off, and fewer new teachers were able to get teaching jobs than would normally be the

case. Thus, we think of this as a lower-bound estimate of entry rates into the profession. For this reason, our analysis used a lower bound of 75% and an upper bound of 90% to model the flow from teacher preparation to the classroom.

Re-entrants. Re-entrants make up the other component of teacher supply. A proportion of teachers each year leave the occupation for personal and professional reasons.[76] These exits create a reserve pool of teachers who have a teaching credential and experience but are not currently teaching.[77] Some of these individuals come back to teaching at a later date as re-entrants. The size and willingness of candidates in the reserve pool to re-enter is difficult to estimate, but existing data allow us to examine the share of annual hires who come from this pool. In recent years, research has found between 37% and 49% of new hires entering the workforce are re-entrants.[78] Proportions of re-entrants as a share of total hires likely vary with labor market and economic conditions as alternate employment opportunities fluctuate.[79] For example, the 2011–12 estimate of 49% is likely elevated because after the Great Recession, as the workforce began to expand, schools rehired many teachers who had been laid off just a few years prior as re-entrants. In 2003–04 and 2007–08, the proportion of new hires that were re-entrants was lower, at 41% and 37%, respectively.[80]

Research suggests that many re-entrants left with the intention of returning, including teachers who stepped out for child-rearing or other personal reasons.[81] Estimates suggest that just under a third (between 28% and 32.3%) of teachers who leave teaching come back to the classroom within five years.[82] On average, teachers who are female and who have more teaching experience (controlling for age) are more likely to re-enter teaching, as are those who receive higher salaries.[83] Most teachers who choose to re-enter teaching do so after just one or two years out of the classroom. The more time a teacher spends away from the classroom, the less likely he or she is to return to the profession.[84]

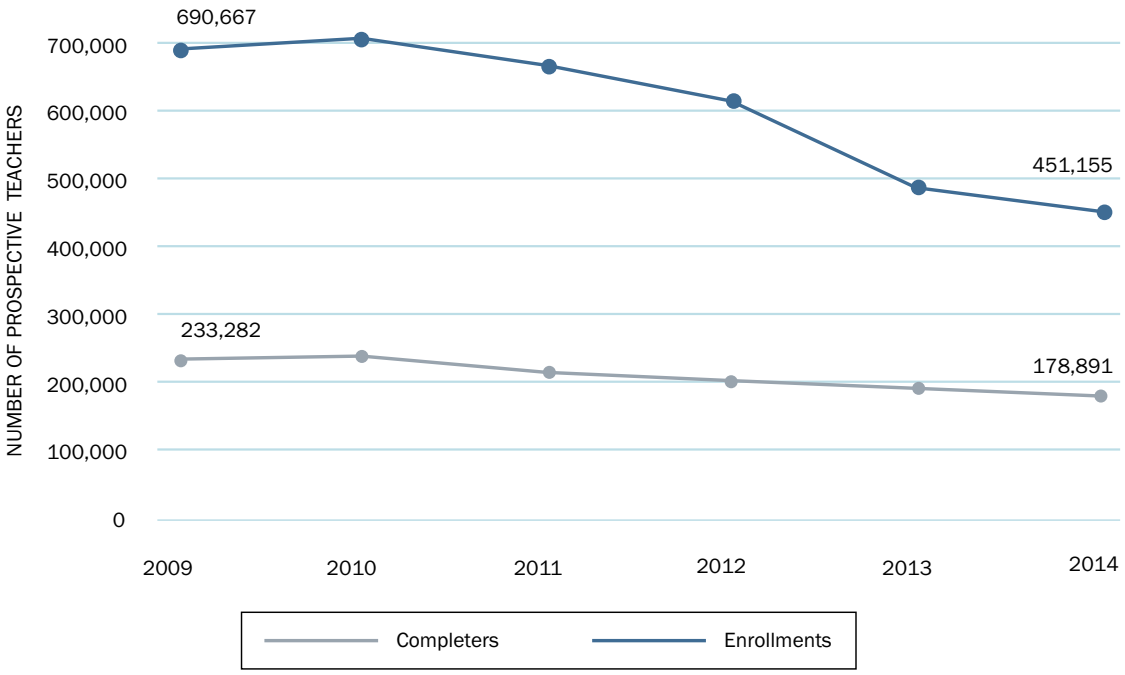
Understanding that the proportion and rate of re-entrants can vary, in our analysis we estimate an upper and lower bound for the rate at which teachers who leave return to the classroom within five years of leaving. The upper-bound rate is 32.3%[85] and the lower bound is 28%,[86] which are based on the range of estimates found in high-quality studies on teacher re-entrance.

Estimates suggest that just under a third (between 28% and 32.3%) of teachers who leave teaching come back to the classroom within five years.

Current Teacher Supply

Currently, key indicators point to a significant decrease in the supply of teachers. Enrollments in teacher preparation programs across the country have decreased steadily in recent years. Between 2009 and 2014, the most recent years of data available, there was a 35% reduction in undergraduate and postbaccalaureate teacher preparation enrollments, which amounts to a decrease of almost 240,000 fewer professionals working their way toward the classroom in 2014 as compared to 2009. Another way of looking at the future teacher supply is by observing the number of prospective candidates who attend a teacher preparation program and complete the requirements for a credential. The number of completers decreased by over 23% from 2009 to 2014.[87] Together, these decreases indicate significantly reduced teacher supply (see Figure 8).

Figure 8
National Teacher Preparation Program Enrollments and Completers



Source: LPI analysis of the Title II Data Collection, 2004–2014, U.S. Department of Education.

A common hypothesis for the dramatic downturn in supply is that the highly publicized teacher layoffs during the Great Recession left a mark on the public psyche, including individuals who might have been considering a teaching career. In addition to the fact that there were few jobs available, budget cuts resulted in frozen salaries and deteriorated teaching conditions as resource limitations led to increased class sizes, and fewer materials and instructional supports.

One sign of the cumulative impact of these factors is that only 5% of the students in a recent survey of those taking the ACT college entrance exam were interested in pursuing a career in education, a decrease of 29% between 2010 and 2014.[88] In an annual national survey of college freshmen, only 4.2% of students indicated their probable field of study would be education. This is fewer than half the share who expressed interest in 2007, when 9.2% of students intended to major in education, and the lowest proportion of students considering teaching in the last 45 years.[89]

Only 5% of the students in a recent survey of those taking the ACT college entrance exam were interested in pursuing a career in education, a decrease of 29% between 2010 and 2014.

These simple indicators—enrollments and completers—reveal important information about the current teacher labor market. Modeling teacher supply using these data

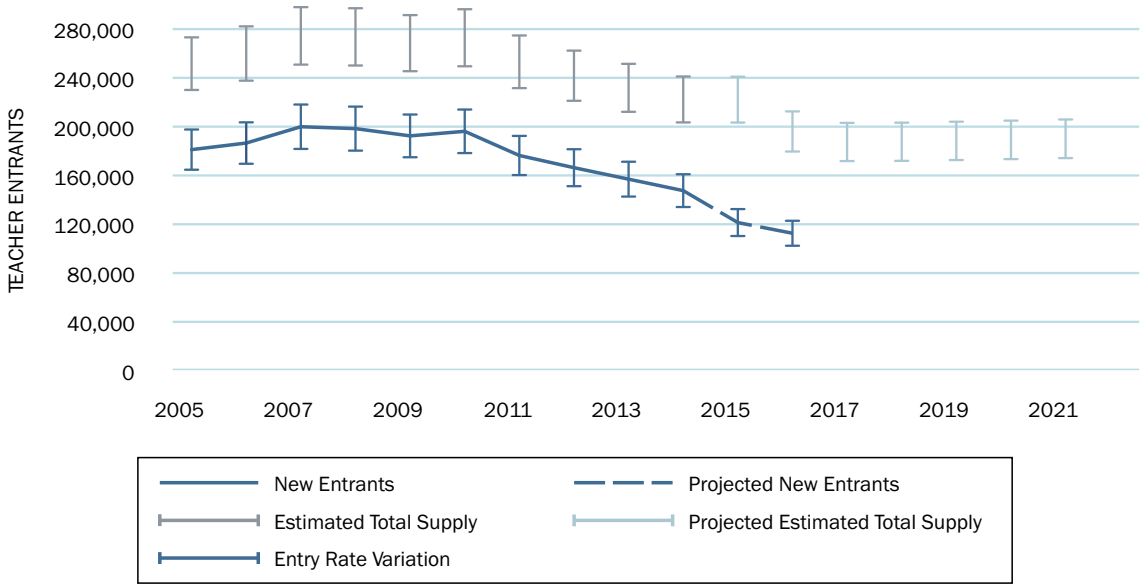
in tandem with longitudinal analysis of college graduates and teacher re-entry allows a more powerful analysis.

Figure 9 estimates new teacher entrants over the past decade using universal data on teacher preparation programs collected by the U.S. Department of Education under Title II of the Higher Education Act[90]—the most recent and complete national data on teacher preparation. We use the average ratio of completers to enrollments (.303) to project current enrollments into future completers. We then obtain a range of new teacher estimates by multiplying the number of completers by a lower and upper bound (75% and 90%) for the rate at which completers are expected to end up in the classroom.

We estimate total teacher supply using the average annual attrition rate reported by the National Center for Education Statistics (7.88%),[91] the upper (32.3%) and lower (28%) bounds of re-entry rates, and estimates of the timing of return for these re-entrants by Grissom and Reininger (2012).[92] To estimate supply into the future, we exponentially smooth new teacher entrants through 2025 following the same methods as described above to produce total teacher supply.

Figure 9 shows a steady decline in the teacher supply starting in 2009. According to our model, we estimate 2016 to have the lowest number of available new entrants in over 10 years, at around 113,000 first-time teachers.[93] The upper and lower bounds in brackets indicate where total supply will lie based on variation in re-entrants and the entry rate. In 2015–16, the overall teacher supply (new entrants and re-entrants) is estimated to be between 180,000 and 212,000 teachers, while the demand is approximately 260,000.

Figure 9
Estimated Teacher Supply



Note: Error bars represent high and low projections for total teacher supply to account for varying economic conditions that affect the entry and re-entry rates.

Source: LPI analysis of the Title II Data Collection, 2004–2014, U.S. Department of Education; N2Derived Data File, 2012, from the Baccalaureate and Beyond (B&B), National Center for Education Statistics.

Depending on economic conditions and changes in the desirability of teaching, teacher supply will vary. Assuming that new entrants and re-entrants remain at 2016 levels, this model estimates that supply will decrease through 2017 and remain near that low level through 2021. Constant supply is unlikely given the reactive nature of supply and demand; however, projecting current trends into the future illuminates the extent of the labor market gap if nothing is done to alter current trends.

Candidates do not necessarily choose the fields and subject areas in which there are large numbers of vacancies, nor do they choose to teach in the hard-to-staff locations where the shortages are most pronounced.

As one indicator of current trends at the state level, where more recent data are available, there was a small (roughly 4%) uptick in California teacher preparation program enrollments and completers in 2015 as the labor market shifted.[94] Although promising, the increases were far too small to meet the sharply increased demand, and there was continued enrollment decline in the shortage fields that had been experiencing large shortages even during the downturn (mathematics, science, and special education).

Thus, even as they respond to the market, candidates do not necessarily choose the fields and subject areas in which there are large numbers of vacancies, nor do they choose to teach in the hard-to-staff locations where the shortages are most pronounced. In fact, candidates are often less likely to go to these higher-need schools when there are more vacancies in well-heeled districts that tend to have easier working conditions and better salaries. Policymakers must ensure not only that there are enough teachers to meet demand, but also that there is an adequate supply of teachers for the fields and locations where they are needed most.

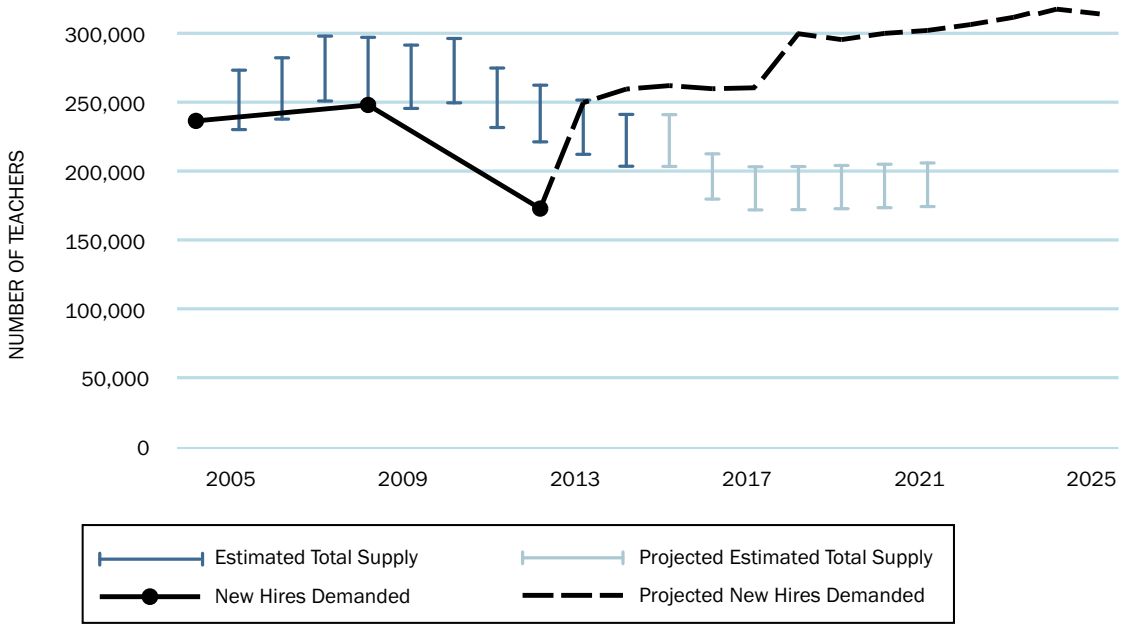
IV. The Teacher Labor Market: Predicting the Trends Ahead

So far, we have looked at supply and demand separately. For each component of the labor market, we have examined the contributing factors and the current outlook, and we have modeled estimates of current and future trends. Looking at these components separately allowed us to investigate each in a degree of detail necessary to later understand how supply and demand interact together in a policy context. Now, combining supply and demand together allows us to investigate the teacher labor market as a whole.

Figure 10 shows the size of the predicted teacher shortage. In the early 2000s, demand fell roughly within the brackets of total teacher supply, suggesting relative balance in the teacher labor market. In 2010, 2011, and 2012, supply was greater than demand. This finding matches with reality—during the Great Recession, there was a teacher "surplus": Teachers were being laid off, and it was difficult to find work. In 2013, however, as the economy recovered, demand rose steeply, while supply continued to remain low and declined further in 2014 and 2015. During this period, the teacher labor market moved into a shortage condition.

Currently, there are not enough qualified teachers to meet the demand. The shortage in the 2015–16 school year is estimated to be between 47,000 and 80,000 teachers. If supply trends were to persist at these current lows, in 2018, as demand increases again, supply could be around 112,000 teachers short of demand. We can expect some increase in the number of individuals entering teaching in response to greater demand. Nonetheless, even if supply increases to pre-recession levels of 260,000 teachers a year, demand would still be outstripping supply by approximately 40,000 teachers. Furthermore, the perennial areas of acute shortages (special education, mathematics, and science) thus far show little sign of response to labor market demand.

Figure 10
Projected Teacher Supply and Demand



Source: U.S. Department of Education, multiple databases (see Appendix A).

Figure 10 suggests that the United States is in the midst of a teacher shortage that, if current trends continue, may worsen further. The effects are likely to be felt in some subject areas, states, and communities more than others, as we describe below.

Supply Trends in Shortage fields

Looking at the Title II teacher education completer data from the last two years available (2011–12 and 2012–13), there was a decrease in new teacher entrants in almost every subject area,[95] including those with perennial shortages, such as mathematics and science.[96] More recent data from California continued to show ongoing declines in mathematics and science credentials through 2014–15, even when supply was beginning to improve in other areas in response to greater demand.[97] These trends will further exacerbate hiring difficulties in the mathematics and science fields. Constant shortfalls exist in these areas because average non-teacher wages for individuals with mathematics and science degrees are so high relative to teaching.[98]

No two states are the same; thus, a national teacher shortage will be felt and experienced by each state differently. Examining the distribution of teacher preparation programs, starting salaries, and working conditions, as we do below, helps us understand the variability in teacher labor markets by state, and how those differences could have an impact on teacher supply and demand.

Supply Trends in States

Availability of New Teachers

States vary in the number and size of preparation programs they sponsor, and their yield in relation to state hiring demands. According to the Title II data collection, in 2014 there were 2,085 teacher preparation programs across the nation. Texas, California, and New York have the largest number of providers, 199, 143, and 139, respectively, and in 2013–14 prepared around 50,000 teachers, a quarter (27%) of the newly prepared teachers in the country. By contrast, Wyoming has only one teacher preparation program, and in 2013-14 prepared just 256 teachers.[99]

However, the number of teachers prepared as a percentage of a state's total teacher workforce can tell a different story. For example, California prepares a large number of teachers (the third most teachers of any state), but this is a smaller proportion of its total workforce than in most other states. On average, each year, states prepare 6% of their teacher workforces. Yet Alaska, California, Connecticut, Florida, Nevada, and Wyoming all prepare less than 4% of their teacher workforces. Conversely, Arizona, New York, Utah, and Washington, DC, prepare far greater numbers of teachers in relation to the size of their workforces (between 9% and 12%.)

This variation creates states that are net importers of teachers and others that are net exporters. For example, in 2013–14, states, on average, awarded 34% of their initial teaching credentials to candidates who received their teacher preparation in another state.[100] Some of these teachers represent an interstate trade—for example, a teacher who prepared in Connecticut teaching in Massachusetts, balanced by a teacher who prepared in Massachusetts teaching in Connecticut—but others represent net imports. Wyoming, Alaska, and North Dakota—net importers—issued 72%, 75%, and 100%, respectively, of their initial teaching credentials to out-of-state prepared candidates

in 2013–14. On the other hand, in the same year, New Jersey and New York—net exporters—issued effectively no initial teaching credentials to individuals who prepared out of state.[101]

Teachers do move around the country; one analysis found about one-quarter of all applicants for teaching positions across the country were from out of state.[102] At the same time, states that prepare a great many teachers, relative to their needs, have at least two advantages. First, many teachers prefer to teach near where they grew up or went to school,[103] and some will have job offers from the districts where they student taught. In addition, teachers earn state-specific credentials while they are preparing, and candidates sometimes encounter a variety of barriers in trying to transfer credentials to other states, creating steep transaction costs for moving. States that prepare fewer teachers must attract out-of-state candidates to fill their vacancies, which can be even more difficult in times of shortage. Thus, the concentration of teacher preparation providers and number of candidates completing these programs is likely one reason for the variation in labor markets by state.

Salaries

State differences in starting teacher salaries can also contribute to the variability in teacher labor markets. Salaries can affect the attractiveness of teaching jobs in ways that impact both recruitment and retention.[104] According to data from the National Education Association, the average starting teacher salary in the United States in 2013 was $36,141,[105] but the range was very wide. In 2013, the District of Columbia had the highest starting salary at $51,539, and Montana had the lowest starting salary at $27,274, unadjusted for cost of living differentials (see Appendix B).

Within states, school district funding often varies, with strong consequences for salary levels. Great inequalities in salaries across districts typically cause shortages in those that are not able to offer a competitive wage.[106] Some of this variation can be explained by cost-of-living differences, but even in higher-paying states, such as California, there can be wide variations in wages that are not associated with cost-of-living differentials, leaving many teachers struggling with the higher cost of living and lower purchasing power.[107] These variations in salaries are another reason why states experience teacher shortages differently.

Great inequalities in salaries across districts typically cause shortages in those that are not able to offer a competitive wage.

The competitiveness of teachers' wages to those of non-teaching occupations requiring similar levels of education can be just as important as teacher salaries themselves, as these are an influential factor in teachers' decisions to enter the profession.[108] Wage competitiveness also varies from state to state. After controlling for age, education level, hours worked per week, and weeks worked per year, teachers in Wyoming earned 94% of what non-teachers in the state earned in 2012. The ratio in Alaska and Iowa was 85%. Conversely, teachers in Arizona and Virginia earned only 62% and 63%, respectively, of what this group of non-teachers earned[109] (see Appendix B).

Working Conditions

Working conditions that teachers report as important to their decisions to stay, leave, or return to the classroom vary by state. One working condition important to teachers is the average number of students they teach: their class sizes or pupil loads. Although a higher number than average pupil-teacher ratios, the two are correlated, and widely varying across the country. In 2014, when the national average pupil-teacher ratio was 16-to-1, California's ratio was 24-to-1, while Vermont's was 11-to-1[110] (see Appendix B).

Other conditions found to be related to teachers' decisions to stay in or leave a school—such as competent and supportive leadership, a school's testing and accountability environment, and teacher autonomy in making key classroom decisions—also vary substantially.

For instance, according to data from the 2011–12 SASS, more than twice as many teachers in Arkansas strongly agreed that their administration was supportive as did teachers in the District of Columbia (58% vs. 24%) (see Figure 11). More than 10 times as many teachers in Indiana and Florida strongly agreed their job security was impacted by the performance of their students or school on state or local tests as in Vermont and North Dakota (25–26% vs. 2%) (see Figure 12). Whereas roughly 88% of teachers in Montana, North Dakota, and Vermont agreed they have decision-making autonomy in the classroom, fewer than 60% felt this way in Delaware, Florida, and Maryland[111] (see Figure 13). All of these differences are associated with differences in teachers' plans to leave teaching across these states.

More than 10 times as many teachers in Indiana and Florida strongly agreed their job security was impacted by the performance of their students or school on state or local tests as in Vermont and North Dakota (25–26% vs. 2%).

Attrition Rates

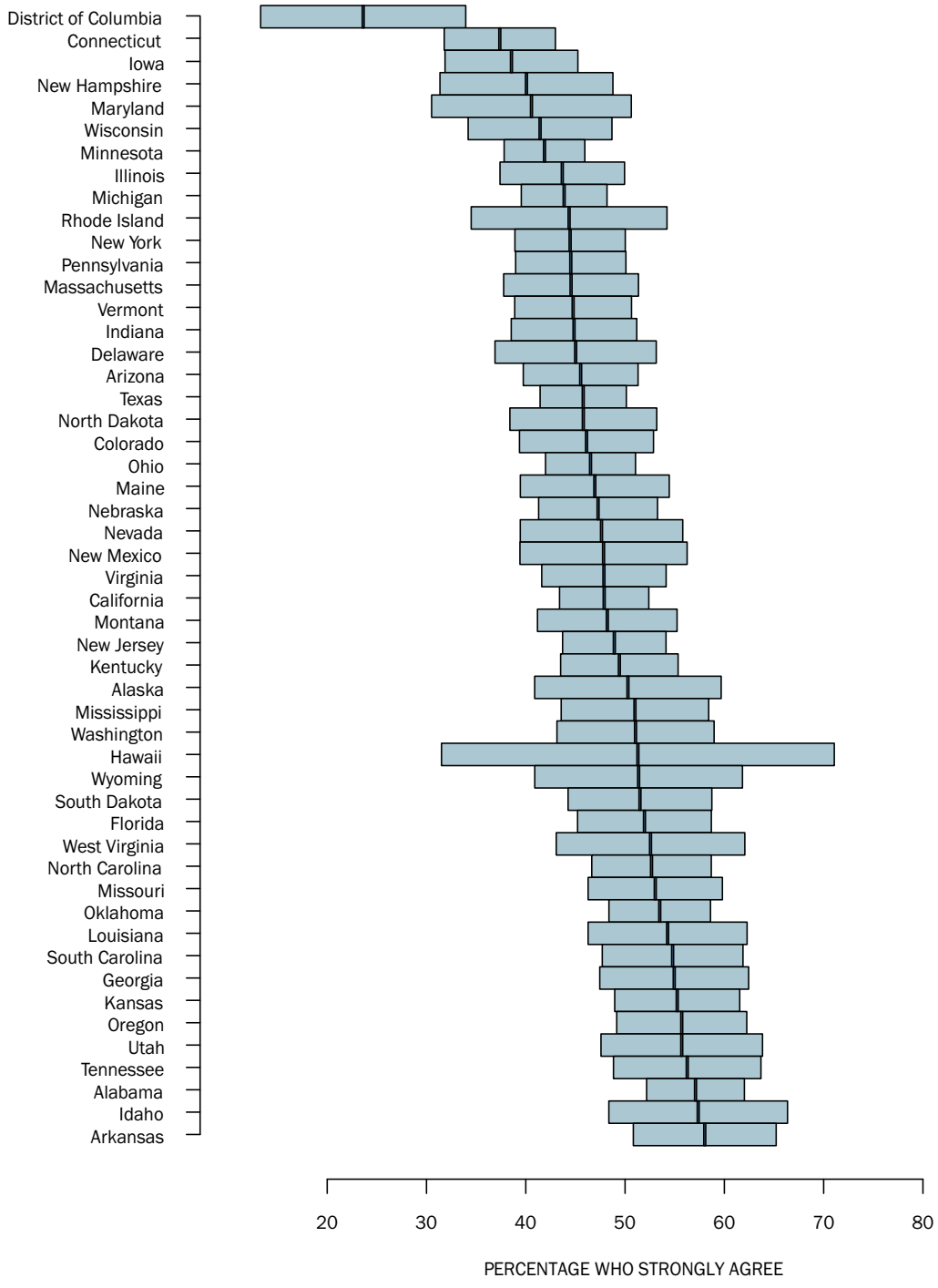
It should be no surprise, then, that teachers' estimates of how long they will stay in the profession also differ by state. Teachers in Washington, DC, are more than five times as likely to report they plan to leave the classroom as soon as possible as are teachers in South Dakota. Teachers are most likely to say they plan to leave teaching in Arizona, Nevada, and Washington, DC, and least likely to report plans to leave in Illinois, Rhode Island, and South Dakota[112] (see Figure 14). Indeed, federal data show that close to one in four teachers moves schools or leaves the profession annually in Arizona and Washington, DC, more than three times the rate in Rhode Island, for example[113] (see Appendix B). Not surprisingly, states with more teachers who plan to leave teaching tend to be the same states with a smaller percentage of teachers planning to teach as long as possible or until they are eligible for retirement benefits.

Teachers in Washington, DC, are more than five times as likely to report they plan to leave the classroom as soon as possible as are teachers in South Dakota.

Figure 11

Teacher Reports of Administrative Support by State

Percent of teachers who strongly agree that "the school administration's behavior toward the staff is supportive and encouraging"



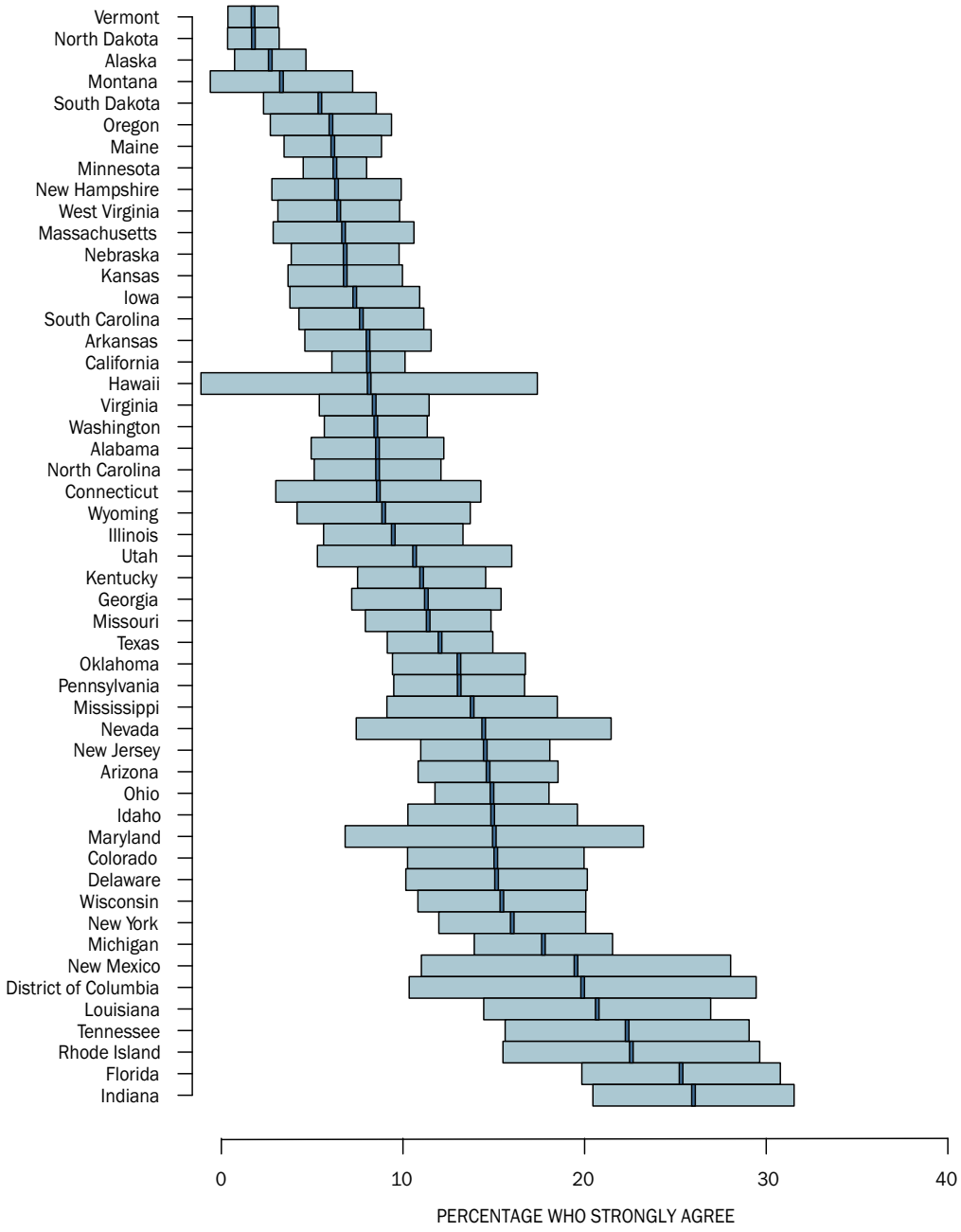
Note: Bars represent 95% confidence interval.

Source: LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

Figure 12

Teacher Reports of Testing-Related Job Insecurity by State

Percent of teachers who strongly agree that they "worry about the security of my job because of the performance of my students or my school on state and/or local tests"



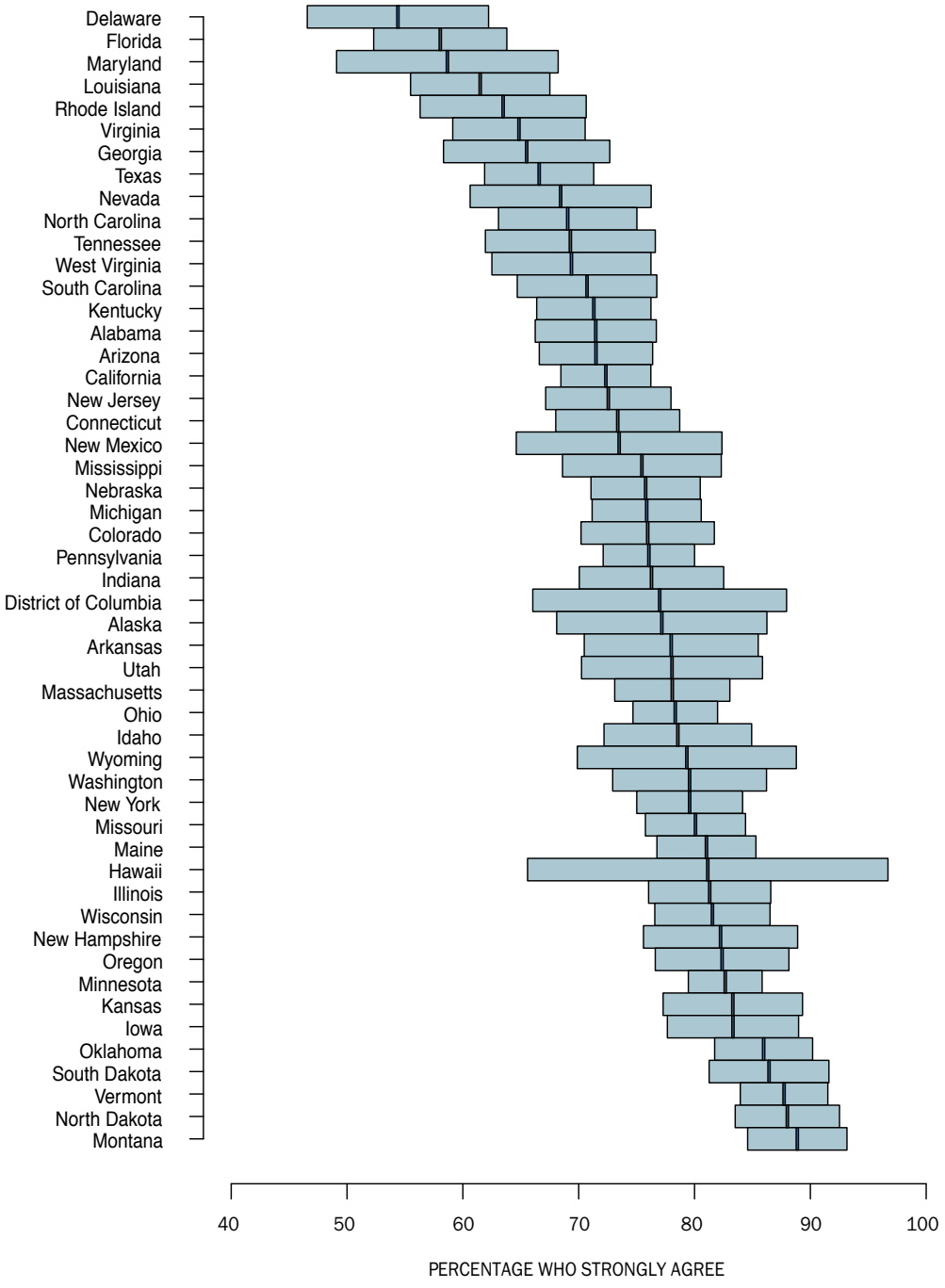
Note: Bars represent 95% confidence interval.

Source: LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

Figure 13

Teacher Reports of Classroom Autonomy by State

Percent of teachers who strongly agree that they have control in their classroom in the following areas of planning and teaching: textbooks and class materials, content and skills to be taught, teaching techniques, evaluating students, discipline, and homework



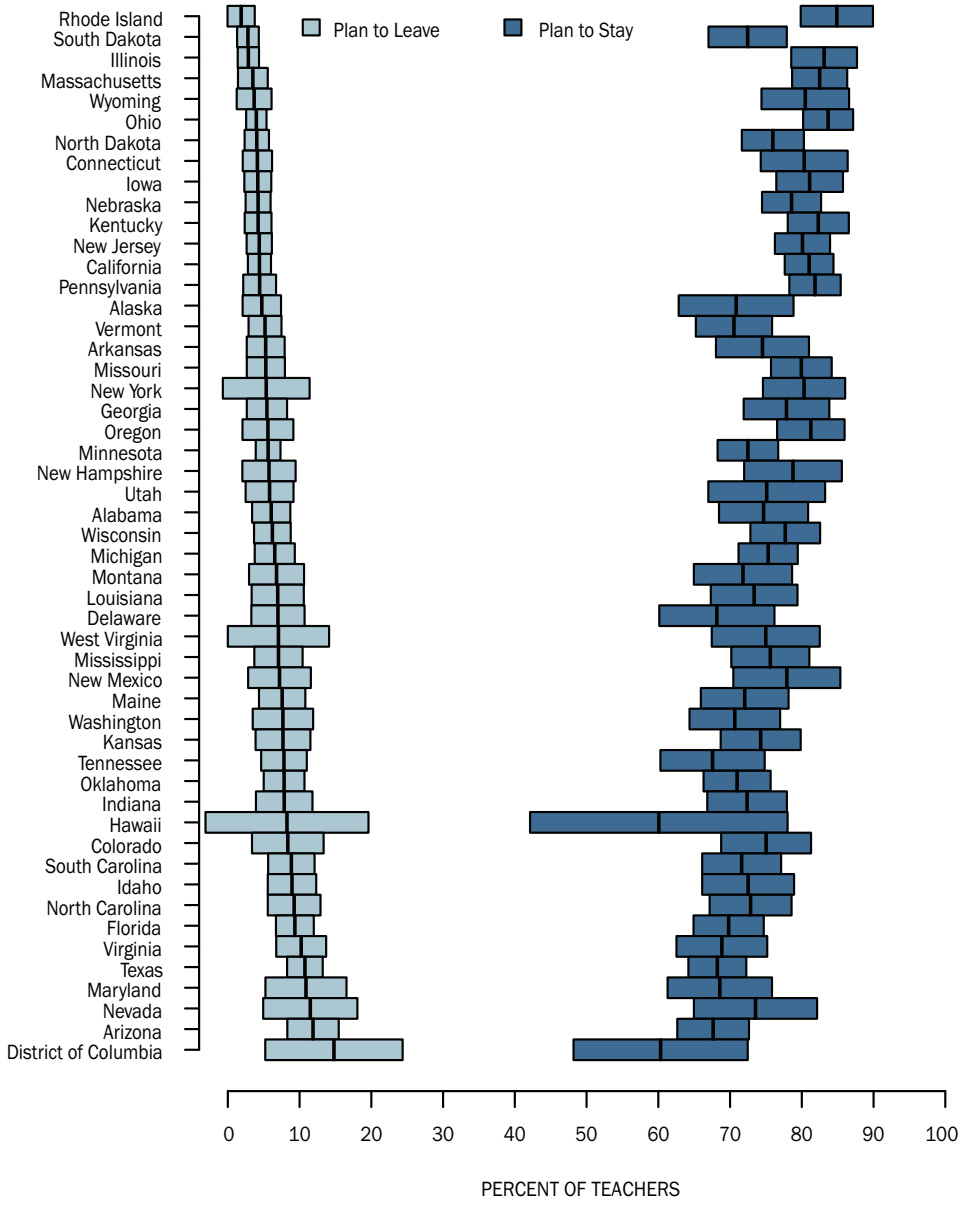
Note: Bars represent 95% confidence interval. Teacher autonomy in the classroom is measured using a Cronbach Alpha-generated construct of classroom control derived from the six components listed above.

Source: LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

Figure 14

Teachers Who Plan to Leave vs. Those Who Plan to Stay

Percent of teachers who plan to either leave teaching immediately or when a better job comes around vs. percent of teachers who plan to remain in teaching as long as able or until they are eligible for retirement benefits



Note: Bars represent 95% confidence interval.

Source: LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

Sources of Shortages

In order to respond effectively, it is important to understand what factors are driving these shortages and what can be done to shift teacher supply and demand to bring the teacher labor market to equilibrium.

Based on the evidence available, the emerging teacher shortage appears to be driven by four main factors:

1. Decline in teacher preparation enrollments,
2. An effort to return to pre-recession course offerings and class sizes,
3. Increasing student enrollment, and
4. High teacher attrition.

We identify the first three factors because these have shown the largest changes at the same time teacher shortages have increased. For example, between 2009 and 2014, there was a 35% decrease in teacher preparation program enrollment. Meanwhile, the teacher workforce has been increasing, although it is still 145,000 teachers short of pre-recession pupil-teacher ratios, and student enrollment has begun to increase and is projected to grow by 3 million students.

Reducing attrition would actually make a greater difference in balancing supply and demand than any other intervention.

While these factors have been changing, a more constant factor—and by far the largest component of annual demand—is the high rate of teacher attrition in U.S. schools. As we discuss below, this rate is much higher than in many other countries that offer more competitive wages for teachers and more uniformly supportive working conditions. Reducing attrition would actually make a greater difference in balancing supply and demand than any other intervention. Given the large impact that attrition has on teacher demand and on the adequacy of supply, we examine its characteristics and effects before turning to a broader discussion of policy drivers and potential solutions.

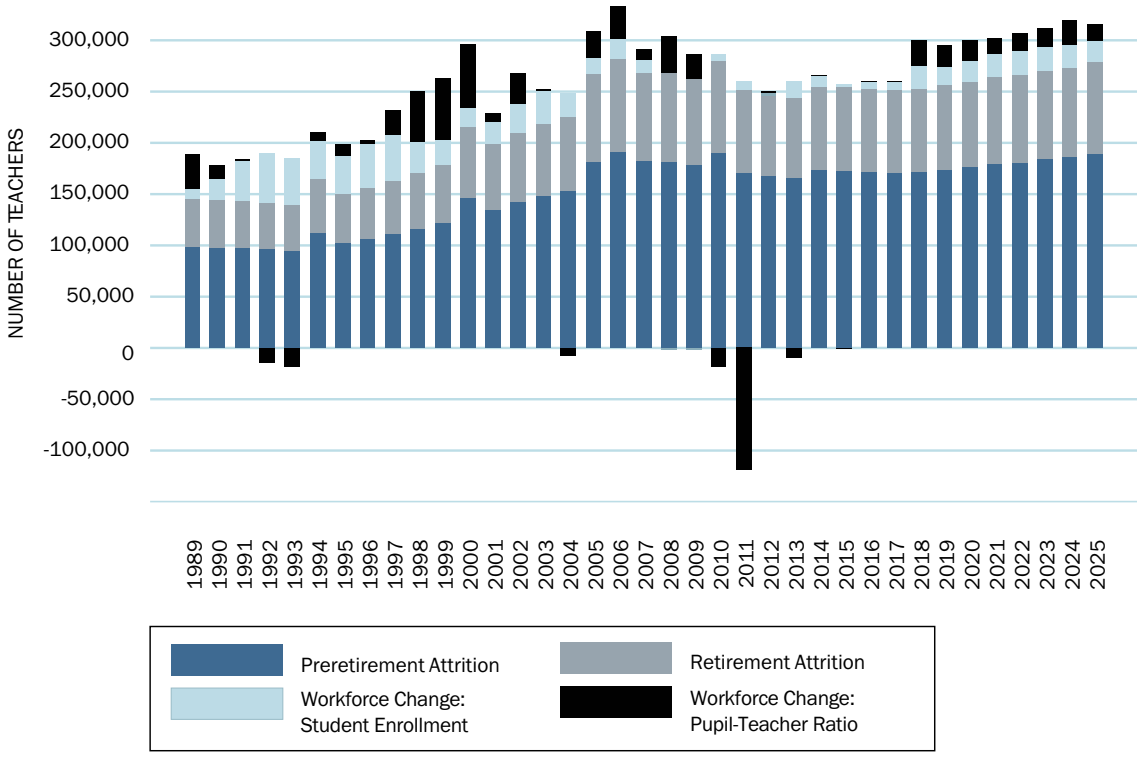
V. The Role of Teacher Attrition

Using workforce estimates, student enrollment, and attrition data from the SASS 1988–89 to 2011–12, Figure 15 shows the relative contribution of different factors to teacher demand.[114] Estimates vary from actual demand for the years 1989 to 2012 because the model does not perfectly predict demand, especially in unusual circumstances that stray from averages, like the Great Recession.

> The most important driving factor of teacher shortages is high teacher attrition.

Figure 15 highlights two main points: First, although the number of teachers who leave the profession has not dramatically changed in recent years, it constitutes the lion's share of demand, representing anywhere from two-thirds to nearly 100% of the demand for teachers in any given year. Thus, the most important driving factor of teacher shortages is high teacher attrition. Second, while workforce growth due to student enrollment increases and reductions in pupil-teacher ratios will play a bigger role in demand from 2018 to 2025 than they have in recent years, attrition still swamps these variables as a driver of teacher demand.

Figure 15
Teacher Demand Factors Over Time



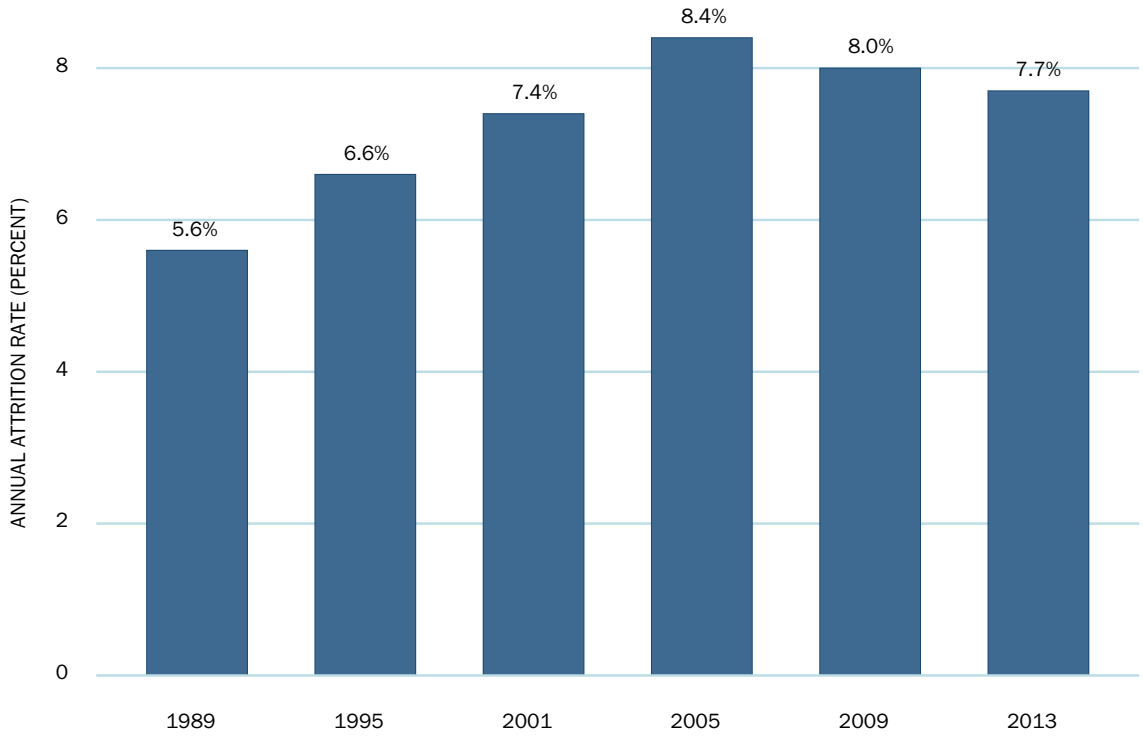
Note: Negative number of teachers represents a decrease in the total number of teachers.

Source: U.S. Department of Education, multiple databases (see Appendix A).

Attrition has not always been such a dominant factor in demand. In the late 1980s and early 1990s, attrition was less than 6%, and demand was, consequently, lower, as fewer teachers had to be replaced each year (see Figures 15 and 16). The higher attrition rates of recent years have had a very large impact on demand. Between 1989 and 2005, attrition rates increased by 50%, and they have stayed high since then. Consequently, compared to 25 years ago, attrition is now responsible for a larger number of teachers demanded each year.

Figure 16

Attrition Rate Over Time



Source: National Center for Education Statistics (2015). Digest of Education Statistics. Mobility of public elementary and secondary teachers, by selected teacher and school characteristics: Selected years, 1987–88 through 2012–13. Washington, DC: U.S. Department of Education.

In times of shortages, policymakers often focus attention, understandably, on how to get more teachers into the profession. However, it is equally important to focus on how to keep effective teachers in the workforce. In fact, as we show below, reducing attrition could virtually eliminate overall shortages, with the exception of distributional imbalances across fields and locations that may require specific incentives.

Compared to high-achieving nations like Finland, Singapore, and Ontario, Canada—where only about 3% to 4% of teachers leave in a given year[115]—U.S. attrition rates are quite high: hovering near 8% over the last decade, and much higher for new teachers and teachers in high-poverty schools and districts.[116] In many states and districts, relatively little attention is paid to supporting teachers after they have joined the profession.

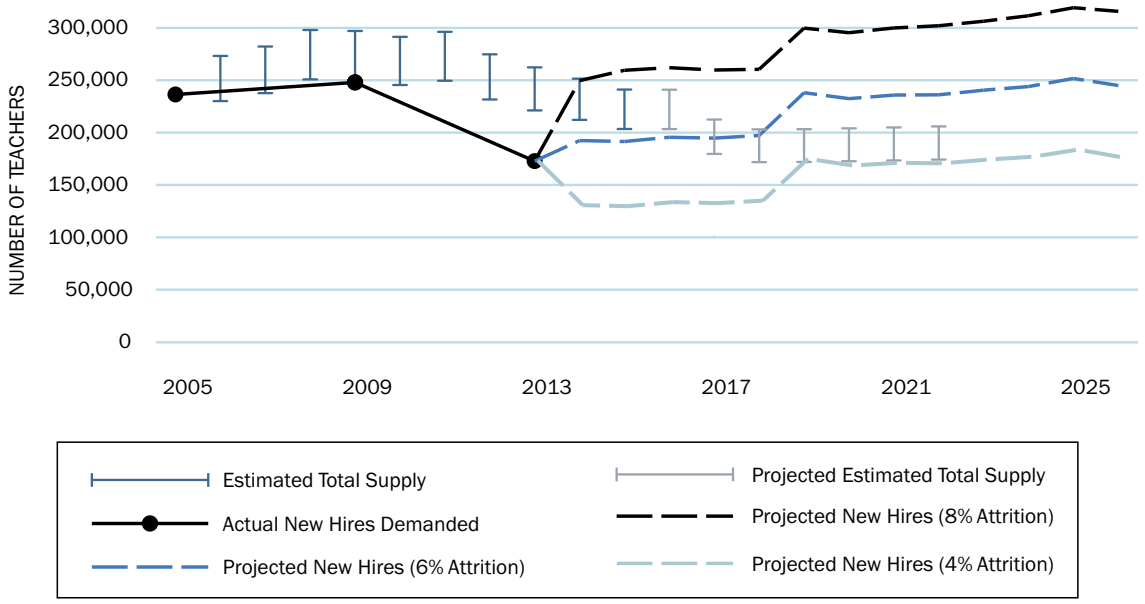
The Costs of Attrition

Figure 17 displays the teacher labor market under different assumptions of teacher attrition. Relatively small differences in the attrition rate have huge implications for the teacher labor market. The attrition rate during the projection period (black dashed line) is 8%. If the annual attrition rate could be reduced from the current projection of 8% to 6%—slightly higher than the U.S. teacher attrition rate in 1989—hiring needs would decrease by at least 60,000 teachers annually. This modest decrease in the attrition rate would reduce the demand for teachers in each year to about 200,000 teachers instead of 260,000.[117]

If the attrition rate could be reduced to 4%, closer to where it is in some other countries,[118] U.S. hiring needs would be reduced by roughly 130,000 teachers annually, cutting annual demand by nearly half. This large reduction in demand would not only largely eliminate current teacher shortages, but also allow for increased selectivity, boosting the quality of our nation's teachers.

Figure 17

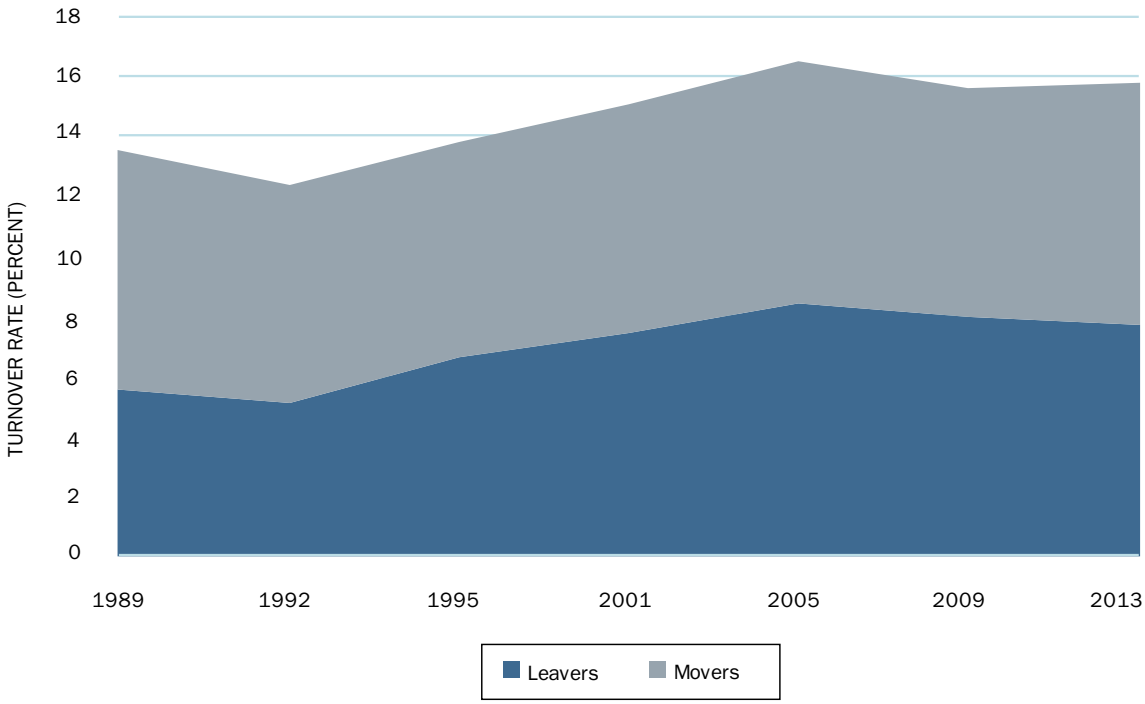
Projected Supply and Demand with Varying Attrition Rates



Source: U.S. Department of Education, multiple databases (see Appendix A).

Beyond those who leave the profession, teachers who move from one school to another are an equally important component of teacher turnover. We use the term "turnover" to denote the rate at which teachers leave a school, whether to teach elsewhere (movers) or to leave the profession entirely (leavers). At the school level, teachers who leave for a different school have the same impact as teachers who leave the profession—a vacancy that must be filled, along with both fiscal and academic costs associated with the turnover. Nationally, on average, close to 16% of teachers leave the school at which they teach each year (see Figure 18). These rates are higher in some schools than others, based on conditions in the school, which we discuss further below.

Figure 18
Trends in Teacher Turnover



Source: National Center for Education Statistics (2015). Digest of Education Statistics. Mobility of public elementary and secondary teachers, by selected teacher and school characteristics: Selected years, 1987–88 through 2012–13. Washington, DC: U.S. Department of Education.

Hard-to-staff schools with high turnover rates typically end up with a disproportionate number of relatively inexperienced teachers, which can both create greater churn, if they leave rapidly as many beginning teachers do, and undermine student achievement as a function of both teacher inexperience and overall instability.[119] High teacher turnover rates have been found to negatively affect the achievement of all students in a school, not just students in a new teacher's classroom.[120] Research shows that stability, coupled with shared planning and collaboration, helps teachers to improve their effectiveness,[121] and that teachers improve more rapidly in supportive and collegial working environments.[122] High teacher turnover undermines these benefits, which arise through shared knowledge and collaboration among colleagues.

As a principal in a poorly resourced, high-turnover school in California explained:

> (H)aving that many new teachers on the staff at any given time meant that there was less of a knowledge base. It meant that it was harder for families to be connected to the school because, you know, their child might get a new teacher every year. It meant there was less cohesion on the staff. It meant that every year, we had to re-cover ground in professional development that had already been covered and try to catch people up to sort of where the school was heading.[123]

Such schools must continually pour money into recruitment efforts and professional support for new teachers, many of them untrained, without reaping dividends from these investments. Other teachers, including the few who could serve as mentors, are stretched thin and often feel overburdened by the needs of their colleagues as well as their students. Scarce resources are squandered trying to reteach the basics each year to teachers who come in with few tools and leave before they become skilled.[124]

Each time a teacher leaves a district, it not only increases demand but also imposes replacement costs on districts. A decade ago, replacement costs for teachers were estimated to range from around $4,400 in a small rural district to nearly $18,000 in a large urban district for every teacher who leaves—a national price tag of over $7 billion a year.[125] With inflation, those costs would be more than $8 billion today. A comprehensive approach to reducing attrition would effectively both lessen the demand for teacher hiring and save money that could be better spent on mentoring and other evidence-based approaches to supporting teacher development.

Attrition is one of the most important aspects of demand to focus on, both because it is such a large component of demand and because it is policy malleable. To understand the policy actions that could reduce attrition, we must understand why people are leaving the profession, who is leaving the profession, where attrition is the greatest, and what factors are associated with it.

Each time a teacher leaves a district, it not only increases demand but also imposes replacement costs on districts.

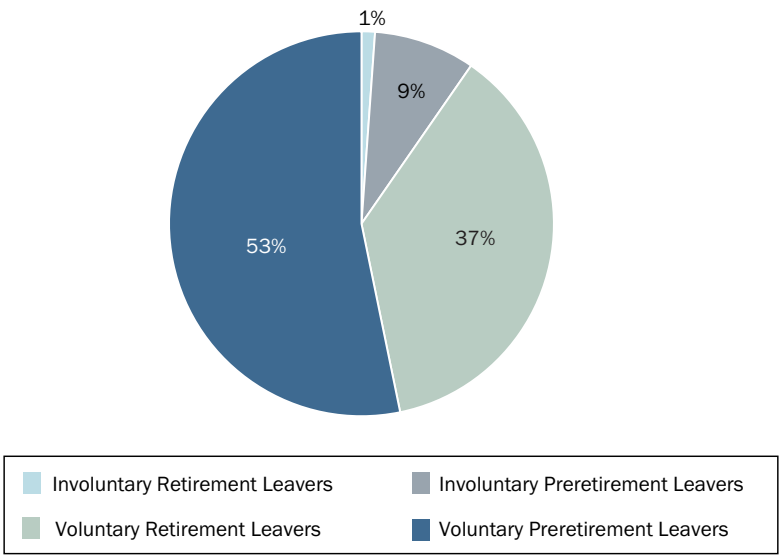
Reasons for Attrition

Rhetoric used in discussions about teacher demand often suggests that high levels of teacher attrition are driven by an aging teaching force, but current data suggest otherwise. Contrary to common belief, only a third of departing teachers in 2012 listed retirement as a very or extremely important reason for leaving.[126] Only 12.6% of teachers who left the teaching workforce said the *most* important factor for their departure was retirement.[127]

High attrition rates in the United States are driven much more by teachers leaving for other reasons. Even during a period of substantial layoffs and incentives for early retirement, most teachers left voluntarily for reasons other than retirement in 2011–12 (see Figure 19). This rate varies year to year with the economy and retirement incentives.[128] For example, in 2008–09, 69.3%, or seven out of every 10 leavers, left voluntarily for reasons other than retirement.

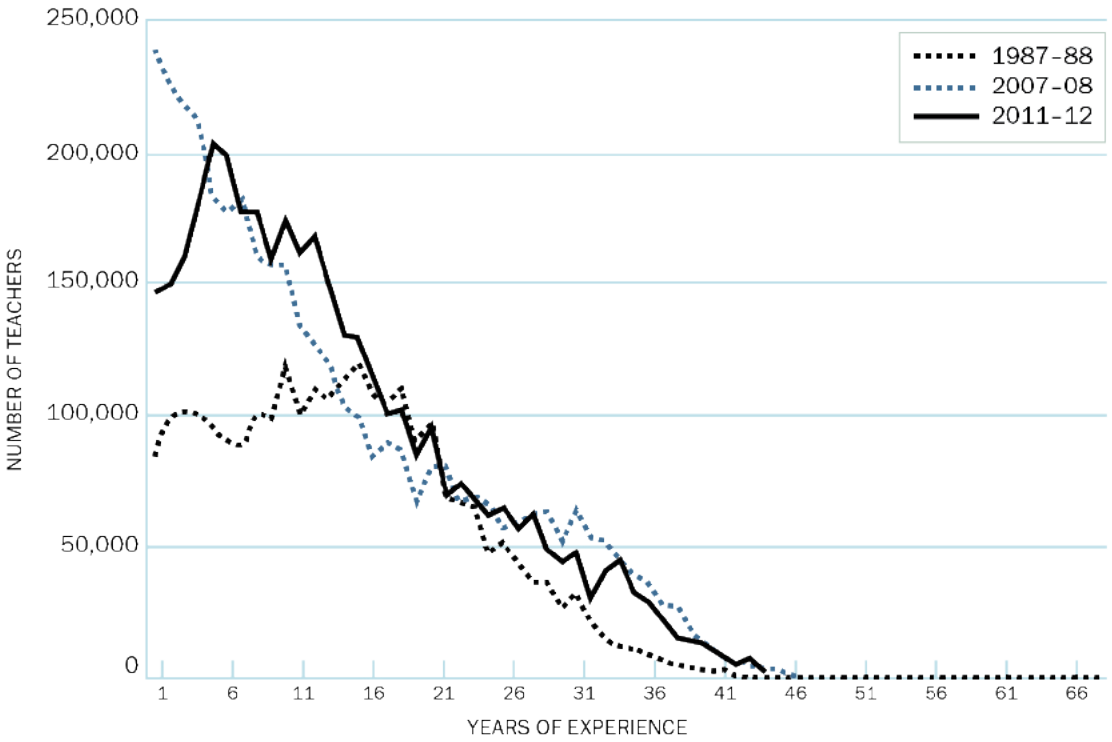
New teachers leave at greater rates than others in the preretirement period.[129] National estimates have suggested that new teachers leave at rates of somewhere between 19% and 30% over their first five years of teaching.[130] Because more new teachers have been hired over the last decade, this high attrition is having a greater and greater impact on the teacher labor market and on students' experiences in school (see Figure 20).[131]

Figure 19
Distribution of Leavers by Voluntary Retirement Status



Source: LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

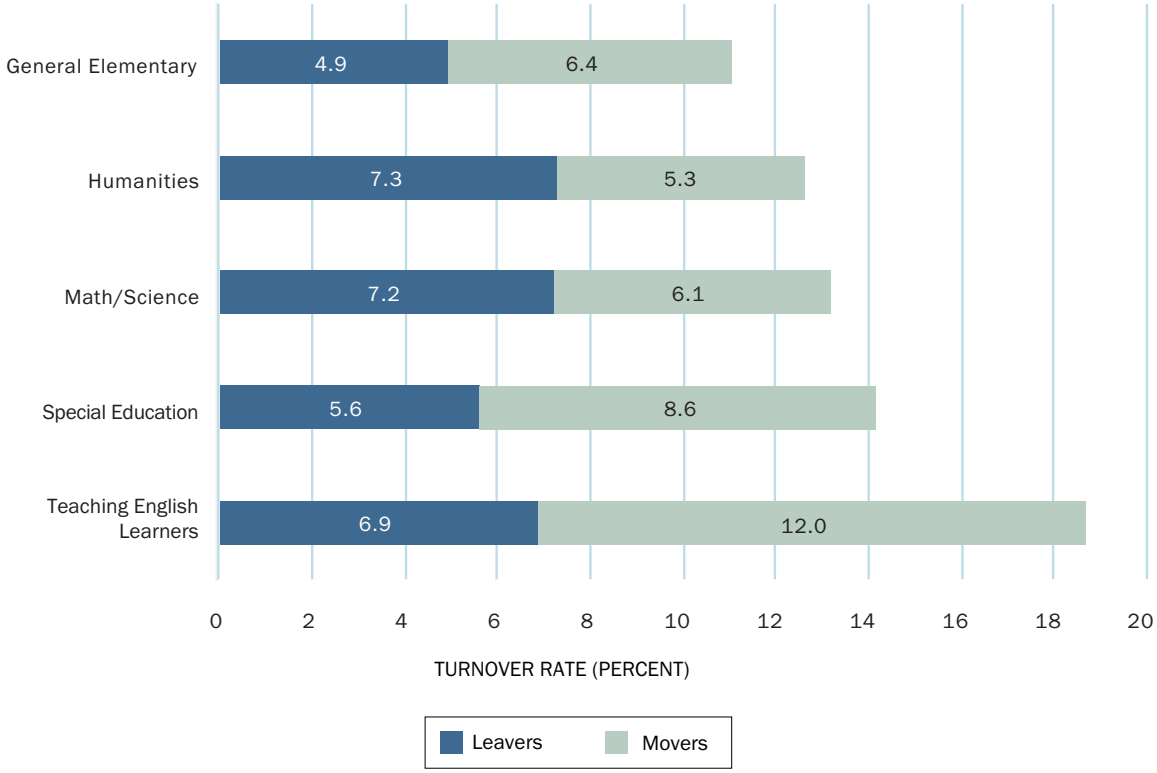
Figure 20
Teaching Experience of Public School Teachers, 1987–88, 2007–08, and 2011–12



Source: Ingersoll, R. M., Merrill, L., and Stuckey, D. (2014). Seven Trends: The Transformation of the Teaching Force. Philadelphia, PA: Consortium for Policy Research in Education.

Which Teachers Leave? The literature suggests that turnover rates and reasons for leaving vary for different teacher populations. Mathematics and science teachers, for example, move schools and leave teaching at higher rates than humanities teachers and general elementary teachers (see Figure 21). Special education teachers and teachers of English language learners leave and move at even higher rates.

Figure 21
Teacher Turnover Rate by Primary Teaching Assignment



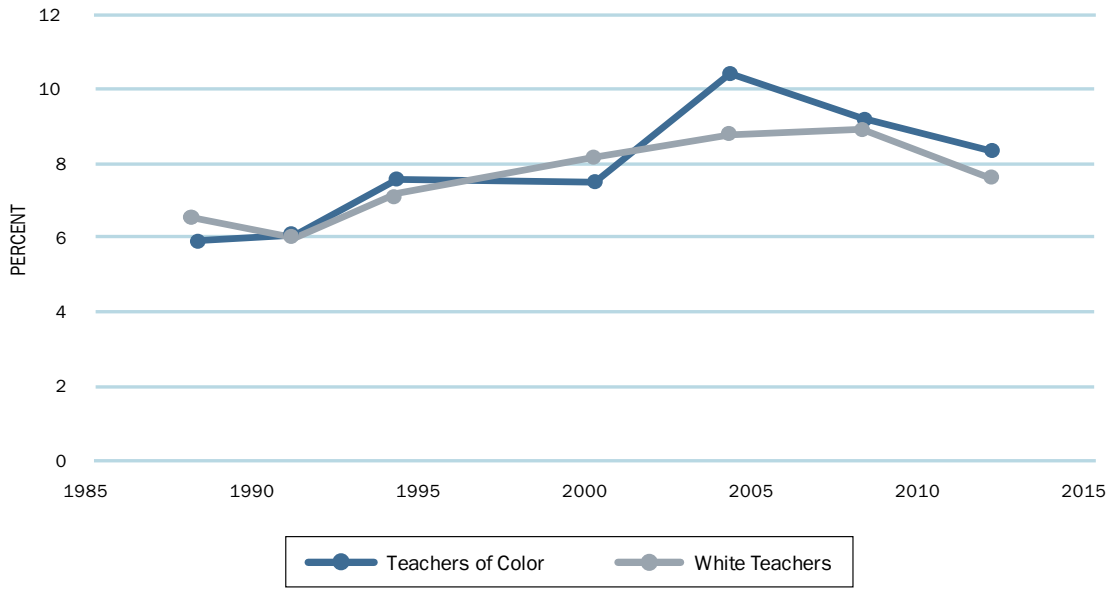
Source: LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

Teachers of color and teachers working in high-poverty, high-minority schools also tend to have higher turnover rates. Historically, teachers of color and white teachers have left the workforce at similar rates (see Figure 22), but teachers of color have moved schools at noticeably greater rates for most of the last two decades (see Figure 23).

Some of these teacher attrition differences can be explained by the association between teacher characteristics and school working conditions. More than three-quarters of all teachers of color teach in the quartile of schools with the most students of color.[132] These schools, which are often under-resourced and plagued by poor working conditions, typically experience greater turnover.

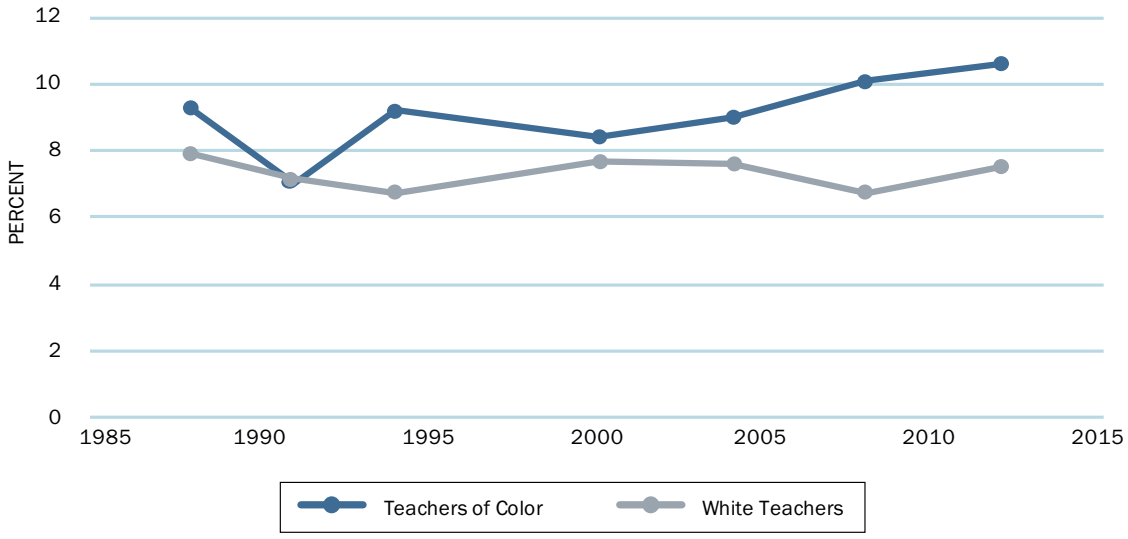
For example, the turnover rate in Title I schools is nearly 50% greater than that of non-Title I schools. Furthermore, across content areas, teachers in Title I schools have less experience and shorter tenures.[133]

Figure 22
Leaver Rate
1988–89 to 2012–13



Source: Ingersoll, R. M., and May, H. (2011). The minority teacher shortage: Fact or fable? Kappan Magazine, 93(1), 62–65; LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

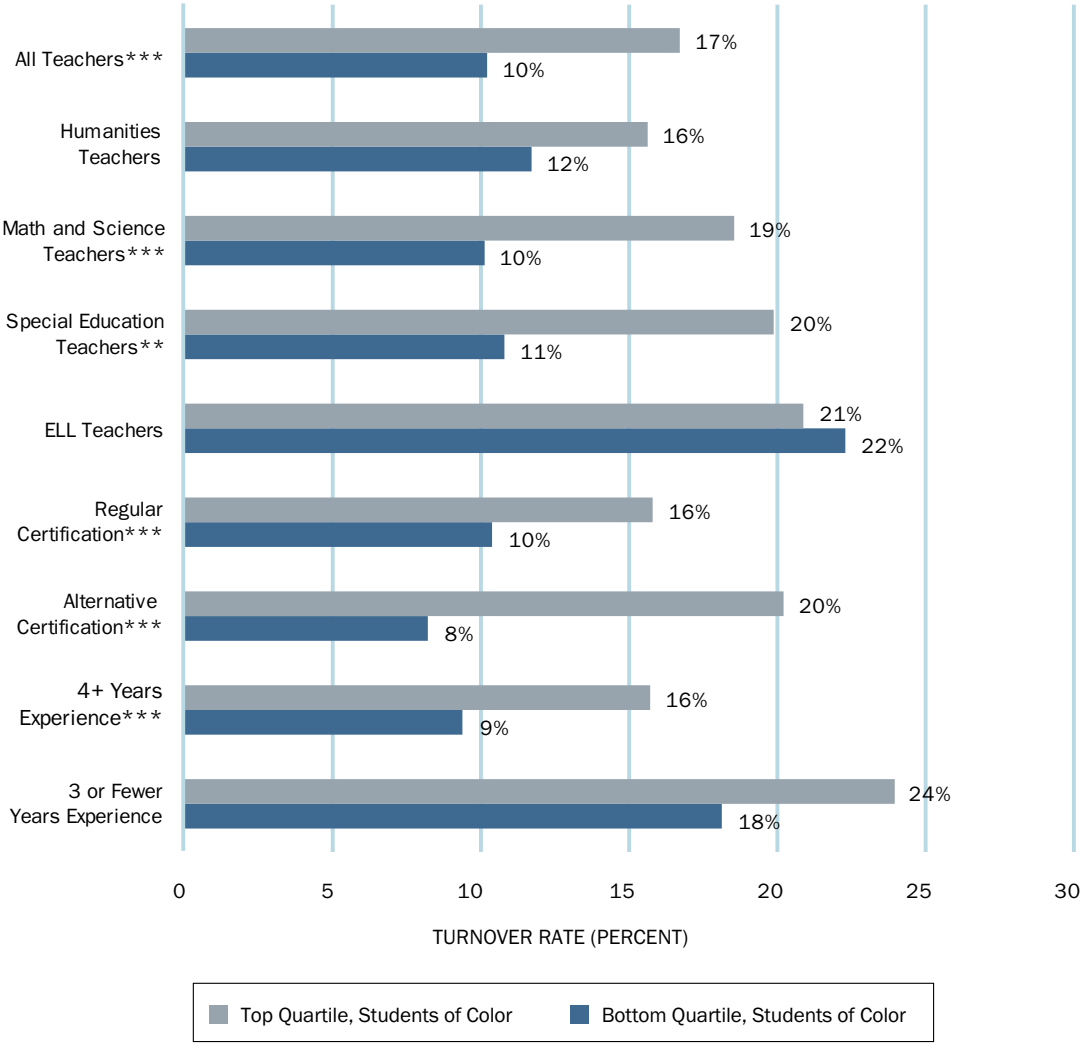
Figure 23
Mover Rate
1988–89 to 2012–13



Source: Ingersoll, R. M., and May, H. (2011). The minority teacher shortage: Fact or fable? Kappan Magazine, 93(1), 62–65; LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

The disparities are even greater for schools with different racial compositions, as shown in Figure 24. In schools in the quartile with the most students of color, the turnover rate is 64% greater than in the quartile of schools with the fewest students of color. Turnover rates are higher in these schools for teachers across content areas, years of experience, and certification type. Annual turnover rates are especially high in these schools for inexperienced teachers (24%) and for those who have entered through alternative certification pathways (20%). Alternatively certified teachers were 2½ times more likely to leave high-minority schools than they were to leave schools with few students of color.

Figure 24
Teacher Turnover by Teacher Characteristics



Note: Asterisks indicate significant differences in means between quartiles: *p <.10; **p < .05; ***p < .01. In the top quartile of schools, 55% of students are students of color. In the bottom quartile, 9% of students are students of color.

Source: LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics; Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

Our analysis of the Schools and Staffing Surveys found that teachers who enter the profession through an alternative certification program have higher rates of annual turnover (17% versus 13% for regular pathway teachers). Among full-time teachers, after controlling for school and teacher characteristics, alternatively certified teachers are 20% more likely to leave their schools than teachers who entered teaching with standard certification.[134]

More than half of all alternatively certified teachers teach in schools serving primarily students of color, and they account for 21% of teachers in these schools. In contrast, alternatively certified teachers account for less than 9% of teachers in schools with predominantly white students. We find similar patterns in Title I schools.[135]

More than half of all alternatively certified teachers teach in schools serving primarily students of color, and they account for 21% of teachers in these schools.

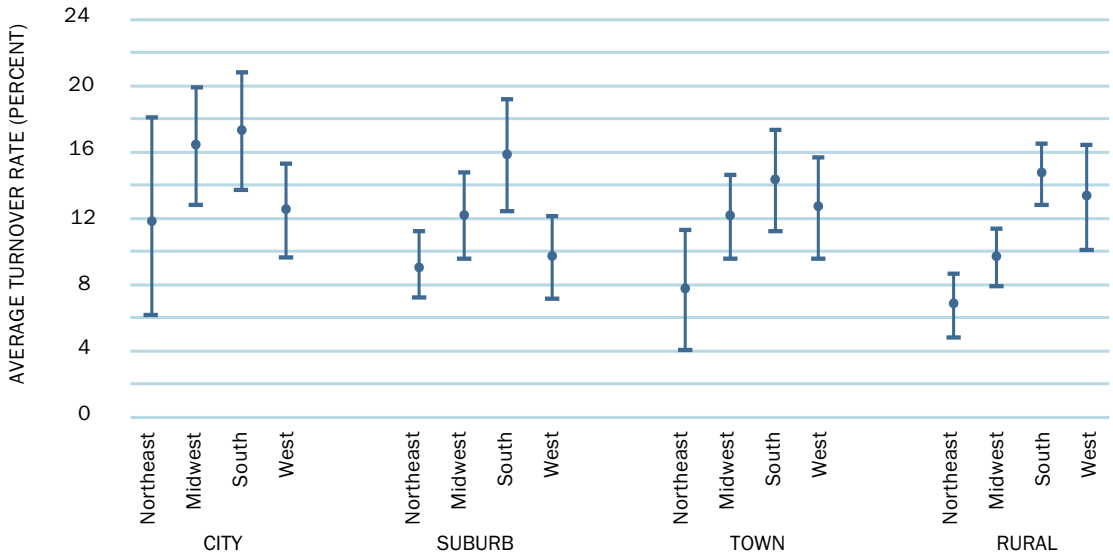
Unfortunately, many of the teachers in hard-to-staff fields receive less pedagogical preparation because they are encouraged to enter before they have completed training, as districts seek to meet their pressing hiring needs. For example, mathematics and science teachers are more likely to be certified via an alternative pathway (21% of the total) than those teaching other subjects (less than 14%),[136] and they have had less pedagogical training than other teachers on average.[137] Similarly, more than twice as many teachers of color are certified via an alternative pathway (25%) as white teachers (12%).

Where is turnover greatest? Teacher turnover rates also vary considerably across the country. At over 16% annually, the South has a particularly high turnover rate compared to the Northeast, Midwest, and West census regions, where turnover rates average about 13% or less. Southern and Midwestern cities have the highest rates of teacher turnover, followed by Southern suburbs, towns, and rural areas (see Figure 25). The higher-spending Northeast averages the lowest turnover rates across all district types.[138] In the west, turnover in cities and suburbs is among the lowest, while in towns and rural areas, it is among the highest. For most regions, turnover is higher in cities than in any other district type.[139]

The variation in annual turnover is even greater between states, ranging from under 9% in Utah to 24% in Arizona (see Figure 26). Retirement represents less than a third of all turnover in every state except for two: Oregon and New Jersey. By contrast, in Delaware, less than 6% of turnover can be attributed to retirement. Finally, the highest rates of teachers leaving the profession for reasons other than retirement are found in North Dakota (10.7%), Arizona (8.7%), and Indiana (8.5%).

Figure 25

Turnover Rates by Region and District Type

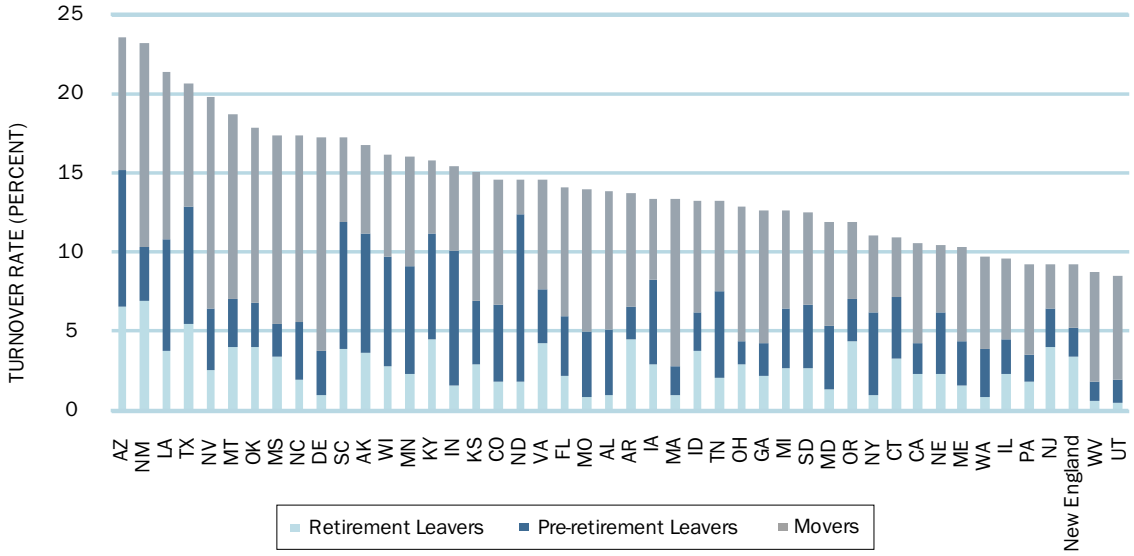


Note: Interval bars represent upper and lower bounds of a 95% confidence interval; District types are based on 2000 Census population and geography information. For more information, see Documentation to the NCES Common Core of Data Public Elementary/Secondary School Universe Survey: School Year 2009–10 (NCES 2008–332).

Source: LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

Figure 26

Teacher Turnover by Source and State

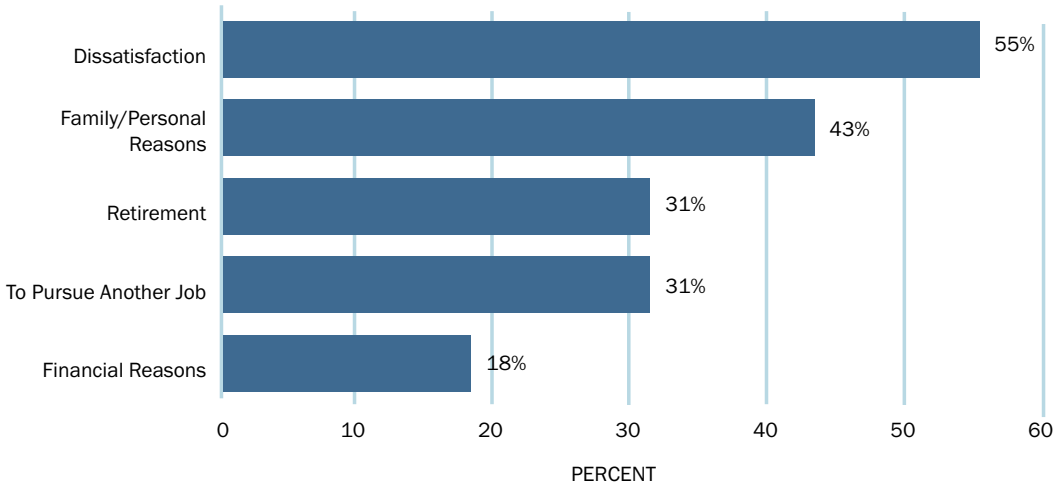


Note: States with fewer than 25 teachers surveyed were excluded (DC, HI, and WY). Three small New England states with similar data patterns were combined (NH, RI, and VT).

Source: LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

Why Do Teachers Leave? Studies find that attrition is often due to family reasons, lack of administrative support, low salaries, and poor working conditions.[140] More recently, with the rise of accountability systems in education, many teachers have reported that high-stakes testing policies have encouraged them to leave the profession early.[141] Figure 27 shows the importance of different types of factors on a teacher's decision to leave. Most teachers who voluntarily leave the classroom list some area of job dissatisfaction as very important or extremely important in their decision to leave the profession. As shown in Table 1, these areas of dissatisfaction can range from physical conditions—such as class sizes, facilities, and classroom resources—to unhappiness with administrative practices—such as lack of support, classroom autonomy, or input to decisions—to policy issues, such as the effects of testing and accountability.

Figure 27
Types of Reasons Given by Teachers for Leaving the Profession



Note: These five factors combine survey questions into common categories (see Table 1). Percentages do not add to 100 because teachers can select multiple reasons.

Source: LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

Within the above categories, the top five reasons teachers identified as important or very important in their decision to leave the classroom, other than retirement, were child care or pregnancy (37%), pursuit of another career (28%), dissatisfaction with recent school accountability measures (25%), dissatisfaction with the administration (21%), and dissatisfaction with teaching as a career (21%) (see Table 1).[142]

Table 1
Reasons Teachers Listed as Important to Their Decision to Leave

Reason for Exit	Survey Questions in Each Category	% Rated Very or Extremely Important
Dissatisfaction (55%)	Dissatisfied because of assessments and accountability measures	25%
	Dissatisfied because not enough support to prepare students for assessments	17%
	Dissatisfied with compensation tied to student performance	8%
	Dissatisfied with the administration	21%
	Too many intrusions on teaching time	18%
	Discipline issues were an issue at school	17%
	Not enough autonomy in the classroom	14%
	Dissatisfied with lack of influence over school policies and practices	13%
	Dissatisfied with teaching as a career	21%
	Not enough opportunities for leadership or professional advancement	9%
	Dissatisfied with job description or assignment	12%
	Dissatisfied with large class sizes	10%
	Dissatisfied with working conditions (facilities, classroom resources, school safety)	9%
Family/Personal Reasons (43%)	Wanted to take a job more conveniently located	11%
	Other personal life reasons (e.g., pregnancy/child care, health, caring for family…)	37%
To Pursue Another Job (31%)	Decided to pursue another career	28%
	Taking courses to improve career opportunities within the field of education	13%
	Taking courses to improve career opportunities outside the field of education	5%
Retirement (31%)	Decided to retire or receive retirement benefits	31%
Financial Reasons (18%)	Wanted or needed a higher salary	13%
	Needed better benefits	8%
	Concerned about job security	7%

As we noted earlier, aside from the personal reasons that individuals step out of teaching, dissatisfactions with the job are a predominant driver of attrition. Researchers have identified a number of workplace conditions associated with teacher attrition, including instructional leadership, school culture, collegial relationships, time for collaboration and planning, teachers' decision-making power, experiences with professional development, facilities, lack of parental support or involvement, and resources.[143]

Poor workplace conditions are, unfortunately, common in schools with disadvantaged student populations and explain much of the high attrition rates those schools experience.[144] Although rates of attrition are higher in high-poverty schools, in studies that control for workplace conditions, the explanatory power of student demographic characteristics is reduced or eliminated. Turnover has been found to be largely a product of the lower salaries and poorer working conditions at these schools, rather than a function of the students' characteristics.[145]

Poor workplace conditions are, unfortunately, common in schools with disadvantaged student populations and explain much of the high attrition rates those schools experience.

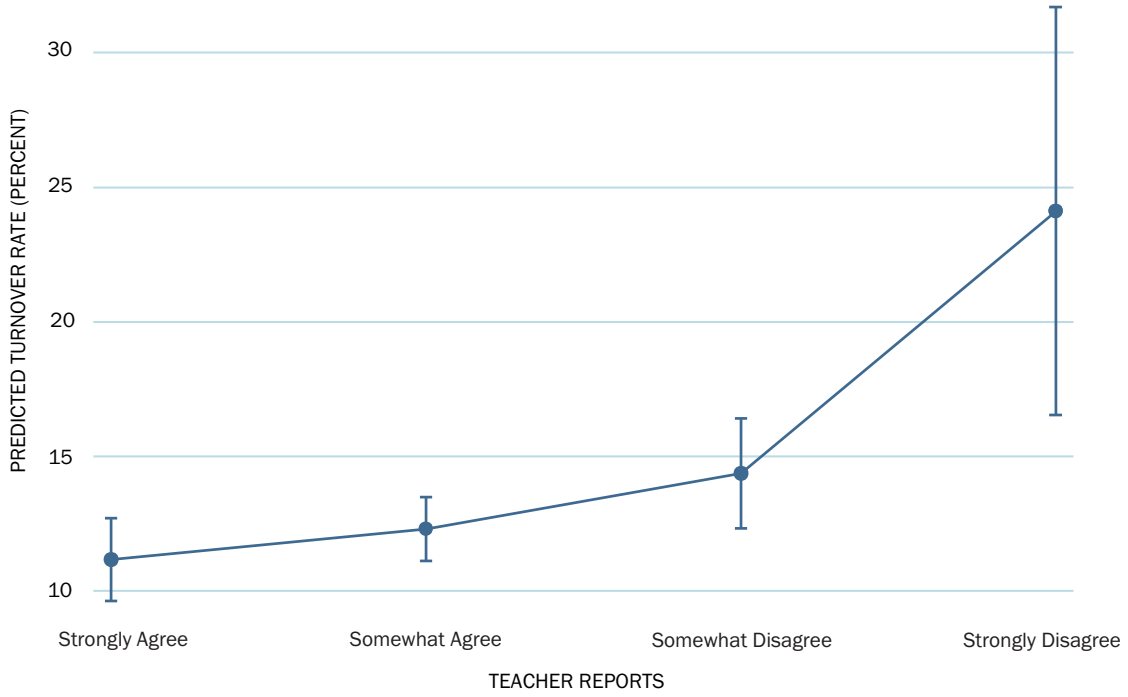
Among these working conditions in recent years has been the threat of firing, displacement, and school closures associated with accountability schemes under No Child Left Behind. Increased accountability measures and the resulting decrease in classroom autonomy, including the limited ability for teachers to select texts, content, and assessments, are heavily associated with minority teacher turnover.[146] Accountability pressures particularly impact teachers of color because there are more teachers of color in schools serving higher-needs students, which are the schools that have struggled most to meet test-based accountability requirements.[147] Unfortunately, the recent rise of accountability measures undermines efforts to increase teacher diversity, especially in high-need schools.

A comprehensive research review of attrition in high-poverty schools finds that the most significant workplace conditions associated with teacher attrition are teachers' perceptions of their principal, collegial relationships, and school culture.[148] Similarly, in our own analyses, we found that the single most predictive workplace condition was whether teachers reported lacking administrative support. When teachers strongly disagree that their administrator encourages and acknowledges staff, communicates a clear vision, and generally runs a school well, turnover rates for movers and leavers jump to nearly one in four, more than double the rate of those who feel their administrators are supportive[149] (see Figure 28).

In the quartile of schools with the most students of color, teachers are almost twice as likely to report severe dissatisfaction with their administration as teachers in schools with the fewest students of color.[150] This may be in part because the same factors that produce teacher shortages also produce shortages of administrators in high-need schools.[151]

Figure 28
Probability of Teacher Turnover in Relation to Administrative Support

Teachers' reports about the extent to which their "school administration is supportive"



Source: LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

In sum, more than half of teachers who leave the profession list dissatisfaction with some part of their job as "very" or "extremely important" in their decision. Research indicates that turnover is driven less by student or teacher characteristics than by teaching circumstances. Among working conditions, administrative support is especially central, along with other factors that are often a function of the administrator's approach: school culture and collegial relationships, time for collaboration, and decision-making input.

Reducing attrition from the current 8% to about 4%—the norm in high-achieving nations like Finland, Singapore, and Ontario, Canada, and a few states—could virtually eliminate overall teacher shortages. Because most attrition is voluntary, preretirement attrition policy can have a big impact on reducing the number of people who leave the classroom and on increasing the number of those who have left but who later return. In the next section, we discuss policy responses that research suggests can help resolve shortages and create a stable, long-term, high-quality teaching force.

VI. Policies to Meet Demand with a High-Quality Supply of Teachers

While policymakers often focus on how to recruit more teachers when there are shortages, it is important to recognize that policies which decrease teacher attrition are at least equally important. Cutting teacher attrition in half—and hence reducing teacher demand—would make our current supply largely adequate and would allow greater focus on the quality of teachers. This is essentially what high-achieving nations do. As we noted earlier, high-achieving countries like Finland, Singapore, and Ontario, Canada, have rates of attrition that are typically less than half the rate the United States has recently been experiencing each year. These countries manage to attract, prepare, and distribute well-trained teachers to all students by increasing incentives rather than lowering standards.

These countries and others that rarely experience teacher shortages have made substantial investments in teacher training and distribution in the last two decades, including:

- Salaries that are competitive with other professions, such as engineering, and equitable across schools (often with additional incentives for hard-to-staff locations);
- High-quality teacher education, usually at the graduate level and largely at government expense, including extensive practice teaching in a clinical school connected to the university;
- Mentoring for beginners in their first year of teaching from expert teachers, coupled with a reduced teaching load and shared planning time;
- Collegial work settings offering ongoing professional learning embedded in 10–20 hours a week of planning and professional development time; and
- Opportunities for expert, veteran teachers to be engaged in leading curriculum development, professional development, and mentoring/coaching for their peers.[152]

Unfortunately, unlike other industrialized nations that are high-achieving, the United States lacks a systematic approach to recruiting, preparing, and retaining teachers, or for using the skills of accomplished teachers to help improve schools. With unequal resources across states and districts, and few governmental supports for preparation or mentoring, teachers in the United States enter:

- With dramatically different levels of training—with those least prepared typically teaching the most educationally vulnerable children;
- Earning salaries typically below those of other occupations—with those teaching the neediest students often earning the least;
- Working under radically different teaching conditions—with those in the most affluent communities benefiting from small classes and a cornucopia of materials, equipment, specialists, and supports, while those in the poorest communities teach classes of 30 or more without adequate books and supplies; and
- With little time for collaboration and uneven access to on-the-job mentoring or professional learning to help improve their skills.[153]

The United States needs a systemic approach if it is ever to build a strong teaching profession, and recruit and retain teachers where they are most needed. There are a number of states and districts that have undertaken successful approaches that could be emulated.[154] Ultimately, a national teacher supply policy is critically needed,[155] coupled with a rethinking of the teaching career so that teachers can become highly effective, have strong reasons to stay in the career, use their skills where they are needed most, and enhance the expertise of the profession as a whole.

No single policy can solve the nation's emerging teaching shortage. What is needed is a comprehensive set of strategies at the federal, state, and local levels that are focused on increasing the number of well-prepared entrants to the field of teaching, directing them to the fields and locations where they are needed, and plugging the leaky bucket of teacher attrition, which has high costs for both district budgets and student achievement.

The United States needs a systemic approach if it is ever to build a strong teaching profession, and recruit and retain teachers where they are most needed.

Without policy interventions, it is likely that even if more new candidates—heartened by reports of greater hiring—consider teaching, they will fail to choose the fields in which there are shortages or go to the high-poverty communities where they are more sorely needed. Furthermore, a status quo approach will not leverage better preparation that supports student achievement or stem turnover where it is currently high.[156]

To ensure that all children have access to effective teachers, we need a national teacher supply policy based on well-developed federal-state partnerships, like those the nation has pursued in the field of medicine. Intelligent, targeted subsidies for preparation, coupled with stronger supports at entry, incentives for competitive salaries, and productive working conditions, could go a long way toward ensuring that all students have access to a strong cadre of teachers prepared to support their learning.

Based on what we know about what matters and what works, policies should focus on:

- **Creating competitive, equitable compensation packages** that allow teachers to make a reasonable living across all kinds of communities;
- **Enhancing the supply of qualified teachers targeted to high-need fields and locations** through training subsidies and high-retention pathways;
- **Improving teacher retention, especially in hard-to-staff schools,** through more effective mentoring, induction, working conditions, and career development; and
- **Developing a national teacher supply market** that can facilitate getting and keeping teachers in the places they are needed over the course of their careers.

We treat each of these areas, with associated recommendations, below.

1. Creating Competitive, Equitable Compensation Packages

Even if teachers may be more motivated by altruism than some other workers, teaching must compete with other occupations for talented college and university graduates. Since the early 1990s, teacher salaries have been declining in relation to other professional salaries. Even after adjusting for the shorter work year in teaching, beginning teachers nationally earn about 20% less than individuals with college degrees in other fields, a wage gap that widens to 30% by mid-career.[157] This gap is even wider in a number of states, especially in the South and West, as we show in Appendix B. By contrast, in high-achieving nations, teachers' salaries are generally comparable to those of other college graduates.[158]

A study by the Center for American Progress (CAP) in 2014 found that, increasingly, a teacher's salary in much of the United States is too low to support a middle-class lifestyle. In 11 states, more than 20% of teachers work second jobs during the school year to supplement their incomes, as well as the additional work they take on in the summertime. The CAP study found that experienced teachers with 10 years of teaching experience made less than unskilled workers in a number of states.[159] In 30 states, mid-career teachers who head families of four or more qualify for three or more public benefit programs, such as subsidized children's health insurance or free or reduced-price school meals.

Compounding the problem of low wages in the teaching profession overall are great inequities in teacher salaries among districts within the same labor market, leaving some high-need, under-resourced districts at a strong disadvantage in hiring. An analysis of the Schools and Staffing Survey found that the best-paid teachers in low-poverty schools earned 35% more than their counterparts in high-poverty schools.[160] Teachers in more advantaged communities also usually experience much better working conditions, including smaller class sizes and more control over decision-making in their schools.[161] Given these salary differentials among districts, high-poverty districts consistently struggle to attract and retain effective teachers, who can often take a less-demanding, higher-paying job in another district down the road.[162]

The Importance of Compensation

Research finds that teachers are more likely to choose to enter the occupation when teacher salaries are competitive in comparison to other occupations.[163] Starting salaries and salary growth have an impact on recruiting and retaining individuals both to the profession and to particular states or districts.[164]

Salaries also influence teacher attrition. Recent data from the National Center for Education Statistics show a 10 percentage point attrition gap between beginning teachers whose first-year salary was $40,000 or more as compared to those earning less.[165] Both beginning and veteran teachers are more likely to quit when they work in districts with lower wages and when their salaries are low relative to alternative wage opportunities, especially in high-demand fields like mathematics and science.[166]

Alishia Morris, a 4th grade teacher who had recently transferred to a district 15 miles away and across the border in Arkansas after six years of teaching in Oklahoma, explained how compensation and teaching resources influenced her decision:

> "It wasn't the school's fault. If it was, it wouldn't have been so difficult for me to leave. It's just that Arkansas has more resources—they just make teaching easier," Morris said. On top of a salary increase of $8,000 to $9,000 over the $33,500 she made at Westville [in Oklahoma], Morris now has reading and math facilitators to help her with her students, and Siloam Springs teachers [in Arkansas] get a $500 annual allowance for classroom materials.[167]

States and districts that have addressed these compensation issues have eliminated shortages and, especially when they have also put in place policies to improve preparation and licensing, have improved quality (see box).

Investing in Compensation and Quality Together

Two of the most comprehensive examples, Connecticut and North Carolina, made omnibus investments in teaching during the 1980s and '90s that solved perennial teacher shortages and created a strong supply of well-qualified teachers. Both states coupled major statewide increases in teacher salaries with improved pay equity across districts. A local control state, Connecticut provided funding incentives to help districts raise beginning salaries to a statewide minimum, offering more aid to lower-wealth districts, which made it possible for urban and poor rural districts to compete for qualified teachers. North Carolina increased its statewide salary schedule to reach the national average. In both cases, teacher shortages rapidly turned to surpluses.

At the same time, both states strengthened teacher education and raised licensing standards. In this way, supply and quality were improved simultaneously. Connecticut required a content major and more extensive pedagogical training for literacy, special education, and teaching new English learners. North Carolina also boosted requirements and mandated that all public teacher education programs secure national accreditation. Both raised entry and licensing standards.

Connecticut ended the practice of granting emergency credentials. Furthermore, because state teacher salary assistance could be spent only for fully certified teachers, districts had greater incentives to recruit those who had met the high new standards, and individuals had greater incentives to meet them.

Both states instituted scholarships and forgivable loans targeted to individuals preparing to teach in high-demand fields. North Carolina launched a mentoring program for new teachers that greatly increased their access to early career support. Connecticut provided trained mentors for all beginning teachers and student teachers as part of its staged licensing process. Both also invested in extensive professional development for teachers and principals, aiming to create more productive school environments where strong instruction could flourish. North Carolina also adopted a groundbreaking performance-based salary increase—12% of base salary—for teachers who achieved National Board Certification—a process of demonstrating accomplished teaching that is associated with greater teacher effectiveness.[168]

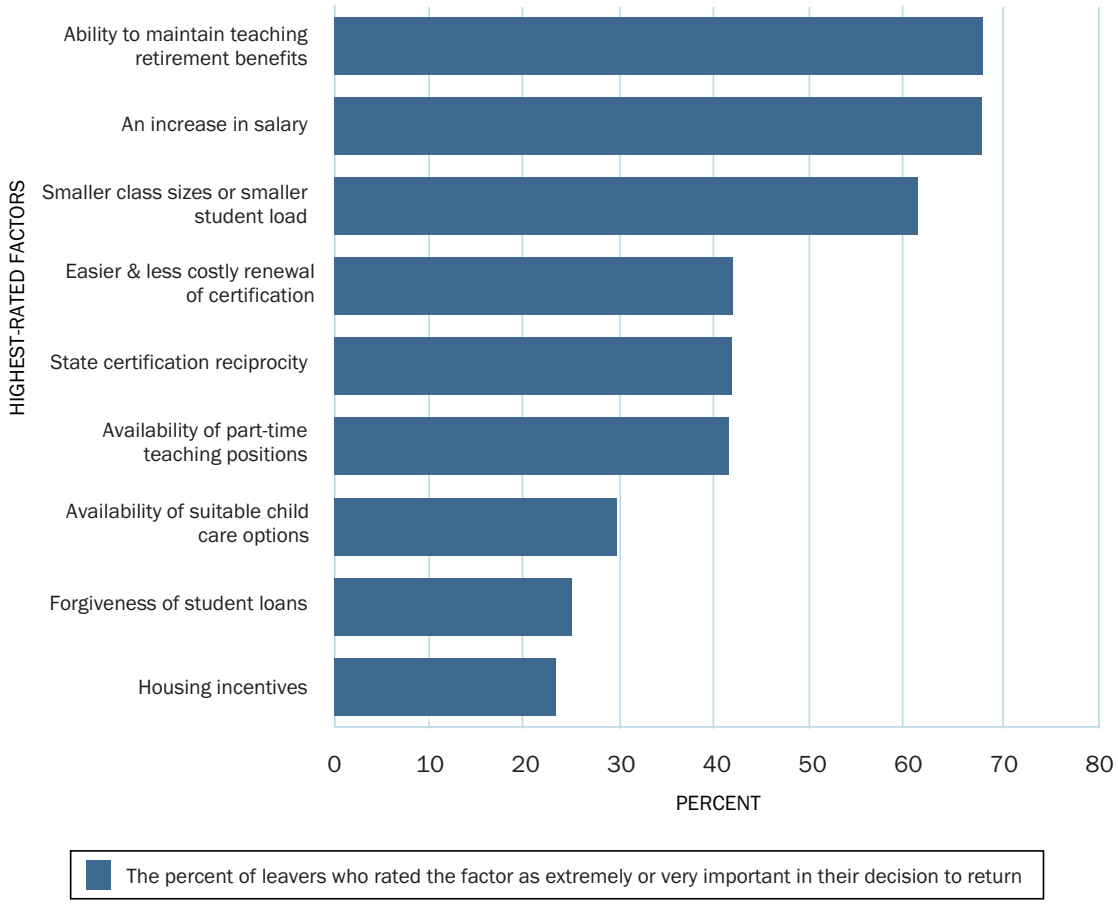
As documented by the National Assessment Governing Board,[169] both states experienced steep gains in achievement on the National Assessment of Educational Progress, with Connecticut becoming the top-ranked state in the nation after a decade of these investments, and North Carolina posting the largest gains and the sharpest reduction in the achievement gap of any state during that same period of time—becoming the first Southern state to achieve above national norms in reading and mathematics.[170]

A comprehensive study of North Carolina's teaching workforce also found that student achievement gains were significantly greater for students whose teachers had the strong academic and teaching preparation the state's strategic policy investments have tried to leverage, along with those whose teachers were National Board Certified.[171] A study of Connecticut's achievement gains found that in districts with sharply improved achievement, educators cited the high quality of teachers and administrators as a critical reason for their gains. They also noted that "when there is a teaching opening in a Connecticut elementary school, there are often several hundred applicants."[172]

Most notably, both states held to the course of teacher improvement over a sustained period—more than 15 years in each case. They demonstrate what state policy in support of good teaching can accomplish.

Another way to mitigate shortages is by attracting former teachers back to the classroom. A number of factors that past teachers say would make them consider returning to the classroom are related to compensation in one way or another. According to the National Center for Education Statistics (NCES), 53% of teachers who left the profession said they would consider returning to the classroom. When asked what would bring them back to teaching, aside from the availability of jobs, leavers' responses included salary increases and the ability to maintain retirement benefits (both at 68%), as well as student loan forgiveness and housing incentives (about 25% each). Some former teachers who said they would consider returning to the profession listed the availability of part-time teaching positions and having child care options (41% and 30%, respectively), strategies that would allow them to balance home and work life (see Figure 29).

Figure 29
What Would Bring Leavers Back?
Factors rated by former teachers as important in a decision to return



Note: Leavers included in this table are the 53% of teachers who left and said they would consider returning to the teaching workforce.

Source: LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

To address these issues, we recommend that states and districts consider policies addressing compensation both directly and indirectly, as described below:

Leverage more competitive and equitable salaries

As many states and nations have discovered, a balanced teacher labor market during a time of high demand requires salaries that are competitive with other fields and that are equitable across districts, so that those serving high-need students have a fair shot at recruiting well-qualified educators. Given the inequalities in funding across most states, it is critical to leverage more resources to the districts that, because of this, are frequently hard to staff. States can accomplish this by equalizing funding across districts, as California and Massachusetts have done with weighted student funding formulas that direct resources to districts in relation to the different kinds of students they serve (e.g., those in poverty, English learners, foster care students). States can provide districts incentives to raise salaries to a competitive minimum level, as Connecticut did, subsidizing poor districts more extensively. They can increase statewide salary schedules, as North Carolina did. Different strategies will be appropriate in distinctive state contexts. Whatever the tactic, enabling teachers to earn a competitive wage across districts is associated with stronger recruitment and retention, and with a more robust and highly qualified supply of teachers.

Create incentives that make living as a teacher more affordable

In addition to salary hikes, states and districts can consider multiple strategies for making teaching more financially viable. Other forms of compensation are incentives that support teachers' ability to stay in or re-enter the profession, such as:

- mortgage guarantees, down payment assistance, or other housing supports, in exchange for service commitments;
- child care supports; and
- opportunities to continue teaching and mentoring after retirement.

About 25% of teachers nationally point to housing incentives as an important factor in their potential decision to return to teaching, and some districts are developing housing solutions as part of their recruitment and retention initiatives. Among many others, for example, San Francisco recently passed a measure to provide stabilized housing for 500 teachers by 2020, and is building housing units on district-owned land. Texas provides eligible teachers with low, fixed-rate home loans and grants for down payment assistance.[173] The federal government could help by expanding its efforts through the U.S. Department of Housing and Urban Development (HUD) to discount housing prices for public servants in revitalization areas, and by creating more broad-based initiatives to support housing for teachers.

Another 30% of prospective re-entrants point to child care supports as a potential enticement to return to teaching. Two-thirds of those who have left note that the ability to maintain retirement benefits if they returned could encourage them to re-enter the profession. All of these are potential incentives that districts or states could put in place.

2. Increasing Supply in Shortage Fields and Areas

As policymakers address shortages, there is often a great deal of pressure to try to get warm bodies into classrooms quickly, even if that means skipping teacher preparation. This strategy, however, creates a leaky bucket that ultimately feeds greater shortages, as unprepared entrants into teaching leave at much higher rates, and they can create churn in schools that is costly both for student achievement and for district pocketbooks.

It is clear that in the fields with nationwide shortages—such as mathematics, science, special education, and bilingual/ESL education—the pipelines into teaching must be expanded. Given the strong effects of preparation and mentoring on candidates' effectiveness and rates of retention in teaching, it is important that strategies for increasing supply do so by strengthening incentives to enter along with supports to succeed.

This can be accomplished by drawing in part on the federal experience with medical manpower programs. Since 1944, the federal government has subsidized medical training and facilities to meet the needs of underserved populations, to fill shortages in particular fields, and to increase diversity in the medical profession. Beginning with the Medical Manpower Act during the 1950s, the Health Professions Education Assistance Act of 1963, and continuing ever since, the federal government has invested in the preparation and distribution of physicians for high-need fields and locations, and has collected data to monitor and plan for medical manpower needs. This consistent commitment has contributed significantly to America's world-renowned system of medical training and care.

Making Preparation Affordable

A growing body of evidence indicates that attrition is unusually high for those who lack preparation for teaching. [174] One recent study found that teachers who received little pedagogical training were more than twice as likely to leave teaching after their first year than teachers who had received a comprehensive preparation, including observing others teaching, student teaching a full semester, receiving feedback, and taking five or more courses in teaching methods, in addition to receiving training in learning theory and selecting instructional materials.[175]

Teachers who received little pedagogical training were more than twice as likely to leave teaching after their first year than teachers who had received a comprehensive preparation.

Another study found that 30% of uncertified entrants left the profession within five years, compared to 15% of certified entrants.[176] As we described earlier, our analyses of the Schools and Staffing database found that alternatively certified teachers (who typically enter without student teaching, and take courses on nights and weekends) were much less likely to stay in teaching. Of note, they also had a much shorter tenure in schools serving concentrations of low-income and minority students than teachers who were fully prepared—averaging about 5½ years in those schools in comparison to nine years for regularly certified teachers.[177]

Other national studies, plus local studies in New York, North Carolina, and Texas, have found that individuals who enter teaching before they have had the opportunity to prepare are less effective when they are teaching while still in training,[178] and leave teaching at much higher rates than those who are fully prepared when they enter.[179]

A key issue, however, is how candidates can afford adequate preparation—especially when they may have had to go into debt to prepare to enter a profession that earns less than other alternatives. Many prospective teachers are saddled with college debt incurred while undergoing their teacher training.[180] Research shows that the more debt college students incur, the less likely they are to choose to work in a lower-wage profession, like teaching. One study of students at a highly selective undergraduate institution found that incurring debt increased the odds that students chose "substantially higher-salary jobs" and "reduce[d] the probability that students [chose] low-paid 'public interest' jobs."[181] The influence of debt on job choice was "most notable on the propensity to work in the education industry."

To make teaching affordable, some states and the federal government have provided forgivable loans and service scholarships that subsidize preparation, just as the Health Professions Education Assistance Act has long done for doctors. These subsidies are paid back with a number of years of service in the profession.

A recent review of research on these strategies in both medicine and teaching found that loan forgiveness or service scholarship programs covering a significant portion of tuition and/or living costs are effective in recruiting candidates into the profession and into high-need locations and fields.[182] Among the things that federal and state governments can do are the following:

Offer forgivable loans and service scholarships

First, as it does in medicine, the federal government should maintain a substantial, sustained program of service scholarships that cover training costs in high-quality preparation programs at the undergraduate or graduate level for those who will teach in a high-need field or location for at least four years. (After three years, candidates are much more likely to remain in the profession and to make a difference for student achievement.*)* State governments can augment such an approach with programs targeted to specific local needs.

As noted earlier, research on such programs in medicine and teaching has found that they are effective in recruiting and retaining candidates in the profession, and into high-need locations and fields, if they cover a large enough share of candidates' training costs.[183]

Whereas other high-achieving countries underwrite all of the costs of high-quality teacher preparation and often offer additional wages to those who go to high-need areas, in the United States, there are few supports for teacher education or distribution. The major supports that were enacted in the 1960s and '70s to underwrite preparation for teachers to go to high-need fields and high-need schools (under the National Defense and Education Act) ended in the 1980s, and have not been fully reinstated since then. While some federal grants are currently available, they are not designed to serve as an adequate incentive to candidates.

Service scholarships (as opposed to post hoc forgivable loans), which have the benefit of being able to target candidates who might not otherwise enter teacher preparation, can be used proactively to recruit specific kinds of candidates to the fields and locations where they are needed.

Perhaps the best-known model of such an approach—subsequently copied in other states—is the **North Carolina Teaching Fellows Program**. In operation for more than 25 years, the program selected highly able high school students and paid all college costs, including an enhanced and fully funded teacher education program, in return for several years of teaching.[184] The program has recruited nearly 11,000 candidates into teaching, representing approximately 10% of all teachers credentialed each year in North Carolina. Among these have been a larger than usual number of males, minority candidates, and mathematics and science teachers. A recent study of the program found that the Teaching Fellows are on average more effective than their peers in supporting student achievement. In addition, they are much more likely to stay in teaching, with 75% still in teaching by the fifth year, as compared to only about 60% of other prepared entrants and 40% of alternative route entrants.[185] Many of the remaining Fellows were still in education as administrators.

Similar programs were later started in South Carolina (the **South Carolina Teaching Fellows**) and California (the **Governor's Teaching Fellowships**). In South Carolina's program, over 82% of 1,502 graduates between 2000 and 2011 either satisfied the service scholarship commitment or are currently teaching to fulfill the commitment in a South Carolina public school district.[186] California's program, which established $20,000 service scholarships to high-ability college graduates who would prepare to teach in underperforming schools, recruited candidates entering one-year graduate-level teacher education programs. An evaluation found this program provided a supply of high-ability, well-trained candidates to high-need schools in a short time period, encouraging many who would not otherwise have gone to such schools to do so, with high retention rates.[187]

The financial incentives offered by service scholarships like these enhance the attractions to teaching and support stronger preparation by eliminating student debt payments, while improving candidates' preparedness. States can launch similar programs. As in medicine, the federal government should also play a major role, for at least two reasons. First, a federal approach can influence the flow of talent across areas of the country, allowing candidates trained in exporting states (those that prepare more teachers than they need) to pay off their loans or scholarships by working in states that prepare too few. Second, the budgetary implications are extremely modest for the federal government relative to the states. A relatively small federal outlay could go a long way—and ultimately save the nation sizable sums by reducing attrition. For example, a program costing $800 million a year could support 40,000 new teachers with $20,000 loans or scholarships, addressing most of the nation's teacher shortfall over the course of a few years.

Create career pathways and "Grow Your Own" programs

To attack the systemic nature of teacher shortages in urban and isolated rural schools, it is important also to develop pipelines of candidates who are committed specifically to those communities. Since many young teachers have a strong preference to teach close to home, states and the federal government can help urban and rural schools

High school career pathway programs, such as cadet programs and teaching academies, are ways to interest high school students in teaching and start them on the path to the profession.

enhance the pipeline of potential teachers from these neighborhoods by developing high school career pathways and "Grow Your Own" programs.[188]

High school career pathway programs, such as cadet programs and teaching academies, are ways to interest high school students in teaching and start them on the path to the profession.[189] Teacher Cadet programs in South Carolina[190] and North Carolina[191] offer college-level courses in education to high school students, along with extracurricular activities focused on teaching and tutoring, which result in many later entering teacher preparation.

In some states, high school career academies have focused on teaching as a profession, combining college preparatory academic study with education-related courses and real-world experiences for students. [192] The Education Academy at Skyline High School in the Oakland Unified School District, in California, for example, now has graduates serving as teachers and administrators in that district.[193] Hamline University's partnership with Mounds View Public Schools outside of Saint Paul, Minnesota, allows students to earn credits toward both a teaching credential and high school graduation requirements during their junior and senior years in high school.[93] Targeted expansions of federal Perkins Career Technical Education Act funds could support the growth of these kinds of programs.

Grow Your Own programs recruit community members into teaching and support them as they complete their bachelor's degree and teaching credential. One model is the California Teacher Pathway program, which recruits young people interested in becoming educators; supports them through the process of earning their associate's degree, bachelor's degree, and teaching credential; and helps them gain stable employment in after-school programs, while they are studying to gain experience working with youths and to support them through their studies.[194]

Other models support paraprofessionals and teachers' aides in earning a teaching credential. Such programs have proven highly successful for recruiting diverse individuals who are rooted in communities and already have a great deal of experience working with students, often in special education and bilingual settings where there are significant shortages, and retaining them in teaching.[195] California's Paraprofessional Teacher Training Program, for example, trained more than 2,200 graduates, two-thirds of whom were people of color and bilingual. As of its 13th year of operation, 92% remained California school employees.[196]

In addition to specifically targeted funding sources, federal Workforce Innovation and Opportunity Act funds can be used to support these types of comprehensive teacher training programs designed to address local workforce needs in times of teacher shortages.

Establish teacher residency models in hard-to-staff districts

New approaches to training and recruitment are needed if we are to solve shortages in communities and fields that have long-standing challenges with the interrelated problems of adequate preparation and adequate supply. When underprepared recruits leave the profession quickly, students can face a revolving door of teachers. Under these circumstances, everyone loses. Student achievement is undermined by high rates of teacher turnover and teachers who are inadequately prepared for the challenges they face. Schools suffer from continual churn, undermining long-term improvement efforts. Districts pay the costs of both students' underachievement and teachers' high attrition.

The teacher residency model is a new and important strategy that solves many of these problems. Urban and rural residency programs, sponsored by individual districts or consortia of districts, place candidates who plan to teach in shortage fields and who want to commit to high-need urban or rural schools into paid year-long apprenticeships with expert mentor teachers, while they complete tightly linked credential coursework and earn a master's degree from partnering universities. When they become teachers, these recruits also receive two years of mentoring. In exchange for this high-quality preparation—which is directly focused on becoming an excellent teacher in the specific community where they are hired—candidates pledge to spend three to five years in the district's schools. Most stay on for the long haul, becoming leaders in the schools rather than dropouts from the profession. Research has shown residencies to be effective at recruiting and retaining talented and diverse candidates in high-need schools, and better preparing them for the challenges they will face.[197]

> When underprepared recruits leave the profession quickly, students can face a revolving door of teachers.

These initiatives are much like the federally funded urban medical training models that have created programs specifically designed to prepare doctors and other health professionals for urban communities, and have established community health centers to support clinical preparation.[198]

Such programs solve several problems simultaneously—creating a pipeline of committed teachers who are well prepared to engage in best practice for children in high-need schools, while creating demonstration sites that serve as models for teaching and teacher education. To significantly expand the reach of these programs, the Teacher Quality Partnership grants, which fund residencies, could be expanded to their authorized level of $300 million. AmeriCorps funds and TEACH grants or other scholarship programs can also support these candidates.

3. Improving Teacher Retention

In addition to incentives for entering teaching, improving teacher retention is a critical goal. High attrition and turnover are a major part of the problem, especially for beginning teachers and in hard-to-staff schools. A great unfinished task in American education is to create conditions for better support of new teachers, as well as the conditions under which experienced teachers will want to stay in the profession and in schools serving high-need students.

The Importance of High-Quality Mentoring and Induction for Beginners

Expert mentoring in the first years of teaching enhances the retention effects of strong initial preparation. Early induction opportunities offering mentoring and other teaching supports are an important part of keeping beginning teachers in the profession and building their competence and self-efficacy, which in turn enhances retention. The more teachers know about how to do their jobs well, the more they experience a sense of self-efficacy and derive satisfaction from teaching.[199] They are, in turn, supported by having had useful coursework and clinical learning experiences both before entry and while on the job.

A number of studies have found that well-designed mentoring programs improve retention rates for new teachers, as well as their attitudes, feelings of efficacy, and instructional skills.[200] Key to success is having a mentor teacher in the same subject area, common planning time with teachers in the same subject, and regularly scheduled collaboration with other teachers.[201] Beginning teachers' practice is enhanced further when their mentors also receive formal training, and are released from some of their own classroom duties to provide one-to-one observation and coaching in the classroom, so they can demonstrate effective methods and help new teachers solve immediate problems of practice.[202]

The amount and kind of induction support matters. In addition to mentoring, collaboration time for planning instruction with other teachers is key and can, if coupled with a beginning teacher seminar, reduce turnover by 34%. In the Cadillac version, if a teacher receives basic mentoring, plus collaboration, a strong teacher network, and extra resources (a reduced number of preparation periods and a teacher's aide), first-year turnover (leaving the school or the profession) is cut by more than half, from 41% to 18%.[203]

Well-designed mentoring programs improve retention rates for new teachers, as well as their attitudes, feelings of efficacy, and instructional skills.

Researchers have found that beginning teachers who participate in induction are more able to keep students on task, develop workable lesson plans, use effective questioning practices, adjust classroom activities to meet students' interests, maintain a positive classroom atmosphere, and demonstrate successful classroom management.[204] At least one study has found that students of beginning teachers who participated in induction showed stronger achievement gains.[205]

Despite the fact that most states have some kind of requirement for beginning teacher induction, few offer the suite of supports that are most effective for keeping teachers in the profession. As of 2011–12, only 33% of beginning teachers had access to mentoring, common planning, supportive communication with their principal, and seminars, and only 2.5% had access to the most comprehensive set of supports described above.[206]

Furthermore, the funding for these programs has been cut in many states in recent years as a function of shrinking budgets. The proportions of teachers receiving induction services of all kinds dropped between 2008 and 2012. For example, the share of beginners working with a mentor and supported by periodic conversations with the principal dropped from 75% to only 59% in that period of time.[207] Consequently, beginning teachers' access to high-quality mentoring and induction is much more variable than it was a few years ago.

Develop strong, universally available induction programs

With new teachers leaving at high rates, especially in urban and poor rural areas, the revolving door cannot be slowed until the needs for beginning teacher support are addressed. Other high-achieving countries invest heavily in structured induction for beginning teachers. They fund schools to provide released time for expert mentors, and they fund other learning opportunities for beginners, such as seminars in key areas (e.g., classroom management, working with special education

students, and engaging with parents), visits to other teachers' classrooms, and joint planning time. As noted above, such strategies are also found effective in reducing beginning teacher turnover in the United States, but very few teachers receive the complement of supports that are most effective.

Federal or state matching grant programs aimed at these features could ensure support for every new teacher in the nation through investments in district mentoring programs. Based on the funding model historically used in California's Beginning Teacher Support and Assessment Program, for example, an allocation of $4,000 for each beginning teacher, matched by local district funds, could fund mentoring for every novice. At 125,000 new teachers each year,[208] a federal investment of $500 million per year could ensure that each novice is coached by a trained, accomplished mentor with expertise in the relevant teaching field.

Alternatively, federal leverage could be applied by offering matching grants to states to develop or expand induction programs that provide the key elements known to make the most difference in teacher retention: mentoring by a trained mentor in the same teaching field, collaborative planning time, a reduced teaching load, and additional learning opportunities on key issues.

How Teaching Conditions Matter

Surveys of teachers have long shown that teaching conditions play a major role in their decisions to move schools or leave the profession. As Alishia Morris noted of her decision to move schools, teaching conditions such as the availability of resources for materials and instructional specialists factored into the decision, along with salaries. The relatively poor teaching conditions in many low-wealth schools are a major reason why teachers in high-poverty schools are more than twice as likely to leave due to dissatisfaction as those in low-poverty schools.[209]

Beyond resources, teachers' plans to stay in teaching and their reasons for actually having left are strongly associated with how they feel about administrative support, collegial opportunities, and teacher input into decision-making. When these conditions are present, retaining teachers is much easier. As a 20-year public school veteran in Minneapolis noted,

> For the past decade, I've worked at a school where 97% of the children qualify for free and reduced-price lunch. I stay because the school climate is good for children and teachers alike. I stay because my principal is wonderful, supports us, does what's best for children, and because I trust her. I stay because my colleagues are gifted teachers and good company, and because I continually learn from them.[210]

A poll by the Public Agenda Foundation found that almost 80% of teachers said they would choose to teach in a school where administrators supported them, as opposed to only about 20% who said they would teach at one with significantly higher salaries.[211]

Some policies have emphasized monetary bonuses or stipends to attract teachers to high-need schools. Under some circumstances, such bonuses have helped make a dent in schools' hiring needs.[212] However, they are rarely enough, by themselves, to solve shortage problems. For example, one study of efforts to recruit high-performing teachers to struggling schools found that, among 1,500 such teachers in the Talent Transfer Initiative, only 22% were willing to apply to transfer to high-need schools for a two-year bonus of $20,000, and fewer than 5% ultimately did so. Although

the targeted teachers filled most of the 81 vacancies, attrition rates of these teachers soared to 40% after the bonuses were paid out and the money disappeared.[213] As another review found:

> [S]chool districts have tried offering additional pay for high-needs schools without much positive result, even when substantial bonuses are awarded. In 2004, Palm Beach, Florida, eliminated its $7,500 high-needs school stipend after few teachers took the offer. Dallas's offer of $6,000 to accomplished teachers to move to challenging schools also failed to generate much interest. … A decade ago, South Carolina set out to recruit "teacher specialists" to work in the state's weakest schools. Despite the offer of an $18,000 bonus, the state attracted only 20% of the 500 teachers it needed in the first year of the program, and only 40% after three years.[214]

Although money can help, teachers are primarily attracted by principals who are good instructional leaders, by like-minded colleagues who are committed to the same goals, by having the teaching conditions and instructional materials they need readily available, and by having learning supports that enable them to be effective. As one National Board Certified teacher noted in a discussion of what would attract him to a high-needs school:

> I would move [to a low-performing school], but I would want to see social services for parents and children, accomplished leadership, adequate resources and facilities, and flexibility, freedom, and time. … One of the single greatest factors in school success is principal leadership. Effective administrators are magnets for accomplished teachers. In addition, it is amazing to me that attention is being paid to teaching quality in hard-to-staff schools when little is done to address the sometimes appalling conditions in which teachers are forced to work and students are forced to learn. … Finally, as an accomplished teacher, my greatest fear is being assigned to a hard-to-staff school, and not being given the time and the flexibility to make the changes that I believe are necessary to bring about student achievement.[85]

Create productive school environments

To create school environments that attract and retain great teachers, it is critical to provide both the tangible resources that enable teachers to teach—instructional materials, texts, computers, reasonable class sizes, and instructional specialists—and the context that allows them to feel supported and become effective.

To keep high-quality teachers in high-poverty communities, schools need to offer working conditions that support teacher and student success. One policy strategy is to allocate state and/or district funds specifically to improve teaching conditions in hard-to-staff schools: smaller classes and pupil loads, administrative supports for necessary materials and supplies, and time for teacher planning and professional development—all of which help attract and keep teachers in schools.

Montgomery County, Maryland, pursued a policy that reduced class sizes, and expanded teacher collaboration time and training to ensure stronger supports for teachers in its schools serving concentrations of low-income and minority students. These moves enhanced recruitment and retention, strengthened the teaching force, and increased the levels of achievement in those schools.[215] California implemented a similar approach in its Teachers as a Priority Program, which sent resources to high-need schools to recruit and retain fully certified teachers through improving

working conditions, adding mentors, reducing class sizes, and providing hiring or retention bonuses. The state also implemented $10,000 bonuses for National Board Certified teachers, increased to $20,000 for such teachers who taught in low-performing schools—a strategy that led to much more equitable distribution of these accomplished teachers than common in other states.[216]

As part of a broader career ladder initiative, federal and/or state matching grants to districts can provide incentives for the design of innovative approaches to attract and keep accomplished teachers in priority low-income schools, including through compensation for accomplishment and for additional responsibilities, such as mentoring and coaching.

Finally, as recent data and research have highlighted, teachers have been discouraged from staying in high-need schools by accountability pressures tied to negative labels and sanctions.[217] Of the teachers who voluntarily left the profession after the 2011–12 school year for reasons other than retirement, approximately 25% reported that dissatisfaction with the influence of school assessment and accountability measures on their teaching or curriculum was *extremely* or *very important* in their decision to leave teaching; 17% reported that dissatisfaction with support preparing students for assessments was *extremely* or *very important* in their decision to leave teaching.[218]

With the advent of the Every Student Succeeds Act (ESSA), which has replaced No Child Left Behind, it will be important for the federal government, states, and districts to consider how to create productive approaches to accountability that enable schools to improve without creating disincentives for staff to work in the most challenging environments. State and district efforts to focus on identifying areas for improvement with productive resources to enable that improvement would better support the recruitment and retention of capable teachers in high-need schools.

Strengthen principal training programs

Teachers are clear that their decisions to stay in the profession rest substantially on the capacity of administrators to create a productive teaching and learning environment in which they can be effective and continue to develop their skills. As we described earlier, teacher attrition rates increase sharply when teachers feel they do not have administrative support. However, school leadership influences teacher turnover in ways that go beyond administrative support of teachers,[219] since principals influence just about every major area of school functioning, from hiring, evaluation, and professional development to the organization of time and resources to opportunities for teacher input and creativity in the classroom, all of which affect the context of teaching.

Efforts to improve the knowledge and skills of school leaders would go a long way toward improving teacher recruitment and retention, as well as teacher effectiveness. This is particularly true in disadvantaged schools. Multiple studies of teacher attrition in high-poverty schools have found that teachers' perceptions of their school's leader is a dominant factor in their decision to remain in the school.[220] Teachers working in schools with large proportions of low-income and minority students tend to rate their principals as less effective, and the impact of this rating on their decisions to leave is larger in such schools.[221]

A synthesis of six studies analyzing teacher turnover in high-poverty schools found that effective school leaders were:

- Effective school managers (ensuring that teachers have the necessary resources, communication channels, sensible budgets).
- Effective instructional leaders (strategically hiring teachers and staff, providing regular and fair teacher evaluations, helping their teachers to continually improve).
- Inclusive decision-makers (listening to teachers' ideas and engaging them in change, providing teacher autonomy within their classrooms as appropriate).[222]

Teachers in high-poverty schools identify an inclusive environment characterized by respect and trust among colleagues, formal structures that promote collaboration, and the presence of a shared mission among teachers as important to them.[223]

Creating a cadre of principals who know how to create such environments is critically important, and it is an area where the United States lags behind other leading nations. There are no major federally funded initiatives, and few state initiatives to support the high-quality recruitment and training of school principals. North Carolina's Principal Fellows Program, which supports preparation that includes a full-time internship under the mentorship of an expert principal, is an exception, as is Delaware's mentoring program for beginning principals, provided through its state leadership academy.[224]

State and federal policies should support efforts to recruit promising candidates for school leadership positions, something that has become increasingly important as the challenges of the job often discourage strong candidates from entering the field.[225] State and federal agencies could offer grant funding and technical assistance for creating and expanding high-quality principal training programs that focus on these abilities, as well as competitive service scholarship programs for principal preparation to attract exemplary candidates to the field. States can fund leadership training through state leadership academies.

Finally, states and districts should consider means to recruit the most successful principals to the settings where the needs for their skills are the greatest. This could take the form of compensation, but also the provision of school resources needed to do the job well: wraparound social supports for students; overstaffing that allows for mentoring, reasonable pupil loads, and collaborative time; opportunities to recruit teachers; and plentiful professional development resources to support learning and success.

4. Facilitating a National Labor Market for Teachers

Finally, there is a need to enable teachers to stay in the profession when they move across the country. In addition to the one-quarter of teachers who end up teaching in a state where they did not prepare,[226] there are many others who drop out of teaching when they move across state lines. This is frequently because of the challenges of securing a different state license; maintaining pension benefits, which vary from state to state; or transferring their years of seniority into the salary schedule, so that they do not fall back in compensation.

Of teachers who have left and would consider returning to teaching, more than 40% cited state certification reciprocity as an important factor, and nearly 70% cited the ability to keep teaching retirement benefits.

Support teacher mobility

Federal policy can help create the foundation of a national labor market for teachers, including the removal of unnecessary interstate barriers to teacher mobility. Because teacher supply and demand vary regionally, the country can benefit only if states with teacher surpluses in particular fields can be connected to states with corresponding shortages. States could work together, potentially with federal incentives like those used to create the interstate highway system, to accomplish three goals:

1. Support common licensing exams that evaluate teaching performance and interstate agreements about content and pedagogical coursework that would facilitate more complete license reciprocity.

2. Create a system of pension portability across the states.

3. Provide labor market data and analyses for federal, state, and local planning.

Several groups already are working on these agendas in ways that could be leveraged toward genuine changes. For example, National Board Certification—a rigorous demonstration of teaching accomplishment—is already accepted for license reciprocity in some states. The Interstate New Teacher Assessment and Support Consortium (INTASC), sponsored by the Council of Chief State School Officers, has developed common licensing standards adopted or adapted in most states that could provide the basis for agreements on coursework and assessments. A new national performance assessment for beginning teachers, modeled on the National Board portfolio, has been developed based on these standards and has been piloted or adopted for use by programs in more than 30 states.[227] These elements could be the basis for an eventual national system.

The organization of State Higher Education Executive Officers, along with the Education Commission of the States, has examined how to achieve teacher pension portability, and TIAA-CREF has developed such analyses as well. A public/private partnership to stimulate the next steps in these plans could be extremely productive.

In addition, the long-standing federal role of keeping statistics and managing research is well suited to the job of creating a database and analytic agenda for monitoring teacher supply and demand. Such a system, which would inform other policies, could document and project shortage areas and fields; determine priorities for federal, state, and local recruitment incentives; and support plans for institutional investments where they are needed.

VII. Conclusion

Current data and projections reveal an emerging teacher shortage in the United States that will, if trends continue, grow worse before it improves and exacerbate perennial shortages in areas such as mathematics, science, and special education. These shortages also worsen the inequitable distribution of qualified teachers to schools serving concentrations of low-income students and students of color.

Attention to the current status of the teaching force could provide an opportunity for the United States to take a long-term approach to establishing a comprehensive and systematic set of strategies to build a strong, stable profession, as was done in medicine more than half a century ago. This would include:

- Creating competitive and equitable compensation packages that make teaching an affordable choice for candidates across communities.
- Enhancing the supply of qualified teachers targeted to high-need fields and locations through targeted training subsidies and high-retention pathways.
- Improving teacher retention, especially in hard-to-staff schools, through improved mentoring, induction, working conditions, and career development.
- Developing a national teacher supply market, with license reciprocity and portable pensions that can facilitate getting and keeping teachers in the places they are needed over the course of their careers.

Although these proposals are associated with costs, it is likely that they would ultimately save far more than they would cost. The savings would include the more than $8 billion now wasted annually on replacement costs because of high teacher turnover, plus much of the cost of grade retention, summer schools, and remedial programs required because too many children are poorly taught—not to mention the broader social costs of dropouts, unemployment, and incarceration that are associated with a failure to ensure that high-quality teaching can occur in our highest-need communities.

In the competition for educational investment, the evidence strongly points to the importance of teacher quality for educational improvement. Preventing and solving teacher shortages so that all children receive competent, continuous instruction in every community every year is, in a 21st century economy, essential for the success of individuals as well as for society as a whole.

Appendix A: Methodology

Data

The analyses in this report rely on a number of databases. To analyze and project demand, we first examine teacher turnover in the workforce using the Schools and Staffing Survey (SASS) Teacher File 2003–04, 2007–08, and 2011–12, and the SASS Teacher Follow–Up Survey 2004–05, 2008–09, and 2012–13. Both of these are nationally representative data sources that monitor teachers and schools over time. The Common Core of Data (CCD), years 1999–00 through 2012–13, a universal database on teachers and students in the United States, provides accurate teacher and student counts. Finally, public school teacher projections 2000 to 2025 published in the Digest of Education Statistics allow for our model to estimate workforce trends a decade into the future.

To examine teacher production and the supply side of the labor market, this analysis uses universal data on teacher preparation programs collected by the U.S. Department of Education under Title II of the Higher Education Act[228]—the most recent and complete national data on teacher preparation. To further investigate an individual's journey from teacher preparation to the classroom, we use the 2008:2012 Baccalaureate and Beyond (B&B), a longitudinal dataset that follows recent baccalaureates from 2008 until 2012, four years after their graduation, with a special focus on careers in education. This collection of data is used in tandem with the modeling techniques below to provide the estimates and projections in this paper.

Modeling Demand

The demand model aims to predict the number of teachers districts want to hire in each school year. As explained in the main text, teacher demand is shifted by three factors: student enrollment, pupil-teacher ratio, and the attrition rate. Due to the structure of data available, in the context of this methodology, demand is thought of as having two main sources: (1) growth or decline in the workforce due to student enrollment and pupil-teacher ratios, and (2) vacancies created due to attrition. Together, these two factors make up demand for teacher hires in a given year.

Our overall methodological approach comprises four steps:

1. Estimate the increase or decrease in the necessary number of public school teachers to educate all students between 2011–12 and 2012–13, using the NCES workforce projections.
2. Estimate the number of teachers who left the classroom between 2011–12 and 2012–13—vacancies created due to attrition.
3. Combine the change in total teachers demanded in step 1 with the number of teachers who left the classroom and need to be replaced in step 2 to calculate the demanded hires in 2012–13.
4. Repeat for years 2014 to 2025, assuming trends affecting public school enrollment (e.g., birthrates, immigration, and grade progression rates), teacher wages and education revenue, teacher experience-based continuation rates, the experience distribution for newly hired teachers, and general economic and political conditions remain similar during the projected period.

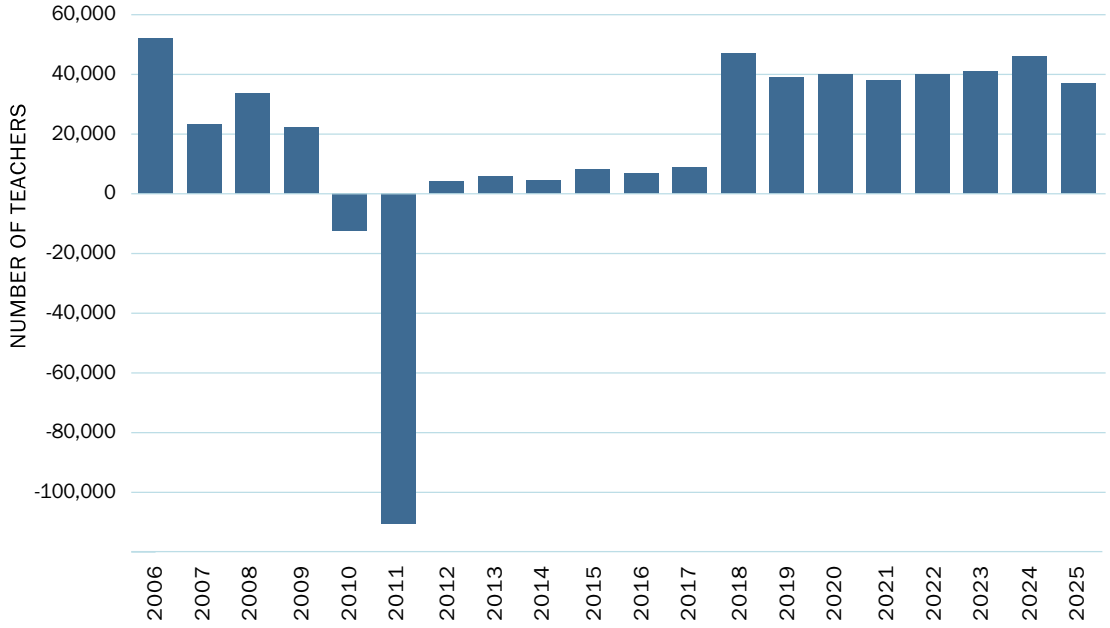
Each of these steps has its own more complex methodological strategy to produce responsible and accurate projections.

As explained above, the number of teacher hires needed due to growth or decline in the workforce is driven by both student enrollments and changes in the pupil-teacher ratio, both of which are directly incorporated in the NCES teacher projections.[229] Calculating the year-to-year difference in projected public school teachers reveals the estimated growth or decline in the teacher workforce. For example, the teacher workforce growth between 2011–12 and 2012–13 is estimated to be 5,839 teachers.[230]

Change in workforce estimates can be found for every year in Table A1 below, also shown in Figure A1. These data reveal severe shrinking of the workforce during the recession, followed by a slow increase in the workforce during recovery. Most notably, there is a predicted increase of 47,000 teachers in the 2017–18 school year. This increase persists through the end of the projection period, signaling a continued increase in demand. It is worth noting these estimates account for only student enrollment, pupil-teacher ratio, and the subsidiary factors that are used to calculate those figures, such as birthrates, migration, immigration, and current school budget—all assumed to continue with similar trends in the projected period. Some of these intermediate projections can be quite difficult to produce, making these estimates just that—estimates. They do not account for exogenous shocks that could take place in the future, such as a sudden recession or a shift in education policy that funds smaller class sizes. In all, these projections are assuming the continuation of conditions in the current time period.

Figure A1

Annual Change in Teacher Workforce Size Over Time



Note: Negative number of teachers represents a decrease in the total number of teachers.

Source: National Center for Education Statistics. (2015). Digest of Education Statistics. Public and private elementary and secondary teachers, enrollment, pupil-teacher ratios, and new teacher hires: Selected years, fall 1955 through fall 2024. Washington, DC: U.S. Department of Education.

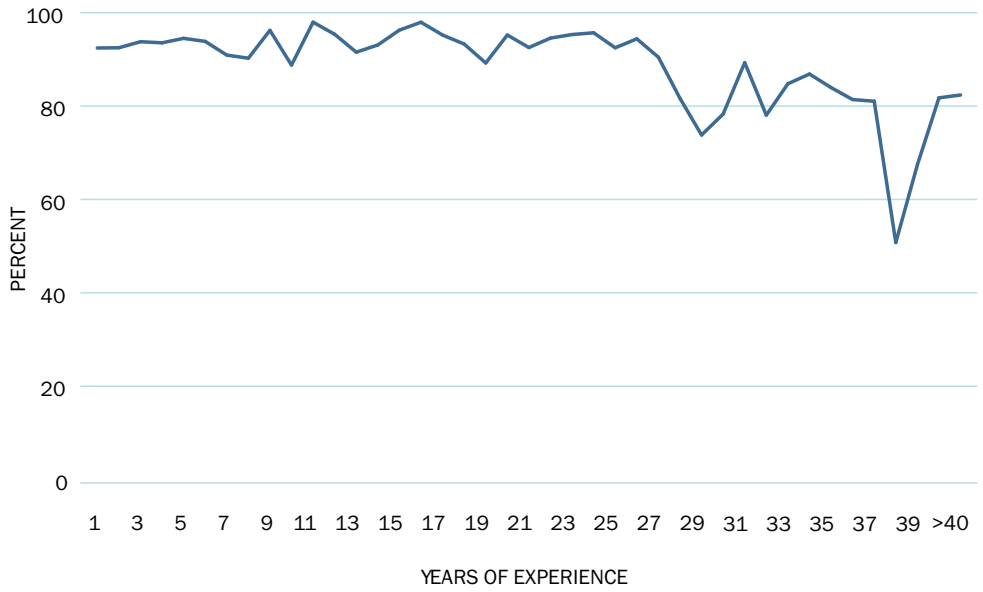
The next step is to calculate the number of hires needed due to attrition. In order to better estimate the number of teachers who left in a given year, it is important to differentiate teachers by shared characteristics, because a first-year teacher will not leave at the same rate as a teacher in her or his 10th year. This paper assumes that teachers with similar levels of experience will exit the teaching workforce at similar rates. Other analyses disaggregate attrition by age; however, because it is more and more common to enter teaching at a variety of ages,[231] and some evidence suggests that teacher attrition behavior at the start of the career is associated with years of experience, there are arguments for both methods. Early in one's career, it makes sense that experience may be a driving factor in differential attrition rates; however, when retirement rolls around, age might be a bigger factor than experience. Results using both methods are displayed here for comparison purposes. The projections turn out to be very similar: Age-based attrition estimates are on average lower by 3,306 teachers (see Table A2 in this Appendix).

To calculate demand due to attrition, the first step is to apply the experience distribution observed in the SASS 2011–12 TFS to the total number of teachers in 2011 per the CCD.[232] Because there are small sample sizes for teachers with more than 40 years of experience, these teachers are clumped into one category of teachers with over 40 years of experience. This decision yields a sample size of at least 34 for all experience groups under 40.

Next, for each experience group of teachers, an experience-specific continuation rate is applied. For example, 92.45% of first-year teachers continue on to the next year, 92.5% of second-year teachers continue on to the next year, and so on. When projecting into the future, these rates were exponentially smoothed to appropriately weight observed data from the 2004–05 TFS and 2008–09 TFS into the projections. In general, teacher-leaving rates increase noticeably after about 25 years of experience. Figure A2 displays the continuation rates for each experience level.

Figure A2

Public School Experience-Based Continuation Rates, 2011–13

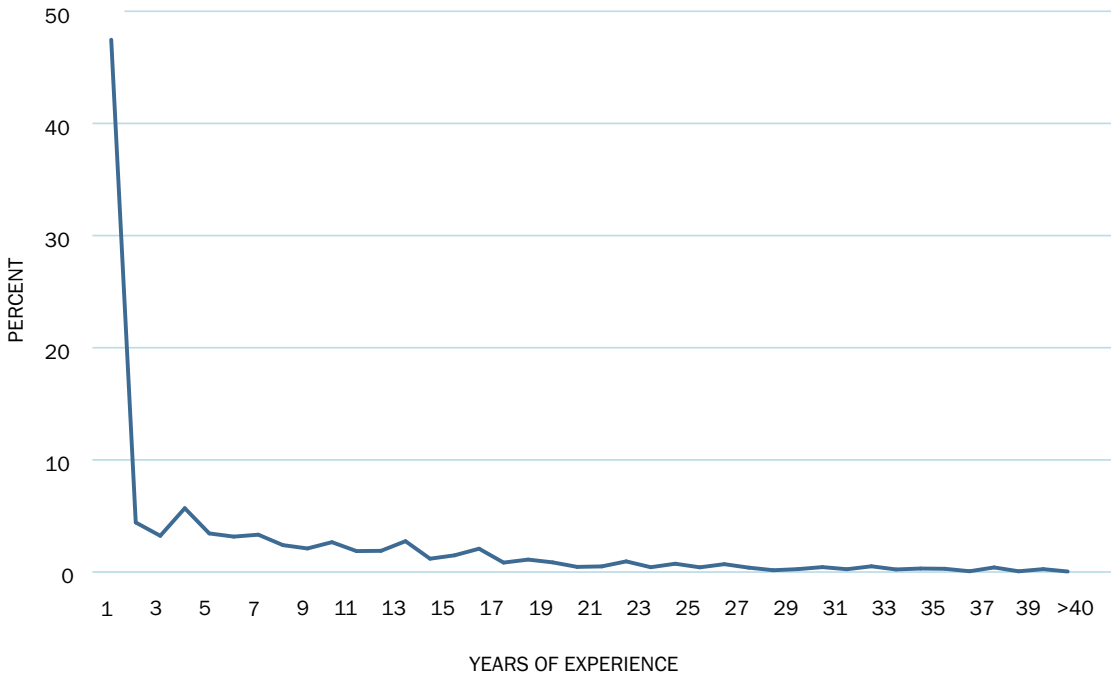


Source: LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics; Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

To determine how many teachers left the classroom, each experience group is aggregated to calculate how many teachers continued from 2011–12 to 2012–13 school years. This number is then subtracted from the total number of teachers in 2011–12 to obtain the number of teachers who left teaching.

By combining the new teachers demanded due to workforce growth with the new teachers demanded due to teachers leaving the workforce, we derive estimated new hires for 2012–13. The final step is to repeat this process for years 2014–25. In this step, because another school year has passed, teachers must advance by one year in the experience distribution. Each teacher is moved up one experience category, with teachers with 40 years of experience being moved to the over 40 years of experience category. By shifting these teachers' experience by one year, there are no new teachers. It would be easy to fill this empty value if all new hires were first-year teachers; however, many new hires are actually re-entrants and have prior teaching experience. In order to appropriately account for the different experience levels of new hires, using the SASS 2011–12 public school teacher data file, the experience distribution of new teachers is applied to the estimated new teacher hires from the prior year. Figure A3 displays the experience distribution of new teacher hires. As expected, most new hires are first-year teachers, but a significant portion are re-entrants.

Figure A3
Experience Distribution of New Teacher Hires, 2011–12



Source: LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

Once the new hires have been distributed across the experience groupings, steps 1 through 3 are repeated for each year. Experience-based continuation rates are exponentially smoothed into the

future to appropriately weight each year of observed data. The most recent data are weighed most heavily, with exponentially diminishing value given to the older observed data from the SASS 2008–09 TFS and SASS 2004–05 TFS. This process yields projected teacher demand estimates to 2024–25. The main limitation of the aforementioned methodology, which is used in most forecasting, is that the model heavily relies on one year of data—data collected from the SASS 2011–12. Although using exponential smoothing for continuation rates helps incorporate older data, most of the data and assumptions are derived from the 2011–12 school year.

In summary, the demand estimates of new teacher hires are projected a decade into the future using the data described above. Demanded new hires are calculated by combining the number of new teachers in response to changes in the workforce and the number of new teachers necessary to replace teachers who left. To model these estimates into the future, remaining teachers gain an additional year of experience, and new hires are distributed into the corresponding experience category according to the SASS 2012–12 experience distribution of new hires. Additionally, experience-based continuation rates are exponentially smoothed to incorporate more base data into the projections, while at the same time weighting older observations.

Disaggregating demand—analysis used in Figures 2, 6, and 15

As described above, teacher demand in a given year is driven by two factors: additional teachers due to marginal increases (or decreases) in the size of the teacher workforce, and additional teachers to replace those who left teaching. To disaggregate these estimates into smaller components, workforce growth was separated into student enrollment-driven workforce growth and pupil-teacher ratio-driven workforce growth. Teacher demand due to student enrollment growth can be calculated by dividing the increase in student enrollment by the current teacher-pupil ratio. The difference between the number of teachers necessary under the current pupil-teacher ratio and the number of teachers necessary under the NCES projected pupil-teacher ratio represents the increase in teachers needed due to changes in the pupil-teacher ratio. To break down attrition into retirement and non-retirement attrition, this analysis uses data from the SASS 2004–05, 2008–09, and 2012–13 TFS that find on average 32% of teachers who leave teaching do so to retire.

A new hire is defined as a teacher who is teaching in a public school in the current year but was not teaching in a public school the previous year. Additionally, a private school teacher moving to the public sector is a "new hire."

Modeling Supply

The goal of the supply model is to estimate the number of qualified teachers available to enter the classroom in a given year. The analysis can be broken down into two questions: (1) how many new entrants (i.e., first-time teachers) are available to be hired? and (2) how many re-entrants, teachers who had left teaching but are now returning to the classroom, are in the labor market?

New Entrants. In order to estimate new entrants, this report leverages the fact that there is a lag between candidates' initial enrollment in and subsequent completion of a preparation program. Decreased enrollment in teacher preparation does not bring down the number of completers in that year but does so over the subsequent years, depending on how long it takes candidates to finish their requirements.[233] The steadily decreasing enrollment numbers indicate that completers will continue to decrease at least in the several years after the most recent national data available for

enrollments—2013–14. The ratio of current enrollments to future completers is .303.[234] In other words, on average 30% of teacher preparation enrollments two years ago are completers in the current year. This estimation is not the graduation rate; the other 70% do not drop out; more often than not, they complete in other years. This is to be expected given that some teacher preparation programs take one year, some two years, and others up to four years. The extrapolation from enrollments to completers provides data on completers from 2005 to 2016,[235] where 2015 and 2016 are projected using these lagged ratios.

One of the biggest challenges of modeling new entrants is determining how many of these program completers end up in the classroom the following year, how many are delayed entrants, and how many never end up teaching at all. We used survey responses from the 2008:2012 Baccalaureate and Beyond (B&B), a longitudinal study that follows college graduates four years after they receive their BA degree to determine the percentage of students who were prepared to teach but did not end up in the classroom.[236] This longitudinal analysis found that 25.01% of students who received a BA degree in 2008, and had prepared for teaching or did so within the next three years, did not end up teaching by 2012.[237] The four-year average rate allows for more completers to enter the classroom than the one-year rate that is typically calculated. This larger time window controls for many delayed entrants.[238]

It is important to note that the years sampled were during the Great Recession during precisely the years that many beginning teachers were being laid off, and fewer new teachers were able to get teaching jobs than would normally be the case. Thus, in order to control for economic variation in the entry rate, we use the B&B estimate of 75% as a lower bound and 90% as an upper bound. This allows us to more accurately represent the range of entry rates found in the literature and be responsive to shifts in economic conditions.

Re-entrants. The next step is to model re-entrants. Re-entrants are often a forgotten segment of supply that turns out to be a fairly significant piece of the labor market. We model teacher re-entry by applying adapted re-entrant rates by year estimated by Grissom and Reininger.[239] These authors use the National Longitudinal Surveys of Youth 1979 to follow over 200 teachers who leave and re-enter teaching.[240] They find that in all, 38% of teachers who leave the profession return at a later date. Because our forecast period is not long enough to accurately account for teachers re-entering over a 10-year period, like much of the literature, we use a five-year re-entry rate. We know from Grissom and Reininger's time to re-entry estimates that 85% of re-entry happens in the first five years. Therefore, if 38% of all leavers re-enter at some point, 85% of the 38% of leavers enter within the first five years, which yields a five-year re-entry rate of 32.3%. Next, to adapt the Grissom and Reininger's estimates of a leaver's time to re-entry, we apply the existing proportions of re-entry to the new re-entry rate of 32.3%. Consequently, of the 32.3% who return to teaching within five years, 55.9% of them return after just one year, 24.1% after two years, 8.7% after three years, 9.2% after four years, and 2.9% after five years.[241]

This paper uses these re-entry rates in combination with the Common Core of Data (CCD), a universal national dataset on teachers and students,[242] National Center for Education Statistics estimates of total attrition per year, and Title II data to model re-entrants over time.[243] First, we apply the average attrition rate between 2000–12 of 7.88% to the total teacher supply.[244] This calculation yields the number of teachers who left teaching each year. Next, because the research indicates the re-entry rate is dependent on current economic conditions,[245] we calculate an upper

and lower bound for the re-entry rate. The upper bound rate is 32.3%,[246] and the lower bound is 28%,[247] based on the range of estimates found in high-quality studies on five-year teacher re-entrance.[248] This step produces the number of teachers who will return in each year. Because some teachers do return after five years, and we are using a five-year re-entry rate, we can assume our estimate for teacher supply in some years is a slight underestimate.

Next, these re-entering teachers are distributed by year based on Grissom and Reininger's (2012) estimates. For example, 55.9% of the projected re-entrants from teachers who left in 2008 are modeled as re-entrants in 2010, 24.1% are modeled as re-entrants in 2011, and so on for each additional year.[249] This is repeated for each year's attrition-based re-entrant projections. Due to data limitations, there is no reliable way to determine the exact number of re-entrants in a given year over time; however, using literature from the field, we can use upper and lower bounds to approximate the number of re-entrants to produce more reliable teacher supply estimates.

Projecting Supply. Finally, to project total supply into the future, this analysis exponentially smooths total new entrant estimates and then combines those estimates with the re-entrant estimates to project total teacher supply. Assuming supply holds constant, meaning new entrants and re-entrants remain constant at 2016 levels, these projections illustrate future supply. Constant supply is unlikely given the reactive nature of supply and demand; however, projecting current trends into the future illuminates the extent of the labor market gap if nothing is done to alter current trends.

Table A1
Workforce Growth

Year	Workforce Change
2005	42,273
2006	52,078
2007	23,388
2008	33,604
2009	22,159
2010	-12,482
2011	-110,577
2012	4,168
2013	5,839
2014	4,663
2015	8,236
2016	7,000
2017	9,000
2018	47,000
2019	39,000
2020	40,000
2021	38,000
2022	40,000
2023	41,000
2024	46,000
2025	37,000

Note: Negative number of teachers represents a decrease in the total number of teachers.

Source: National Center for Education Statistics. (2015). Digest of Education Statistics. Public and private elementary and secondary teachers, enrollment, pupil-teacher ratios, and new teacher hires: Selected years, fall 1955 through fall 2024. Washington, DC: U.S. Department of Education.

Table A2
Differences in Demand Estimates: Experience-Based vs. Age-Based Attrition Rates

Year	Experience-Based Demand Estimates	Age-Based Demand Estimates
2004	**236,407**	**236,407**
2005		
2006		
2007		
2008	**247,964**	**247,964**
2009		
2010		
2011		
2012	**172,754**	**172,754**
2013	249,632	245,930
2014	259,531	276,063
2015	262,032	269,391
2016	259,777	267,465
2017	260,459	268,314
2018	299,813	306,743
2019	295,433	299,987
2020	299,959	304,200
2021	302,092	304,314
2022	306,366	307,996
2023	311,622	311,860
2024	319,510	319,114
2025	316,013	313,758

Note: Data for teachers are expressed in full-time equivalents (FTE). Bolded values represent actual teacher hires demand measured using the Schools and Staffing Survey 2004, 2008, and 2012.

Source: LPI analysis of the Public School Teacher File, 2004, 2008, and 2012, from the Schools and Staffing Survey, National Center for Education Statistics; Teacher Follow-Up Survey (TFS), 2005, 2009, and 2013, from the Schools and Staffing Survey, National Center for Education Statistics; State Universe Survey, 2004-2014, from the Common Core of Data, National Center of Education Statistics; National Center for Education Statistics. (2015). Digest of Education Statistics. Public and private elementary and secondary teachers, enrollment, pupil-teacher ratios, and new teacher hires: Selected years, fall 1955 through fall 2024. Washington, DC: U.S. Department of Education.

Appendix B: State Indicators Influencing Supply and Demand

This table highlights a number of key factors that reflect and influence teacher supply and attrition, and signal whether states are likely to have an adequate supply of qualified teachers to fill their classrooms. Based on these data—which treat compensation, teacher turnover, working conditions, and qualifications—each state is assigned a "teaching attractiveness rating," indicating how supportive it appears to be of teacher recruitment and retention. The data are drawn from national data sources (listed in the footnotes), representing the most recent data available for analysis. Interpretations of the data should keep in mind that, depending on the specific statistic, these sources are from 2012, 2013, or 2014. Some states may have recently experienced changes in policies or conditions that would change the statistic reported if it were collected today. In addition, in some cases, sample sizes are relatively small. We do not report data for states where the samples are too small to meet NCES guidelines for reporting.

Quintile

1	2	3	4	5

Lowest... Highest

	Compensation		Teacher Turnover			Working Conditions					Teacher Qualifications		
State	Average Starting Salary[1] (2013)	Wage Competitiveness Ratio[2] (Teachers to Non-teachers) (2012)	% of Teachers Planning to Leave as Soon as Possible[3] (2012)	Teacher Attrition (Leavers)[4] (2013)	Teacher Turnover (Movers and Leavers)[5] (2013)	% of Teachers Who Feel Supported by Their Administrator[6] (2012)	% of Teachers Worried about Job Security Because of Testing[7] (2012)	% of Teachers Who Report Staff Cooperation[8] (2012)	% of Teachers Who Feel They Have Control in Their Classroom[9] (2012)	Pupil-Teacher Ratio[10] (2014)	% of Teachers Not Certified[11] (2014)	% of Teachers Inexperienced[12] (2014)	Teaching Attractiveness Rating[13]
Alabama	$36,198	71	6.0%	6.8%	13.8%	57%	9%	39.2%	71%	15.8	0.87%	10.7%	3.33
Alaska	$44,166	85	4.7%	†	16.8%	50%	3%	39.6%	77%	16.6	0.88%	10.5%	3.73
Arizona	$31,874	62	11.9%	18.8%	23.6%	46%	15%	39.2%	71%	22.8	5.04%	15.1%	1.50
Arkansas	$32,691	74	5.3%	4.6%	13.7%	58%	8%	43.2%	78%	14	1.45%	11.5%	3.67
California	$41,259*	75	4.4%	4.6%	10.6%	48%	8%	39.3%	72%	24.3	1.49%	8.9%	3.67
Colorado	$32,126	68	8.4%	6.3%	14.6%	46%	15%	38.1%	76%	17.5	11.33%	17.6%	2.00
Connecticut	$42,924	71	4.1%	6.1%	10.9%	37%	9%	35.9%	73%	12.6	1.18%	9.3%	3.42
Delaware	$39,338	75	7.0%	†	17.3%	45%	15%	37.9%	54%	14	1.10%	11.0%	2.73
District of Columbia	$51,539*	68	14.8%	†	23.1%	24%	20%	27.9%	77%	13	17.84%	17.9%	1.91
Florida	$35,166	73	9.3%	6.6%	14.1%	52%	25%	38.0%	58%	15.3	4.20%	28.6%	2.25
Georgia	$33,664	68	5.4%	5.5%	12.7%	55%	11%	43.4%	66%	15.8	2.08%	5.9%	3.25
Hawaii	$41,027	77	†	†	20.5%	51%	†	†	81%	15.9	3.58%	15.3%	2.75
Idaho	$31,159	72	8.9%	†	13.2%	57%	15%	43.3%	79%	19.8	0.66%	14.1%	2.82
Illinois	$37,166	73	2.9%	5.3%	9.6%	44%	9%	36.1%	81%	15.2	0.60%	12.4%	3.42
Indiana	$34,696	70	7.9%	9.3%	15.4%	45%	26%	38.1%	76%	17.5	0.55%	14.8%	2.17
Iowa	$33,226	85	4.2%	7.0%	13.4%	39%	7%	37.2%	83%	14.2	0.01%	9.8%	3.58
Kansas	$33,386	70	7.7%	8.2%	15.1%	55%	7%	40.8%	83%	13	1.29%	12.8%	3.17
Kentucky	$35,166	71	4.2%	14.8%	15.8%	49%	11%	39.7%	71%	16.2	0.65%	9.8%	2.92
Louisiana	$38,655	75	7.0%	9.9%	21.4%	54%	21%	36.8%	61%	15.3	4.33%	12.7%	2.42
Maine	$31,835	81	7.6%	†	10.3%	47%	6%	38.5%	81%	11.9	2.10%	9.1%	3.64

Maryland	$43,235	75	10.9%	†	11.9%	41%	15%	26.9%	59%	14.8	3.16%	14.3%	2.18
Massachusetts	$40,600	69	3.5%	3.0%	13.4%	45%	7%	36.8%	78%	13.6	2.39%	13.8%	3.17
Michigan	$35,901	78	6.5%	10.0%	12.7%	44%	18%	39.5%	76%	18.1	0.49%	9.4%	3.08
Minnesota	$34,505	71	5.6%	10.2%	16.0%	42%	6%	36.5%	83%	15.6	1.72%	11.4%	2.75
Mississippi	$31,184	72	7.1%	†	17.4%	51%	14%	34.5%	75%	15.3	1.70%	12.7%	2.18
Missouri	$30,064	68	5.3%	5.9%	14.0%	53%	11%	44.2%	80%	13.8	0.86%	11.5%	3.33
Montana	$27,274	74	6.8%	†	18.7%	48%	†	31.6%	89%	14	7.68%	11.3%	2.50
Nebraska	$30,844	77	4.2%	†	10.4%	47%	7%	38.2%	76%	13.7	0.20%	12.6%	3.55
Nevada	$35,358	82	11.5%	†	19.8%	48%	14%	30.9%	68%	20.6	0.26%	14.1%	2.27
New Hampshire	$34,280	73	5.7%	†	9.7%	40%	6%	34.1%	82%	12.6	1.14%	7.0%	3.55
New Jersey	$48,631	76	4.4%	8.8%	9.2%	49%	15%	38.0%	73%	12	1.48%	11.2%	3.42
New Mexico	$31,960	78	7.2%	†	23.2%	48%	20%	30.4%	73%	15.3	2.09%	13.8%	2.18
New York	$43,839	81	†	8.2%	11.1%	44%	16%	34.7%	80%	13.2	0.53%	7.9%	3.45
North Carolina	$30,778	67	9.2%	5.5%	17.4%	53%	9%	42.6%	69%	15.4	0.33%	11.5%	2.67
North Dakota	$32,019	70	4.0%	†	14.6%	46%	2%	38.0%	88%	11.8	1.42%	12.9%	3.27
Ohio	$33,096	75	4.0%	4.1%	12.9%	47%	15%	37.6%	78%	16.3	0.69%	10.4%	3.33
Oklahoma	$31,606	67	7.8%	5.6%	17.9%	53%	13%	40.8%	86%	16.2	1.55%	13.2%	2.50
Oregon	$33,549	75	5.6%	†	11.9%	56%	6%	46.2%	82%	22.2	0.40%	9.8%	4.09
Pennsylvania	$41,901	80	4.4%	4.5%	9.3%	45%	13%	40.9%	76%	14.5	0.54%	7.5%	3.92
Rhode Island	$39,196	78	†	†	7.4%	44%	23%	37.9%	63%	14.5	0.94%	6.9%	3.00
South Carolina	$32,306	73	8.9%	13.9%	17.3%	55%	8%	43.9%	71%	15.5	3.10%	11.6%	2.75
South Dakota	$29,851	68	2.8%	†	12.5%	51%	5%	43.3%	86%	13.8	0.26%	12.1%	3.82
Tennessee	$34,098	66	7.8%	†	13.2%	56%	22%	44.0%	69%	15.1	0.48%	10.0%	3.09
Texas	$38,091	69	10.7%	14.9%	20.7%	46%	12%	38.0%	67%	15.4	1.53%	14.4%	2.00
Utah	$33,081	71	5.8%	†	8.5%	56%	11%	44.2%	78%	23	2.27%	15.7%	3.00
Vermont	$35,541	75	5.2%	†	9.9%	45%	2%	34.1%	88%	10.6	0.90%	8.8%	3.82
Virginia	$37,848	63	10.2%	8.0%	14.6%	48%	8%	36.0%	65%	14.1	3.52%	10.4%	2.58
Washington	$36,335	69	7.7%	7.2%	9.7%	51%	9%	40.7%	80%	19.3	0.19%	6.8%	3.50
West Virginia	$32,533	77	†	†	8.7%	53%	6%	38.3%	69%	14.1	3.45%	10.5%	3.40
Wisconsin	$33,546	76	6.2%	10.5%	16.2%	41%	15%	38.2%	82%	15.1	1.07%	15.1%	2.42
Wyoming	$43,269	94	3.7%	†	10.5%	51%	9%	37.7%	79%	12.3	0.19%	13.2%	4.00
United States	$36,141	74‡	6.6%	7.7%	14.2%	48%	12%	38%	77%	16.1	1.9%	13%	–

* NEA salary data are from 2011-12.

‡ Average of the 51 states (including Washington, DC) calculations, rather than a separate average for the United States as a whole.

† Reporting standards not met. Either there are too few cases for a reliable estimate or the coefficient of variation (CV) is greater than 50%.

[1] NEA Collective Bargaining/Member Advocacy's Teacher Salary Database, based on affiliate reporting as of December 2013; see www.nea.org/home/2012-2013-average-starting-teacher-salary.html.

[2] The competitiveness wage index is calculated by dividing the predicted annual wage of elementary and secondary teachers by the predicted wage of non-teachers working in the same state with master's degrees at both age 25 and 45. Baker, B., Farrie, D., & Sciarra, D.G. (2016). *Mind the gap: 20 years of progress and retrenchment in school funding and achievement gaps*. Table 5. Princeton, NJ: Educational Testing Service. pp. 15.

[3] Percent of teachers who plan to leave as soon as possible or until a more desirable job opportunity. Data are from the 2011-12 school year. LPI analysis of Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.; Interpret estimates from District of Columbia, New Hampshire, and New Mexico with caution—each estimate's coefficient of variation (CV) is between 30% and 35%.

[4] LPI analysis of Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics. Interpret with caution—all estimates other than Texas and Ohio have a coefficient of variation (CV) between 30% and 50%.

[5] LPI analysis of Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics; Schools and Staffing Survey. (2013). Teacher status file 2012-13. Washington, DC: National Center for Education Statistics.

[6] Percent of teachers who strongly agree that their school administration's behavior toward the staff is supportive and encouraging. Data are from the 2011-12 school year. LPI analysis of Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

[7] Percent of teachers who strongly agree that they worry about the security of their job because of the performance of their students or school on state and/or local tests. Data are from the 2011-12 school year. LPI analysis of Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics. Interpret estimates from Alaska, Connecticut, North Dakota, and Vermont with caution—each estimate's coefficient of variation (CV) is between 30% and 45%.

[8] Percent of teachers who strongly agree that there is a great deal of cooperative effort among the staff members. Data are from the 2011-12 school year. LPI analysis of Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

[9] Teacher autonomy in the classroom is measured using a Cronbach Alpha-generated construct of classroom control derived from six components: Control over textbooks and materials, content and skills to be taught, teaching techniques, evaluating students, discipline, and homework. The Cronbach Alpha value was equal to 0.76. LPI analysis of Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

[10] National Center for Education Statistics. (2015). *Digest of education statistics.* Public elementary and secondary teachers, enrollment, and pupil-teacher ratios, by state or jurisdiction: Selected years, fall 2000 through fall 2013. Washington DC: U.S. Department of Education. https://nces.ed.gov/programs/digest/ (accessed 5/18/16).

[11] The Office of Civil Rights defines certified teachers as those who have "met all applicable state teacher certification requirements for a standard certificate" for a beginning teacher or one who has completed the state-required probationary period. "A teacher who is working toward certification by way of alternative routes, or a teacher with an emergency, temporary, or provisional credential is not considered to have met state requirements." LPI Analysis of Civil Rights Data Collection, Public-Use Data File 2013-14, National Center for Education Statistics.

[12] An inexperienced teacher is defined as a teacher in his or her first or second year of teaching. LPI Analysis of Civil Rights Data Collection, Public-Use Data File 2013-14, National Center for Education Statistics.

[13] Teaching attractiveness ratings are calculated by assigning point values for each indicator according to the quintile: 5 points for quintile 5, 4 points for quintile 4, and so on. Teacher turnover indicators, teacher qualification indicators, and pupil-teacher ratio are reverse coded such that the 1st quintile is always the least desirable response. Each state's point total was then divided by the number of available indicators to generate an average teaching attractiveness score for each state. This rating represents the average quintile rank for each state.

KEY	
Color	Quintile
	1st Quintile
	2nd Quintile
	3rd Quintile
	4th Quintile
	5th Quintile
†	Does not meet reporting standards
Note: % of Teachers Planning to Leave as Soon as Possible, Teacher Attrition, Teacher Turnover, Pupil-Teacher Ratio, % of Teachers Not Certified, and % of Teachers Inexperienced are reverse coded such that the 1st quintile is always the least desirable response.	

Appendix C: Distribution of Uncertified and Inexperienced Teachers by State

Drawing on data from the Office of Civil Rights, this table identifies the extent to which uncertified or inexperienced teachers are hired within states and the extent to which they are disproportionately assigned to students of color. Each state is assigned a "teacher equity rating," indicating the extent to which students, in particular students of color, are assigned uncertified or inexperienced teachers.

Quintile

1	2	3	4	5

Lowest... Highest

State	Percent of Teachers Not Certified in High-Minority Schools* (2014)	Percent of Teachers Not Certified in Low-Minority Schools* (2014)	Ratio of the % Uncertified Teachers in High-Minority to Low-Minority Schools (2014)	Percent of Inexperienced Teachers in High-Minority Schools* (2014)	Percent of Inexperienced Teachers in Low-Minority Schools* (2014)	Ratio of the % Inexperienced Teachers in High-Minority to Low-Minority Schools (2014)	Teacher Equity Rating[1]
Alabama	1.569%	0.246%	6.38	12.76%	8.77%	1.45	3.7
Alaska	4.938%	0.806%	6.12	19.70%	7.26%	2.71	2.2
Arizona	7.225%	8.408%	0.86	22.48%	12.59%	1.79	1.8
Arkansas	3.671%	3.026%	1.21	16.61%	9.56%	1.74	2.5
California	2.067%	0.452%	4.57	10.80%	8.49%	1.27	3.7
Colorado	20.964%	4.544%	4.61	25.54%	13.72%	1.86	1.3
Connecticut	5.281%	0.378%	13.97	15.18%	6.53%	2.32	2.5
Delaware	2.070%	0.785%	2.64	15.02%	8.36%	1.8	3
District of Columbia	22.884%	20.686%	1.11	19.47%	18.09%	1.08	2.3
Florida	5.422%	3.964%	1.37	36.67%	29.20%	1.26	2
Georgia	3.336%	1.383%	2.41	8.46%	3.11%	2.72	3
Hawaii	5.030%	4.086%	1.23	14.22%	15.58%	0.91	2.7
Idaho	0.713%	0.522%	1.36	15.82%	12.42%	1.27	3.7
Illinois	1.116%	0.082%	13.54	17.00%	9.91%	1.72	3
Indiana	1.222%	0.472%	2.59	25.61%	10.74%	2.38	2.5
Iowa	0.040%	0.000%	N/A	12.37%	9.69%	1.28	4.2
Kansas	1.538%	1.346%	1.14	16.82%	10.90%	1.54	3
Kentucky	0.538%	0.335%	1.6	9.35%	8.76%	1.07	4.5
Louisiana	11.749%	1.492%	7.87	17.27%	8.71%	1.98	2
Maine	2.175%	3.964%	0.55	12.04%	9.35%	1.29	3.5
Maryland	5.995%	0.501%	11.97	25.39%	6.78%	3.75	2.2
Massachusetts	4.423%	1.343%	3.29	22.89%	10.29%	2.22	2
Michigan	1.179%	0.649%	1.82	13.88%	8.64%	1.61	3.7
Minnesota	2.383%	1.867%	1.28	14.60%	12.39%	1.18	3.2
Mississippi	4.045%	0.685%	5.91	18.88%	9.06%	2.09	2.3
Missouri	2.051%	1.384%	1.48	14.64%	12.91%	1.13	3
Montana	1.820%	0.711%	2.56	17.47%	20.33%	0.86	3
Nebraska	0.884%	0.446%	1.98	15.45%	9.41%	1.64	3.5
Nevada	0.184%	0.620%	0.3	21.67%	9.10%	2.38	3
New Hampshire	2.355%	0.859%	2.74	9.66%	8.82%	1.1	3.8

New Jersey	2.748%	0.638%	4.31	13.90%	9.48%	1.47	3
New Mexico	2.088%	1.440%	1.45	15.04%	12.02%	1.25	3
New York	2.285%	0.099%	23.08	16.72%	5.43%	3.08	3
North Carolina	0.811%	0.297%	2.73	15.46%	8.80%	1.76	3.7
North Dakota	1.898%	0.294%	6.44	12.44%	13.31%	0.93	3.3
Ohio	1.789%	0.172%	10.4	16.62%	9.94%	1.67	3.2
Oklahoma	4.138%	0.319%	12.98	16.31%	10.45%	1.56	2.7
Oregon	0.855%	1.079%	0.79	11.71%	10.72%	1.09	4
Pennsylvania	1.823%	0.170%	10.72	9.47%	7.02%	1.35	4
Rhode Island	3.207%	0.036%	88.99	12.40%	4.62%	2.68	3
South Carolina	7.043%	2.845%	2.48	16.86%	9.27%	1.82	2
South Dakota	0.497%	0.676%	0.74	16.78%	11.29%	1.49	3.3
Tennessee	1.971%	0.308%	6.41	12.55%	8.99%	1.4	3.5
Texas	3.661%	0.776%	4.72	18.80%	11.51%	1.63	2.3
Utah	4.009%	2.355%	1.7	16.82%	13.17%	1.28	2.3
Vermont	0.722%	0.784%	0.92	7.43%	8.19%	0.91	4.7
Virginia	4.180%	0.960%	4.36	14.39%	7.59%	1.9	2.8
Washington	1.003%	0.245%	4.1	9.63%	4.85%	1.99	4
West Virginia	3.664%	4.642%	0.79	11.78%	11.13%	1.06	3.3
Wisconsin	2.897%	0.527%	5.49	21.30%	13.26%	1.61	2.3
Wyoming	0.169%	1.277%	0.13	18.53%	10.75%	1.72	3
United States	3.6%	0.9%	4.0	16.6%	9.9%	1.7	–

* "High-minority schools" are schools in the top quartile of minority enrollment in each state. "Low-minority schools" are those in the bottom quartile of minority enrollment in each state.

Source: LPI Analysis of the Civil Rights Data Collection, Public-Use Data File 2013-14, National Center for Education Statistics.

Note: The Office of Civil Rights defines certified teachers as those who have "met all applicable state teacher certification requirements for a standard certificate" for a beginning teacher or one who has completed the state-required probationary period. "A teacher who is working toward certification by way of alternative routes, or a teacher with an emergency, temporary, or provisional credential is not considered to have met state requirements."

[1]Teacher Equity ratings are calculated by assigning point values for each indicator according to the quintile: 5 points for quintile 5, 4 points for quintile 4, and so on. (Note: Percent of Teachers Not Certified in High-Minority Schools, Percent of Teachers Not Certified in Low-Minority Schools, Percent of Inexperienced Teachers in High-Minority Schools, and Percent of Inexperienced Teachers in Low-Minority Schools are reverse coded such that the 1st quintile is always the least desirable response.) Each state's point total was then divided by the number of indicators to generate an average Teacher Equity score for each state. This rating represents the average quintile rank for each state.

KEY	
Color	Quintile
	1st Quintile
	2nd Quintile
	3rd Quintile
	4th Quintile
	5th Quintile
N/A	Undefined (not able to divide by zero)
Note: Percent of Teachers Not Certified in High-Minority Schools, Percent of Teachers Not Certified in Low-Minority Schools, Percent of Inexperienced Teachers in High-Minority Schools, and Percent of Inexperienced Teachers in Low-Minority Schools are reverse coded such that the 1st quintile is always the least desirable response.	

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59. For methodological details see Appendix A.

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82. Grissom, J. A., & Reininger, M. (2012). Who comes back? A longitudinal analysis of the reentry behavior of exiting teachers. *Education Finance and Policy*, *7*(4), 425–454. p. 428–429; Murnane, R., Singer, J. D., Willett, J. B., Kemple, J., & Olsen, R. (2009). *Who will teach? Policies that matter*. Cambridge, MA: Harvard University Press.

83. Grissom, J. A., & Reininger, M. (2012). Who comes back? A longitudinal analysis of the reentry behavior of exiting teachers. *Education Finance and Policy*, *7*(4), 425–454.

84. Grissom, J. A., & Reininger, M. (2012). Who comes back? A longitudinal analysis of the reentry behavior of exiting teachers. *Education Finance and Policy*, *7*(4), 425–454. *See also*, Haggstrom, G. W., Darling-Hammond, L., & Grissmer, D. W. (1988). *Assessing teacher supply and demand.* Santa Monica, CA: RAND Corporation.

85. Grissom and Reininger (2012) found that 38% of teachers who leave the classroom return at some point. However, using their time to re-entry estimates by year, we know within the first five years, 85% of teachers return; therefore, 32.3% of all teachers who left, returned within five years. See: Grissom, J. A., & Reininger, M. (2012). Who comes back? A longitudinal analysis of the reentry behavior of exiting teachers. *Education Finance and Policy*, *7*(4), 425–454.

86. Murnane, R., Singer, J. D., Willett, J. B., Kemple, J., & Olsen, R. (2009). *Who will teach? Policies that matter*. Cambridge, MA: Harvard University Press.

87. LPI analysis of the Title II Data Collection, 2009–2014, U.S. Department of Education. https://title2.ed.gov/Public/Home.aspx (accessed 9/3/15).

88. ACT. (2014). *The condition of future educators 2014*. Iowa City, IA: ACT. http://www.act.org/newsroom/data/2014/states/pdf/FutureEducators.pdf.

89. Cooperative Institutional Research Program, Higher Education Research Institute, U. of California at Los Angeles accessible through: Backgrounds and Beliefs of College Freshmen. (2016). *The Chronicle of Higher Education*. http://chronicle.com/interactives/freshmen-survey.

90. For more information on the Title II data, see https://title2.ed.gov/Public/Home.aspx

91. This average was calculated using public school attrition estimates available from years 2000–2013. National Center for Education Statistics. (2015). *Digest of education statistics*. Mobility of public elementary and secondary teachers, by selected teacher and school characteristics: Selected years, 1987–88 through 2012–13. Washington, DC: U.S. Department of Education. https://nces.ed.gov/programs/digest/ (accessed 11/10/15).

92. Grissom, J. A., & Reininger, M. (2012). Who comes back? A longitudinal analysis of the reentry behavior of exiting teachers. *Education Finance and Policy*, *7*(4), 425–454.

93. This estimate is calculated by finding the mid-point between the upper and lower bound of new entrants.

94. Darling-Hammond, L., Furger, R., Shields, P. M., & Sutcher, L. (2016). *Addressing California's emerging teacher shortage : An analysis of sources and solutions*. Palo Alto, CA: Learning Policy Institute.

95. These calculations are produced using Title II data on completers by subject area. New teacher entrants are calculated by taking completers and applying an 82.5% entry rate (the midpoint between the upper and lower bound estimates of 75% and 90%). However, it is worth noting that there are several issues with the Title II data that produced these subject estimates. The main issues stem from the fact that the subject categories are not mutually exclusive. For example, a student can be counted in the "Secondary education" category in addition to the "Science" category. Furthermore, each state and the Institute of Higher Education categorize their students differently. Some double count and some treat them as mutually exclusive. We have no way to know if the data are underestimating or overestimating the true completers. However, since states started to require subject specific credentials for secondary teachers, we can assume this is less of an issue in recent years.

96. Hale, L. (2015). Behind the shortage of special ed teachers: Long hours, crushing paperwork. *NPR*. http://www.npr.org/sections/ed/2015/11/09/436588372/behind-the-shortage-of-special-ed-teachers-long-hours-crushing-paperwork; Ingersoll, R. M., & May, H. (2010). The magnitude, destinations, and determinants of mathematics and science teacher turnover. *Educational Evaluation and Policy Analysis*, *34*(4), 1–64., p. 2.

97. Darling-Hammond, L., Furger, R., Shields, P. M., & Sutcher, L. (2016). *Addressing California's emerging teacher shortage : An analysis of sources and solutions*. Palo Alto, CA: Learning Policy Institute.

98. Murnane, R. J., Singer, J. D., & Willett, J. B. (1989). The influences of salaries and "opportunity costs" on teachers' career choices: Evidence from North Carolina. *Harvard Educational Review*, *59*(3), 325–347.

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100. LPI analysis of the Title II Data Collection, 2014, U.S. Department of Education. https://title2.ed.gov/Public/Home.aspx (accessed 9/3/15).

101. New Jersey and New York issued 0% of their initial teaching credentials to out-of-state prepared individuals. With rounding, 0% could mean there were some initial credentials issued to out-of-state prepared candidates, but this would at most represent less than half a percent of the new initial credentials. Note: This analysis excludes New Mexico, which did not report these data. LPI analysis of the Title II Data Collection, 2014, U.S. Department of Education. https://title2.ed.gov/Public/Home.aspx (accessed 9/3/15).

102. Ingersoll, R. M., & Perda, D. (2010). Is the supply of mathematics and science teachers sufficient? *American Educational Research Journal*, *47*(3), 563–594.

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104. Adamson, F., & Darling-Hammond, L. (2012). Funding disparities and the inequitable distribution of teachers: Evaluating sources and solutions. *Education Policy Analysis Archives*, *20*(7), 1–46.

105. National Education Association. (n.d.). 2012-2013 Average starting teacher salaries by state. http://www.nea.org/home/2012-2013-average-starting-teacher-salary.html (accessed 3/14/16).

106. Adamson, F., & Darling-Hammond, L. (2011). *Speaking of salaries: What it will take to get qualified, effective teachers in all communities*. Washington, DC: Center for American Progress.

107. One analysis of California teacher salaries found a 2 to 1 ratio of wages for similarly experienced and educated teachers across the state, which actually grew to a 3 to 1 differential when cost of living differentials were taken into account. These differences were closely associated with teacher shortages in low-wage districts. Adamson, F., & Darling-Hammond, L. (2011). *Speaking of salaries: What it will take to get qualified, effective teachers in all communities*. Washington, DC: Center for American Progress.

108. Loeb, S. & Beteille, T. (2009). Teacher quality and teacher labor markets. In G. Sykes, B. Schneider & D. N. Plank (Eds.), *Handbook of Education Policy Research* (p. 596–612).

109. It is important to remember there are two moving parts in these ratios—teacher wages and non-teacher wages. So a high-wage competiveness ratio could represent high teacher wages and average non-teacher wages, or average teacher wages and low non-teacher wages, or any combinations in between.

110. National Center for Education Statistics. (2015). *Digest of education statistics*. Public elementary and secondary teachers, enrollment, and pupil-teacher ratios, by state or jurisdiction: Selected years, fall 2000 through fall 2013. Washington, DC: U.S. Department of Education. https://nces.ed.gov/programs/digest/ (accessed 3/7/16).

111. Teacher autonomy in the classroom is measured using a Cronbach Alpha generated construct of classroom control derived from six components: Control over textbooks and materials, content and skills to be taught, teaching techniques, evaluating students, discipline, and homework. The Cronbach Alpha value was equal to 0.76.

112. 14.8% of teachers in Washington, DC, 11.9% of teachers in Arizona, and 11.5% of teachers in Nevada reported they planned to leave as soon as possible or when a more desirable job opportunity comes along; 1.9% of teachers in Rhode Island, 2.8% of teachers in South Dakota, and 2.9% of teachers in Illinois reported they planned to leave as soon as possible or when a more desirable job opportunity comes along. LPI analyses of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

113. 23.6% of teachers in Arizona, 23.3% of teachers in New Mexico, and 23.1% of teachers in Washington, DC, did not stay in their current school; 7.4% of Rhode Island teachers did not remain teaching in their current school. LPI analysis of the Public School Teacher File, 2012, from the Schools and Staffing Survey, National Center for Education Statistics.

114. For methodological details, see Appendix A.

115. Darling-Hammond, L., & Rothman, R. (2011). *Teacher and leader effectiveness in high-performing education systems*. Washington, DC: Alliance for Excellent Education; Stanford, CA: SCOPE. http://eric.ed.gov/ERICWebPortal/recordDetail?accno=ED517673.

116. Loeb, S., Darling-Hammond, L., & Luczak, J. (2005). How teaching conditions predict teacher turnover. *Peabody Journal of Education*, *80*(3), 44–70.

117. National Center for Education Statistics. (2015). *Digest of education statistics*. Public and private elementary and secondary teachers, enrollment, pupil-teacher ratios, and new teacher hires: Selected years, fall 1955 through fall 2024. Washington, DC: U.S. Department of Education. https://nces.ed.gov/programs/digest/ (accessed 12/4/15).

118. Darling-Hammond, L., & Rothman, R. (2011). *Teacher and Leader effectiveness in high-performing education systems*. Washington, DC: Alliance for Excellent Education; Stanford, CA: SCOPE. http://eric.ed.gov/ERICWebPortal/recordDetail?accno=ED517673.

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120. Ronfeldt, M., Loeb, S., & Wyckoff, J. (2013). How teacher turnover harms student achievement. *American Educational Research Journal*, *50*(1), 4–36.

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124. Darling-Hammond, L. (2003). Keeping good teachers: Why it matters, what leaders can do. *Educational Leadership*, *60*(8), 6–13.

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126. LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

127. LPI analysis of the Teacher Follow-Up Survey (TFS), 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

128. For example, in 2011–12, 90.3% of leavers were voluntary, while in 2008–09, 94.6% of leavers were voluntary. LPI analysis of the Teacher Follow-Up Survey (TFS), 2009 and 2013, from the Schools and Staffing Survey, National Center for Education Statistics.

129. National Center for Education Statistics. (2015). *Digest of education statistics*. Mobility of public elementary and secondary teachers, by selected teacher and school characteristics: Selected years, 1987–88 through 2012–13. Washington, DC: U.S. Department of Education. https://nces.ed.gov/programs/digest/ (accessed 4/15/16). *See also*, Ingersoll, R. M. (2003). *Is there really a teacher shortage*. Seattle, WA: Center for the Study of Teaching and Policy.

130. Studies have produced a range of estimates for beginning teacher attrition, all of which have shortcomings. For example, one recent estimate using national longitudinal data put the attrition rate around 17%, finding 83% of beginning teachers still teaching at the end of their fifth year, including some who had left and re-entered. (See Gray, L., Taie, S., & O'Rear, I. (2015). *Public school teacher attrition and mobility in the first five years: Results from the first through fifth waves of the 2007–2008 Beginning Teacher Longitudinal Study*. Washington, DC: U.S. Department of Education. http://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=ED556348&site=ehost-live.) However, the analysis omitted the large number

of individuals who did not respond to the survey at various points during these years without adjusting for nonresponse bias. In general, survey evidence finds that those who do not respond to such surveys are more likely to have left their position than to have continued teaching. For that reason, the 17% figure likely underestimates attrition by an unknown margin. Our own imputations to adjust these data based on the characteristics of nonrespondents suggest that the attrition rate is likely at least 19%. Older estimates of attrition using national cross-sectional data suggested about a 30% attrition rate at the end of five years. See Darling-Hammond, L., & Sykes, G. (2003). Wanted: A national teacher supply policy for education: The right way to meet the "highly qualified teacher" challenge. *Education Policy Analysis Archives*, *11*(33), 1–55.

131. Ingersoll, R. M. (2012). Beginning teacher induction: What the data tell us. *Kappan*, *93*(8), 47–52.

132. See also Carver-Thomas, D. (2016). *National trends in teacher attrition: An analysis of 2011–12—2012–13 stayers, movers, and leavers.* Palo Alto, CA: Learning Policy Institute. (forthcoming).

133. Carver-Thomas, D. (2016). *National trends in teacher attrition: An analysis of 2011–12—2012–13 stayers, movers, and leavers.* Palo Alto, CA: Learning Policy Institute. (forthcoming).

134. Holding other factors constant: school size, school level (i.e., elementary or secondary), district type (i.e., suburb, rural, town, city), percentage of students eligible for free/reduced-price lunch, percentage students of color, city x percent eligible for FRPL, average class size, teacher gender, teacher age (i.e., younger than 30, older than 50), years of experience, teacher race, main teaching assignment (i.e., mathematics/science, humanities, special education, elementary, arts, foreign languages, physical education, career technical education, miscellaneous), school working conditions (i.e., administrative support, salary satisfaction, student behavior, parental support, school resources, interference on teaching time, collegiality, job security, classroom control, school influence, beginning district salary, highest district salary).

135. Carver-Thomas, D. (2016). *National trends in teacher attrition: An analysis of 2011–12–2012–13 stayers, movers, and leavers.* Palo Alto, CA: Learning Policy Institute. (forthcoming).

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137. Ingersoll, R. M., Merrill, L., & May, H. (2014). *What are the effects of teacher education and preparation on beginning teacher retention?* Philadelphia, PA: Consortium for Policy Research in Education.

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139. Only in the west, the city attrition rate mirrors that in all other district types (except for western suburbs, which have lower attrition rates).

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143. For a comprehensive review, see Simon, N. S., & Johnson, S. M. (2015). Teacher turnover in high-poverty schools: What we know and can do. *Teachers College Record*, *117*(March), 1–36. http://isites.harvard.edu/fs/docs/icb.topic1231814.files/Teacher Turnover in High-Poverty Schools.pdf.

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146. Ingersoll, R. M., & May, H. (2011). *Recruitment, retention and the minority teacher shortage*. Philadelphia, PA: Consortium for Policy Research in Education. p. 45.

147. See also Carver-Thomas, D. (2016). *National trends in teacher attrition: An analysis of 2011–12–2012–13 stayers, movers, and leavers.* Palo Alto, CA: Learning Policy Institute. (forthcoming).

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149. See also Carver-Thomas, D. (2016). *National trends in teacher attrition: An analysis of 2011–12–2012–13 stayers, movers, and leavers.* Palo Alto, CA: Learning Policy Institute. (forthcoming).

150. See also Carver-Thomas, D. (2016). *National trends in teacher attrition: An analysis of 2011–12–2012–13 stayers, movers, and leavers.* Palo Alto, CA: Learning Policy Institute. (forthcoming).

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161. Adamson, F., & Darling-Hammond, L. (2011). *Speaking of salaries: What it will take to get qualified, effective teachers in all communities*. Washington, DC: Center for American Progress. p. 7.; citing Henke, R. R., Choy, S. P., Chen, X., Geis, S., & Alt, M. N. (1997). *America's teachers: Profile of a profession, 1993–94*. Washington, DC: U.S. Department of Education. papers3://publication/uuid/32604DB9-A4A7-4F02-A21C-6120E0BCE8DF.; Loeb, S., Darling-Hammond, L., & Luczak, J. (2005). How teaching conditions predict teacher turnover. *Peabody Journal of Education*, *80*(3), 44–70.

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235. Title II data go as far back as the academic year of 1999–00, but the early years of data collection were incomplete. For this reason, this report uses only completer totals as far back as 2004–05. Using this

10-year range, there were only three missing values: Montana in 2004 and 2005, and Delaware in 2008. These were imputed using the median completers for these states in every other year of available data for Montana (788) and Delaware (739).

236. For more information of the B&B 2008:2012, see https://nces.ed.gov/surveys/b&b/

237. By looking at respondents' experiences with teaching as of 2012, we can see 24.5% of the B&B sample prepared to teach. At the same time, 6.13% of the entire sample prepared to teach but never ended up in the classroom as of 2012. Therefore, 25.01% (6.13 divided by 24.5) of teachers who prepared to teach, prepared but had not entered the classroom as of 2012.

238. This benefit is a double-edged sword: it allows us to largely account for delayed entrants in the teacher supply but doesn't properly indicate which specific years these delayed entrants surface in the teacher labor force. Delayed entrants are not distributed over each year, which is partially captured in the four-year average completer to teacher rate. Therefore, each year's estimate of supply is a slight overestimate because future delayed entrants are captured in the year directly after they prepare rather than later in time. However, if in year 1, we overestimate supply because we are counting delayed entrants who haven't yet entered, in year 2 we underestimate supply because the delayed entrants that might have entered in year 2 were already accounted for in year 1. It is difficult to know whether these over- and under-estimates each year cancel each other out or if there is bias in one direction or another. Although there may be some biases year to year, we believe that including imperfect measurements of delayed entrants paints a more reliable long-term picture than not accounting for them at all.

239. Grissom, J. A., & Reininger, M. (2012). Who comes back? A longitudinal analysis of the reentry behavior of exiting teachers. *Education Finance and Policy*, *7*(4), 425–454.

240. The authors note that the sample of 200 teacher career paths is slightly younger than the true age distribution of teachers' potential adding upward bias to their estimates.

241. Grissom and Reininger's (2012) original estimates are as follow: Of the 38% who return to teaching, 47.5% of them return just after one year, 20.5% after two years, 7.4% after three, 7.8% after four years, and 2.5% after five years. To adjust for the fact we are now using a five-year re-entrant rate, we scale the yearly percentages by (100/85). The new adjusted percentages yield the same results as the original estimates because the proportion remains the same.

242. For more information on the CCD, see: https://nces.ed.gov/ccd/

243. Re-entrants are able to be modeled only to 2013–14 because the CCD last year of total teacher estimates is 2013–14. As previously mentioned, the Title II data has missing values for years prior to 2004. Using the range between 2000–12, there were only 22 missing values from nine states. These missing values were imputed using the median completers for these states in every other year of available data for Alabama (1,270), Idaho (1,235), Iowa (2,649), Nebraska (1,722), Wisconsin (4,239), Montana (788), North Dakota (668), Washington (2,857), and Delaware (739).

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