The supply of skills to the teacher profession*

By

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(Preliminary -- do not quote)

Abstract

The return to teacher education has fallen rather substantially since the late 1960s. In addition, the teacher wage distribution is extremely compressed. The return to experience is remarkably low (around 1 percent per annum) and the return to other skills (e.g. verbal and inductive ability) – which are rewarded in other professions – is non-existent. Using unique data, we examine the various dimensions of the supply response to these facts. We show that the number of individuals choosing teacher education has declined, the ability rank of those who, nevertheless, opt for teacher education has fallen, and that the probability of remaining in the teaching profession is lower for those who rank highly on ability tests conducted at age 13.

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1. Introduction

Teachers matter for student achievement, there can be little doubt. A large literature document the existence of "teacher effects"; e.g., Rockoff (2004) and Rivkin et al. (2005). Yet it has been remarkably difficult to show what it is about teachers that matter, or predicting which teachers will be more successful than others based on observed characteristics and credentials (e.g., Hanushek, 1986). One of the few characteristics which appear to be systematically related to student performance is teacher experience; see Rockoff (2004).

That student performance is strongly related to the identity of the teacher, but only weakly related to what we observe about the teachers, suggests that what constitutes a good teacher is typically unobserved in most data sets. The incentives to become a teacher are fundamentally important to get a favorable selection of teachers on all kinds of characteristics (whether observed or unobserved); a reasonable pay-off to skills is presumably necessary to attract skilled individuals to the teacher profession. In this paper, we document the evolution of teacher incentives and changes in the supply of teacher skills.

To fulfill this objective we utilize a unique data set. The data include objective measures of skills (observed at age 13) for successive cohort born between 1948 and 1977. To these data we have matched information on subsequent educational attainment, subsequent career choices and wages in 2004. For each cohort, we can thus trace individuals who subsequently opt for teacher education and the teacher profession in the "ability distribution". With these data we are able to paint a much richer picture of the changes in teacher quality than what is available elsewhere in the literature (see Corcoran et al., 2004, for US evidence and Nickell and Quintini, 2002, for UK evidence).

We document a rather drastic reduction in the incentives for becoming a teacher between 1968 and 2003. As an apparent response to this development, the number and the average ability of individuals opting for teacher education have declined. Moreover, the ability of the teacher educated leaving the profession appears to be systematically higher. This additional supply response seems to be the result of the lack of returns to skill in the teacher profession.

This paper is outlined as follows. Section 2 documents the evolution of incentives. We focus on monetary incentives. This is not to say that non-monetary incentives are unimportant; it is just

that information on the evolution of these incentives is largely absent. Section 2 also describes the salient features of the teacher wage distribution. In Section 3 we turn to the supply of quality to the teacher profession. We examine the variation in the number of individuals opting for teacher education, the abilities of those choosing a teacher education, and the quality of certified teachers who have left the profession. Section 4 concludes.

2. The incentives to become a teacher

We begin by looking at changes in the incentives for becoming a teacher in Sweden over the past several decades. In Figure 1 we plot the evolution of teacher relative wages over the past eighty years. Relative to the wages of production workers, teacher wages have declined precipitously since the beginning of the 1940s.[1] Since 1945, the relative wage has declined by almost 50 percent. The decline in the relative wage has slowed somewhat over the past thirty years, but the general decline has continued.

The decline of teacher relative wages is not a unique Swedish phenomenon. For almost all countries for which there are data, teacher relative wages have declined since the mid-1960s. However, the international evidence suggests that the decline in Sweden was particularly dramatic; see Lakdawalla (2001). Today, experienced Swedish teachers are paid less than their Nordic and OECD counterparts (OECD, 2002). For instance, experienced Swedish teachers in lower secondary school earn only 82 percent of the OECD average for teachers at this level. The relative wage gap is lower in primary schools and also in terms of starting wages.

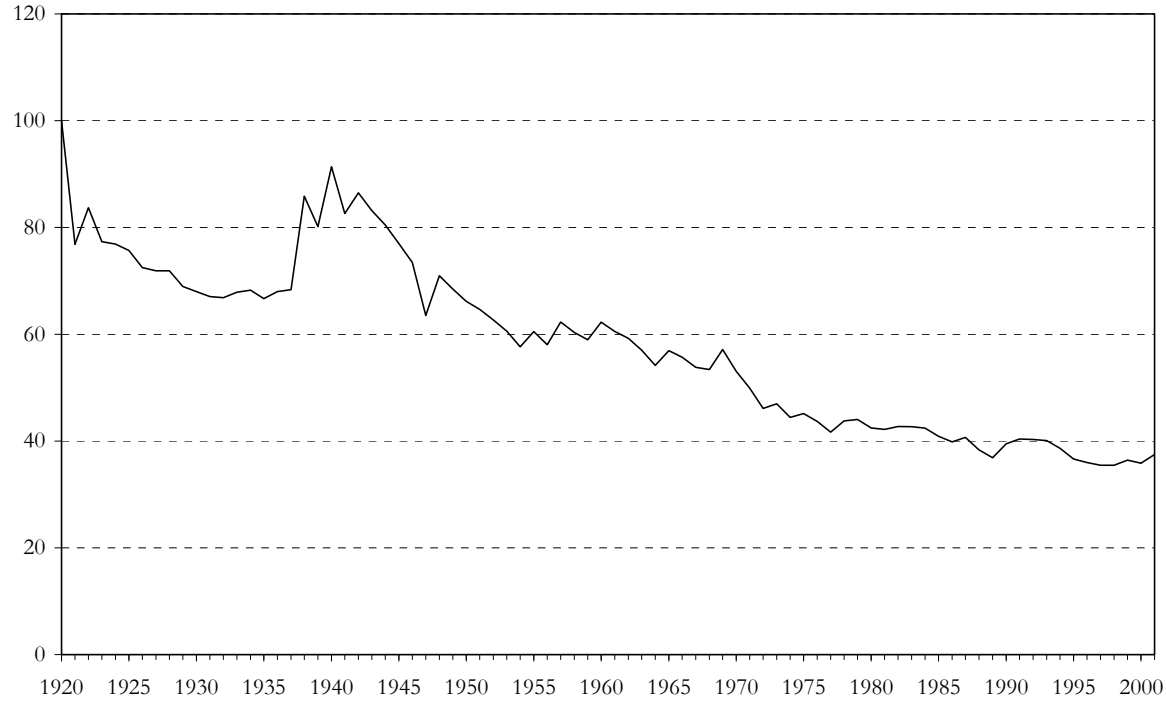
Although Figure 1 is informative about the long-run changes in teacher salaries, there are a number of qualifications to keep in mind. For instance, the share of females in teaching has increased over time, and it is well known that women are generally paid less than men. Also, the development of the teacher relative wage shown in the figure may be the result of a decline in the overall university wage premium over this period.

Of course there are potential comparison occupations other than production workers. Nursing provides a useful comparison since nurses and teachers have similar gender composition

[1] We thank Anders Nilsson for supplying the pre 1975 data on teacher wages.

and education level. Over the past thirty years, teacher wages have declined relative to nurses as well: the relative wage decreased by 20 percent between 1970 and 2001.[2]

Figure 1 Index of teacher wages relative to production worker wages, 1920-2001, 1920=100.



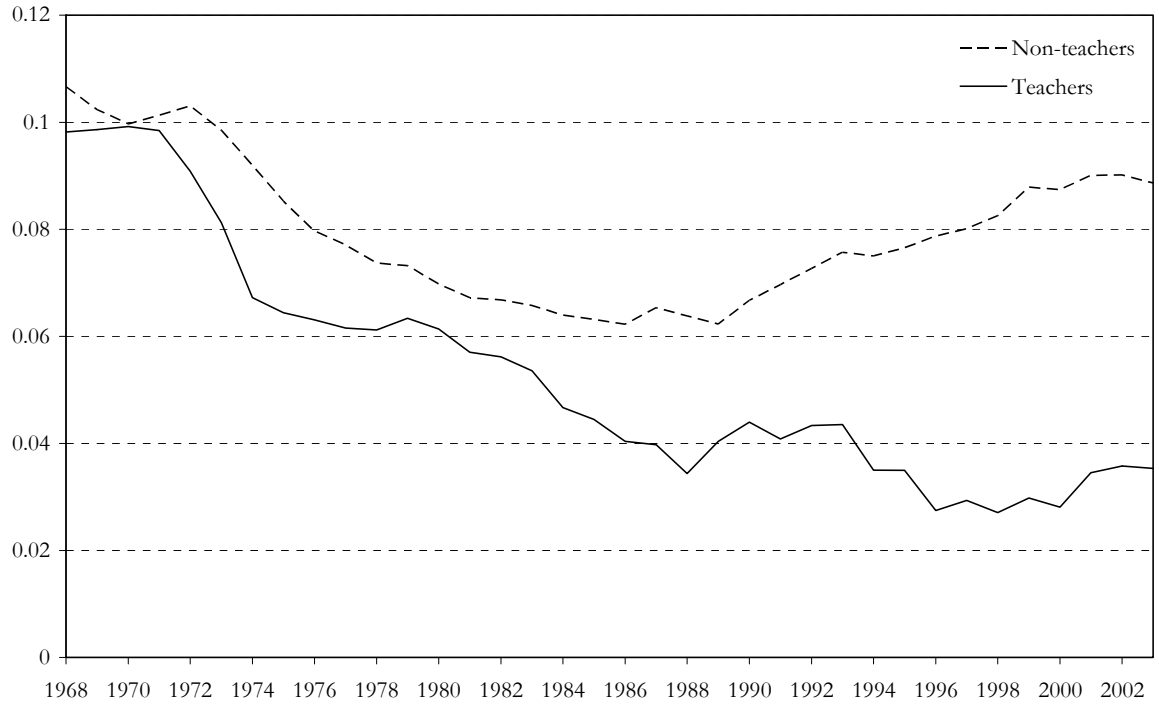
Sources: Nilsson (1984); Swedish Official Statistics, Wages, (SOS Löner) 1975-1989; Statistical Yearbook of Sweden, various issues; Swedish Teachers' Union wage statistics.
Notes: During the period 1920-89, teacher wages refer to the wage in the highest wage category for teachers in primary schools (*folkskola*) or teachers in grades 4 to 6 of the comprehensive school. We have used information on the growth rate of average teacher wages to impute comparable wages from 1990 to 2001. Anders Nilsson has kindly supplied data on teacher wages for the period 1920-74. We also thank Sune Johansson at the Swedish Teachers' Union (*Lärarförbundet*) for supplying information on average teacher wages. Production worker wages in general refer to mining and manufacturing, although the included industries vary somewhat over time.

Nonetheless, comparisons with single occupations do not answer the, arguably, most relevant question: How have the incentives to pursue a teaching career once one has decided to pursue a university education evolved over time? To shed light on this question, Figure 2 presents the return to university education for teachers and non-teachers. The calculations are based on the LINDA data base (see Edin and Fredriksson, 2000). This data base contains information on wages from 1992 and onwards and information on earnings, obtained from the income tax registers, from 1968 and onwards. We can thus estimate standard Mincer-type regressions, relating log. wages to education, from 1992 and onwards. In these regressions we also control for

[2] See Statistics Sweden's wage statistics (*Kommunal personal* 1970 and *Statistical Yearbook of Salaries and Wages* 2001) for information on the wages of nurses.

gender, potential experience, immigrant status, and years since migration. For the remainder of the time-period, i.e., 1968-1991, we have imputed the wage return to university education using earnings regressions which are specified analogously. The imputations are based on the relative changes in the return to university education for teachers and non-teachers.[3]

Figure 2 Returns to university by teacher education, 1968-2003.



Notes: Estimates for 1992-2003 are based on wage regressions where the log wage is regressed on a spline in years of schooling with a knot at 12 years of schooling and an interaction between teacher education and the 2nd segment of the spline. The regressions include controls for gender, potential experience, immigrant status, and years since immigration. Estimates for 1968-1991 are imputed using the *relative changes* in the return to schooling estimated from earnings regressions. The earnings regressions were specified in analogy to the wage regressions.
Source: LINDA 1968-2003.

The variation in the return to university education in Sweden is fairly well-known (e.g, Fredriksson and Topel, 2006). From the late 1960s until the mid 1980s it declined along with the overall compression of the wage distribution. Since the early 1990s there is a rather substantial increase. By 2003, the return to university education has almost returned to the level observed in the late 1960s.

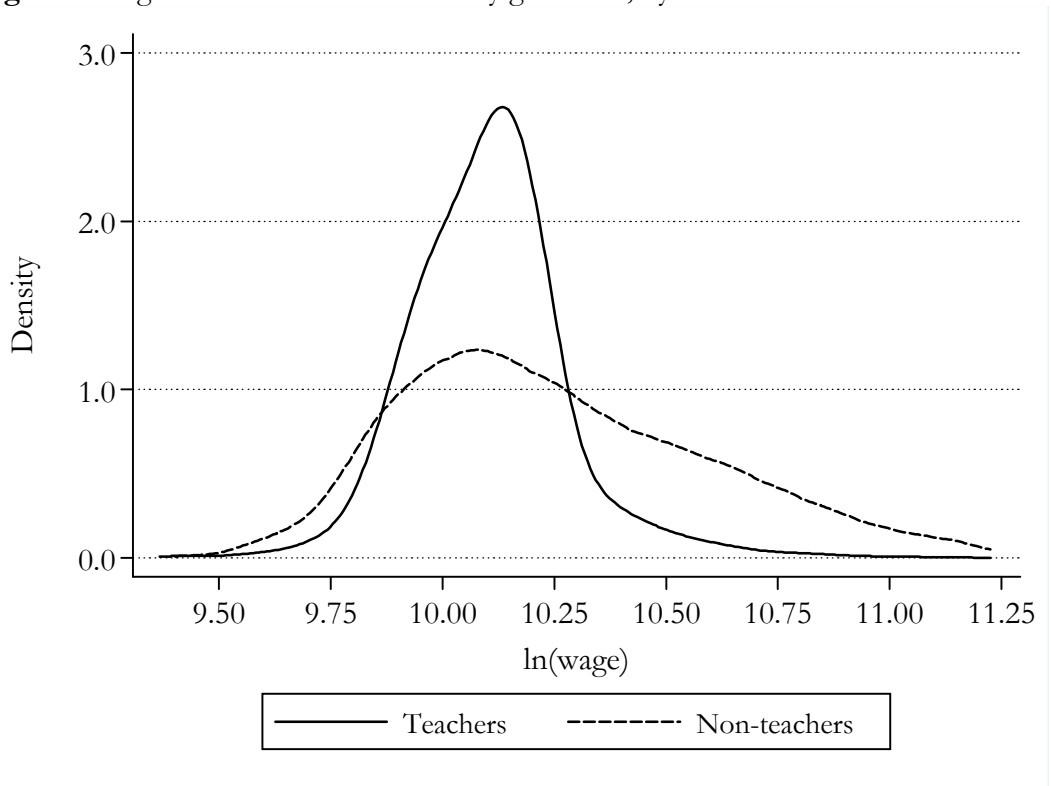
Things are radically different for teachers. In the late 1960s, teachers had about the same return as non-teachers. But during the 1970s and 1980s there is a much steeper decline for

[3] To be specific we have imputed the returns during t =1968,…,1991 using $\rho_t = (\beta_t^e / \beta_{1992}^e) \times \beta_{1992}^w$, where β_t^e denotes estimates based on the earnings equation and β_t^w estimates from the wage equation.

teachers than for other university-educated individuals. Moreover, there is no corresponding rebound in the wage premium during the 1990s. Over the time-period as a whole, the return to teacher education fell by 64 percent, in relative terms; the corresponding decline for other university educated individuals is 17 percent.

To shed some light on why the return to teacher education is relatively low, Figure 3 shows the wage distributions in 2004 for teachers and non-teachers respectively. Here (and in the remainder of the paper "Teachers" are individuals with a degree from a teacher program of 3-4 years-of-length; "Non-teachers" are individuals from other university programs of equal length (i.e. 3-4 years).

Figure 3 Wage distributions for university graduates, by teacher education



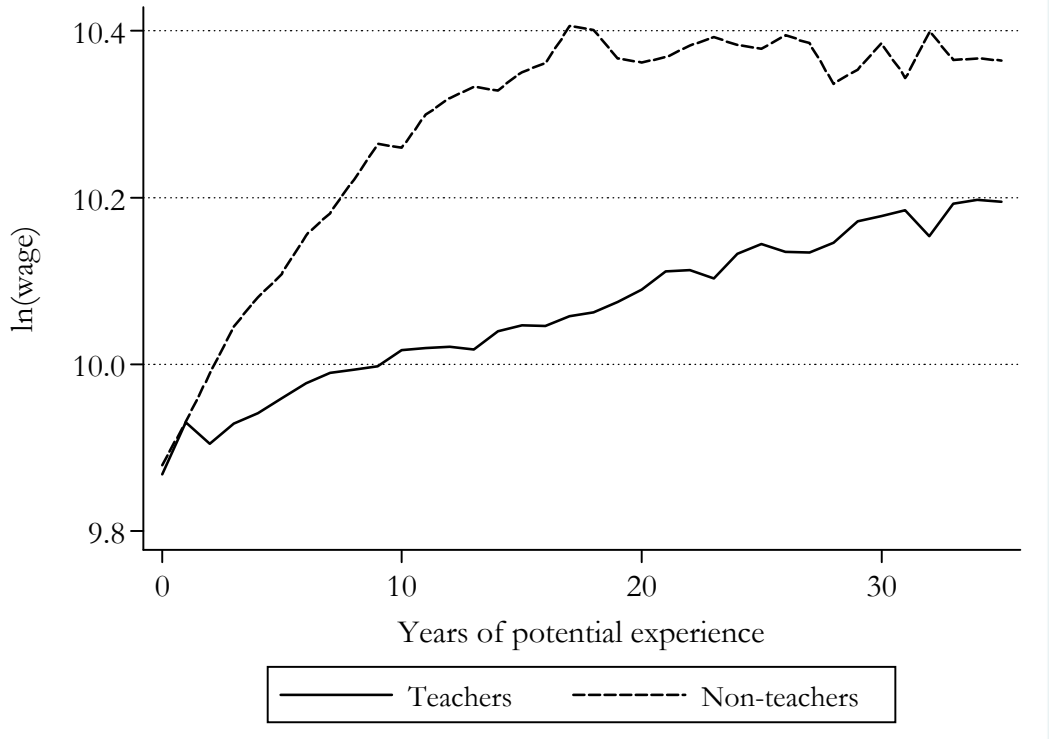
Notes: The figure shows smoothed Kernel-density plots using wages in 2004.

Figure 3 shows that wages among the teacher-educated are more compressed than among other university-educated individuals. To some extent one should not be surprised by this fact – after all, we are comparing one type of education with an aggregate containing several types of educations. Still, the teacher wage distribution is remarkably compressed; in particular the top-end of the wage distribution appears to be largely non-existent.

A particular feature of wage determination is that it was regulated by "wage scales" up to 1996. The wage scales featured a given entry wage and given wage increases by experience in the profession; at 20-25 years of experience there was a wage ceiling imposed. In 1996, teacher wage determination was de-regulated, however. Nevertheless, it is reasonable to believe that the wage distribution in 2004 has reminiscents of the old wage scales, which contributes to the observed wage compression. For instance, the variance of earnings is decreasing in age for teachers, while it is increasing in all other jobs; see Söderström (2006).[4]

Our objective now is to provide more information on the wage incentives facing individuals with a teaching-degree. What are the incentives to stay on in the profession? And how are skills rewarded? Figure 4 takes a first step in this direction by showing the experience profiles for teachers and non-teachers respectively. It seems that those with degrees from teaching programs have about the same starting wages as the remainder of the population with a university degree. But then, wages grow at a much lower rate on average. Thus, the return to staying on in the profession appears to be low.

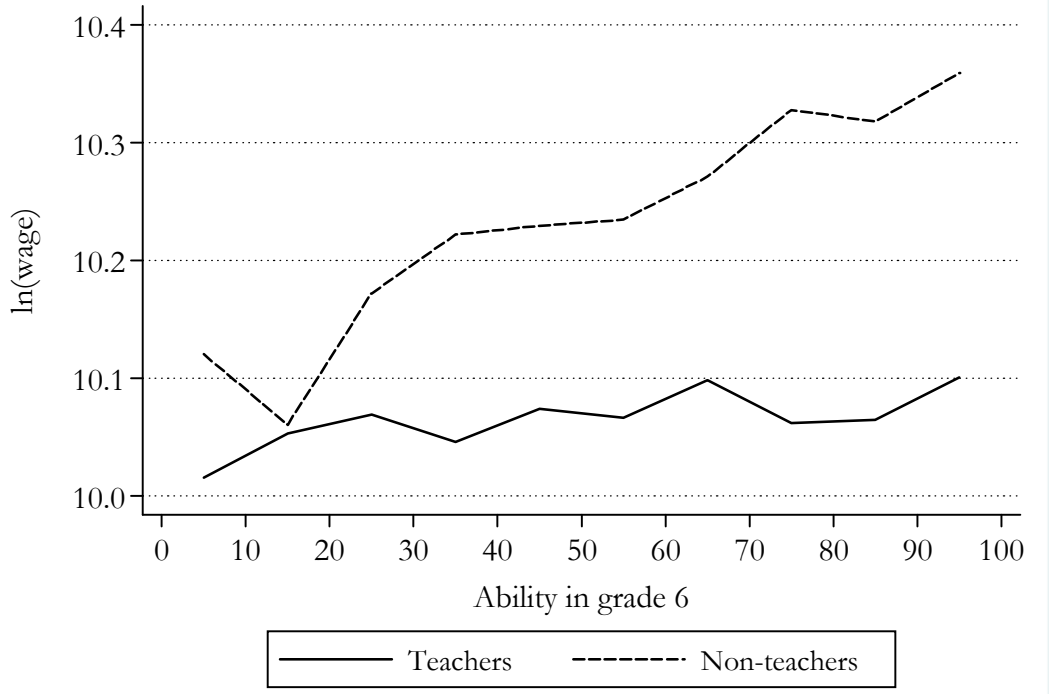
Figure 4 The experience profiles in 2004 for university graduates, by teacher education



[4] Söderström (2006) contains an analysis of how the reform to wage determination affected observed wage differentials.

Figure 5 examines another dimension of the returns to skill. It shows wages by measured ability at age 13, conditional on age and gender.[5] In most data sets this ability measure would be unobserved. The figure shows that the return to "unobserved" skills is lower for those with a teacher education. For those with a teaching degree, the return to skill is about 1 percent per skill decile, on average. For individuals with other degrees, the return is close to 3 percent.

Figure 5 The returns to ability for university graduates, by teacher education



Note: The lines show local average log wages conditional on cohort and gender.

In summary, the relative wages of teachers have declined over the past several decades, and this trend continued into the 1990s. During the 1990s, the return to university education grew steadily. At the same time, however, the return to teacher education was stagnant.[6] The teacher wage structure is very compressed. The returns to experience and other skills are substantially

[5] In the next section, we describe this measure of ability in more detail.

[6] Of course, there are also non-monetary reasons why one might chose a career in teaching, and these may also have changed over time. Björklund et al (2005) show that the percentage of employed teachers suffering from problems due to mental stress at the workplace increased more for teachers than for the average white-collar worker during the 1990s. Between 1991 and 2002, the fraction of teachers reporting health problems due to mental stress increased 5.7 percentage points more in teaching relative to other white-collar professions. It seems highly likely that the increase in reported mental stress is due to a substantial deterioration of working conditions during the 1990s.

lower for individuals with teacher education in comparison to individuals with other university degrees.

3. The supply of skills to the teacher profession

Here we mainly focus on the changes in the quality of teacher supply over a longer time period. To do this, we use data collected by the Departments of Education in Göteborg and Stockholm. These data contain the results on tests of random samples of 6th graders for the cohorts born in 1948, 1953, 1967, 1972, and 1977; see Härnqvist (1998) for a description of the data. Among other things, these data include scores on verbal, inductive, and spatial ability tests, which are identical across all five cohorts. These data have been matched with information on subsequent educational attainment, career choices and wages. We observe all of these outcomes in 2004. Using the matched data sets we can examine the relative performance on tests at age 13 for those who later decided to pursue a teacher education as well as those who entered the teacher profession.

One of the virtues of the data is that they span cohorts which made their career choice at very different time points. The majority of those born in 1948 presumably made their career choices in the late 1960s while those born in 1977 made their choices in the late 1990s. The question is whether the overall decline in the relative wages of teachers has affected the number of individuals opting for teacher education, the relative ability level of those who chose to enter teacher education programs, and, finally, those who work as teachers. As a measure of "ability", we use the sum of the scores from the three tests mentioned above.[7]

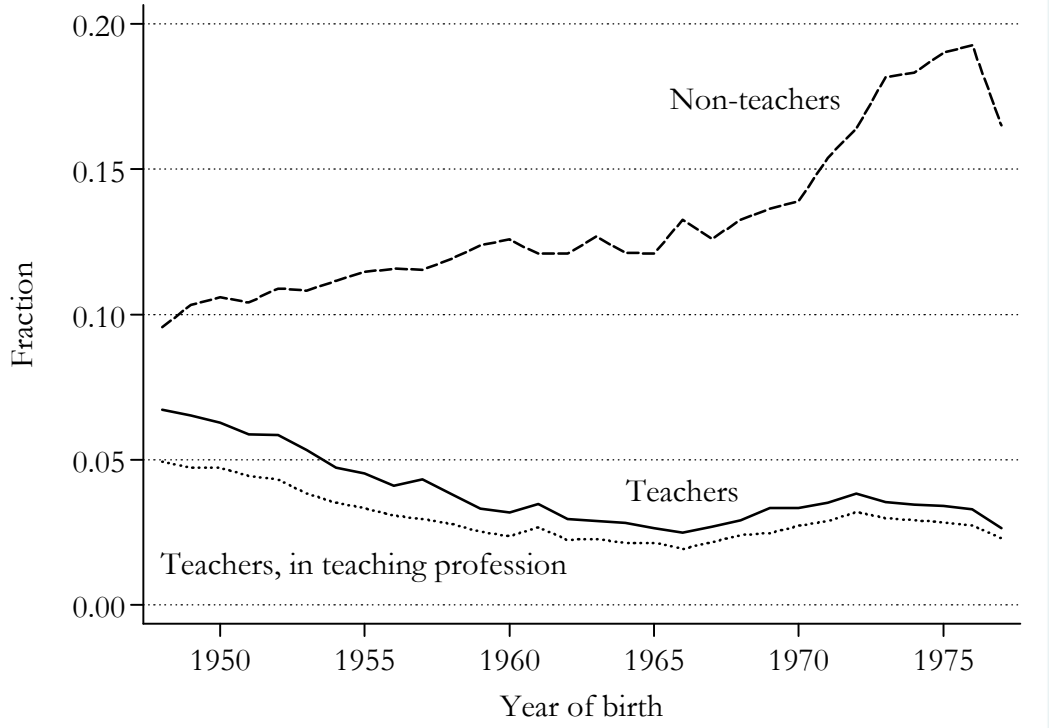
3.1 Quantity adjustments in response to changing incentives

How has the demand for teacher education evolved over time? To answer this question, Figure 6 shows the fraction of individuals with a university-education and teacher education by birth cohort, for the cohorts born 1948-1977.

[7] The appendix shows separate results for each test. The overall flavor of these results is similar to the one presented in the main text.

The number of university-educated increased at a steady rate for the cohorts born between 1948 and 1960; it was roughly flat for individuals born in the 1960s; from 1970 and onwards the share of individuals going to university has increased radically. The propensity to proceed to university education – at least when deviated from trend – thus seems to mirror the swings in the university wage premium relatively well; see Fredriksson (1997) on this issue.

Figure 6 Fraction of cohort with university-education and teacher education, 1948-77 cohorts.



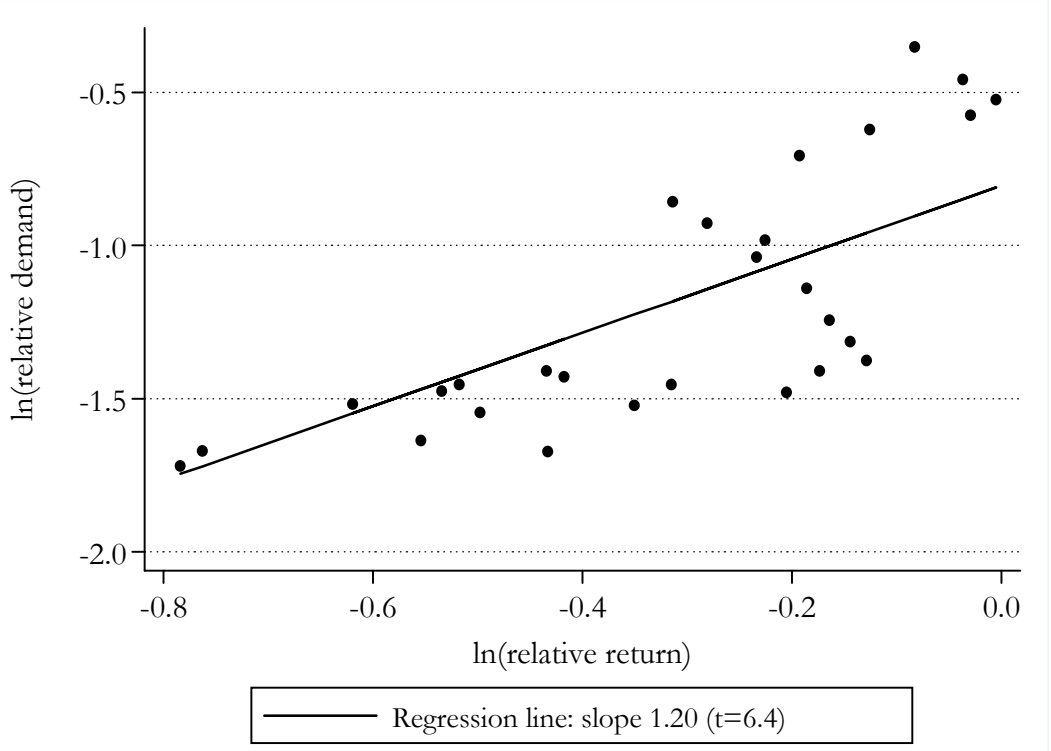
The evolution of the demand for teacher education seems to suggest an even more obvious link between quantity adjustments in response to changing incentives. In the cohort born in 1948, approximately 40 percent of those who obtained a university degree got a teaching degree. For the cohort born in 1975, the corresponding share had plummeted to one seventh.[8]

Figure 7 makes the quantity response to changing incentives explicit. It plots the relative demand for teacher education against the relative return to teacher education. In producing this figure we have, e.g., matched up the cohort born in 1948 with an observation on the relative rate of return observed in 1968. Of course, there are other conceivable assumptions here but it does

[8] Notice that this development is not driven primarily by the supply of slots. During the late 1980s and early 1990s, everyone who applied to teacher education was admitted; see Björklund et al (2005).

not make much difference. The overall conclusion is that there is a strong positive association between the relative demand for teacher education and the relative return. Taken literally, the demand elasticity equals 1.2, i.e., if the relative return increases by 1 % the relative number of individuals opting for teacher education rises by 1.2 %.

Figure 7 Quantity adjustments to changing incentives, 1968-97 (cohorts 1948-77).



Notes: Estimates of the relative return to teacher education is taken from Figure 2 and estimates of the relative demand from Figure 6.

3.2 Quality adjustments in response to changing incentives

How have quality responded to the changes in monetary incentives? Table 1 shows the average ability rank – i.e. the percentile ranked ability scores as defined above – by birth cohort.[9] Here there fewer points of observation, but the drop in the ability rank of those entering teacher education is suggestive of a relatively strong response to the decline in monetary incentives. In particular there is a significant drop between the cohort born in 1948 and the cohort born in 1972, a fall that continued through to the cohort born in 1977. Between the 1948 and 1977

[9] We have also done these calculations separately by gender; see the appendix. Doing the analysis separately by gender does not change the overall message much.

cohorts, the average rank of teachers has been reduced by a full decile. Notice that this drop occurred, even though the share opting for teacher education actually decreased.

Table 1 Ability rank for college graduates by teacher education, 1948-77 birth cohorts

Birth cohort	Teachers	Non-teachers
1948	68.3	70.4
Test for mean equal to 1948	(…)	(…)
Test for equal mean for teachers and non-teachers	[-1.65]	
Percentage of sample	5.2	10.8
1953	66.5	67.5
Test for mean equal to 1948	(-1.06)	(-2.54)
Test for equal mean for teachers and non-teachers	[-0.65]	
Percentage of sample	4.2	10.5
1967	65.2	69.2
Test for mean equal to 1948	(-1.52)	(-1.04)
Test for equal mean for teachers and non-teachers	[-2.07]	
Percentage of sample	2.3	12.0
1972	64.2	66.3
Test for mean equal to 1948	(-2.19)	(-3.86)
Test for equal mean for teachers and non-teachers	[-1.21]	
Percentage of sample	3.3	15.0
1977	57.9	66.6
Test for mean equal to 1948	(-3.21)	(-2.88)
Test for equal mean for teachers and non-teachers	[-2.69]	
Percentage of sample	1.9	15.0

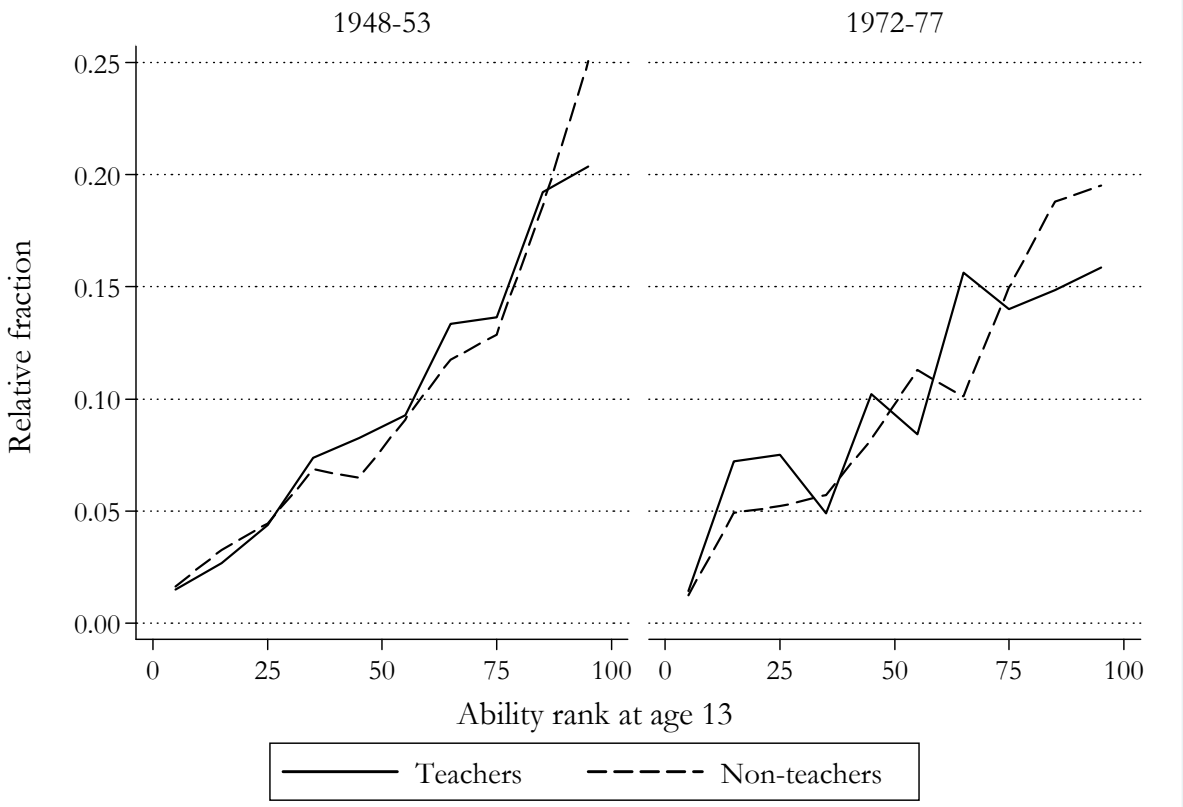
Notes: The ability scores are the sum of the scores on verbal, inductive, and spatial ability tests. The averages are weighted using the sampling weights. Numbers within parentheses are t-statistics from (equal variance) t-tests of the equality of the "current" rank and the 1948 rank; numbers within brackets are t-statistics from (equal variance) t-tests of the equality of the rank for teachers and the rank for non-teachers. Teachers are individuals with a pedagogical college degree of 3 or 4 years. Non-teachers refer to individuals who have another college degree of 3 or 4 years. Number of individuals with scores on all three tests: 9,662; 8,705; 7,714; 7,551 and 3,825 for the 1948, 1953, 1967, 1972 and 1977 cohorts respectively. See Härnqvist (1998) for more details on the study population and the sampling procedure.

The ability rank of individuals entering non-teacher education exhibits a similar downward trend. But note here that the share of each cohort entering university education has increased remarkably over time. Given that the ability rank is positively related to entering university education, there is a mechanical reduction in the average rank of individuals as the share entering university-education increases.[10]

[10] This conjecture can be supported by some formal analysis. There is reduction (increase) in the relative probability that individuals from the top (bottom) quintile of the ability distribution enter university education when the fraction of each cohort attending university rises. The shift in the skill distribution between 1948-53 and 1972-77 for non-teachers in Figure 8 provides further illustration of these facts.

What points in the ability distribution contributed mostly to the decline between the cohort born around 1950 and the cohorts born in the 1970s? Figure 8 examines this question by showing the empirical densities of the probability of having a university degree by ability rank and teacher education.

Figure 8 Distribution of university-educated by ability rank and teacher education, 1948-53 and 1972-77 cohorts



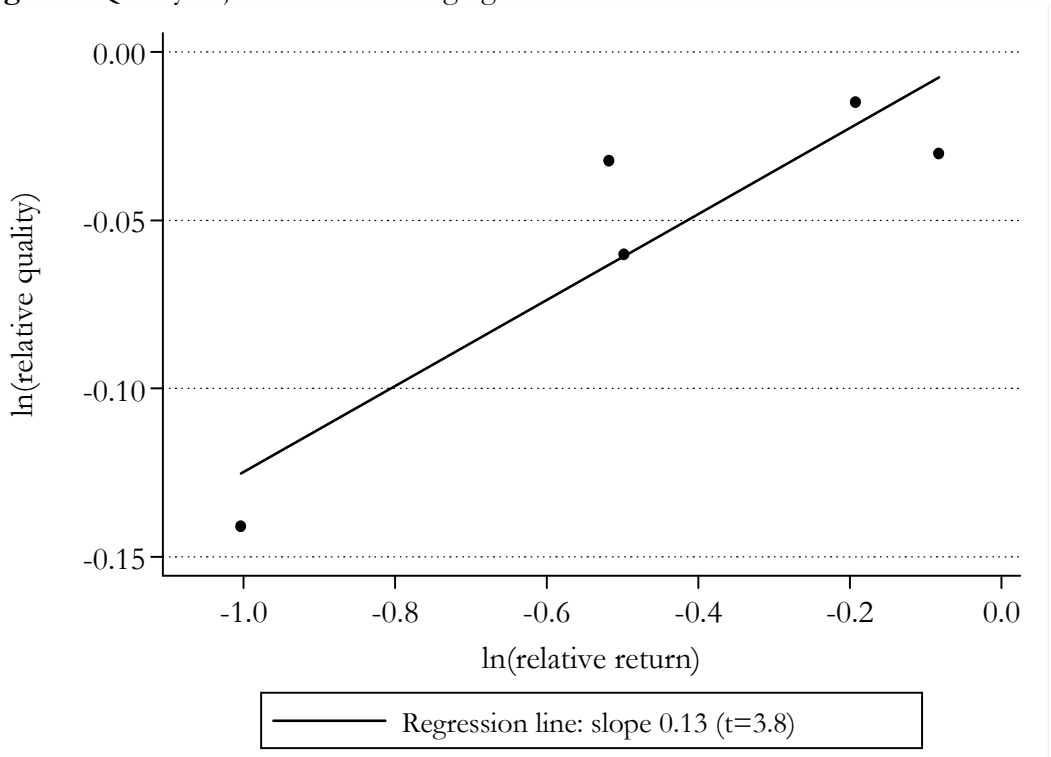
Notes: The relative fractions are constructed by normalizing the data such that they sum to unity by cohort and teacher education.

The change in the distribution for non-teachers over cohorts is suggestive of the "mechanics" alluded to above: the share of each cohort opting for non-teacher programs increased by 50 percent between the cohorts born 1948-53 and the cohorts born in the 1970s. Partly as a result of this increase, the probability that an individual came from the top (bottom) segment of the ability distribution decreased (increased).

There was no corresponding increase in the share opting for teacher education between the late 1940s and the 1970s. Nevertheless, the relative probability that the individual was from the bottom end of the distribution clearly increased.

It is of course tempting to examine the correlation between the supply of quality and the monetary incentive. Figure 9 plots the mean ability rank of individuals choosing teacher education against the relative return to teacher education. Given that there are only five observations, the numbers should be taken with more than the usual grain of salt. Nevertheless, the quality response to changing incentives appears to be relatively strong.

Figure 9 Quality adjustments to changing incentives



Notes: Estimates of the relative return to teacher education comes from Figure 2 and estimates of the relative ability rank of teachers from Table 1.

The evidence presented in this section tell a consistent story: The decline in teacher quality, as measured by scores on standardized tests of those entering teacher education programs, mirrors the decline in the relative wage of teachers from the late 1960s to the early 1990s. Together with the evidence reported in section 3.1, this means that the supply of skills adjusts along two

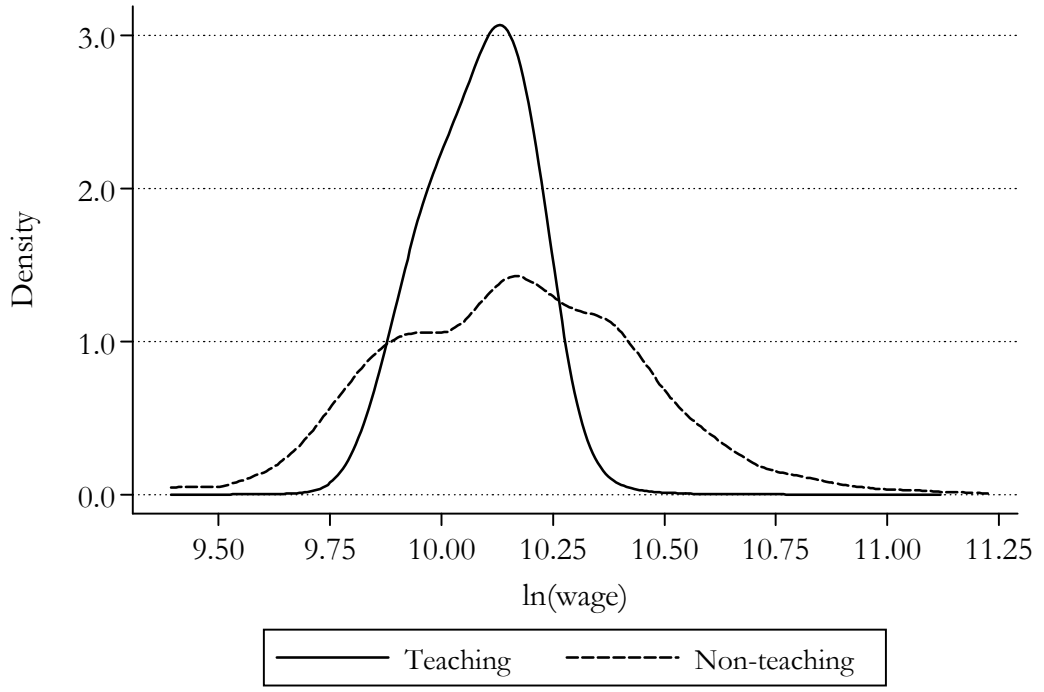
margins – the number of teacher educated as well as the quality of the individuals with a teaching degree both decrease along with decline in the incentives to become a teacher.[11]

With respect to the decline in quality, there is international evidence in a similar vein. Nickell and Quintini (2002) find a decline in the ability of male teachers in Britain. Corcoran et al. (2004) note that, over time, it has become less likely that females in the top decile of the ability distribution enter the teaching profession in the US; there is no decline among men (in fact there is a modest increase).

3.3 The incentives to remain in the profession for those with a teacher education

Now, we turn to the incentives to remain in the teaching profession for those with a teacher education. Figure 10 shows the wage distributions inside and outside teaching for those with teacher education.

Figure 10 Wage distributions for individuals with teacher education, by teaching status



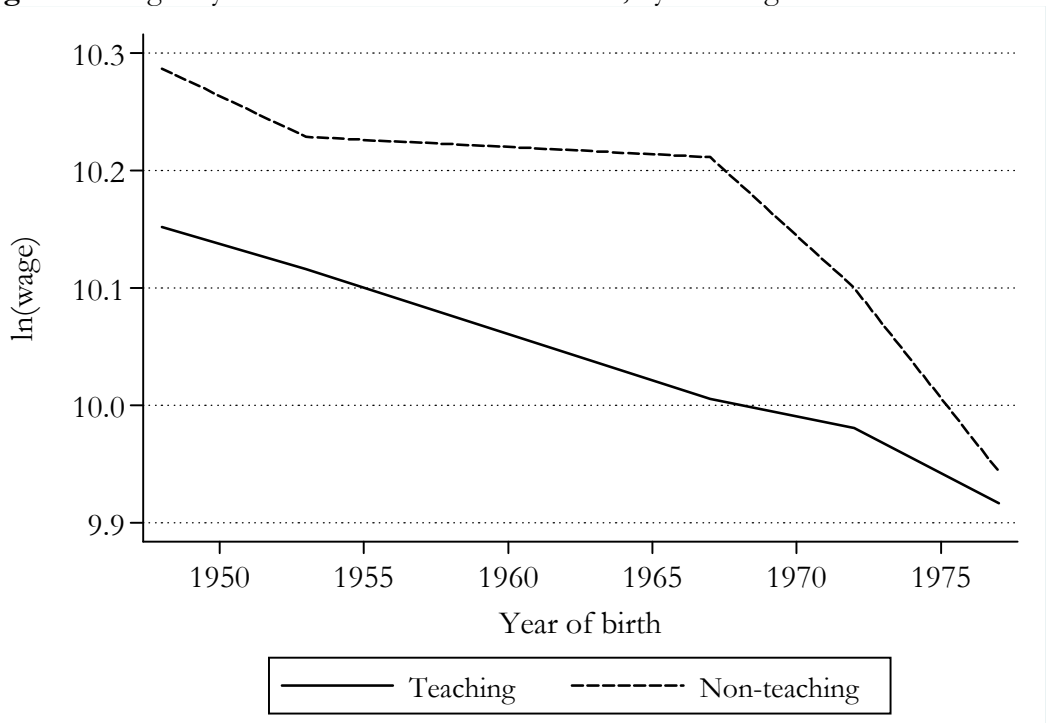
Note: The figure show Kernel density estimates.

[11] Indeed, a regression relating the (log of the) quality adjusted relative demand – i.e. the product of relative ability and the relative number of individuals – to the relative return suggests a demand elasticity of 1.7 with a t-ratio of 4.8.

The figure suggests that leaving teaching increases the probability of having a favorable wage outcome. Leaving teaching may also have negative wage implications, but the relative mass for teacher-educated outside teaching is skewed towards higher wages.

Figure 4 above suggested that the return to experience is low for the teacher-educated. Figure 11 shows that this is true even when we refine the comparison substantially. Here we plot average log wage in 2004, conditional on ability and gender, by cohort. Since years of education are held constant, by construction, the scale on the horizontal axis can basically be interpreted as the return to (potential) experience. For the teacher-educated individuals who leave (or do not enter) teaching, the experience profile is much steeper initially. If we compare individuals born in 1967 and 1977, wages outside teaching grow at 2.7 percent per year of experience, but only at one percent per annum if they stay in the profession. Since teacher experience is the only observed characteristic which is systematically related to student performance in general, the lack of return to experience in teaching may be worrying. Instilling more incentives to remain in teaching may well be a very useful change for students and parents.

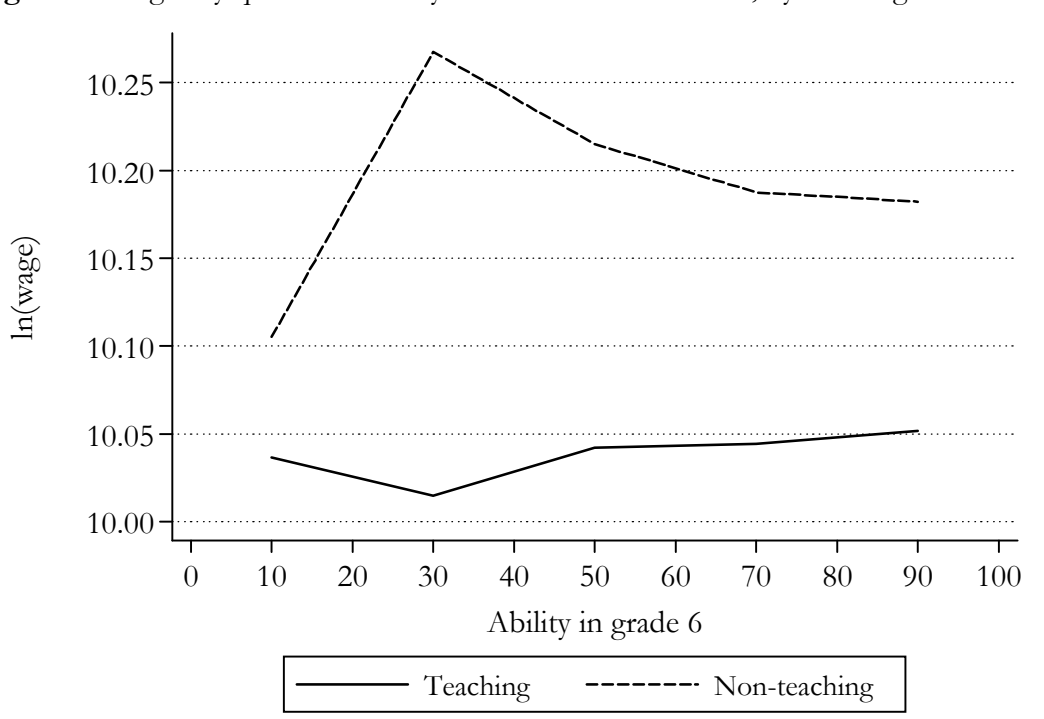
Figure 11 Wages by cohort for the teacher educated, by teaching status



Note: The lines show local average log wages conditional on ability and gender.

Finally, Figure 12 examines the return to ability inside and outside teaching, by showing the log wage by quintile in the ability distribution (conditional on cohort and gender). There is no skill-gradient inside teaching. There is something of a positively sloped, but highly non-linear, skill-gradient outside teaching. The return to leaving teaching is in the order of 15 percent for individuals belonging to the top quintile; it is approximately 7 percent for individuals in the bottom quintile. Again the wage incentives are geared towards losing the individuals that appear to be most able.

Figure 12 Wages by quintile of ability for the teacher educated, by teaching status



Note: The lines show local average log wages conditional on cohort and gender.

In sum, the analysis in this sub-section confirms the initial pass at the data in section 2. Teacher-educated individuals who leave teaching have a much higher return to experience and a greater return to other skills. The question now is whether these stylized facts have implications for the characteristics of individuals who leave the profession.

3.4 Who leaves teaching?

Given the incentive structure in teaching we would expect the more able and experienced to leave teaching. Unfortunately, producing convincing evidence on the latter issue is hard given the

structure of our data. We observe in which occupation individuals work in 2004. This means that individuals who are born early on – who are also those with the greatest amount of potential experience – are the ones who have had the longest time to adjust to the situation on the labor market. With this construction of the data set, the probability of not being in the teacher occupation would be higher for older individuals even if the probability of leaving the profession is independent of the return to experience.

Nevertheless, Figure 6 includes some information on this point. A comparison of the lines headed "Teachers" and "Teachers, in teaching profession", implies that it is less likely that older individuals remain in the profession. But for problems alluded to above, it is difficult to place much emphasis on this conclusion.

However, we can credibly look at the ability dimension. Table 2 shows the differences in mean ability for teachers and non-teachers, inside and outside teaching. Panel a) of the table shows that, on average, the most skilled leave the profession. Furthermore, non-teachers who enter teaching constitute a negative selection of the non-teacher ability distribution. Nevertheless, they are more skilled than the teachers who remain in the teacher profession.

Panel b) of the table, which does the same analysis separately by gender, shows that these selection patterns are almost entirely driven by men. The skill differences for females by teaching status are comparatively small; for males the differences are striking.

Figure 13 provides further details on the selection pattern by illustrating how the probability of remaining in teaching varies across the ability distribution. In order to control for the fact that time will automatically increase the probability to be observed outside the profession we condition on cohort (this is not done in Table 2). The graph shows that the probability of remaining in the teacher occupation is around 8 percentage points higher if you are from the bottom quartile of the distribution relative to the top quartile of the ability distribution.

In sum, this section shows that the supply of skills to the teacher profession adjusts along a third margin – namely the likelihood of remaining in the profession, conditional on having a teacher education. The evidence suggests that it is less probable that the more able – as measured at tests at age 13 – remain in the profession. In all likelihood, this is also a response to poor incentives created by the compressed structure of teacher wages.

Table 2 Ability rank for teachers/non-teachers by teaching status, all cohorts

Panel a) Males and females

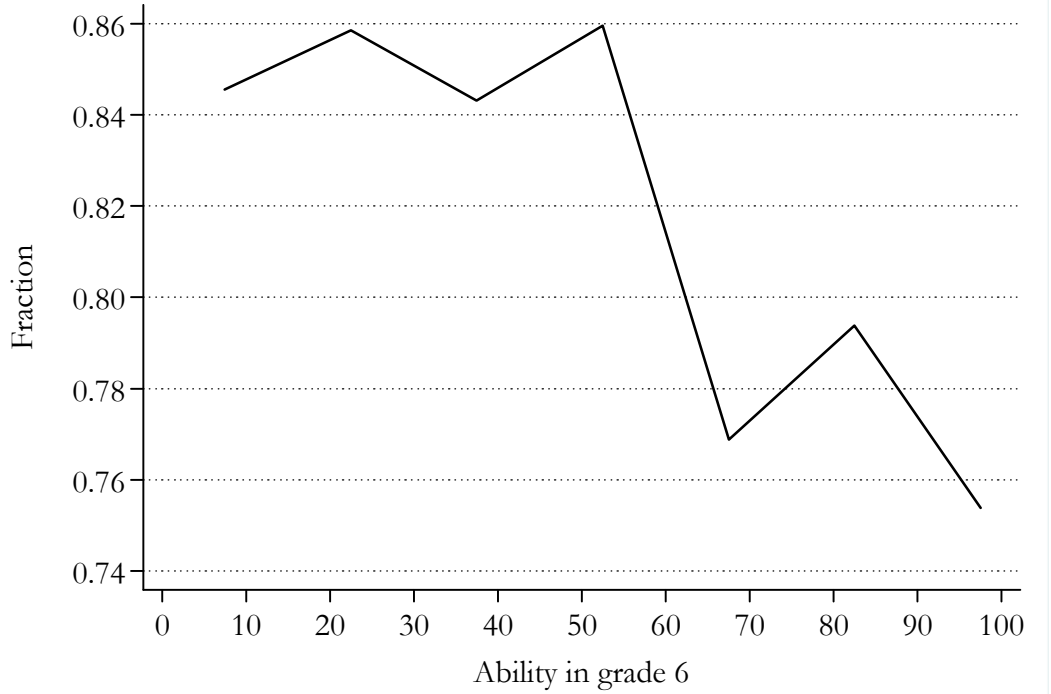
	Profession in 2004		
Education	Teaching	Non-teaching	All
Teacher	63.29	68.45	64.34
	(0.84)	(1.64)	(0.75)
Non-teacher	66.13	71.10	70.99
	(3.03)	(0.51)	(0.50)
All	63.54	70.94	69.42
	(0.81)	(0.48)	(0.42)

Panel b) By gender

	Profession in 2004		
Education	Teaching	Non-teaching	All
		Women	
Teacher	64.46	66.18	64.80
	(0.95)	(2.01)	(0.86)
Non-teacher	68.24	67.99	68.00
	(3.66)	(0.75)	(0.73)
All	64.76	67.83	66.95
	(0.92)	(0.70)	(0.56)
		Men	
Teacher	60.16	73.59	63.18
	(1.70)	(2.70)	(1.49)
Non-teacher	62.23	73.68	73.51
	(5.37)	(0.68)	(0.67)
All	60.39	73.68	72.08
	(1.62)	(0.66)	(0.62)

Notes: The ability scores are the sum of the scores on verbal, inductive, and spatial ability tests. Teachers are individuals with a pedagogical college degree of 3 or 4 years. Non-teachers refers to individuals who have another college degree of 3 or 4 years. The averages are weighted using the sampling weights. Standard errors are in parentheses.

Figure 13 Fraction of the teachers in teaching by ability rank



Note: The line shows local average fractions conditional on cohort and gender.

4. Conclusions

This paper has examined how the incentives to pursue a career in teaching have varied over time. We have shown that the return to teacher education deteriorated substantially between 1968 and 2003, relative to other university tracks. The teacher wage structure is remarkably compressed; in particular the return to experience and other skills (*inter alia* verbal and inductive ability) are very low in a comparative and absolute sense.

The supply of teacher skills has adjusted along a number of margins. The number of individuals opting for a teacher education has been reduced substantially, the ability rank of those getting a teaching degree has fallen, and the most able teachers appear to leave the profession.

Given the pervasiveness of "teacher effects" in explaining student outcomes, it seems most likely that these developments will have adverse consequences for student performance. Instilling appropriate incentives into the teacher wage structure should thus be a major concern for policy-makers.

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Appendix: Some additional descriptive statistics

Table A1 Ability rank for college graduates by teacher education, 1948-77 birth cohorts

	Verbal test		Spatial test		Inductive test	
Birth cohort	Teachers	Non-teachers	Teachers	Non-teachers	Teachers	Non-teachers
1948	69.77	70.29	58.18	61.67	66.15	67.62
Test for mean equal to 1948	(…)	(…)	(…)	(…)	(…)	(…)
Test for mean for teachers equal to non-teachers	[-0.40]		[-2.45]		[-1.09]	
Percentage of sample	5.24	10.85	5.24	10.85	5.24	10.85
1953	68.69	69.02	57.21	59.17	64.83	65.00
Test for mean equal to 1948	(-0.64)	(-1.15)	(-0.53)	(-1.99)	(-0.78)	(-2.25)
Test for mean for teachers equal to non-teachers	[-0.22]		[-1.15]		[-0.11]	
Percentage of sample	4.20	10.43	4.20	10.43	4.20	10.43
1967	67.17	67.66	56.29	61.82	63.47	67.07
Test for mean equal to 1948	(-1.21)	(-2.33)	(-0.83)	(0.12)	(-1.25)	(-0.48)
Test for mean for teachers equal to non-teachers	[-0.24]		[-2.54]		-1.78]	
Percentage of sample	2.28	12.02	2.28	12.02	2.28	12.02
1972	66.36	65.13	53.37	59.42	64.58	64.86
Test for mean equal to 1948	(-1.85)	(-4.89)	(-2.32)	(-1.93)	(-0.80)	(-2.51)
Test for mean for teachers equal to non-teachers	[0.72]		[-3.17]		[-0.16]	
Percentage of sample	3.31	15.01	3.31	15.01	3.31	15.01
1977	61.76	65.24	51.85	59.38	56.60	66.04
Test for mean equal to 1948	(-2.57)	(-3.95)	(-1.96)	(-1.61)	(-2.99)	(-1.20)
Test for mean for teachers equal to non-teachers	[-1.12]		[-2.33]		[-2.97]	
Percentage of sample	1.92	14.98	1.92	14.98	1.92	14.98

Notes: The ability scores are the sum of the scores on verbal, inductive, and spatial ability tests. The averages are weighted using the sampling weights. Numbers within parentheses are t-statistics from (equal variance) t-tests of the equality of the "current" rank and the 1948 rank; numbers within brackets are t-statistics from (equal variance) t-tests of the equality of the rank for teachers and the rank for non-teachers. Teachers are individuals with a pedagogical college degree of 3 or 4 years. Non-teachers refer to individuals who have another college degree of 3 or 4 years. Number of individuals with scores on all three tests: 9,662; 8,705; 7,714; 7,551 and 3,825 for the 1948, 1953, 1967, 1972 and 1977 cohorts respectively. See Härnqvist (1998) for more details on the study population and the sampling procedure.

Table A2 Ability rank for college graduates by teacher education and gender, 1948-77 cohorts

	Women		Men	
Birth cohort	Teachers	Non-teachers	Teachers	Non-teachers
1948	67.99	66.22	69.06	73.57
Test for mean equal to 1948	(…)	(…)	(…)	(…)
Test for mean for teachers equal to non-teachers	[1.04]		[-2.07]	
Percentage of sample	7.69	9.50	2.82	12.17
1953	66.38	63.82	66.86	71.23
Test for mean equal to 1948	(-0.83)	(-1.41)	(-0.70)	(-1.59)
Test for mean for teachers equal to non-teachers	[1.32]		[-1.63]	
Percentage of sample	5.93	10.48	2.46	10.42
1967	65.84	69.14	63.07	69.30
Test for mean equal to 1948	(-0.89)	(1.78)	(-1.57)	(-2.77)
Test for mean for teachers equal to non-teachers	[-1.39]		[-1.79]	
Percentage of sample	3.29	13.30	1.25	10.82
1972	62.93	63.87	67.05	69.41
Test for mean equal to 1948	(-2.36)	(-1.49)	(-0.53)	(-2.87)
Test for mean for teachers equal to non-teachers	[-0.46]		[-0.69]	
Percentage of sample	5.14	16.92	1.64	13.28
1977	58.53	62.26	53.48	73.08
Test for mean equal to 1948	(-2.84)	(-2.14)	(-1.36)	(-0.28)
Test for mean for teachers equal to non-teachers	[-1.10]		[-1.72]	
Percentage of sample	3.35	18.75	0.56	11.55

Notes: The ability scores are the sum of the scores on verbal, inductive, and spatial ability tests. The averages are weighted using the sampling weights. Numbers within parentheses are t-statistics from (equal variance) t-tests of the equality of the "current" rank and the 1948 rank; numbers within brackets are t-statistics from (equal variance) t-tests of the equality of the rank for teachers and the rank for non-teachers. Teachers are individuals with a pedagogical college degree of 3 or 4 years. Non-teachers refers to individuals who have another college degree of 3 or 4 years. Number of individuals with scores on all three tests: 9,662; 8,705; 7,714; 7,551 and 3,825 for the 1948, 1953, 1967, 1972 and 1977 cohorts respectively. See Härnqvist (1998) for more details on the study population and the sampling procedure.