Reforming Teacher Education:
Academic Selection and Occupational Matching*

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Abstract

This paper examines whether changes to teacher education attract academically stronger students and how they shape graduates' entry into the labor market. I study Sweden's 2011 reform, which aimed to make teacher education more attractive and better suited to the demands of different teaching occupations. The reform introduced more distinct pathways for preschool and primary teachers and raised educational requirements in primary and selected upper-secondary programs. Using nationwide administrative data and a difference-in-differences design, I estimate effects separately for each affected program group by comparing changes across entry cohorts with those in programs without corresponding changes. Relative to the comparison programs, average pre-entry GPA increased by 0.11 standard deviations among preschool teacher graduates and 0.14 among primary teacher graduates. Similar increases were already evident among students entering these programs. These gains were larger at universities where preschool and primary teacher education were less differentiated before the reform, suggesting that clearer professional pathways contributed to improved academic selection. The reform also affected graduates' entry into the labor market, but the effects differed across programs. Primary teacher graduates became more likely to enter compulsory-school rather than preschool teaching and earned more, without a clear increase in overall entry into teaching. In contrast, preschool teacher graduates, who already had high rates of occupational matching before the reform, experienced relative declines in employment, the likelihood of working as teachers, and earnings. Graduates from the extended upper-secondary programs also earned more, despite no clear improvements in academic selection or occupational matching, suggesting potential benefits from additional subject preparation. Overall, the findings suggest that clearer professional pathways can attract academically stronger students, but that more targeted preparation may come at the cost of broader occupational opportunities.

JEL codes: I20, I21, I28, J24

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1 Introduction

Teachers are among the most important school-based determinants of student achievement, and being taught by an effective teacher has lasting effects on students' outcomes later in life (Rockoff, 2004; Rivkin et al., 2005; Chetty et al., 2014). Attracting promising candidates and preparing them for teaching are therefore important policy objectives (OECD, 2019).[1] Teacher education can influence both processes: its structure and requirements may affect which students enroll and graduate, while its content may shape the knowledge and skills that graduates bring to the classroom.

The recruitment role of teacher education is particularly relevant given concerns about the profession's ability to attract academically strong candidates. Studies have documented declines in the academic aptitude of those entering teaching in Sweden and the United States (Corcoran et al., 2004; Hoxby and Leigh, 2004; Grönqvist and Vlachos, 2016). Previous research shows that relative compensation and alternative employment opportunities influence who chooses to enter teaching (Hoxby and Leigh, 2004; Bacolod, 2007; Nagler et al., 2020). Pay policies also influence teacher mobility and the composition of the teaching workforce (Biasi, 2021). While labor-market incentives influence who becomes a teacher and where they work, less is known about how the organization of teacher education affects academic recruitment and graduates' entry into the labor market.

This paper examines whether changes to teacher education attract academically stronger students and how they shape graduates' entry into the labor market. To address these questions, I study Sweden's 2011 teacher education reform, which introduced more distinct pathways for preschool and primary teachers and raised educational requirements in selected programs.

The reform aimed to make teacher education more attractive and better suited to the demands of different teaching occupations (Regeringen, 2010). Before the reform, preschool and primary teacher education offered flexible and overlapping pathways, while subject-teacher programs were more clearly defined. The reform increased professional differentiation by introducing more distinct and occupation-specific pathways for preschool and primary teachers. Preschool teacher education retained its duration and degree level, while primary teacher education was also extended and upgraded to an advanced-level degree. Selected upper-secondary programs were lengthened through additional subject preparation. Lower-

[1] Predicting teacher effectiveness before classroom entry remains challenging, as conventional credentials and broad observable teacher characteristics explain relatively little of the variation in effectiveness across teachers (Rivkin et al., 2005; Kane et al., 2008; Jackson et al., 2014). Nevertheless, evidence linking teachers' cognitive skills to student achievement suggests that academically strong candidates represent a promising pool of future teachers (Rockoff et al., 2011; Hanushek et al., 2019).

secondary programs and upper-secondary programs in Swedish and civics did not undergo corresponding program-specific changes and serve as the comparison group.

To estimate the effects of these program-specific changes, I use a difference-in-differences design comparing entry cohorts before and after the reform in affected and comparison programs within universities. Students entering from autumn 2011 onward were exposed to the reformed programs. Since both affected and comparison programs were subject to common reform measures, the design does not identify the overall effect of the reform. Instead, it estimates the relative effects of the program-specific reform packages. While the effects of individual changes cannot be separately identified, comparing outcomes across programs with different reform packages helps assess which dimensions of teacher education design appear most important.

Using nationwide Swedish administrative data, I follow students who entered teacher education between 2007/08 and 2014/15 through graduation and into the labor market. I focus primarily on graduates because the reform changed program content and degree requirements, making the academic composition of those completing these programs a central outcome. Completed qualifications also allow me to identify programs more precisely, particularly before the reform.

Academic selection improved among preschool and primary teacher graduates. Relative to the comparison programs, their average pre-entry upper-secondary school GPA increased by 0.11 and 0.14 standard deviations, respectively. For graduates from the extended upper-secondary programs, the estimated effect on pre-entry GPA was not statistically distinguishable from zero. Together, these results point to clearer professional pathways as the leading explanation for the improvements in academic selection.

Since the main analysis focuses on graduates, the improvements in academic composition could reflect changes in who completes teacher education rather than who enrolls. However, similar gains were already evident at entry: GPA increased by 0.14 standard deviations among preschool entrants and 0.15 among primary entrants.[2] Enrollment patterns show little evidence of a relative decline in intake, and GPA gains extend across the pre-reform distribution, providing limited support for tighter capacity constraints as the main explanation. Post-reform application rankings suggest that preschool and primary teacher education are close substitutes, but that substitution with subject-teacher education is limited. This reduces concerns that the estimated GPA gains are amplified by a reallocation of academically stronger applicants from the comparison programs.

[2]Before the reform, initial registration records do not always clearly distinguish preschool from primary teacher education or the different subject-teacher programs. The entrant analysis therefore uses a broader program classification and comparison group.

To explore the role of professional differentiation, I first examine graduates' average course portfolios. Before the reform, preschool and primary teacher education had similar course portfolios, with comparable shares of subject studies and pedagogical coursework. Following the reform, primary teacher education placed greater emphasis on subject studies, while the average composition of preschool teacher education remained largely unchanged. Given the previously flexible and overlapping pathways, the reform would also be expected to make course portfolios more similar within programs and more distinct between them within universities. Both patterns are evident in the data. Importantly, the scope for increased professional differentiation varied across universities. GPA gains were larger at universities where, before the reform, course portfolios varied more within programs and overlapped more between preschool and primary teacher education. These findings provide further support for the role of professional differentiation in improving academic selection.

The reform also affected graduates' entry into the labor market, but the effects differed across programs. Among graduates with an observed occupation, the probability of working in compulsory-school teaching increased by 17.8 percentage points for primary teacher graduates relative to the comparison programs during the first three years after graduation. This shift in occupational allocation was not accompanied by a clear increase in overall entry into teaching. Their average annual earnings also increased. In contrast, preschool teacher graduates experienced relative declines in employment, the likelihood of working in teaching, and earnings. Graduates from the extended upper-secondary programs also earned more.

Before the reform, many primary teacher graduates worked in preschool teaching, while most preschool teacher graduates already worked in their intended occupation. Clearer professional pathways may therefore have improved matching for primary graduates but reduced preschool graduates' opportunities in related teaching jobs. For primary graduates, the roles of additional education, improved matching, and changes in graduate composition cannot be separated, although controlling for pre-entry GPA has little effect on the estimates. Higher earnings among graduates from the extended upper-secondary programs, without clear improvements in academic selection or occupational matching, suggest potential benefits from additional subject preparation. However, the estimates may also be affected by occupation-specific trends in labor demand and pay, particularly for preschool graduates, whose labor market is less closely related to that of the subject-teacher comparison group.

The paper makes three contributions. First, it adds to research on the academic selection of future teachers. Previous studies have examined the role of pay and alternative employment opportunities (Hoxby and Leigh, 2004; Bacolod, 2007; Nagler et al., 2020), as well as alternative certification routes and admissions policies (Boyd et al., 2006; Sass, 2015; Schaede and Mankki, 2026). I instead examine how changes to the structure and requirements of

conventional teacher education programs affect the academic composition of entrants and graduates. The findings suggest that clearer professional pathways can strengthen academic recruitment, while extensions to already differentiated programs showed no clear changes in academic selection.

Second, the paper contributes to research on educational specialization and occupational matching (Malamud, 2011; Kinsler and Pavan, 2015; Eckardt, 2026). Previous research has highlighted a potential trade-off between the labor-market benefits of occupation-specific training and reduced occupational flexibility (Hanushek et al., 2017; Eggenberger et al., 2018). I examine specialization between closely related teaching occupations within an already professionally oriented field. By distinguishing entry into teaching from employment in the occupation targeted by each program, I study how clearer professional pathways affect graduates' allocation within the profession. The findings provide further evidence consistent with a trade-off between improved occupational matching and reduced flexibility to work in related teaching occupations.

Third, the paper contributes to research on the labor-market returns to higher education, including university access (Öckert, 2010; Zimmerman, 2014), field of study (Kirkeboen et al., 2016), and program duration (Webbink, 2007; Gong and Pan, 2023). I examine extensions to existing upper-secondary teacher education programs that increased subject-specific coursework without changing their occupational focus. The findings suggest that additional subject preparation may improve graduates' early-career earnings.

The remainder of the paper is organized as follows. Section 2 describes teacher education in Sweden and the 2011 reform. Sections 3 and 4 present the data and empirical strategy, respectively. Section 5 reports the results, and Section 6 concludes.

2 Institutional Setting and Reform

2.1 Teacher Education in Sweden

In Sweden, the standard route into teaching is through a professional degree from a university or university college (*högskola*). Teacher education combines educational science, subject or specialization studies, and supervised teaching practice. National degree requirements specify program length, core content, and intended teaching roles, while institutions decide how to organize their programs. Institutions offering teacher education are spread across Sweden and vary in size and research capacity (Åstrand, 2023; SOU, 2024).

This paper focuses on four teacher categories: preschool teachers, primary teachers, and lower- and upper-secondary subject teachers. Preschool teacher education focuses on chil-

dren's development, learning, and care across different educational areas. Primary teacher education prepares teachers for preschool class and grades 1–6, combining pedagogy with preparation in several school subjects, particularly Swedish, mathematics, and English. Although these programs prepare teachers for different educational settings, both offer broader preparation than the more subject-specialized programs for teaching older pupils.

Subject-teacher education prepares students to teach specific subjects in lower-secondary school (grades 7–9) or upper-secondary school (grades 10–12). These programs emphasize subject knowledge and subject-specific teaching methods, with greater specialization at the upper-secondary level. Throughout the analysis, I use these teaching categories consistently across changes in degree requirements and program structures. Other programs, including leisure-time center, vocational and special-needs teacher education, as well as supplementary programs for candidates with prior subject studies, are excluded from the analysis.

Swedish teacher education has undergone several reforms in response to changing expectations of teachers and their preparation. The 1977 reform brought previously separate teacher training traditions into higher education, while the 1993 reform gave universities greater freedom to design programs within national degree requirements. In 2001, several teaching degrees were combined into a common degree, aiming to provide a shared professional foundation and greater flexibility across teaching roles (SOU, 2024). The following sections describe this system and the changes introduced in 2011.

2.2 Teacher Education Before the Reform

From 2001 until the 2011 reform, Swedish teacher education was organized around a common teacher degree (*lärarexamen*). However, qualifying for different teaching roles still required different combinations of subject studies and preparation for specific age groups. Within this framework, universities offered different orientations and course combinations to meet these requirements. Despite these distinctions, educational pathways could overlap, particularly in preschool and primary teacher education, where courses and orientations could be shared and some universities offered pathways preparing students for both settings (Åstrand, 2023; SOU, 2024).

Teacher education followed a modular structure consisting of a general educational core (*allmänt utbildningsområde*) of 90 ECTS, orientations (*inriktningar*) of at least 60 ECTS each, and specializations (*specialiseringar*) of at least 30 ECTS each.[3] The general core covered knowledge common to the teaching profession, while orientations focused on school subjects, age groups, or interdisciplinary fields. Specializations allowed students to deepen

[3]All credits are expressed in ECTS equivalents, with 60 ECTS corresponding to one year of full-time study. Before 2007, Sweden used a credit system in which 40 credits corresponded to one academic year.

or broaden their studies. Supervised teaching practice was integrated into both the general core and orientations (Regeringen, 2000).

The modular structure gave both universities and students considerable flexibility. In particular, national requirements for preschool and primary teacher education left considerable room for variation in course content. Universities decided how to organize orientations, while students could choose among the options offered at their institution. As a result, students preparing for the same teaching role could graduate with different course portfolios, while those preparing for preschool and primary teaching could have similar course portfolios.

Subject-teacher education was more tightly regulated through national requirements for subject specialization. Lower-secondary teacher qualifications required at least 90 ECTS in one relevant subject, while upper-secondary qualifications required at least 90 ECTS in two subjects. For upper-secondary teaching in Swedish or civics, the requirement was 120 ECTS in each of these subjects (Regeringen, 2000; SFS, 2007). These requirements limited the range of possible course combinations but did not necessarily require separate courses for different teaching levels.

Program length also varied across teaching roles. Preschool and primary teacher qualifications required at least three and a half years of full-time study, although the flexible framework also allowed four-year pathways for primary teaching. Lower- and upper-secondary teacher qualifications generally required four and a half years. For upper-secondary teaching, programs involving Swedish or civics required five years, increasing to five and a half years when both subjects were combined (Regeringen, 2000).[4]

2.3 The 2011 Reform

The reform was introduced at the start of the 2011/12 academic year in response to criticism of the teacher education system established in 2001. Evaluations and a government inquiry identified weaknesses in curricular coherence and progression. They also raised concerns that the flexibility available to universities and students did not always result in preparation suited to the needs of schools and preschools (Högskoleverket, 2005, 2008; SOU, 2008). The reform aimed to create clearer professional pathways and better align teacher education with different teaching roles (Regeringen, 2010).

[4]Following Sweden's adaptation to the Bologna framework at the beginning of the 2007/08 academic year, the common teacher degree could be awarded at first- or second-cycle level, depending on program length and advanced-level study requirements.

2.3.1 Common Changes Across Teacher Education Programs

The reform replaced the common teacher degree (*lärarexamen*) with four distinct professional degrees: preschool teacher (*förskollärarexamen*), primary teacher (*grundlärarexamen*), subject teacher (*ämneslärarexamen*), and vocational teacher (*yrkeslärarexamen*).

The new degrees came with more detailed requirements for program content, replacing the previous flexible system of orientations and specializations. For subject-teacher education, these requirements also restricted which teaching subjects could be combined. Together, these changes reduced the flexibility to construct individual qualification profiles that had characterized the previous system (Regeringen, 2010).

The reform also replaced the general educational core (*allmänt utbildningsområde*) with a 60-ECTS educational science core (*utbildningsvetenskaplig kärna*, UVK) and established school-based training (*verksamhetsförlagd utbildning*, VFU) as a separate component of 30 ECTS. These changes made the national requirements for teacher preparation more explicit, while universities retained responsibility for organizing and delivering courses (Regeringen, 2010).

Other reforms affecting Swedish schools, teacher certification, and teacher employment were introduced around the same period. Appendix A summarizes their timing and scope.

2.3.2 Program-Specific Changes

The reform introduced more distinct pathways for preschool and primary teaching. While the previous common teacher degree allowed overlapping orientations and coursework, the new degrees established separate requirements for the two teaching roles. Within primary teacher education, separate orientations were also introduced for preschool class and grades 1–3 and for grades 4–6.[5] I refer to this clearer alignment between educational pathways and intended teaching roles as professional differentiation.

The reform set the duration of primary teacher orientations at four years and introduced more specific subject requirements. This added one semester compared with the previous three-and-a-half-year pathways, although the flexible pre-reform framework also allowed students to combine courses into four-year pathways. Preschool teacher education remained three and a half years long.

For upper-secondary teacher education, the reform increased the minimum requirement in the main teaching subject from 90 to 120 ECTS, adding one semester of subject studies. Programs without Swedish or civics were therefore extended from four and a half to five

[5]Preschool class (*förskoleklass*, K) serves children around age six. The K–3 and 4–6 orientations correspond approximately to ages 6–9 and 10–12, respectively. The primary teacher degree also included an orientation toward leisure-time centers, which is outside the scope of this paper.

years. Programs involving Swedish or civics already required 120 ECTS in these subjects and retained their previous duration: five years with either subject and five and a half years with both. Lower-secondary teacher education also retained its four-and-a-half-year duration at the introduction of the reform (Regeringen, 2010).

The reform also required primary teacher education to lead to second-cycle professional degrees, while preschool teacher education remained at first-cycle level. This raised the degree level relative to the previous three-and-a-half-year pathways, although the flexible pre-reform framework already allowed four-year pathways that could lead to second-cycle degrees. Lower- and upper-secondary teacher education continued to lead to second-cycle qualifications.

The reform thus introduced different combinations of professional differentiation, program duration, and degree-level requirements across teacher education programs. Table 1 summarizes these program-specific changes.

Table 1: Program-specific changes under the 2011 teacher education reform

Program	Professional differentiation	Duration	Degree level
Preschool (PS)	↑		
Primary (K–6)	↑	↑	↑
Lower-secondary (7–9)			
Upper-secondary (10–12)		↑	
Upper-secondary (10–12 Sw/Civ)			

Notes: Arrows indicate increases in professional differentiation, nominal program duration, or required degree level; blank cells indicate no corresponding program-specific increase. Professional differentiation refers to clearer pathways into specific teaching occupations. The 10–12 group excludes Swedish and civics, while 10–12 Sw/Civ includes qualifications involving either subject. All programs were also affected by common reform measures, including the introduction of the educational science core (UVK) and more detailed national requirements. The table summarizes the dimensions relevant to the empirical analysis rather than all changes introduced by the reform.

3 Data

The analysis uses nationwide Swedish administrative records to follow teacher candidates from initial enrollment through graduation and into the labor market. The main analysis focuses on teacher education graduates, complemented by analyses of candidates at entry. Educational records are linked to individual background characteristics and labor-market outcomes using pseudonymized identifiers provided by Statistics Sweden (SCB). This section

describes the data sources, sample construction, and outcome measures.

3.1 Data Sources and Linkages

The main data source is the Swedish Higher Education Register (*Universitets- och högskoleregistret*), which contains information on program enrollment, course registration and completion, and awarded degrees. The available records cover program enrollment from the 1977/78 academic year and courses and degrees from 1993/94. All educational records extend through the fall semester of 2023.

Program records identify the institution and program in which a student enrolls. Course records contain institution-specific course identifiers and names, national subject and orientation codes, course credits and completed credits, and information on whether courses are taken within a program. Degree records identify graduation dates, awarding institutions, degree orientations and levels, and credit requirements. Together, these records allow me to follow candidates from initial enrollment through coursework to graduation.

I link these records to final upper-secondary school grade point averages (*Gymnasieskola: Betyg*) and demographic and family characteristics. Parents are identified through the Multi-Generation Register (*Flergenerationsregistret*), and their educational attainment is measured in 2007 using the Education Register (*Utbildningsregistret*).

Annual labor-market data come from the Longitudinal Integrated Database for Health Insurance and Labour Market Studies (LISA). The records contain information on employment status, occupations, unemployment insurance benefits, and earnings. The measures used in the analysis are available through 2022, except for registered employment status, which is available through 2021.

I also use application and admission records from the Swedish Higher Education Register (*Universitets- och högskoleregistret: sökande och antagna*). These records are available from the fall semester of 2013 onward and therefore cover only post-reform applications.

3.2 Sample Construction and Follow-up

The starting population consists of individuals who first enrolled in a relevant teacher education program between the 2007/08 and 2014/15 academic years.[6] I begin with the autumn

[6] I identify programs preparing preschool, primary, lower-secondary, or upper-secondary teachers using university-specific program and orientation codes from enrollment records, supplemented by historical program names. Programs for leisure-time centers, vocational and special-needs teachers, supplementary pedagogical training, and other non-regular pathways are excluded. The classification procedure is available upon request.

2007 entry cohort to ensure that all pre-reform candidates entered teacher education under the same institutional framework, following Sweden's implementation of the Bologna reforms.[7]

Reform status is determined by the semester of first enrollment in a relevant teacher education program.[8] Candidates entering in autumn 2011 or later are classified as post-reform entrants, while earlier entrants belong to the pre-reform cohorts. Enrollment records identify candidates and their broad program categories regardless of whether they subsequently graduate.

The main analysis population consists of candidates from these entry cohorts who subsequently complete a relevant teaching qualification. I classify graduates based on their awarded degree, using degree codes and specialization information. I distinguish between preschool, primary, lower-secondary, and upper-secondary teacher qualifications, further dividing the upper-secondary category according to whether the qualification includes Swedish or civics. This yields five analytical categories.[9]

I retain graduates who complete their degree within its nominal duration plus three years, measured from initial enrollment. This restriction ensures a common maximum time to degree that can be observed for all entry cohorts.

The graduate sample is restricted to university–program combinations with graduates from at least two academic entry cohorts before and two after the reform. This leaves 20 institutions.[10]

Table 2 presents descriptive statistics for the graduate sample across the five teacher education categories. Preschool and primary teacher graduates account for approximately four-fifths of the sample. Women constitute the majority of graduates, particularly in these two categories. Upper-secondary teacher graduates have higher average standardized pre-entry GPA and are more likely to have a parent with tertiary education.

[7]The new higher-education framework took effect on 1 July 2007, with the first teacher education programs under the new framework starting in autumn 2007. The framework introduced first- and second-cycle degree requirements and explicit learning outcomes.

[8]Individuals may have previously enrolled in higher education outside teacher education.

[9]Appendix B.1 describes the classification procedure, including the use of initial program information when degree records do not identify a sufficiently specific orientation.

[10]The requirement is applied separately to each university–program combination before outcome-specific exclusions. It does not require representation in every semester or that each institution offer all program categories. The sample includes the University of Gothenburg, Dalarna University, Kristianstad University, the University of Borås, the University of Gävle, Halmstad University, Jönköping University, University West, Karlstad University, Linköping University, Luleå University of Technology, Linnaeus University, Mid Sweden University, Malmö University, Mälardalen University, Stockholm University, Södertörn University, Uppsala University, Umeå University, and Örebro University. Institutional identifiers are harmonized throughout the sample period: the Stockholm Institute of Education is grouped with Stockholm University (merged in January 2008), and the University of Kalmar and Växjö University are grouped with Linnaeus University (formed in January 2010).

Table 2: Descriptive statistics for the teacher education graduate sample

	(1)	(2)	(3)	(4)	(5)
	PS	K–6	7–9	10–12	10–12 Sw/Civ
Graduates	17,293	13,834	1,542	3,868	3,214
Share of sample (%)	43.5	34.8	3.9	9.7	8.1
Age at entry	27.55	25.42	25.80	24.64	23.62
	(7.91)	(6.67)	(7.51)	(6.31)	(5.15)
Female	0.956	0.896	0.681	0.530	0.610
	(0.206)	(0.305)	(0.466)	(0.499)	(0.488)
Standardized pre-entry GPA	0.149	0.271	0.280	0.509	0.514
	(0.689)	(0.687)	(0.776)	(0.704)	(0.702)
Parental tertiary edu.	0.321	0.420	0.475	0.568	0.570
	(0.467)	(0.494)	(0.500)	(0.495)	(0.495)

Notes: Entries are means with standard deviations in parentheses, except for the graduate counts and sample shares in the first two rows. The sample pools pre- and post-reform entrants from 2007/08–2014/15 who completed a relevant teaching qualification within its nominal duration plus three years. Programs are classified by awarded qualification. Statistics use available observations for each characteristic. GPA is standardized within upper-secondary school graduation cohorts. Female and parental tertiary education are indicators; the latter identifies at least one parent with a tertiary degree, measured in 2007. PS denotes preschool; K–6, 7–9, and 10–12 denote primary, lower-secondary, and upper-secondary teacher education. Column (4) excludes qualifications including Swedish or civics; column (5), labeled 10–12 Sw/Civ, includes them.

A complementary analysis of entrants examines whether changes in graduates' academic composition are already evident at enrollment or may reflect differential completion. This analysis classifies candidates based on their initial program registration and uses a broader comparison group, including lower-secondary and both upper-secondary teacher education categories.

For the labor-market analysis, I further restrict the graduate sample to individuals who completed their degrees between June 2012 and February 2020.[11]

Follow-up is defined relative to an adjusted graduation year. Graduates completing their degrees in January or February are assigned to the preceding calendar year, while other graduates retain their year of graduation.[12] Outcomes are measured in the first, second, and third calendar years after the adjusted graduation year. For example, a graduate completing their degree in February 2020 is followed in 2020, 2021, and 2022.

For each outcome, the preferred analysis includes only graduates observed in all three

[11]I begin the graduation window in June 2012 to improve overlap in graduation timing across teacher education programs with different nominal durations. By this date, entrants from autumn 2007 could have completed five years of study. An earlier starting point would disproportionately represent graduates from shorter programs among the earliest entry cohorts.

[12]The autumn semester extends into January, and degrees following autumn-semester studies are often recorded in January or February. For these graduates, the first follow-up year therefore coincides with the calendar year of graduation, allowing at least ten months between graduation and the end of that year.

follow-up years, keeping the sample fixed across annual and three-year specifications. Since most labor-market outcomes are available through 2022, the latest graduation date is February 2020. For registered employment, which is available only through 2021, the corresponding cutoff is February 2019. Samples may therefore differ across outcomes but remain fixed across follow-up years within each outcome. Robustness analyses extend the graduation window while maintaining the requirement of three years of observed outcomes.

Table B.1 in Appendix B.2 reports the sample sizes for the different analyses.

3.3 Measures of Outcomes

Academic portfolio at graduation. To examine how the reform affected graduates' educational qualifications and coursework, I combine information on awarded degrees with coursework completed through the year of graduation. The measures include the degree's required credits and qualification level, total accumulated credits, credits across six broad course categories[13], and credits completed at the second-cycle level.

Academic selection. The measure of academic selection is pre-entry upper-secondary school GPA. I standardize GPA within upper-secondary school graduation cohorts to have a mean of zero and a standard deviation of one. This accounts for differences in the distribution of grades across cohorts, including those associated with changes in grading practices. Since GPA is measured before entry into teacher education, it reflects prior academic achievement rather than skills acquired during the program.

Additional background characteristics include age at entry, gender, and parental tertiary education. The latter is an indicator equal to one if at least one parent holds a tertiary degree.

Labor-market attachment and occupational matching. I measure labor-market attachment using two indicators: employment in November and receipt of unemployment insurance benefits during the calendar year. Employment is defined as being classified as gainfully employed (*förvärvsarbetande*) in the registers, while the benefit indicator identifies any receipt of unemployment insurance benefits (*arbetslöshetsersättning*) during the year. These measures are not mutually exclusive, as individuals may receive benefits during the year and be employed in November.

I use four-digit codes from the Swedish Standard Classification of Occupations (SSYK) to identify teaching occupations and measure occupational matching. Occupational information

[13]The six categories are social sciences, natural sciences, humanities, practical subjects, pedagogy including teaching practice, and residual or unclassified coursework.

refers to individuals' main occupation recorded in November.

The teaching indicator includes preschool, leisure-time, compulsory-school, and upper-secondary teachers, as well as vocational and special education teachers and teachers of aesthetic and practical subjects.

The target-matching indicator identifies whether the recorded occupation corresponds to the teaching level targeted by the completed qualification. For preschool teacher graduates, a match is defined as preschool or leisure-time teaching (*förskollärare och fritidspedagoger*);[14] for primary and lower-secondary teacher graduates, compulsory-school teaching (*grundskollärare*), since occupation codes do not distinguish between these teaching levels; and for both upper-secondary teacher groups, general upper-secondary teaching (*gymnasielärare*), excluding vocational teaching.

Both the teaching and target-matching indicators are defined only for graduates with an observed occupation code. Other observed occupations are coded as zero, and neither indicator is additionally conditional on registered employment.

Earnings. I measure annual gross earnings from employment, adjusted to 2017 prices using the consumer price index. The main outcome is annual earnings in levels, expressed in thousands of Swedish kronor and including observed zeros. I also examine an indicator for positive annual earnings and log annual earnings among graduates with positive earnings. Missing earnings are treated separately from observed zeros. Annual earnings reflect both pay and the amount of work undertaken during the year.

For the three-year specifications, I use mean annual earnings across follow-up years 1–3, including observed zeros. For the positive-earnings indicator, the three-year outcome is the share of follow-up years with positive earnings. The log-earnings outcome is the logarithm of mean annual earnings. To keep the sample fixed across annual and three-year specifications, I restrict the log-earnings analysis to graduates with positive observed earnings in all three years. Because this restriction selects individuals based on earnings that may themselves be affected by the reform, the log estimates complement the earnings-level estimates.

4 Empirical Strategy

I exploit variation in program-specific changes introduced by Sweden's 2011 teacher education reform. Preschool teacher education became more professionally differentiated, while

[14] Occupation codes follow SSYK96 in 2011–2013 and SSYK2012 from 2014 onward. SSYK96 combines preschool and leisure-time teachers in a single category. I retain this combined category under SSYK2012 to ensure comparability over time.

primary teacher education combined greater professional differentiation with longer program duration and a requirement for a second-cycle degree. Upper-secondary programs not involving Swedish or civics were lengthened. Lower-secondary programs and upper-secondary programs involving Swedish or civics did not undergo corresponding changes in these dimensions and serve as comparison programs.

Using a difference-in-differences design, I compare changes across entry cohorts between affected and comparison programs, accounting for persistent differences across university–program combinations and changes common to entry cohorts. The main analysis focuses on graduates, whose program affiliation is defined by their awarded qualification. Reform status is determined by the semester of initial enrollment, with candidates entering in autumn 2011 or later classified as post-reform entrants.

The baseline specification is

$$Y_{iugt} = \alpha + \phi_{ug} + \lambda_t + \sum_{k \in \mathcal{T}} \beta_k \left(\text{Post}_t \times \mathbf{1}\{g = k\} \right) + \varepsilon_{iugt}, \tag{1}$$

where Y_{iugt} denotes the outcome for individual i, who entered teacher education program g at university u in semester t. University-by-program fixed effects, ϕ_{ug}, account for persistent differences in student composition and outcomes across programs within universities. Entry-semester fixed effects, λ_t, absorb changes common to entry cohorts across programs, including shared effects of contemporaneous reforms. The indicator Post_t equals one for entrants in autumn 2011 or later, and $\mathcal{T}$ includes preschool, primary, and the lengthened upper-secondary teacher education programs.

Each coefficient β_k estimates the effect of the package of changes introduced in program k, relative to developments in the comparison programs. The estimates therefore capture the combined effect of the program-specific changes, rather than the effect of the reform as a whole, and do not separately identify the contribution of individual design dimensions.

Identification requires that, in the absence of the program-specific changes, outcomes in affected and comparison programs would have followed parallel trends, conditional on the fixed effects. To assess the plausibility of this assumption, I estimate event-study specifications that interact each affected program with academic-year entry cohorts, using the final pre-reform cohort as the reference period. The pre-reform coefficients allow me to examine whether outcomes were already evolving differently before the reform, while the post-reform coefficients describe the timing and evolution of the estimated effects.

For each affected program $k \in \mathcal{T}$, I estimate a separate event-study regression including

graduates from program k and the same set of comparison programs:

$$Y_{iugt} = \alpha^{(k)} + \phi_{ug}^{(k)} + \lambda_t^{(k)} + \sum_{a \neq a_0} \beta_{ka} \mathbf{1}\{g = k\} \mathbf{1}\{a(t) = a\} + \varepsilon_{iugt}^{(k)}. \tag{2}$$

Here, $a(t)$ denotes the academic year of initial enrollment, and $a_0 = 2010/11$ is the final pre-reform entry cohort, which serves as the reference period. Each coefficient β_{ka} measures the change in outcomes between cohorts a_0 and a for program k, relative to the corresponding change in the comparison programs. University-by-program and entry-semester fixed effects are estimated separately for each affected program.

A potential concern is that other reforms introduced around the same time may have affected teacher education programs differently. Appendix A provides an overview of these reforms. I discuss whether these reforms offer plausible alternative explanations for the estimated effects alongside the results.

Standard errors are clustered at the university–program level to allow for correlation across individuals and entry cohorts within each university–program combination. As robustness checks, I also report university-clustered standard errors and wild cluster bootstrap p-values.

Labor-market outcomes. For labor-market outcomes, I extend equation (1) separately for each of the first three follow-up years and for the corresponding three-year outcomes. Follow-up is defined relative to the adjusted graduation year, as described in Section 3.2.

Because teacher education programs differ in length, graduates entering in the same semester may enter the labor market in different years and therefore face different labor-market conditions. These differences are not captured by entry-semester fixed effects. I therefore add graduation-year fixed effects to the preferred labor-market specification, alongside entry-semester and university–program fixed effects. At each follow-up horizon, these additional fixed effects account for labor-market conditions common to graduates observed in the same calendar year.

The labor-market estimates reflect both changes in teacher preparation and qualifications and changes in the composition of graduates. They therefore cannot separate the effects of these changes. The academic selection analysis helps assess changes in graduate composition. As robustness checks, I add flexible controls for pre-entry GPA and estimate the model without graduation-year fixed effects. Controlling for GPA accounts for differences in observed academic achievement but not selection on unobserved characteristics.

Graduates from different teacher education programs enter different segments of the labor market. Although graduation-year fixed effects account for common labor-market conditions,

they do not capture occupation-specific changes in teacher demand or pay, or the effects of other reforms affecting the teaching profession. Such changes could confound the estimates if they affect graduates from the affected and comparison programs differently over time. I discuss these potential alternative explanations alongside the labor-market results.

5 Results

This section presents the results in three steps. First, I examine how the reform changed graduates' academic portfolios, focusing on program duration, degree level, and professional differentiation. Second, I estimate the effects on academic selection, examine alternative explanations, and explore differences across universities in the scope for increased professional differentiation. Finally, I examine graduates' early-career employment, occupational matching, and earnings.

5.1 Program-specific changes among teacher education graduates

Qualifications and completed coursework. The reform extended primary teacher education from 3.5 to 4 years (210 to 240 ECTS) and upper-secondary teacher education in subjects other than Swedish and Civics from 4.5 to 5 years (270 to 300 ECTS). Program duration remained unchanged for preschool, lower-secondary, and upper-secondary programs involving Swedish or Civics. For primary teacher education, four-year pathways had already been possible before the reform but now became mandatory.

Figure 1a shows that degree requirements increased accordingly from the first reformed entry cohort. Table 3 reports relative increases of 24.2 and 26.4 ECTS in degree requirements for primary and affected upper-secondary graduates, respectively. Total completed credits increased by 23.5 and 17.5 ECTS, while the corresponding estimate for preschool graduates was small and statistically insignificant. Completed credits need not follow degree requirements exactly, as they also include coursework outside the program and before initial enrollment.

The reform also made a second-cycle qualification mandatory for primary teacher education, whereas both first- and second-cycle qualifications had been possible before the reform. Figure 1c shows that the share of primary teacher graduates with a second-cycle qualification, measured using the SUN classification, increased from approximately 15 percent to nearly 100 percent. Similarly, Figure 1b shows that their completed advanced-level coursework increased from around 30 to 60 ECTS. Column (3) of Table 3 reports relative increases of 33.9 ECTS for primary teacher graduates and 12.3 ECTS for affected upper-secondary

graduates, compared with the comparison programs.

Professional differentiation. The reform introduced more distinct, occupation-specific pathways for preschool and primary teacher education. To examine how this changed graduates' training, Figure 2 compares their course portfolios before and after the reform. Before the reform, preschool and primary graduates had similar portfolios, with pedagogy and teaching practice accounting for around 60 percent of completed credits. Following the reform, primary teacher education became more subject-oriented, with the share of subject studies increasing from 37.3 to 53.5 percent, while preschool portfolios changed relatively little.

To assess whether training became more distinct between programs and more consistent within them, I construct two measures based on completed credits across six course categories. External separation measures differences between the average portfolios of preschool and primary graduates within the same university and entry semester. Internal fragmentation measures differences among graduates within each program. Both measures use cosine dissimilarity; construction details are provided in Appendix B.3.

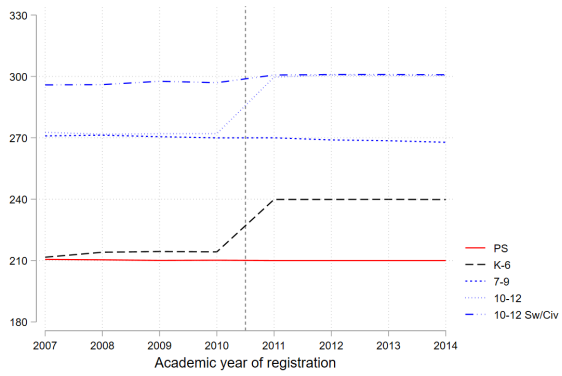
Figure 3 shows that separation between preschool and primary portfolios increased from nearly zero to approximately 0.10 with the first reformed cohort. At the same time, internal fragmentation declined in both programs, although the reduction was more persistent in primary teacher education. Subject-teacher programs also experienced an initial decline in fragmentation, but no comparable increase in separation between programs (Figure C.1).

Overall, the results show that the reform's program-specific changes are reflected in graduates' academic portfolios. Degree requirements increased in primary and affected upper-secondary programs, second-cycle qualifications became mandatory in primary teacher education, and preschool and primary programs developed more distinct and internally consistent course portfolios.

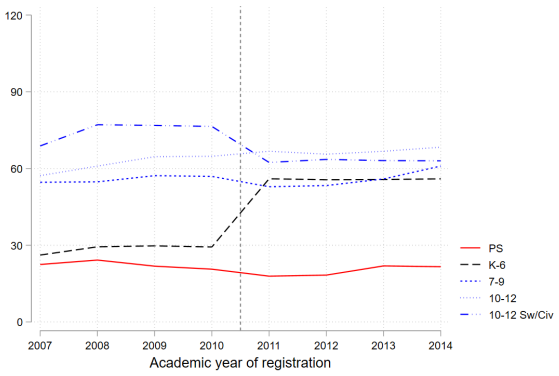
Table 3: Changes in degree requirements and completed coursework

	(1)	(2)	(3)
	Required credits	Total credits	Advanced-level credits
Post × PS	-2.021**	4.531	4.890
	(0.843)	(3.127)	(4.122)
Post × K–6	24.230***	23.450***	33.850***
	(1.959)	(3.224)	(5.988)
Post × 10–12	26.370***	17.510***	12.320**
	(0.891)	(3.317)	(4.939)
Observations	39751	37645	37645
Pre-reform mean (PS)	210.3	220.6	22.2
Pre-reform mean (K–6)	213.5	234.5	28.6
Pre-reform mean (7–9)	270.7	301.2	55.9
Pre-reform mean (10–12)	272.1	309.0	61.9
Pre-reform mean (10–12 Sw/Civ)	296.6	334.8	74.9
University–program clusters	92	92	92
Adj. R^2	0.962	0.395	0.758

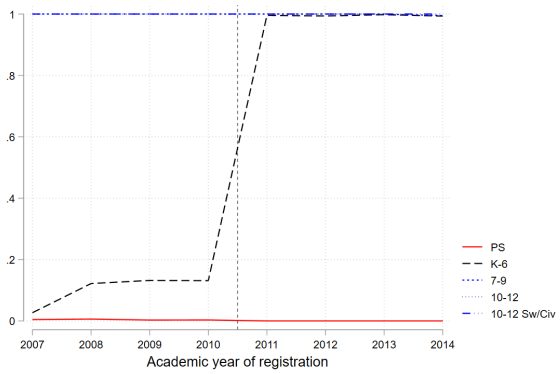
Notes: Outcomes are measured in credits: degree requirements in column (1), accumulated completed credits through the year of graduation in column (2), and accumulated advanced-level credits through that year in column (3). The sample consists of teacher education graduates. Estimates use Equation (1), with university–program and entry-semester fixed effects. Comparison programs are lower-secondary and upper-secondary Swedish/Civics. Standard errors in parentheses are clustered by university–program. Pre-reform means are reported within each regression sample. PS denotes preschool; K–6, 7–9, and 10–12 denote primary, lower-secondary, and upper-secondary teacher education. The 10–12 treatment interaction refers to programs excluding Swedish or civics; 10–12 Sw/Civ denotes qualifications including these subjects. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.



(a) Required credits



(b) Advanced-level credits



(c) Higher-level qualification

Figure 1: Qualifications and coursework by entry cohort and teacher education program

Notes: Panel a reports mean credit requirements recorded for awarded degrees; Panel b reports mean accumulated advanced-level credits through the year of graduation; Panel c reports the share of graduates with a two-digit SUN education-level code of at least 54, a register-based proxy for higher degree level. The sample consists of teacher education graduates, classified by awarded qualification. Initial enrollment cohorts run from autumn 2007 through spring 2015 and are grouped by academic year. Axis labels denote academic-year starting years; 2011 denotes 2011/12, the first cohort exposed to the reform.

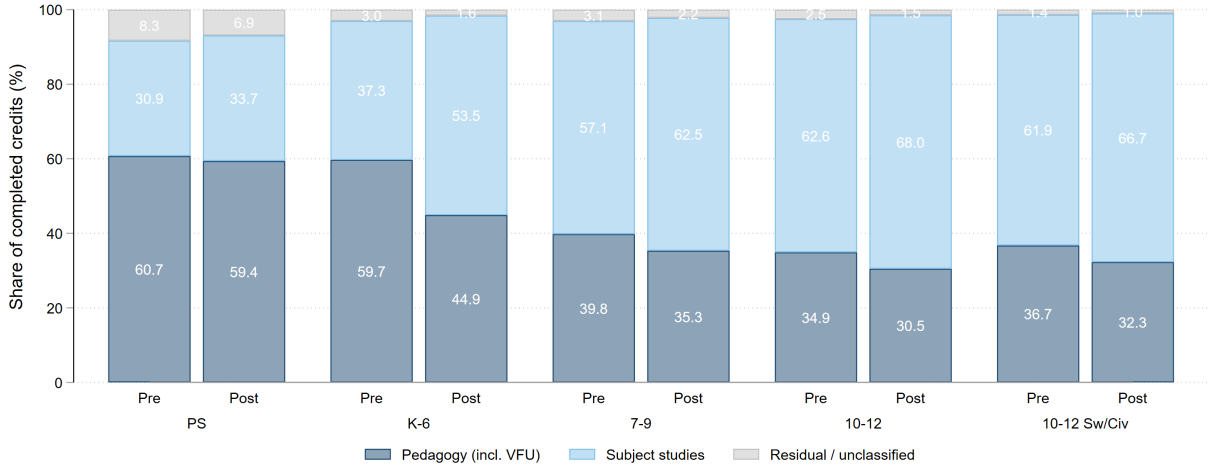
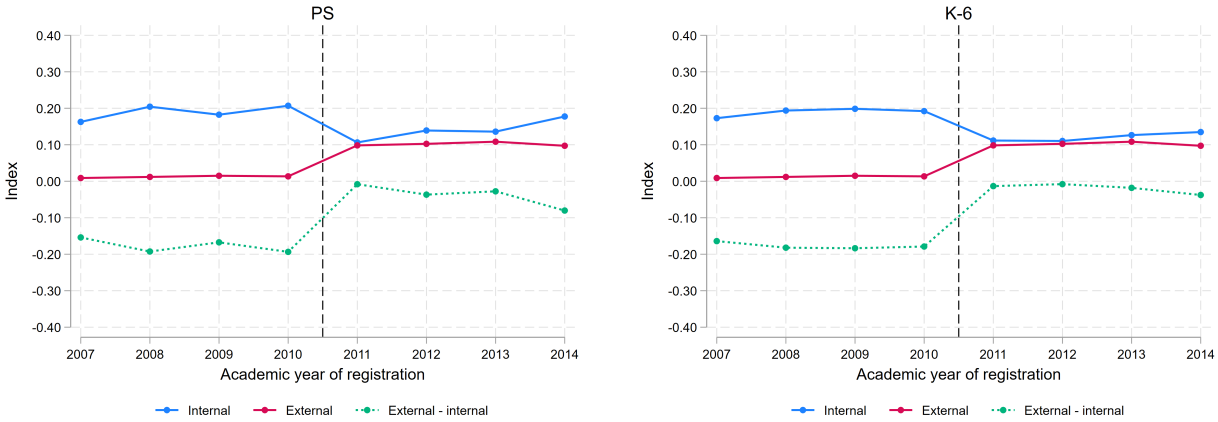


Figure 2: Course portfolios before and after the reform by teacher education program

Notes: The figure reports completed-credit shares in percent among teacher education graduates, using accumulated coursework through the year of graduation. Subject studies combine social sciences, natural sciences, humanities, and practical subjects; pedagogy includes teaching practice (VFU). Programs are classified by awarded qualification. Pre- and post-reform groups are defined by initial enrollment before autumn 2011 and from autumn 2011 onward, respectively. Entry cohorts span autumn 2007–spring 2015. PS denotes preschool; K–6, 7–9, and 10–12 denote primary, lower-secondary, and upper-secondary teacher education. The 10–12 group excludes qualifications including Swedish or civics; 10–12 Sw/Civ includes these qualifications. Appendix B.3 describes the portfolio categories.



(a) Preschool teacher education

(b) Primary teacher education

Figure 3: Trends in professional differentiation in preschool and primary teacher education

Notes: The sample consists of teacher education graduates, classified by awarded qualification. Internal fragmentation measures within-program portfolio heterogeneity; external separation measures differences between mean preschool and primary portfolios and is common to both panels. Both use cosine dissimilarity across six-category completed-credit shares. The green line reports external separation minus internal fragmentation. Series give equal weight to universities. Entry cohorts span autumn 2007–spring 2015; axis labels denote academic-year starting years. The vertical line separates pre-reform cohorts from those entering from autumn 2011 onward. Appendix B.3 provides definitions and aggregation details; Figure C.1 reports the subject-teacher measures.

5.2 Academic Selection into Teacher Education

Having documented how the reform changed graduates' academic portfolios, I next examine whether it also affected their academic composition. I measure academic selection using upper-secondary GPA, recorded before entry into teacher education. I first present the results for graduates and then examine entrants and progression to graduation to assess whether the changes originated at enrollment or during the program.

Column (1) of Table 4 shows that pre-entry GPA increased by 0.11 and 0.14 standard deviations among preschool and primary teacher graduates, respectively, relative to the comparison programs. Both effects are statistically significant and particularly notable given the relatively low pre-reform GPA among graduates from these programs. No statistically significant change is found among affected upper-secondary teacher graduates. The concentration of selection gains in preschool and primary teacher education suggests that increased professional differentiation may have played an important role.

Column (2) shows that the share of primary teacher graduates with at least one parent with tertiary education increased by 5.6 percentage points. The corresponding estimate for preschool graduates is smaller and not statistically significant (2.6 percentage points). Columns (3) and (4) show no statistically significant changes in age at entry or gender composition.

Figures 4a–4c show no clear evidence of differential pre-reform trends in GPA for any of the treated groups.[15]

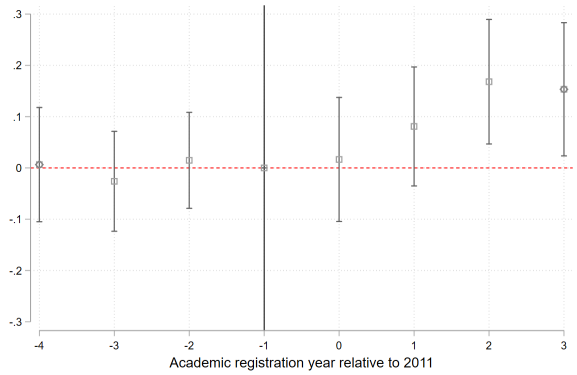
The results are also robust to alternative specifications and inference procedures. Table D.1 in Appendix D shows that the GPA gains among preschool and primary graduates remain similar when accounting for university-specific cohort shocks or excluding individual universities. Both effects also remain statistically significant with university-level clustering and wild cluster bootstrap inference. For affected upper-secondary graduates, the estimates remain negative but are not statistically significant at the five-percent level.

[15] Joint tests of the pre-reform coefficients yield p-values of 0.81, 0.85, and 0.82 for preschool, primary, and affected upper-secondary teacher education programs, respectively.

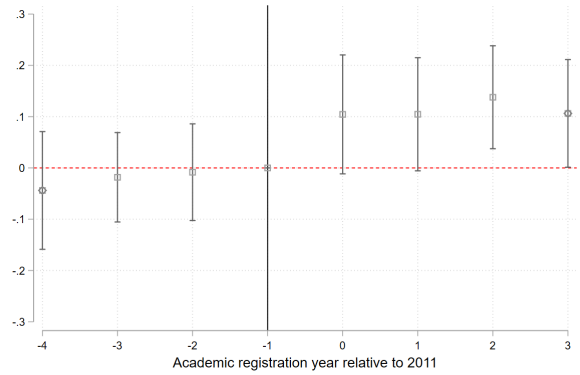
Table 4: Effects on the composition of teacher education graduates

	(1)	(2)	(3)	(4)
	Std. GPA	Parental tertiary education	Age at entry	Female
Post × PS	0.108**	0.026	-0.737	0.014
	(0.042)	(0.019)	(0.897)	(0.019)
Post × K–6	0.137***	0.056***	-0.421	-0.009
	(0.040)	(0.020)	(0.504)	(0.022)
Post × 10–12	-0.064	-0.015	-0.589	-0.017
	(0.042)	(0.025)	(0.576)	(0.027)
Observations	35691	37175	39683	39683
Pre-reform mean (PS)	0.105	0.305	28.564	0.962
Pre-reform mean (K–6)	0.214	0.397	26.096	0.910
Pre-reform mean (7–9)	0.299	0.485	26.969	0.713
Pre-reform mean (10–12)	0.539	0.574	25.473	0.545
Pre-reform mean (10–12 Sw/Civ)	0.523	0.568	23.921	0.611
University–program clusters	92	92	92	92
Adj. R^2	0.053	0.045	0.118	0.182

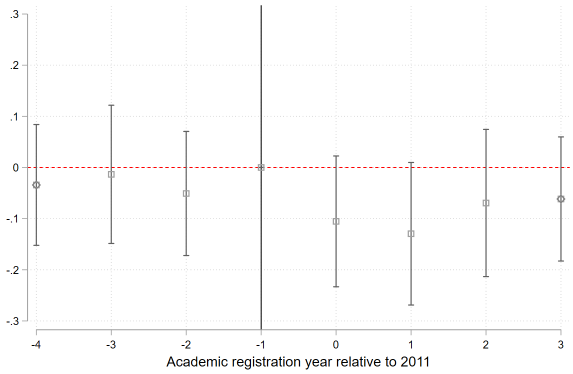
Notes: The outcomes are standardized pre-entry GPA, parental tertiary education, age at entry in years, and female status. GPA is standardized within upper-secondary school graduation cohorts. Parental tertiary education and female status are indicators; their coefficients, standard errors, and means are reported as proportions. Parental tertiary education identifies at least one parent with a tertiary degree, measured in 2007. The sample consists of teacher education graduates, classified by awarded qualification; reform exposure is determined by initial enrollment. Estimates use Equation (1), with university–program and entry-semester fixed effects. Comparison programs are lower-secondary and upper-secondary Swedish/Civics. Standard errors in parentheses are clustered by university–program. Pre-reform means are reported within each regression sample. PS denotes preschool; K–6, 7–9, and 10–12 denote primary, lower-secondary, and upper-secondary teacher education. The 10–12 treatment interaction refers to programs excluding Swedish or civics; 10–12 Sw/Civ denotes qualifications including these subjects.
$^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.



(a) Preschool teacher education (PS)



(b) Primary teacher education (K–6)



(c) Lengthened upper-secondary (10–12)

Figure 4: Event-study estimates of the effect on the academic composition of teacher education graduates

Notes: The outcome is pre-entry GPA, standardized within upper-secondary school graduation cohorts. The sample consists of teacher education graduates, classified by awarded qualification. Each panel reports a separate event-study regression using Equation (2), comparing the indicated treated program with lower-secondary and upper-secondary Swedish/Civics teacher education. The affected upper-secondary group excludes qualifications including Swedish or civics. Event time is defined by academic year of initial enrollment: 2011/12 is $t = 0$, and 2010/11 ($t = -1$) is the omitted cohort. All specifications include university–program and entry-semester fixed effects. Standard errors are clustered by university–program; error bars show 95 percent confidence intervals.

5.2.1 Alternative Explanations

The increase in graduates' GPA does not necessarily imply that the reform attracted academically stronger students. I consider four alternative explanations. First, the higher GPA among graduates could reflect positive selection into graduation rather than improved recruitment. If students with higher pre-entry GPA became more likely to complete their degrees relative to students with lower GPA, the academic composition of graduates could improve even without any change in the composition of entrants. Second, reduced admission capacity could mechanically raise average GPA by excluding applicants with lower grades. Third, academically stronger students may have shifted from comparison programs into preschool and primary teacher education. This could raise GPA in the treated programs while lowering it in the comparison programs, thereby amplifying the difference-in-differences estimates. Finally, other reforms may have affected the relative attractiveness of different teaching occupations and influenced students' choices.

I examine these explanations using GPA at entry, degree completion, enrollment counts, the GPA distribution, and applicants' ranked program choices. I also consider the timing and coverage of other reforms discussed in Appendix A.

Graduation effects. The higher GPA among graduates could reflect positive selection into graduation rather than improved recruitment. If students with lower pre-entry GPA became less likely to complete their degrees after the reform, average graduate GPA could increase even without any change in the composition of entrants.

To examine this possibility, I compare changes in GPA among entrants and graduates and examine degree completion. For this analysis, program affiliation is defined at enrollment rather than by awarded degree. This classification is less precise before the reform, when broad programs could lead to different teaching qualifications. Moreover, upper-secondary subject specializations cannot be distinguished at entry, so the comparison group includes all upper-secondary and lower-secondary teacher entrants.

Table D.2 in Appendix D reports the results. Column (1) shows graduate GPA increases of 0.117 and 0.138 standard deviations for preschool and primary teacher education, respectively, close to the main estimates. Column (2) shows that degree completion declined by 5.9 percentage points among primary teacher entrants, while the smaller decline for preschool entrants (2.1 percentage points) is not statistically significant.[16] Column (3) shows that GPA also increased among all entrants, by 0.144 and 0.150 standard deviations for preschool and primary teacher education, respectively.

[16]Completion is defined as obtaining a teaching degree within three years of expected graduation.

The GPA gains are already evident at enrollment and are slightly larger than those observed among graduates. This establishes improved selection at entry as a key component of the gains among graduates, rather than an effect arising solely from differential completion.

Capacity constraints. The increase in entrants' GPA could also arise from reduced admission capacity rather than improved recruitment. If programs admitted fewer students with lower GPA, average GPA could increase without attracting more academically strong candidates. This explanation would imply a reduction in enrollment and improvements concentrated in the lower end of the GPA distribution.

Panel A of Table D.3 in Appendix D shows no evidence of reduced enrollment. The estimated number of entrants increased by 29.0 and 11.0 per university–program–semester cell for preschool and primary teacher education, respectively, although the latter estimate is imprecise. Moreover, the GPA distribution improved at both ends. The share of entrants below the pre-reform 25th percentile fell by 6.6 and 6.8 percentage points, respectively, while the share above the 90th percentile increased by 4.7 and 3.9 percentage points. Panels B and C show similar patterns among graduates.

Together, these findings indicate that the improvement in academic selection was not driven by reduced admission capacity, but also involved an increased representation of academically strong students.

Reallocation from comparison programs. Improved recruitment into preschool and primary teacher education necessarily involves students choosing these programs over other programs. Such reallocation is part of the reform's recruitment effect. The concern for identification arises if academically stronger students are drawn specifically from the comparison teacher education programs. This would raise GPA in the treated programs while lowering it in the comparison group, thereby amplifying the difference-in-differences estimates.

If reallocation from comparison programs were an important driver of the results, we would expect a corresponding decline in their GPA around the reform. Figure D.1 shows a pronounced upward shift in GPA among primary teacher graduates and a smaller, more gradual increase among preschool graduates. GPA subsequently declines in several program groups, including primary and the comparison programs, although primary remains above its pre-reform level. Importantly, the comparison programs show no comparable discontinuous decline at the time of the reform.

To further assess whether these programs are close substitutes, I examine applicants' ranked choices using admissions data from autumn 2015. These choices reflect the post-reform equilibrium, in which students induced by the reform to choose preschool or primary

teacher education are included among those admitted to these programs. Their alternative choices are therefore informative about potential substitution with the comparison programs. For each admitted applicant, I identify the next lower-ranked distinct program as a proxy for an alternative educational choice. [17]

Table D.4 shows that subject-teacher education, which includes the comparison programs, was rarely the next alternative. Among applicants admitted to preschool and primary teacher education, only 2.7 and 7.6 percent, respectively, listed subject-teacher education as their next distinct alternative. By contrast, preschool and primary teacher education were more frequently listed as alternatives to one another: 14.4 percent of preschool applicants listed primary as their next alternative, compared with 24.9 percent in the opposite direction. Moreover, 48.2 percent of preschool applicants and 35.0 percent of primary applicants listed no distinct lower-ranked alternative. All shares are calculated among admitted applicants, including those without another alternative.

Together, the GPA trends and applicants' ranked choices provide little support for reallocation from comparison programs as a major explanation for the estimated selection gains.

Other reforms. A final concern is that other reforms may have affected the attractiveness of different teaching occupations and thereby influenced academic selection. I assess this possibility by considering which teacher groups were affected and whether the timing of these reforms matches the observed GPA changes. Further details are provided in Appendix A.

The introduction of teacher certification requirements affected all teacher categories and recognized relevant older degrees. Any common recruitment response is therefore absorbed by the registration-semester fixed effects. The simultaneous clarification of preschool teachers' responsibilities may have contributed to the preschool result, but cannot explain the improvement among primary teacher graduates.

The expansions of mathematics instruction in 2013 and 2016 may have increased demand for primary teachers. However, the increase in primary graduates' GPA began in 2011 and remained relatively stable thereafter (Figure 4), making these later changes unlikely to explain the initial improvement.

The 2013 career-ladder reform improved career opportunities in school teaching but excluded preschool. It would therefore be expected to favor school teaching relative to preschool, contrary to the positive preschool result. Since both primary and comparison occupations were covered, explaining the primary result would require different recruitment

[17] Applications to the same type of teacher education at different universities are treated as a single educational choice. Comparable pre-reform application data are unavailable.

responses within the school sector. Moreover, the early and relatively stable primary GPA gain provides little support for this explanation. Timing is less decisive for preschool, where the GPA increase was more gradual and the career reform had been proposed before implementation.

Finally, the Teacher Salary Boost was introduced in 2016, after all cohorts in the analysis had entered teacher education. Its budget proposal also followed the application deadline for the final cohort. Although earlier political commitments may have influenced some applicants, the reform cannot readily explain GPA gains beginning in 2011.

Taken together, the timing and coverage of these reforms provide limited support for them as the main explanation for the improvements in academic selection.

5.2.2 Professional Differentiation and Academic Selection

If clearer professional pathways helped attract academically stronger students, selection gains may have been larger at universities where there was greater scope for increased professional differentiation. Before the reform, universities differed in how consistent course portfolios were within programs and how distinct preschool and primary teacher education were from each other. Universities with more fragmented programs and greater overlap between the two programs therefore had more room to establish coherent and distinct educational pathways.

To examine this, I use the measures of internal fragmentation and external separation introduced in Section 5.1, with their construction described in Appendix B.3. I investigate whether their pre-reform values are associated with changes in graduates' GPA following the reform. The analysis compares GPA changes across universities within preschool and primary teacher education, accounting for permanent differences between university–program combinations and changes common to each program over time. Both measures are included jointly.

Table D.5 shows that GPA gains were larger where pre-reform programs were more internally fragmented and preschool and primary portfolios were less distinct. A 0.10 higher pre-reform fragmentation index is associated with GPA increases that are 0.18 standard deviations larger for preschool and 0.15 for primary teacher graduates. Similarly, a 0.10 lower pre-reform separation index is associated with GPA gains that are 0.05 and 0.07 standard deviations larger, respectively. Both associations are statistically significant at the five-percent level for preschool and at the ten-percent level for primary.

These findings suggest that the reform improved academic selection most where there was greater scope to create coherent and differentiated educational pathways. Although the effects of individual reform components cannot be separately identified, the patterns are consistent with professional differentiation playing an important role in the selection gains.

5.3 Labor-market outcomes

I next examine graduates' early-career employment, entry into teaching, occupational matching, and earnings. The analysis uses the labor-market sample described in Section 3.[18] The reform introduced different changes across programs that may have affected their labor-market opportunities. Preschool and primary teacher education became more professionally differentiated, while primary teacher education was also extended and required a second-cycle qualification. Affected upper-secondary programs were extended to provide additional subject-specific training.

These changes may affect labor-market outcomes in different ways. Longer and more advanced training may improve graduates' preparation and earnings, while clearer professional pathways may improve occupational matching but reduce flexibility to work in related teaching occupations.

The consequences of increased professional differentiation may also depend on graduates' occupational allocation before the reform. Table 5 reports occupational destinations one year after graduation. Before the reform, 54.5 percent of primary teacher graduates worked in compulsory-school teaching, while 38.5 percent worked in preschool or leisure-time teaching. Preschool teacher graduates, by contrast, were already largely employed in their intended occupation, with 89.3 percent working in preschool or leisure-time teaching.

Following the reform, the share of primary teacher graduates working in compulsory-school teaching increased to 91.2 percent, while the share in preschool or leisure-time teaching fell to 3.6 percent. The corresponding occupational distribution among preschool graduates changed relatively little. Although these are descriptive changes, they illustrate the different starting points of the two programs and the greater scope for improved occupational matching among primary teacher graduates.

Employment and occupational matching. I distinguish between overall employment, employment in teaching, and employment in the occupation targeted by each degree. This distinction helps establish whether the reform affected graduates' overall labor-market attachment or their allocation across teaching occupations.

Table E.2 shows that employment was already high before the reform, at approximately 97–98 percent. Preschool teacher graduates experienced a relative decline in employment of 2.2 percentage points over the first three years after graduation. No statistically significant changes are found for primary or affected upper-secondary graduates.

[18]The labor-market sample requires three years of observed outcomes and therefore differs from the main graduate sample. Table E.1 shows that changes in graduates' pre-entry academic composition are similar across the two samples.

Table 5: Occupational destinations one year after graduation

Program	Preschool/ leisure-time	Compulsory school	Upper-secondary	Other teaching	Other occupations	Observed SSYK (%)
Panel A: Pre-reform entrants						
PS	**89.3**	5.1	0.0	0.1	5.5	90.1
K–6	38.5	**54.5**	0.5	1.3	5.1	90.0
7–9	2.6	**70.3**	12.8	2.6	11.9	91.6
10–12	1.9	50.0	**33.2**	3.6	11.3	90.5
10–12 Sw/Civ	1.1	46.1	**37.4**	3.2	12.2	91.4
Panel B: Post-reform entrants						
PS	**92.6**	0.8	0.1	0.1	6.5	92.4
K–6	3.6	**91.2**	0.8	1.1	3.3	97.0
7–9	0.4	**90.9**	4.1	0.9	3.7	98.0
10–12	0.5	48.7	**39.0**	2.2	9.6	96.1
10–12 Sw/Civ	0.2	40.7	**47.7**	1.7	9.8	96.8

Notes: Occupational shares are percentages among graduates with observed SSYK codes in the first follow-up year and sum to 100 before rounding. The final column reports SSYK coverage among all graduates in each row, including those with missing codes. The sample includes graduates from June 2012–February 2020 with register coverage for three follow-up years through 2022. Occupational shares require an observed code only in year 1; codes need not be observed in years 2 and 3. Follow-up uses the adjusted graduation year defined in Section 3.2. Programs are classified by awarded qualification; reform exposure is determined by initial enrollment. PS denotes preschool; K–6, 7–9, and 10–12 denote primary, lower-secondary, and upper-secondary teacher education. The 10–12 row excludes qualifications including Swedish or civics, reported separately as 10–12 Sw/Civ. Bold entries identify target occupations: preschool/leisure-time teaching for PS, compulsory-school teaching for K–6 and 7–9, and general upper-secondary teaching for both 10–12 groups. SSYK does not distinguish primary from lower-secondary teaching; preschool and leisure-time teaching are combined for comparability across classifications.

Table E.3 reports employment in teaching occupations among graduates with observed occupation codes. Panel A shows a relative decline of 4.7 percentage points in teaching employment among preschool graduates, while the estimates for primary and affected upper-secondary graduates are not statistically significant.

Panel B shows a different pattern for occupational matching. Primary teacher graduates became 17.8 percentage points more likely to work in their intended occupation, compulsory-school teaching, relative to a pre-reform mean of 58.3 percent. Combined with the absence of a significant increase in overall teaching employment, this suggests that the reform primarily changed how primary graduates were allocated across teaching occupations.

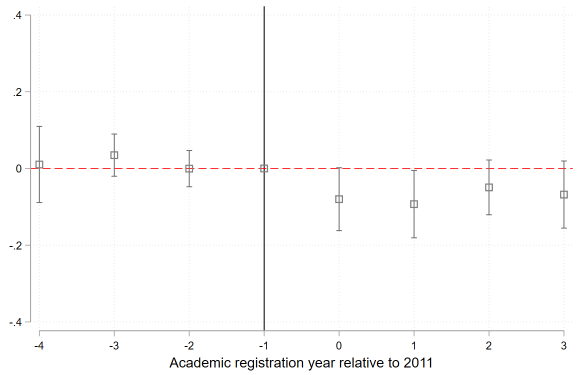
For preschool graduates, target matching declined by 9.2 percentage points relative to the comparison programs, while affected upper-secondary graduates experienced a smaller relative decline of 5.7 percentage points. These estimates reflect relative changes and do not necessarily imply declines in absolute matching rates.

Figure 5 shows that the positive matching estimates for primary graduates emerge with the first reformed cohort and remain positive thereafter. However, the earliest pre-reform estimate is negative, and the joint pre-trend test rejects at the ten-percent level, warranting some caution in interpreting the matching effect.

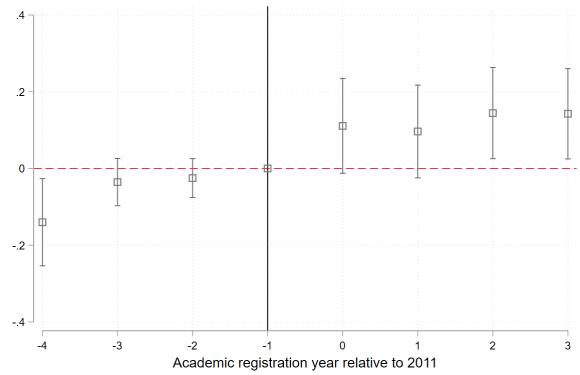
Earnings. Table E.4 reports graduates' annual earnings over the first three years after graduation. Panel A includes zero earnings and measures income in SEK at 2017 prices. Preschool teacher graduates experienced a relative decline in average annual earnings of SEK 26,700. In contrast, earnings increased by SEK 10,100 for primary teacher graduates and SEK 11,800 for affected upper-secondary teacher graduates. All three estimates are statistically significant. For upper-secondary graduates, the earnings gains were concentrated in the first two years.

Panel C shows similar patterns in log earnings among graduates with positive earnings in all three years. Average earnings declined by approximately 6.8 percent for preschool graduates, while increasing by 5.1 percent for primary and 4.3 percent for affected upper-secondary graduates.

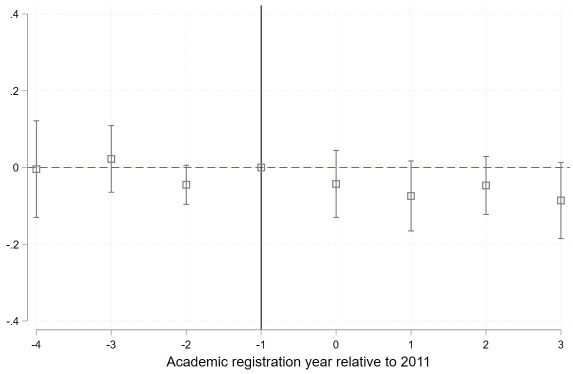
Figure 6 shows that the negative earnings estimates for preschool graduates emerge with the first reformed cohort and persist thereafter. The estimates for primary and affected upper-secondary graduates are generally positive but less precisely estimated across individual cohorts. The event studies show no clear evidence of differential pre-reform earnings trends.



(a) Preschool teacher education (PS)



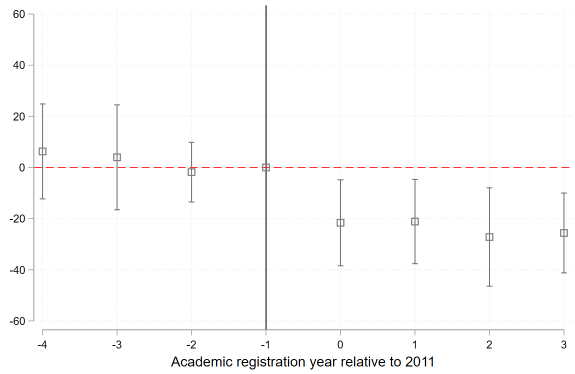
(b) Primary teacher education (K–6)



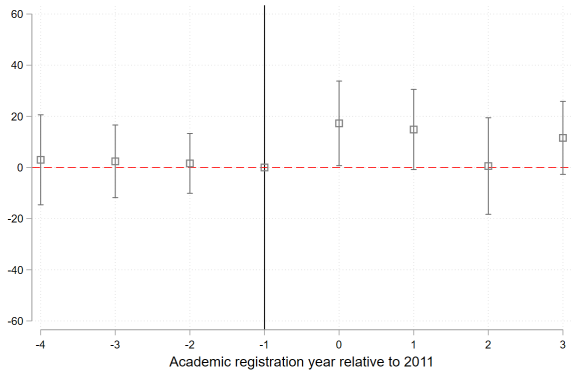
(c) Lengthened upper-secondary (10–12)

Figure 5: Event-study estimates of target matching

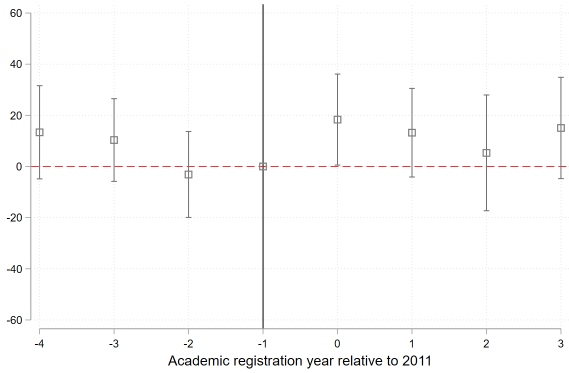
Notes: The outcome is mean target matching over years 1–3, in probability units; multiply by 100 for percentage points. The sample includes graduates from June 2012–February 2020 with observed occupation codes in all three years, without conditioning on registered employment. Target occupations follow the definitions in Section 3.3. Each panel compares one treated program with lower-secondary and upper-secondary Swedish/Civics teacher education, including university–program, entry-semester, and adjusted graduation-year fixed effects. Event time follows initial enrollment: 2011/12 is $t = 0$ and 2010/11 ($t = -1$) is omitted. The black vertical line marks the omitted cohort; the red dashed horizontal line marks zero. Error bars show 95 percent confidence intervals with standard errors clustered by university–program. All panels use the same vertical scale.



(a) Preschool teacher education (PS)



(b) Primary teacher education (K–6)



(c) Lengthened upper-secondary (10–12)

Figure 6: Event-study estimates of mean annual earnings, years 1–3

Notes: The outcome is mean annual earnings over years 1–3, including observed zeros, in SEK 1,000 at 2017 prices. The sample includes graduates from June 2012–February 2020 with observed earnings in all three years. Each panel compares one treated program with lower-secondary and upper-secondary Swedish/Civics teacher education, including university–program, entry-semester, and adjusted graduation-year fixed effects. Event time follows initial enrollment: 2011/12 is $t = 0$ and 2010/11 ($t = -1$) is omitted. The black vertical line marks the omitted cohort; the red dashed horizontal line marks zero. Error bars show 95 percent confidence intervals with standard errors clustered by university–program. All panels use the same vertical scale.

Robustness. Table E.5 shows that the main results are largely robust to alternative graduation windows, controls for pre-entry GPA, fixed-effect specifications, and inference methods. The primary target-matching effect remains between 17 and 21 percentage points, while the negative estimates for preschool graduates' teaching employment, occupational matching, and earnings persist across specifications. The positive earnings estimate for affected upper-secondary graduates is also stable in magnitude.

However, the evidence for higher earnings among primary graduates and lower target matching among affected upper-secondary graduates is less precise when using university-level clustering and wild cluster bootstrap inference.

Alternative explanations. A potential concern is that occupation-specific changes in labor demand and pay may have affected graduates from treated and comparison programs differently. Graduation-year fixed effects account for common labor-market conditions, but not differences across teaching occupations.

The timing of the effects provides some evidence against this explanation. Figure 5 shows that the improvement in occupational matching among primary graduates emerges with the first reformed cohort. Similarly, Figure 6 shows a persistent earnings decline among preschool graduates beginning with the first reformed cohort. These patterns are consistent with changes in teacher preparation rather than gradual shifts in labor demand affecting successive cohorts independently of their training.

However, some caution is warranted when interpreting these estimates, as occupation-specific changes in labor demand and pay could coincide with the reform. This concern is particularly relevant for preschool graduates, whose labor market is less closely related to that of the subject-teacher comparison group. Differences in wage growth and exposure to teacher pay initiatives may therefore have contributed to their weaker relative earnings.

Changes in teacher certification requirements provide another possible explanation. However, relevant degrees from the previous teacher education system continued to qualify graduates for certification, limiting the scope for differences in formal eligibility between pre- and post-reform graduates. Appendix A provides further details on these rules and related reforms.

Overall, the timing of the effects is consistent with the teacher education reform, although occupation-specific labor-market developments may also have contributed to the estimated effects.

Discussion. Taken together, the labor-market results suggest a potential trade-off between occupational matching and flexibility. Primary teacher graduates became more likely to

work in compulsory-school teaching, without a corresponding increase in overall entry into teaching. This is consistent with clearer professional pathways improving the allocation of graduates across teaching occupations. For preschool graduates, who were already largely employed in their intended occupation before the reform, more specialized training may instead have limited opportunities in related teaching roles, contributing to weaker relative employment and earnings.

The positive earnings effects among graduates from lengthened upper-secondary programs suggest potential benefits from additional subject-specific preparation, even without clear improvements in academic selection or occupational matching. However, these interpretations remain suggestive. The estimates capture the combined effects of changes in training, qualifications, and graduate composition, rather than the separate effects of individual reform components.

6 Conclusion

Teacher education is the main pathway into the teaching profession. Given the importance of teachers for pupils' learning, how teacher education can be organized to attract strong candidates and prepare them well is an important policy question. This paper examines how teacher education design affects academic selection and early-career labor-market outcomes. I study Sweden's 2011 teacher education reform, which aimed to improve the quality and attractiveness of teacher education by creating more coherent programs better aligned with different teaching roles. The reform introduced different changes in program organization and requirements, which I exploit in a difference-in-differences design to estimate the effects of these program-specific changes.

I find that preschool and primary teacher education, which became more professionally differentiated, experienced improvements in the academic composition of their graduates. Pre-entry GPA increased by 0.11 and 0.14 standard deviations, respectively, relative to comparison programs, while lengthened upper-secondary programs showed no comparable improvement. The selection gains were already evident at enrollment. Across universities, these gains were larger where pre-reform course portfolios were more heterogeneous within programs and more similar between preschool and primary teacher education, leaving greater scope for increased professional differentiation. Together, these findings suggest that clearer pathways into specific teaching occupations may help attract academically stronger candidates.

The labor-market results point to a potential trade-off between occupational matching and flexibility. Before the reform, primary teacher graduates worked across several teaching

occupations, whereas preschool teacher graduates were already largely employed in their intended occupation. Following the reform, primary teacher graduates experienced improved occupational matching and higher earnings, while preschool teacher graduates experienced weaker relative employment and earnings. These contrasting findings are consistent with clearer professional pathways facilitating entry into intended occupations while potentially limiting opportunities in related teaching occupations.

Many professional education programs struggle to attract academically strong candidates. Raising admission requirements can mechanically improve the academic composition of admitted students without making a program more attractive. The findings of this paper suggest that changing how education is organized may offer another way to improve academic selection. By strengthening the connection between training and its intended occupation, programs may attract academically stronger candidates without raising entry barriers. However, this may not be a general solution. The improvements documented here occurred in programs with relatively low levels of academic selection before the reform. Moreover, clearer professional pathways may come at the cost of reduced flexibility to work in related occupations, which can itself be an attractive feature for prospective students.

The reform changed several aspects of teacher education simultaneously, making it difficult to isolate the effects of individual components. More importantly, while this paper examines academic selection and graduates' early-career labor-market outcomes, it does not establish whether these changes ultimately improve teaching effectiveness. An important direction for future research is therefore to examine how the organization of teacher education affects teachers' classroom performance and pupils' learning. Ultimately, the challenge is not only to attract stronger candidates into teaching, but also to prepare them to become effective teachers.

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Appendix A Other contemporaneous reforms

The teacher education reform coincided with broader changes in Swedish education. This appendix summarizes their timing, institutional content, and coverage across teaching occupations.

Teacher certification and induction. A national certification system for teachers and preschool teachers (*lärarlegitimation*) was legislated in 2011. It linked qualifications to teaching eligibility, permanent employment, and independent grading. Following a delay, central requirements began to apply in December 2013, with transitional provisions for previously employed teachers extending to July 2015 (Sveriges riksdag, 2012). The system recognized both new qualifications and relevant older degrees, with eligibility determined by the school forms, grades, and subjects covered by the qualification (SFS, 2011). Newly graduated teachers and preschool teachers initially had to complete an induction period before obtaining certification. This condition was removed in July 2014, while employers remained responsible for providing induction (Regeringen, 2014).

Curricula and teaching requirements. New curricula for compulsory and upper-secondary education, Lgr11 and Gy11, and an A–F grading scale were introduced in 2011. Grading was extended to grade 6 in autumn 2012 (SOU, 2013; Sveriges riksdag, 2013). Preschool became a separate school form in 2011, and its revised curriculum clarified preschool teachers' pedagogical responsibilities (Skolinspektionen, 2016). Mathematics instruction was expanded by 120 hours from autumn 2013, intended for grades 1–3, and by a further 105 hours from autumn 2016, intended for grades 4–6 (Regeringen, 2013, 2016).

Career ladders. A career reform was proposed in the budget bill for 2012, followed by a detailed proposal in September 2012 (Statskontoret, 2015). The state-supported career-ladder reform introduced first-teacher and senior-lecturer positions (*förstelärare* and *lektor*) in 2013. It covered school forms from preschool class through upper-secondary and adult education, but not preschool. First-teacher positions generally required certification and at least four years of documented teaching experience; senior-lecturer positions additionally required a research qualification (SFS, 2013).

The Teacher Salary Boost. The Teacher Salary Boost (*Lärarlönelyftet*) was announced in the budget bill for 2015 and implemented in 2016 (Sveriges riksdag, 2019). It funded salary increases for selected qualified teachers in preschool class, compulsory education,

and upper-secondary education, including corresponding special-school forms. Participating organizers could allocate up to 10 percent of their funding to preschool and leisure-time centers (Statskontoret, 2017). Eligibility required demonstrated professional qualifications rather than a general four-year experience threshold. Recently graduated teachers were not categorically excluded, although the subsidy could not finance the initial hiring itself (SFS, 2016).

Appendix B Data information

B.1 Classifying program affiliation

I classify graduates into the five program types studied by combining information on their awarded qualification, teaching orientation, and subject specialization. I assign a student the first relevant teacher degree within three years of expected nominal duration. The information required for this classification differs across the two periods. Before the reform, graduates received a common Teacher degree (*Lärarexamen*), so the degree title alone does not distinguish between teaching roles. After the reform, separate degree titles broadly distinguish preschool, primary, and subject teachers. A more detailed classification requires information on teaching orientation in both periods.

I use the recorded teaching orientation to identify the school stage for which each qualification prepares graduates. This information is essential for distinguishing teaching roles within the common pre-reform degree and for separating lower- from upper-secondary subject teachers after the reform. For broad pre-reform orientations covering preschool, leisure-time centres, and the earlier school years, I additionally use the recorded specialization to distinguish among three teaching roles: preschool teaching, leisure-time teaching, and primary teaching. Explicit preschool and leisure-time specializations are assigned to their respective categories, while the remaining qualifications within these broad orientations are assigned to primary teaching where the educational classification permits. For qualifications whose teaching role remains unspecified, I use the graduate's initial program orientation to complete the assignment. Leisure-time teaching is classified separately and excluded from the five program types studied.

Finally, I use the teaching subjects recorded in the degree description to divide upper-secondary graduates into two categories. Qualifications including Swedish, civics, or both form the comparison category, while the remaining upper-secondary qualifications form the category affected by the increase in program duration. Swedish as a second language alone does not count as Swedish in this classification.

B.2 Sample selection

Table B.1: Analysis samples and follow-up restrictions

Sample	Observations
Teacher education entrants	72,508
Teacher education graduates	39,751
Graduation-window restriction for labor-market analysis	
Graduates, June 2012–February 2020	32,986

Notes: Counts refer to individuals who first enrolled in a relevant teacher education program between autumn 2007 and spring 2015. The entrant and graduate samples cover the same set of higher education institutions. The final row restricts graduates to the June 2012–February 2020 graduation window used for labor-market analysis. Counts precede linkage to labor-market records and outcome-specific exclusions, including follow-up requirements.

B.3 Proxies of Professional Differentiation

To measure the curricular dimension of professional differentiation, I construct two complementary proxies from graduates' accumulated course portfolios. Internal fragmentation measures heterogeneity within a degree program, while external separation measures differences between programs preparing graduates for related teaching roles. Lower fragmentation and greater separation are consistent with more coherent and distinct educational pathways. The measures describe realized training among graduates rather than professional identity or prospective students' perceptions directly.

Course portfolios and measurement cells. For each graduate, I use accumulated course credits observed through the graduation year. The six-category portfolio distinguishes social sciences, natural sciences, humanities, practical subjects, pedagogy including teaching practice, and residual or unclassified coursework. Let c_{ib} denote graduate i's credits in category b. The portfolio vector is

$$\mathbf{s}_i = (s_{i1}, \ldots, s_{i6})', \qquad s_{ib} = \frac{c_{ib}}{\sum_{\ell=1}^{6} c_{i\ell}}. \tag{3}$$

The shares sum to one. Retaining residual coursework separately avoids assigning credits with uncertain content to a substantive course category.

A valid portfolio requires nonmissing, nonnegative credits in all six categories, a positive recorded cumulative credit total, and agreement between the category sum and that total within 0.1 credits. Missing credits are not automatically recoded to zero. The shares are normalized by the category sum after this check.

I group graduates by university u, initial registration semester t, and the orientation of their completed degree g. The five program categories are preschool, primary, lower-secondary, upper-secondary excluding Swedish/Civics, and upper-secondary Swedish/Civics. Each graduate receives equal weight within a cell. Cells with fewer than five valid individual portfolios are excluded.

Internal fragmentation. For two portfolio vectors, cosine dissimilarity is

$$d(\mathbf{a}, \mathbf{b}) = 1 - \frac{\mathbf{a}'\mathbf{b}}{\|\mathbf{a}\| \, \|\mathbf{b}\|}. \tag{4}$$

For nonnegative credit-share vectors, dissimilarity ranges from zero to one. It equals zero for identical compositions and one when the portfolios have no content categories in common.

Let $\mathcal{I}_{ugt}$ be the set of graduates with valid portfolios in university–program–registration-semester cell (u, g, t), and let $n_{ugt} = |\mathcal{I}_{ugt}|$. Internal fragmentation is the mean dissimilarity across all distinct pairs of graduates within the cell:

$$F_{ugt} = \frac{2}{n_{ugt}(n_{ugt} - 1)} \sum_{\substack{i<j \\ i,j \in \mathcal{I}_{ugt}}} d(\mathbf{s}_i, \mathbf{s}_j). \tag{5}$$

Thus, the measure averages pairwise distances rather than distances from individual portfolios to a mean portfolio. Higher values indicate greater variation in the allocation of credits across content categories within the same program. Lower values are consistent with a more uniform curricular route into a given teaching role.

External separation. External separation compares the mean portfolios of programs within two families: preschool and primary education form one family, while the three subject-teacher categories form the other. Programs are compared within the same university and registration semester; early-years and subject-teacher programs are not compared with one another.

The mean portfolio is

$$\bar{\mathbf{s}}_{ugt} = \frac{1}{n_{ugt}} \sum_{i \in \mathcal{I}_{ugt}} \mathbf{s}_i. \tag{6}$$

This is the mean of individual credit shares, rather than shares calculated from pooled credit totals. Let $\mathcal{G}(g)$ denote the family containing program g. External separation is

$$S_{ugt} = \frac{1}{|\mathcal{G}(g)| - 1} \sum_{\substack{h \in \mathcal{G}(g) \\ h \neq g}} d(\bar{\mathbf{s}}_{ugt}, \bar{\mathbf{s}}_{uht}) \, . \tag{7}$$

For preschool and primary, this reduces to the cosine dissimilarity between their two mean portfolios. Separation is therefore common to both programs within a university–semester cell. For each subject-teacher category, separation is the equally weighted average of its distances to the other two categories. It can consequently differ across the three subject-teacher programs. These comparisons use distances between program means, not average distances between individuals in different programs.

External separation is defined only when every program in the relevant family has at least five valid portfolios in the university–semester cell. Internal fragmentation can remain available when this family-level requirement is not met.

Aggregation for descriptive trends. Figure 3 uses the six-category measures for initial registration cohorts from autumn 2007 through spring 2015. To compare fragmentation and separation on the same support, the figure requires valid measures for both early-years programs, or all three subject-teacher categories, within each included university–semester cell.

I first average the available semester measures within each university, program, and academic year, giving each available semester equal weight. I then average across universities, giving each university equal weight within a program and academic year. An academic year begins in autumn; for example, the year labelled 2014 includes autumn 2014 and spring 2015. University and semester coverage may vary across academic years.

The figure also reports

$$D_{ugt} = S_{ugt} - F_{ugt}. \tag{8}$$

An increase in this difference reflects greater separation, lower fragmentation, or both. It is a descriptive summary of the two components rather than an independent measure of curricular quality.

Pre-reform organization. For analyses of heterogeneity by initial program organization, I aggregate semester-specific measures over pre-reform registration cohorts, from autumn 2007 through spring 2011. Unlike the descriptive trends, which average available semesters equally within university and academic year, these fixed measures weight semesters by portfolio counts within each university.

Let $\mathcal{T}_{ug}^{F}$ denote the available pre-reform semesters with valid fragmentation measures. The fixed pre-reform fragmentation measure is

$$F_{ug}^{\text{pre}} = \frac{\sum_{t \in \mathcal{T}_{ug}^{F}} n_{ugt} F_{ugt}}{\sum_{t \in \mathcal{T}_{ug}^{F}} n_{ugt}}. \tag{9}$$

Thus, semesters are weighted by the number of valid graduates in the program's own cell.

For external separation, the semester weight is the number of valid graduates across the complete program family, $m_{uft} = \sum_{h \in \mathcal{G}(g)} n_{uht}$, where f denotes the family containing g. Let $\mathcal{T}^S_{uf}$ denote the pre-reform semesters with valid separation measures. The fixed measure is

$$S^{\text{pre}}_{ug} = \frac{\sum_{t \in \mathcal{T}^S_{uf}} m_{uft} S_{ugt}}{\sum_{t \in \mathcal{T}^S_{uf}} m_{uft}}. \tag{10}$$

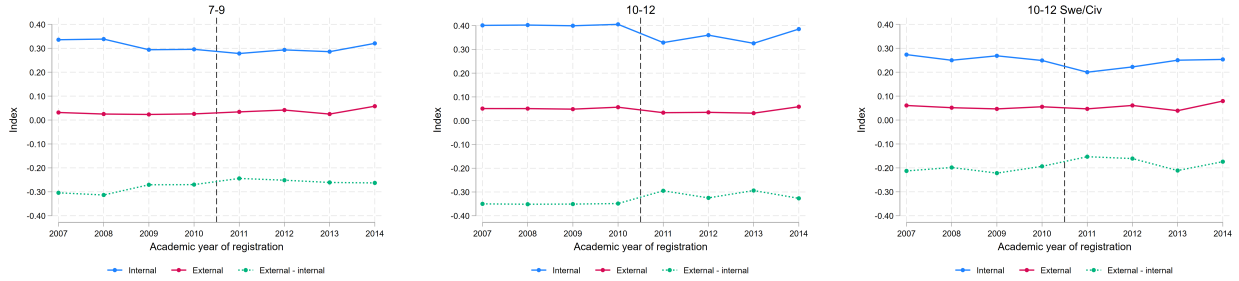
The family-level weights are common to all programs in the family and preserve the equality of preschool and primary separation within each university.

Each pre-reform measure requires at least three valid registration semesters. Support is assessed separately for fragmentation and separation, and a valid pre-reform measure does not require a valid post-reform measure. These are weighted averages of semester-specific distances, not distances calculated after pooling graduates across pre-reform semesters. The resulting values are held fixed when comparing outcomes across pre- and post-reform entry cohorts.

Appendix C Professional differentiation: Other results

For subject-teacher education programs, substantial subject-specific requirements already structured preparation before the reform, leaving less scope for comparable changes in curricular organization. I therefore expect less pronounced changes in separation across these programs and relatively stable course portfolios within programs. However, restrictions on permissible subject combinations may have reduced variation within degree categories by limiting the combinations of subjects subject teacher candidates could pursue.

The subject-teacher education programs display a different pattern (Figure C.1). Pre-reform internal fragmentation is higher, at approximately 0.25–0.40, consistent with graduates pursuing different subject combinations within the same degree category. Fragmentation falls in the first reformed cohort, with more pronounced declines in the two upper-secondary categories than in lower-secondary teacher education. These declines are consistent with the more restrictive subject combinations introduced by the reform. External separation, however, does not show the marked upward shift observed between preschool and primary teacher education.



(a) Lower-secondary teacher education (b) Affected upper-secondary teacher education (c) Upper-secondary teacher education: Sw/Civ

Figure C.1: Trends in professional differentiation in subject-teacher education

Notes: The sample consists of teacher education graduates, classified by awarded qualification. Internal fragmentation measures within-program portfolio heterogeneity; external separation compares each program's mean portfolio with those of the other two subject-teacher categories. Both use cosine dissimilarity across six-category completed-credit shares. The green line reports external separation minus internal fragmentation. Series give equal weight to universities. The affected upper-secondary group excludes qualifications including Swedish or civics; Sw/Civ includes these qualifications. Entry cohorts span autumn 2007–spring 2015; axis labels denote academic-year starting years. The vertical line separates pre-reform cohorts from those entering from autumn 2011 onward. Appendix B.3 provides definitions and aggregation details.

Appendix D Academic Selection: Additional Evidence

Table D.1: Robustness of effects on academic selection

	(1) Baseline	(2) Uni. × cohort FE	(3) LOO min.	(4) LOO max.	(5) Uni. cluster	(6) Wild bootstrap
Post × PS	0.108**	0.118***	0.090**	0.135***	0.108**	0.108**
	(0.042)	(0.034)	(0.043)	(0.041)	(0.043)	[0.020]
p-value	0.011	0.001	0.038	0.001	0.020	
Observations	35691	35691	32976	33388	35691	35691
Clusters	92	92	87	87	20	20
Post × K–6	0.137***	0.132***	0.119***	0.163***	0.137***	0.137**
	(0.040)	(0.033)	(0.041)	(0.040)	(0.039)	[0.012]
p-value	0.001	< 0.001	0.005	< 0.001	0.002	
Observations	35691	35691	32113	33388	35691	35691
Clusters	92	92	87	87	20	20
Post × 10–12	-0.064	-0.070	-0.077*	-0.051	-0.064*	-0.064*
	(0.042)	(0.044)	(0.043)	(0.046)	(0.036)	[0.100]
p-value	0.130	0.118	0.078	0.270	0.092	
Observations	35691	35691	34257	31561	35691	35691
Clusters	92	92	87	87	20	20

Notes: The outcome is pre-entry GPA, standardized within upper-secondary school graduation cohorts. The sample consists of teacher education graduates, classified by awarded qualification; reform exposure is determined by initial enrollment. All specifications include university–program and entry-semester fixed effects; column (2) additionally includes university–entry-semester fixed effects. Comparison programs are lower-secondary and upper-secondary Swedish/Civics. Columns (3)–(4) report the minimum and maximum coefficient for each treated program across leave-one-university-out estimates; the omitted university may differ across rows and columns. Standard errors in parentheses are clustered by university–program in columns (1)–(4) and by university in column (5). Column (6) repeats the baseline coefficients and reports null-imposed wild cluster bootstrap p-values in brackets, using university-level clustering, Webb weights, and 9,999 replications. Stars in column (6) use bootstrap inference; those in columns (1)–(5) use conventional clustered inference. PS, K–6, and 10–12 denote preschool, primary, and affected upper-secondary teacher education; the latter excludes qualifications including Swedish or civics. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table D.2: Academic selection and degree completion

	(1) Std. GPA Graduates	(2) Teacher degree completion	(3) Std. GPA Entrants
Post × PS	0.117**	-0.021	0.144***
	(0.044)	(0.020)	(0.043)
Post × K–6	0.138***	-0.059**	0.150***
	(0.042)	(0.027)	(0.044)
Observations	36336	72508	64174
Pre-reform mean (PS)	0.107	0.706	0.063
Pre-reform mean (K–6)	0.219	0.620	0.141
Pre-reform mean (7–9)	0.356	0.353	0.229
Pre-reform mean (10–12)	0.481	0.355	0.329
University–program clusters	81	84	84
Adj. R^2	0.051	0.106	0.034

Notes: Column (1) reports effects on pre-entry GPA among entrants who subsequently completed a teaching qualification; column (2) reports effects on degree completion among all entrants; column (3) reports effects on pre-entry GPA among all entrants with observed GPA. GPA is standardized within upper-secondary school graduation cohorts; columns (1) and (3) require observed GPA. Degree-completion estimates and means are reported as proportions. Programs are classified by initial enrollment in all columns. The comparison group comprises lower-secondary and all upper-secondary teacher education programs, including those lengthened by the reform, because initial registration records do not distinguish upper-secondary subject specializations. Estimates use Equation (1), with preschool and primary treatment interactions, university–program and entry-semester fixed effects, and reform exposure from autumn 2011 onward. Standard errors in parentheses are clustered by university–program. Pre-reform means are reported within each regression sample by initial program. PS, K–6, 7–9, and 10–12 denote preschool, primary, lower-secondary, and all upper-secondary teacher education programs, respectively. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table D.3: Student intake, graduation, and academic composition

	(1) Number of individuals	(2) Below P25	(3) Above P75	(4) Above P90
Panel A: Entrants, program at entry				
Post × PS	28.96*	-0.066***	0.065**	0.047***
	(14.60)	(0.022)	(0.027)	(0.016)
Post × K–6	10.97	-0.068***	0.040	0.039**
	(18.29)	(0.022)	(0.029)	(0.016)
Observations	894	64173	64173	64173
Adj. R^2	0.614	0.021	0.020	0.010
Panel B: Graduates, program at entry				
Post × PS	13.48*	-0.073***	0.058**	0.043**
	(7.21)	(0.025)	(0.027)	(0.017)
Post × K–6	-2.78	-0.082***	0.055*	0.047***
	(10.50)	(0.023)	(0.028)	(0.017)
Observations	840	36335	36335	36335
Adj. R^2	0.608	0.027	0.015	0.008
Panel C: Graduates, program by awarded qualification				
Post × PS	18.73**	-0.096***	0.063***	0.040***
	(8.28)	(0.023)	(0.020)	(0.012)
Post × K–6	-7.11	-0.103***	0.068***	0.047***
	(9.66)	(0.021)	(0.021)	(0.012)
Observations	1111	35691	35691	35691
Adj. R^2	0.606	0.028	0.016	0.007

Notes: Column (1) reports effects on the number of individuals per university–program–entry-semester cell. Columns (2)–(4) report effects on indicators for pre-entry GPA below the pre-reform 25th percentile or above the 75th and 90th percentiles, respectively; estimates are in proportion units and require observed GPA. Percentile cutoffs are calculated nationally within program before the reform and held fixed thereafter, using the initial-enrollment classification in Panels A–B and the awarded-qualification classification in Panel C. Panel A includes all entrants. Panel B includes entrants who subsequently completed a teaching qualification, retaining their initial program classification. Panel C includes graduates classified by awarded qualification. In all panels, comparison programs are lower-secondary and all upper-secondary teacher education programs, including those lengthened by the reform. All specifications include university–program and entry-semester fixed effects; reform exposure is determined by initial enrollment from autumn 2011 onward. Standard errors in parentheses are clustered by university–program. Observations count cells in column (1) and individuals in columns (2)–(4). PS and K–6 denote preschool and primary teacher education. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

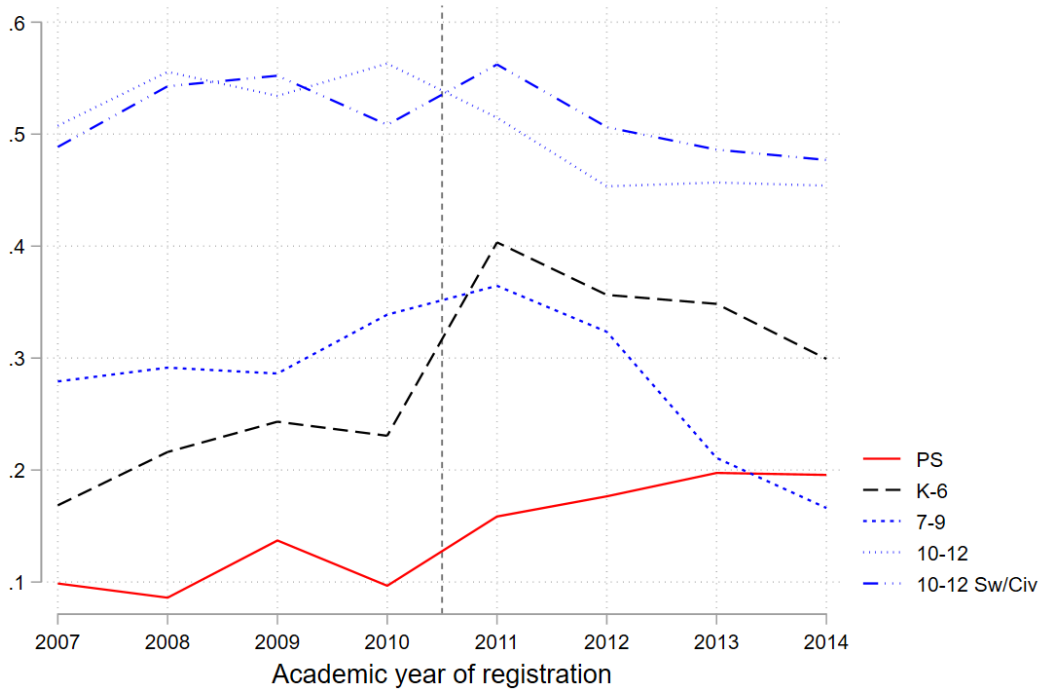


Figure D.1: Average pre-entry GPA among teacher education graduates

Notes: The figure reports mean pre-entry GPA, standardized within upper-secondary school graduation cohorts, among teacher education graduates classified by awarded qualification. Initial enrollment cohorts run from autumn 2007 through spring 2015 and are grouped into academic years, from 2007/08 to 2014/15. The dashed vertical line separates pre-reform cohorts from those entering from autumn 2011 onward.

Table D.4: Next-ranked distinct alternative among admitted applicants

Admitted program	Next-ranked distinct alternative (%)					
	PS	K–6	7–12	Other teacher education	Other education	No distinct alternative
PS ($N = 4{,}271$)	–	14.4	2.7	0.7	34.0	48.2
K–6 ($N = 2{,}720$)	24.9	–	7.6	0.8	31.7	35.0
7–12 ($N = 4{,}484$)	3.6	6.6	–	1.2	43.9	44.7

Notes: Entries are percentages of applicants admitted to the indicated teacher education programs in autumn 2015; each row sums to 100 percent. The next lower-ranked distinct alternative treats applications to the same type of teacher education at different institutions as a single educational choice. PS and K–6 denote preschool and primary teacher education; 7–12 combines lower- and upper-secondary teacher education. Other teacher education comprises teacher education pathways outside these three groups; other education comprises options outside teacher education. No distinct alternative includes applicants whose lower-ranked applications were all to the same type of teacher education and those who listed no lower-ranked option. N is the number of admitted applicants in each row.

Table D.5: Academic selection and pre-reform program organization

	(1) Joint
Post × internal fragmentation: PS	0.180**
	(0.062)
Post × internal fragmentation: K–6	0.147*
	(0.072)
Post × external separation: PS	-0.046**
	(0.020)
Post × external separation: K–6	-0.073*
	(0.038)
University–program FE	Yes
Program–entry-semester FE	Yes
Observations	22657
University clusters	18
Equal slopes, PS vs. K–6: internal fragmentation (p)	0.673
Equal slopes, PS vs. K–6: external separation (p)	0.529

Notes: The outcome is pre-entry GPA, standardized within upper-secondary school graduation cohorts. The sample consists of preschool and primary teacher education graduates, classified by awarded qualification. Internal fragmentation and external separation enter jointly, with separate coefficients for each program. Coefficients measure differential post-reform GPA changes associated with a 0.10 higher pre-reform index, holding the other index constant. Both indices are fixed at their pre-reform values and use cosine dissimilarity across six completed-credit-share categories. Internal fragmentation measures within-program portfolio heterogeneity and varies by university and program; external separation compares mean preschool and primary portfolios within universities and is common to both programs. Appendix B.3 provides construction details. Post denotes initial enrollment from autumn 2011 onward. The specification includes university–program and program–entry-semester fixed effects; the latter absorb changes common across universities within each program and entry semester. Standard errors in parentheses are clustered by university. The final two rows report p-values for equality of the PS and K–6 coefficients. PS and K–6 denote preschool and primary teacher education. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Appendix E Labor-Market Estimates and Robustnes

Table E.1: Characteristics of the labor-market sample

	(1) Required credits	(2) Total credits	(3) Std. GPA
Post × PS	-2.153***	2.996	0.114**
	(0.670)	(2.993)	(0.044)
Post × K–6	22.856***	18.122***	0.154***
	(2.651)	(3.736)	(0.038)
Post × 10–12	26.245***	18.287***	-0.022
	(0.755)	(3.428)	(0.038)
Observations	32986	31197	29750
Pre-reform mean (PS)	210.2	219.9	0.099
Pre-reform mean (K–6)	214.6	237.4	0.203
Pre-reform mean (7–9)	270.6	298.2	0.296
Pre-reform mean (10–12)	272.0	306.7	0.502
Pre-reform mean (10–12 Sw/Civ)	297.0	332.5	0.516
University–program clusters	92	92	92
Adj. R^2	0.970	0.396	0.055

Notes: Outcomes are degree credit requirements, accumulated completed credits through the year of graduation, and pre-entry GPA standardized within upper-secondary school graduation cohorts. The sample includes teacher education graduates completing a relevant qualification between June 2012 and February 2020. Programs are classified by awarded qualification; reform exposure is determined by initial enrollment from autumn 2011 onward. Estimates use the baseline specification in Equation (1), with university–program and entry-semester fixed effects, without graduation-year fixed effects. Comparison programs are lower-secondary and upper-secondary Swedish/Civics. Standard errors in parentheses are clustered by university–program. Pre-reform means are reported within each regression sample. PS denotes preschool; K–6, 7–9, and 10–12 denote primary, lower-secondary, and upper-secondary teacher education. The 10–12 treatment interaction refers to programs excluding Swedish or civics; 10–12 Sw/Civ denotes qualifications including these subjects. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table E.2: Employment and unemployment insurance benefit receipt after graduation

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Average years 1–3
Panel A: Employment				
Post × PS	-2.5***	-2.3***	-1.9**	-2.2***
	(0.7)	(0.6)	(0.8)	(0.5)
Post × K–6	-1.4*	-0.4	-0.1	-0.7
	(0.8)	(0.6)	(0.7)	(0.5)
Post × 10–12	0.0	0.1	-1.1	-0.3
	(1.1)	(0.8)	(1.1)	(0.8)
Observations	30725	30725	30725	30725
Pre-reform mean (PS)	98.3	98.2	97.6	98.0
Pre-reform mean (K–6)	97.9	97.5	97.9	97.8
Pre-reform mean (7–9)	97.5	96.9	97.6	97.4
Pre-reform mean (10–12)	96.8	96.9	97.3	97.0
Pre-reform mean (10–12 Sw/Civ)	96.9	98.2	98.4	97.8
University–program clusters	92	92	92	92
Adj. R^2	0.004	0.004	0.005	0.006
Pretrend p (PS)				0.742
Pretrend p (K–6)				0.618
Pretrend p (10–12)				0.438
Panel B: Unemployment insurance benefit receipt				
Post × PS	0.9	0.2	0.9*	0.7
	(0.9)	(0.6)	(0.5)	(0.5)
Post × K–6	0.0	-0.8	0.1	-0.2
	(0.7)	(0.6)	(0.4)	(0.4)
Post × 10–12	-0.3	-0.4	0.4	-0.1
	(0.9)	(0.7)	(0.5)	(0.5)
Observations	32473	32473	32473	32473
Pre-reform mean (PS)	2.5	1.5	0.8	1.6
Pre-reform mean (K–6)	2.6	1.7	0.9	1.7
Pre-reform mean (7–9)	3.6	3.2	1.3	2.7
Pre-reform mean (10–12)	4.4	2.8	1.8	3.0
Pre-reform mean (10–12 Sw/Civ)	3.1	1.6	1.5	2.1
University–program clusters	92	92	92	92
Adj. R^2	0.019	0.011	0.005	0.021
Pretrend p (PS)				0.068
Pretrend p (K–6)				0.809
Pretrend p (10–12)				0.902

Notes: Panel A measures November employment; Panel B measures annual unemployment insurance benefit receipt. Estimates and standard errors are in percentage points; pre-reform means are in percent. Graduations span June 2012–February 2019 (A) and June 2012–February 2020 (B). Samples are fixed across horizons within panels; column (4) reports mean outcomes over years 1–3. Each regression includes all three treatment interactions and university–program, entry-semester, and adjusted graduation-year fixed effects. Programs follow awarded qualifications and exposure follows initial enrollment. Comparison programs are 7–9 and 10–12 Sw/Civ. Standard errors in parentheses are clustered by university–program. Pretrend p-values jointly test the three pre-reform coefficients relative to 2010/11 in separate treated-versus-comparison event studies for the three-year outcome, with the same fixed effects and clustering. PS, K–6, 7–9, and 10–12 denote preschool, primary, lower-secondary, and upper-secondary teacher education; the 10–12 treatment group excludes Swedish/civics qualifications, shown separately as Sw/Civ. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table E.3: Entry into teaching and occupational matching after graduation

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Average years 1–3
Panel A: Teacher occupation				
Post × PS	-4.9***	-4.8***	-4.3***	-4.7***
	(1.4)	(1.4)	(1.1)	(1.2)
Post × K–6	-1.4	-1.3	-1.8	-1.5
	(1.4)	(1.3)	(1.1)	(1.1)
Post × 10–12	-1.9	0.7	1.3	0.0
	(1.7)	(1.6)	(1.5)	(1.3)
Observations	29562	29562	29562	29562
Pre-reform mean (PS)	95.0	96.2	96.0	95.7
Pre-reform mean (K–6)	95.3	96.2	96.7	96.1
Pre-reform mean (7–9)	88.3	89.4	90.7	89.5
Pre-reform mean (10–12)	88.9	90.2	89.8	89.6
Pre-reform mean (10–12 Sw/Civ)	88.1	89.9	89.5	89.2
University–program clusters	92	92	92	92
Adj. R^2	0.020	0.017	0.017	0.023
Pretrend p (PS)				0.154
Pretrend p (K–6)				0.485
Pretrend p (10–12)				0.299
Panel B: Target matching				
Post × PS	-11.4***	-9.1***	-7.2**	-9.2***
	(3.2)	(3.2)	(3.2)	(3.1)
Post × K–6	18.1***	18.7***	16.5***	17.8***
	(5.8)	(5.7)	(5.4)	(5.6)
Post × 10–12	-7.2**	-4.1	-5.9*	-5.7**
	(3.2)	(2.9)	(3.0)	(2.8)
Observations	29562	29562	29562	29562
Pre-reform mean (PS)	89.7	89.8	88.4	89.3
Pre-reform mean (K–6)	55.1	58.2	61.5	58.3
Pre-reform mean (7–9)	70.8	72.3	73.3	72.1
Pre-reform mean (10–12)	33.2	33.5	35.4	34.1
Pre-reform mean (10–12 Sw/Civ)	37.4	38.7	38.7	38.3
University–program clusters	92	92	92	92
Adj. R^2	0.283	0.288	0.269	0.321
Pretrend p (PS)				0.532
Pretrend p (K–6)				0.069
Pretrend p (10–12)				0.270

Notes: Panel A measures any teaching occupation. Panel B measures target matching: preschool/leisure-time teaching for PS, compulsory-school teaching for K–6 and 7–9, and general upper-secondary teaching for both 10–12 groups. SSYK does not distinguish primary from lower-secondary teaching. Estimates and standard errors are in percentage points; pre-reform means are in percent. Both panels use the same graduates from June 2012–February 2020 with observed occupation codes in all three years, without conditioning on registered employment. Column (4) reports mean outcomes over years 1–3. Each regression includes all three treatment interactions and university–program, entry-semester, and adjusted graduation-year fixed effects. Programs follow awarded qualifications and exposure follows initial enrollment. Comparison programs are 7–9 and 10–12 Sw/Civ. Standard errors in parentheses are clustered by university–program. Pretrend p-values jointly test the three pre-reform coefficients relative to 2010/11 in separate treated-versus-comparison event studies for the three-year outcome, with the same fixed effects and clustering. PS, K–6, 7–9, and 10–12 denote preschool, primary, lower-secondary, and upper-secondary teacher education; the 10–12 treatment group excludes Swedish/civics qualifications, shown separately as Sw/Civ. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table E.4: Annual earnings after graduation

	(1) Year 1	(2) Year 2	(3) Year 3	(4) Years 1–3
Panel A: Annual earnings (SEK 1,000)				
Post × PS	-29.0***	-27.9***	-23.0***	-26.7***
	(6.2)	(7.1)	(8.1)	(6.7)
Post × K–6	11.1**	8.7	10.4*	10.1**
	(4.7)	(5.4)	(5.8)	(4.8)
Post × 10–12	14.4***	15.1***	5.9	11.8**
	(4.9)	(5.6)	(7.3)	(5.3)
Observations	32473	32473	32473	32473
University–program clusters	92	92	92	92
Adj. R^2	0.134	0.114	0.094	0.152
Pretrend p (PS)				0.726
Pretrend p (K–6)				0.983
Pretrend p (10–12)				0.159
Panel B: Positive earnings (percentage points)				
Post × PS	-1.0***	-0.9**	-0.7*	-0.9***
	(0.4)	(0.4)	(0.4)	(0.3)
Post × K–6	-0.3	0.1	-0.1	-0.1
	(0.4)	(0.4)	(0.4)	(0.3)
Post × 10–12	-0.1	0.2	0.1	0.0
	(0.5)	(0.6)	(0.6)	(0.5)
Observations	32473	32473	32473	32473
University–program clusters	92	92	92	92
Adj. R^2	0.002	0.003	0.002	0.004
Pretrend p (PS)				0.404
Pretrend p (K–6)				0.237
Pretrend p (10–12)				0.232
Panel C: Log earnings				
Post × PS	-0.082***	-0.077**	-0.082**	-0.070***
	(0.031)	(0.036)	(0.039)	(0.025)
Post × K–6	0.082***	0.065**	0.084***	0.050***
	(0.022)	(0.025)	(0.028)	(0.016)
Post × 10–12	0.081***	0.051**	0.019	0.042***
	(0.019)	(0.022)	(0.027)	(0.014)
Observations	31775	31775	31775	31775
University–program clusters	92	92	92	92
Adj. R^2	0.056	0.057	0.048	0.123
Pretrend p (PS)				0.600
Pretrend p (K–6)				0.854
Pretrend p (10–12)				0.062

Notes: Panel A reports earnings in SEK 1,000 at 2017 prices, including observed zeros; Panel B measures positive earnings in percentage points; Panel C reports log earnings in log points and requires positive earnings in all three years. Graduations span June 2012–February 2020. Samples are fixed across horizons within panels. Column (4) reports mean annual outcomes in Panels A–B and $\ln[(w_{i1}+w_{i2}+w_{i3})/3]$ in Panel C, where w_{ih} denotes annual earnings; the latter coefficient need not equal the mean of the annual log coefficients. Each regression includes all three treatment interactions and university–program, entry-semester, and adjusted graduation-year fixed effects. Programs follow awarded qualifications and exposure follows initial enrollment. Comparison programs are lower-secondary and upper-secondary Swedish/Civics. Standard errors in parentheses are clustered by university–program. Pretrend p-values jointly test the three pre-reform coefficients relative to 2010/11 in separate treated-versus-comparison event studies for each three-year outcome, with the same fixed effects and clustering. PS, K–6, and 10–12 denote preschool, primary, and affected upper-secondary teacher education; the latter excludes qualifications including Swedish or civics. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table E.5: Robustness of teaching, target matching, and earnings estimates

	(1) Preferred	(2) Expanded window	(3) GPA sample	(4) GPA controls	(5) No grad. FE	(6) Uni. cluster	(7) Wild bootstrap
Panel A: Teacher occupation							
Post × PS	-4.7	-6.0	-4.4	-4.3	-3.8	-4.7	-4.7
	(1.2)	(1.0)	(1.1)	(1.1)	(1.1)	(1.3)	[0.002]
Post × K–6	-1.5	-2.6	-1.3	-1.2	-1.1	-1.5	-1.5
	(1.1)	(1.0)	(1.2)	(1.2)	(1.1)	(1.3)	[0.272]
Post × 10–12	0.0	0.0	-0.1	0.0	-0.1	0.0	0.0
	(1.3)	(1.3)	(1.4)	(1.4)	(1.3)	(0.9)	[0.974]
Observations	29562	34295	26741	26741	29562	29562	29562
Clusters	92	92	92	92	92	20	20
Panel B: Target matching							
Post × PS	-9.2	-10.7	-9.6	-9.7	-6.2	-9.2	-9.2
	(3.1)	(2.8)	(3.4)	(3.4)	(2.9)	(3.3)	[0.027]
Post × K–6	17.8	20.7	17.3	17.2	20.0	17.8	17.8
	(5.6)	(4.9)	(5.5)	(5.5)	(6.0)	(6.6)	[0.034]
Post × 10–12	-5.7	-7.8	-6.5	-6.5	-5.8	-5.7	-5.7
	(2.8)	(2.7)	(3.1)	(3.1)	(2.9)	(3.2)	[0.115]
Observations	29562	34295	26741	26741	29562	29562	29562
Clusters	92	92	92	92	92	20	20
Panel C: Annual earnings (SEK 1,000)							
Post × PS	-26.7	-32.0	-27.2	-26.6	-14.1	-26.7	-26.7
	(6.7)	(6.4)	(6.8)	(6.7)	(6.4)	(5.8)	[0.001]
Post × K–6	10.1	7.1	8.8	9.5	19.4	10.1	10.1
	(4.8)	(4.8)	(5.0)	(5.1)	(4.7)	(4.9)	[0.086]
Post × 10–12	11.8	11.8	10.8	10.7	11.8	11.8	11.8
	(5.3)	(5.4)	(5.7)	(5.7)	(5.3)	(3.2)	[0.004]
Observations	32473	38132	29364	29364	32473	32473	32473
Clusters	92	92	92	92	92	20	20

Notes: Outcomes are individual means over follow-up years 1–3. Panels A–B report teacher occupation and target matching in percentage points, requiring observed SSYK in all three years without conditioning on registered employment. Panel C reports annual earnings in SEK 1,000 at 2017 prices, including observed zeros. Column (1) uses graduates from June 2012–February 2020 with full follow-up through 2022 and university–program, entry-semester, and adjusted graduation-year fixed effects. Column (2) expands the graduation window, retaining entry-cohort limits and full follow-up. Column (3) uses the same sample as column (4), which adds a third-degree polynomial in pre-entry GPA. Column (5) omits graduation-year fixed effects on the preferred sample. Columns (6)–(7) retain the preferred model and sample but use university-level clustering. Parentheses report conventional clustered standard errors, using university–program clustering in columns (1)–(5). Brackets in column (7) report null-imposed wild cluster bootstrap p-values with university-level clustering, Webb weights, and 9,999 replications. No significance stars are used. Programs are classified by awarded qualification; exposure is determined by initial enrollment. Comparison programs are lower-secondary and upper-secondary Swedish/Civics. PS, K–6, and 10–12 denote preschool, primary, and affected upper-secondary teacher education; the latter excludes qualifications including Swedish or civics.