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**TEACHER UNIONIZATION AND THE QUALITY
OF EDUCATION IN PERU:
AN EMPIRICAL EVALUATION USING SURVEY DATA**

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Abstract^{*}

This paper analyzes the evolution and current profile of teacher unionization and estimate the impact of unionization on the quality of public education in Peru. The research uses data from a 1999 household survey (ENAHO) and from a recent evaluation of a public program oriented to improve the quality of Peruvian public education.

Regarding the evolution of unionization, there is evidence compatible with the hypothesis that the rate of teacher unionization has dropped during the last three decades, but especially during the 1990s, due basically to the hiring of temporary teachers.

With respect to the profile of unionization, it is found that unionized teachers are older and more experienced, and that males are more common in the union membership. There is no empirical evidence that unionized teachers enjoy better access to educational infrastructure at the *polidocente* (larger) schools, but they do have better access at the *multigrado* (intermediate) schools.

For the impact of unionization on quality, Hoxby's production function model was adapted to the Peruvian case, in which public education is centralized and in which teachers do not have major influence on the education budget at the school or district levels. The model is estimated to test whether unionization has an impact on teachers' effort and student achievement, but there is no empirical support for these hypotheses. The data indicate that unionization does not currently seem to be a major factor affecting the quality of educational services in the Peruvian public education system.

Introduction

Peruvian public education is characterized by high coverage (at developed country levels) but extremely low expenditures per student, which raises serious concerns regarding the quality of the educational services that Peruvian children are receiving. Recent efforts by the Government of Peru to face this problem have been oriented toward increasing public expenditures on education infrastructure, inputs and teacher training, especially through a program focused on increasing the quality of education called MECEP (*Mejoramiento de la Calidad de la Educacion Peruana*). The program has increased inputs and training to teachers, although without significant changes in the institutional context in which the educational system works. There are concerns that the effectiveness of this policy may be limited due to adverse institutional factors.

One such important institutional factor is the presence of an important teachers' union (known by its Spanish acronym SUTEP) in the Peruvian educational public sector. The union might play a role in the provision of educational services if it affects the allocation of public resources to education and/or the incentives their affiliates face to provide services. This study is oriented toward evaluating empirically whether teacher unionism plays such a role in the Peruvian context.

There are no prior studies in Peru about the role of the teachers' union in the provision of education from an institutional and economic perspective. SUTEP is the only teachers' union in Peru and its current membership is estimated at 145,000 teachers nationwide. Founded in the 1970s, SUTEP has had an important role in the last three decades due to the mobilization of teachers, especially during the 1970s and 1980s. Its political clout and economic importance declined during the 1990s, although recently (2000-2001) it has started to increase its influence on policy in response to the Ministry of Education's controversial practice of appointing temporary teachers. As the union is still one of the largest in Peru's public sector, questions regarding its effect on the quantity and quality of educational services clearly remain important for policymakers and researchers.

In particular, this project addresses four specific questions related to the teachers' union: (i) how has the rate of teacher unionization evolved during the last three decades?; (ii) is the profile of unionized teachers different from that of non-unionized ones?; (iii) is there empirical evidence that teachers affiliated with SUTEP have better access to educational resources than

non-unionized teachers?; and (iv) is there empirical evidence that unionized teachers display different (better or worse) performance in the provision of public educational services?

Recent program evaluations and case studies have made available data that allow for an empirical treatment of these issues. A growing body of evaluations and studies has created a critical mass of information permitting a more rigorous exploration into which institutional and economic factors may affect the quality and provision of education services to Peruvian children (Instituto Apoyo 1999a, 1999b and 2000). In particular, this study uses data taken from a recent evaluation of the MECEP Program (Instituto Apoyo, 1999b) and from a national household survey (ENAHO, 1999) in which there is a large sub-sample of teachers.

This paper is divided into the following five sections: Section 1 describes the institutional context in which teacher unionization has taken place in Peru in the last three decades; Section 2 analyzes questions about the evolution of unionization, union profiles and differential access to educational infrastructure; Sector 3 develops a model which will be used to answer the fourth question on performance based upon a production function approach; Section 4 describes the estimation results for the model; and Section 5 concludes.

1. Unionization and the Peruvian Educational System

In contrast with the U.S. and other Latin American countries (Hoxby, 1996), the public education system in Peru is fairly centralized, and most if not all allocation decisions are made by a central authority, the Ministry of Education (MOE). Likewise, the teachers' union, *Sindicato Unico de Trabajadores de la Educacion del Perú* (SUTEP) is a consolidated and centralized body that seeks to influence both general policies as well as sector decisions. Founded in 1973 through a merger of four autonomous unions, SUTEP has since been the sole teacher's union in Peru, with a current membership of about 145,000 of the country's 265,000 public teachers.

Most analysts of the union agree that the union's influence on policy and salary bargaining reached its peak in the mid 1970s, and in 1975-1977 the union organized one of the longest strikes against the military government. After 1977 about 10,000 teachers (especially those involved in union leadership) were laid off by the military government, seriously weakening the union's power. In those years the leftist party *Patria Roja* gained control over the union leadership, which it still holds today.

During the 1980s SUTEP concentrated its activities on organizing eventual national strikes which were less and less effective as the country's economic conditions deteriorated. In 1984 the union was finally recognized by the Belaúnde Government (1980-1985) after several years of union pressure and mobilization.

In interviews with people related to the union, it was mentioned that unionization in the early years of SUTEP (1970s and early 1980s) was basically related to the political convictions of university students. In those years, young students in the education career were easily attracted to the leftist ideology of *Patria Roja*, and after graduation they became union members as an expected next step. Another proposition that called for attention was that the presence of SUTEP in rural areas was important due to the political work done by the main party behind the leadership. As representation in the union leadership is related to the number of political districts rather than to the number of students in schools (higher in urban sites), rural areas remain important for party advocates and union work.

Each year SUTEP approves a document called the “*Pliego de Reclamos*” in which it lists all its demands to the Government in terms labor conditions, wage increases and educational goals, among other general political issues. The document has been losing importance over the years, but it is still one of the main tools that SUTEP leaders use in their union activities.

Another very important tool of union operation is the DERRAMA fund, a fund that is managed by the SUTEP Executive Committee and used to provide some services (including loans) to union members. The fund started with teacher salaries confiscated during the 1977 strike, and it is also maintained by monthly contributions from members. An important change to the institutional context of the Peruvian educational system was the approval, in 1990 at the end of the Alan García government, of a new law for teachers (*Ley del Profesorado*) that created a special status for teachers. After that law, it was stated that only those persons who have studied to be a teacher can be hired in the public sector, closing this option for other professionals. Also, according to this law, teachers in the public sector are public servants with full duties and privileges. A teacher who is tenured (i.e., which occupies a formal position in the public cadre of personnel, or CAP) has job security and social security benefits when retiring. The approval of the Law is considered one of the SUTEP's most important achievements.

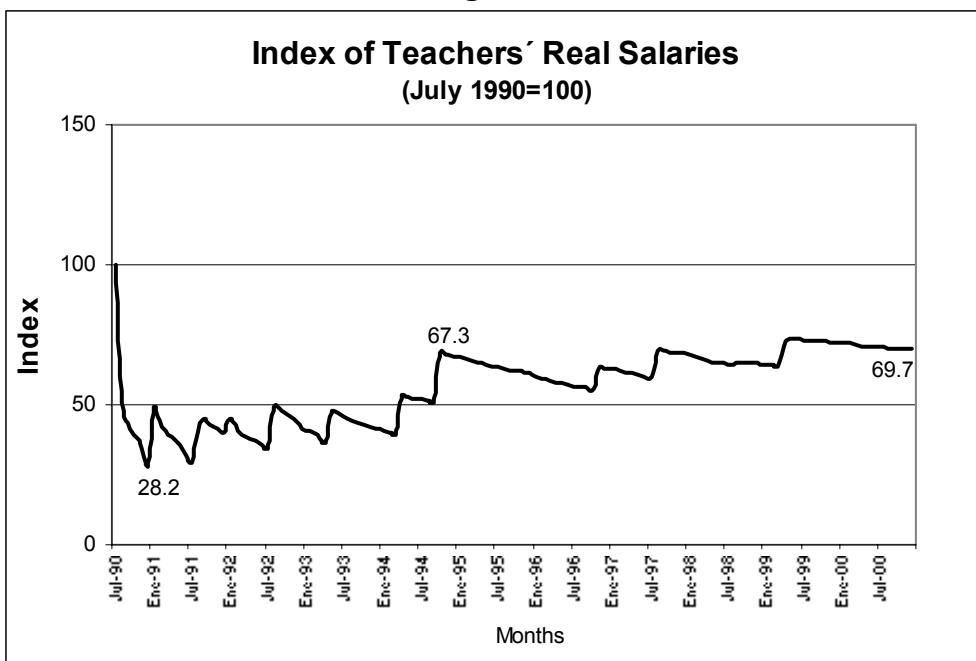
Since the impact of any salary adjustment for teachers on the public budget is generally very big, the last three governments (1980-85, 1985-90, 1990-2000) have been totally opposed to

any significant increase in teachers' wages in real terms. After the severe economic crisis of 1990 (in which inflation reached four digits), the new Fujimori Government froze the size of the educational CAP in order to avoid increasing pressure on the budget from the almost 40,000 retired teachers. However, the demand for teachers remained high in a country in which most of the population sends their children to public schools. Thus, after 1993, the authorities introduced an innovation in its labor relations, allowing the hiring of "temporary" teachers. Currently, it is estimated that about 25 percent of teachers have non-tenured status in the public sector.¹ This dual structure for teachers is not linked to any significant wage differences (differentials are minimal; wages being equally low for all teachers). There is, however, an important distinction: non-tenured teachers do not enjoy job security and as a consequence can be fired at any moment without compensation. In addition, they do not receive any pension benefits, as they are hired under a contract in which the non-tenured teacher is a sort of service provider without any of the considerations of a stable labor relationship. Clearly this option was used to avoid increasing pressure for social benefits among teachers while accommodating the demand for an increasing number of teachers.

In the 1990s the SUTEP did not play a direct role regarding wage bargaining or even policy decisions. After the collapse of wages at the beginning of the 1990s, teachers' real wages did not recover during the whole decade under Fujimori's rule, and at the end of the decade they were a mere 70 percent of real wages in 1990 (Figure 1).

¹ The Toledo administration has recently begun to grant tenure to temporary teachers based on an evaluation, a process which is still contested by SUTEP. The end-point of this process (probably 2003) may change in unexpected ways the specific weight of the union in the educational sector, however, as tenured teachers are more likely to enroll in the union.

Figure 1.



With teachers' salaries at low levels, the Fujimori Government increased public investment in education. Since 1996 the Peruvian educational system enjoyed higher levels of investment, especially in inputs, training and infrastructure.² Although SUTEP did not play a significant role in these decisions, at least at the central level, it may have influenced the impacts on educational outputs. Because of the massive coverage and network structure of the union, the possibility cannot be ruled out that SUTEP plays a significant role in the efficiency of resource allocation; this topic will be explored in Sections 3 and 4.

Another important avenue through which the union may influence the educational output is in the process of teacher allocation itself, for example among rural and urban areas, or among different types of schools. In general, according to experts interviewed for this paper, the process of allocation is not linked to performance or training, and teachers are assigned to rural and urban areas without major planning, evaluation and incentives by the MOE. In recent years, temporary teachers have been much more likely to be assigned to less favorably located schools in rural areas. It is plausible that SUTEP may have ways to influence this allocation process favoring unionized teachers (to better schools), and therefore affecting the final output of the

² This occurred basically through the MECEP program and the investment by FONCODES and INFES in school infrastructure.

education process. This result would be policy relevant if unionized teachers are really different in the provision of educational services, which will be evaluated in Sections 3 and 4.

2. Unionization, Teacher Profile and Access to Educational Infrastructure

2.1. Unionization in the Public Teacher Career

This paper uses two sources of data regarding the unionization status of teachers: (i) the 1999 ENAHO survey, which is a representative sample of all Peruvian households in which there is a sub-sample of 574 teachers; and (ii) the 2000 MECEP evaluation survey, which is based on a stratified sample of 700 schools nationwide, with about 1,400 teachers surveyed.

Table 1 relates teachers' experience to current unionization status in the 1999 ENAHO survey. The rate of unionization among surveyed teachers is 45 percent, and teachers with more experience are more likely to be unionized. The data are also compatible with a declining rate of unionization in the last three decades. For the purpose of relating these figures to rates of unionization, however, it is necessary to accept the assumption that exit rates and changes in union status among teachers do not have a significant impact on the average rate of unionization.

Table 1. Experience and Unionization

	Nº Teachers	Unionized	
Year became teacher			
less 1980	40	28	70%
1980-85	103	61	59%
1986-90	171	99	58%
1991-99	260	72	28%
Total	574	260	45%

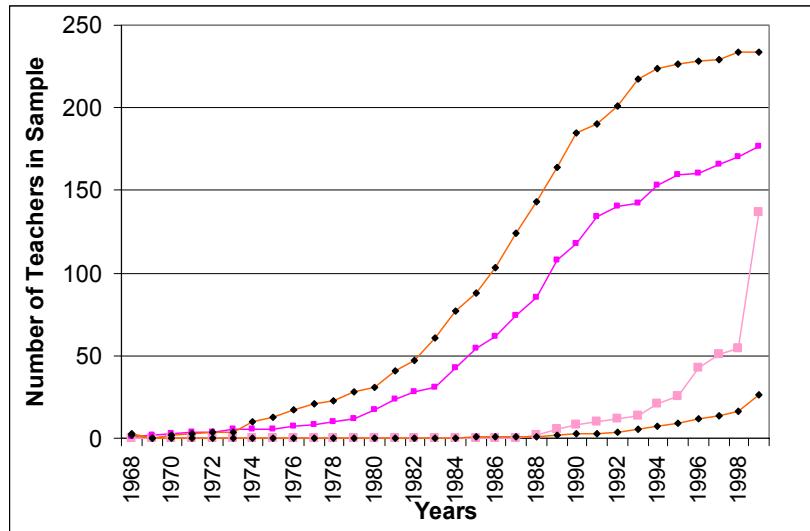
Source: ENAHO 1999

If it is accepted that the rate of unionization in the public educational system has been dropping in the last three decades, the data suggest that this phenomenon has been more dramatic in the 1990s, associated basically with the entry of non-tenured teachers who are less likely to be unionized.

It should be mentioned that the ENAHO sample is not necessarily representative of teachers. Nonetheless, given the importance of teachers in the total number of households (about 12 percent of households include a teacher), it may be a good approximation.

Figure 2 shows the total number of teachers in the ENAHO sample by four categories in terms of unionization and labor contract. The horizontal axis displays the year in which teachers in the sample started teaching.

Figure 2. Teachers Classified by Unionization and Type of Contract

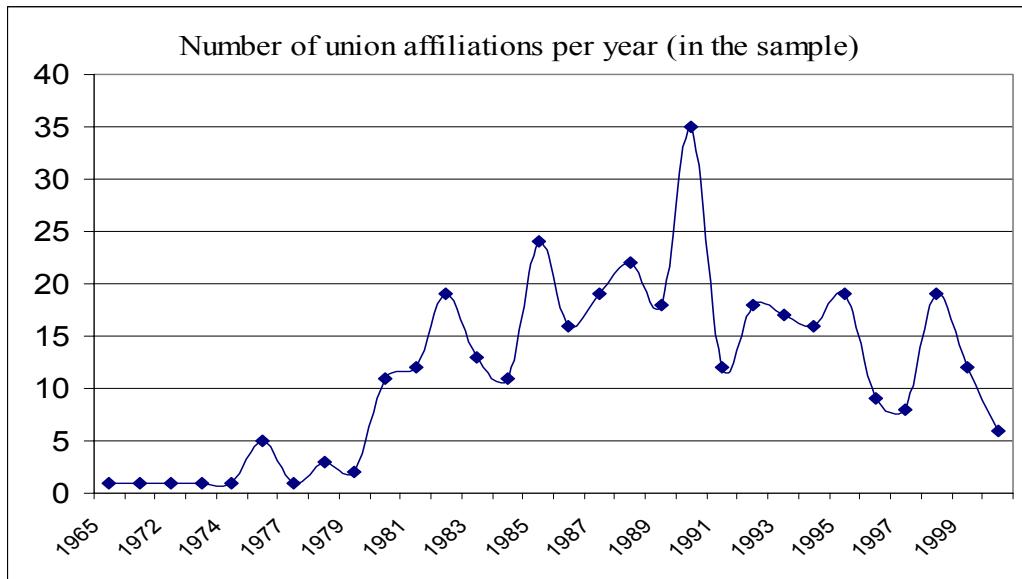


Source: ENAHO 1999.

The figure supports the idea that lower unionization in the 1990s could be associated with the increasing importance of non-tenured teachers in that decade, especially after 1995. If temporarily hired teachers are excluded from the sample, the proportion of unionization is 57 percent instead of 45 percent. Thus, the average rate of SUTEP affiliation may be about 60 percent among tenured teachers.

As shown in Figure 2 below, the sample of teachers from the MECEP evaluation shows the same pattern observed in Table 1. Affiliation with the union has been much more common in teachers with more than 10 years of experience compared to teachers who have recently entered the profession. The presence of temporarily hired teachers in recent years is clearly one of the reasons for this difference.

Figure 3.



Source: MECEP evaluation survey, MOE and Instituto APOYO.

2.2. Teacher Profile and Union Status

Table 2 presents the distribution of teachers taken from the ENAHO sample of teachers at the national level by type of location.

Table 2. Unionization of Teachers and Location

	Non Unionized	Unionized	Rate of Union
Capital cities	81	52	39%
Big cities	58	68	54%
With more than 2,000 inh.	88	57	39%
Total urban	227	177	44%
500-2000 inhabitants	35	43	55%
Disperse	52	40	43%
Total rural	87	83	49%
Total	314	260	45%

Source: ENAHO 1999.

As can be seen, unionization is greater in rural areas (49 percent) than in urban areas (44 percent), a difference that is statistically significant at the 95 percent confidence level. This result is consistent with interviews with SUTEP members, who state that the union has a strong presence in rural areas.

Table 3 displays a similar breakdown for teachers' tenure status.

Table 3. Tenure Status of Teachers and Location

	Non Tenured	Tenured	Rate of Tenure
Capital cities	26	107	80%
Big cities	36	90	71%
With more than 2,000 inh.	46	99	68%
Total urban	108	296	73%
500-2000 inhabitants	22	56	72%
Disperse	33	59	64%
Total rural	55	115	68%
Total	163	411	72%

Source: ENAHO 1999.

As can be seen, non-tenured teachers are more likely to be assigned to rural areas than tenured teachers, which reflects the increasing presence of temporary teachers in rural areas. This factor may negatively affect the rate of unionization in rural areas (as temporary teachers are less likely to join), although it still did not have the effect of making unionization less strong in rural than in urban areas. In general, as mentioned before, temporary teachers are currently being allocated to the poorest schools, which are generally located in rural areas without major incentives.

Table 4 presents the proportion of teachers who have a secondary activity besides teaching, ordered by location. It can be seen that unionized teachers are more likely to have a secondary activity, but this may be the case because teachers with secondary activities join the union in order to have some extra protection from being fired. Unionized and tenured teachers

have a slightly higher presence of secondary activities than non-unionized, but the difference is not significant in statistical terms.

Table 4. Secondary Activity by Teachers

	Non-Unionized			Unionized		
	Non-Tenure	Tenure	Total	Non-Tenure	Tenure	Total
<i>Have secondary activity(%)</i>						
Capital cities	38%	40%	40%	80%	40%	44%
Big cities	35%	52%	43%	80%	33%	37%
With more than 2,000 inh.	41%	39%	40%	57%	58%	58%
Rural 500-2000 inhabitants	53%	39%	46%	60%	55%	56%
Rural disperse	52%	65%	58%	25%	61%	57%
Total	43%	45%	44%	62%	48%	49%

Source: ENAHO 1999.

Looking at other characteristics of teachers and their union status in the ENAHO sample of teachers, a probit estimation was made of the probability of being unionized in relation to several other characteristics. The results are presented in Table 5.

Table 5. Factors Affecting Unionization Rates

Probit estimates for Unionization of Teachers

Number of obs	574
LR chi2(6)	111
Pseudo R2	0.141
Log likelihood =	-339.7

	dF/dx	Std. Err.	z	P>z	x-bar	[95%	C.I.]
Rural	0.079	0.049	1.62	0.10	0.30	-0.02	0.18	
Tenure	0.323	0.054	5.21	0.00	0.72	0.22	0.43	
Single	-0.086	0.056	-1.52	0.13	0.24	-0.19	0.02	
Male	0.125	0.044	2.81	0.01	0.48	0.04	0.21	
Age	-0.005	0.004	-1.06	0.29	34.93	-0.01	0.00	
Experience (years)	0.015	0.006	2.73	0.01	9.05	0.00	0.03	

obs. P .4529617

pred. P .4356322

(at x-bar)

Both rural location (although at a 10 percent level of significance) and tenure status (a tenured teacher is 32 percent more likely to be unionized than a non-tenured teacher) are clearly related to union status, confirming the statistical validity of the previous analysis of differences. In terms of the other features in the regression, it is seen that years of experience as a teacher is an important variable associated with unionization. Even when tenured status and location are

controlled for, the experience variable appears significant implying than unionization is more likely among teachers with more experience. Another important result is that male teachers are much more likely (13 percent) to be unionized than female teachers. Marital status and age appear as non-significant at the 10 percent level of significance.

The data from the MECEP evaluation survey provides similar results in terms of the variables analyzed with the ENAHO survey. However, the MECEP data provide somewhat more information about teachers. For instance, Table 6 presents the level of education and the institution from which teachers graduated. It can be seen that hired (i.e., non-tenured) teachers are more likely to come from an institute than from a university. They are also more likely to come from a private institute in comparison with tenured teachers.

Table 6. Teachers' Levels of Education

	Hired	No Sutep Tenure	Total	Hired	Sutep Tenure	Total	TOTAL
Level of Education							
Only secondary	0	0	0	0	1	1	1
Institute	88	291	379	12	238	250	629
University	18	93	111	3	80	83	194
Other	2	35	37	1	18	19	56
Institution							
Public Institute	71	301	372	11	237	248	620
Private Institute	15	15	30	1	10	11	41
Public University	16	78	94	1	72	73	167
Private University	2	12	14	1	11	12	26
Other	4	13	17	2	5	7	24
Total	108	419	527	16	335	351	878

	Percentages by column						
	Hired	No Sutep Tenure	Total	Hired	Sutep Tenure	Total	TOTAL
Level of Education							
Only secondary	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%	0.1%
Institute	81.5%	69.5%	71.9%	75.0%	71.0%	71.2%	71.6%
University	16.7%	22.2%	21.1%	18.8%	23.9%	23.6%	22.1%
Other	1.9%	8.4%	7.0%	6.3%	5.4%	5.4%	6.4%
	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Institution							
Public Institute	65.7%	71.8%	70.6%	68.8%	70.7%	70.7%	70.6%
Private Institute	13.9%	3.6%	5.7%	6.3%	3.0%	3.1%	4.7%
Public University	14.8%	18.6%	17.8%	6.3%	21.5%	20.8%	19.0%
Private University	1.9%	2.9%	2.7%	6.3%	3.3%	3.4%	3.0%
Other	3.7%	3.1%	3.2%	12.5%	1.5%	2.0%	2.7%

Source: MECEP Evaluation Survey, MOE, Instituto APOYO

This sample shows that 9 percent of teachers are not degreed, a proportion which is greater among unionized teachers (10 percent versus 6 percent among the non-unionized). In the non-unionized group, non-degreed teachers are found exclusively among temporarily hired teachers, whereas in the unionized group the non-degreed percentage is the same for hired and tenured teachers.

2.3. Access to Educational Resources

Teachers may have differentiated access to educational resources according to different characteristics and the decisions made by the MOE. This sub-section therefore analyzes the access of teachers to some educational resources using data from the MECEP evaluation study.

Table 7 presents data related to educational infrastructure by teachers according to their tenure and unionization status. As can be seen, tenured teachers are more likely to be located at bigger and better schools (*polidocentes*) than non-tenured teachers. In other words, non-tenured teachers are more likely to be present in *unidocente* (i.e., rural) schools.

Table 7. Infrastructure and Teachers' Union and Tenure Status

	Non-Union		Union		Total
	Non-Tenure	Tenure	Non-Tenure	Tenure	
Teachers	188	419	46	454	1107
<i>School features</i>					
Polidocente	22%	57%	17%	62%	52%
Multigrado	37%	43%	20%	36%	38%
Unidocente	42%	0%	63%	2%	11%
Drinkable water	52%	73%	50%	78%	71%
Electricity	23%	54%	22%	61%	50%
Sewarage	17%	44%	11%	53%	42%
Director in Sutep	20%	28%	93%	43%	36%
<i>Local features</i>					
Drinkable water	58%	73%	59%	81%	73%
Electricity	28%	56%	26%	64%	54%
Sewarage	16%	42%	9%	52%	40%
Health center	33%	66%	33%	69%	60%
Hospital	4%	18%	2%	20%	16%
Telephone	18%	45%	11%	54%	42%
Paved road	29%	48%	20%	64%	50%
Bank	3%	17%	2%	25%	17%
Police station	10%	29%	11%	38%	29%
Secondary school	18%	49%	17%	60%	47%
Spanish	61%	79%	76%	84%	78%

Source: MECEP Evaluation, MOE, Instituto APOYO.

This pattern clearly affects access to educational and local infrastructure. *Polidocente* schools are more likely to have electricity and drinkable water. Also, in terms of the context in which the school is located, it is apparent that *polidocente* schools are more common in urban areas and so, have better local services. This analysis suggests that in comparing access to educational resources by unionized or non-unionized teachers it is necessary to control for type of school

The table shows that when the surveyed teacher is affiliated with SUTEP the principal of the school is also more likely to be a member of the union. This seems to be related to the fact

that in *multigrado* and *unidocente* schools the interviewed teacher is generally the principal of the school as well.

In order to make the analysis easier and to incorporate other variables associated with teachers, an index of access to educational infrastructure was constructed in which school features have a weight of 75 percent and local services 25 percent.³ This index gives a good idea of differences in school quality, i.e., in teachers' access to educational infrastructure.

Two regressions were run, one for *polidocente* schools and the other for *multigrado* schools, in order to see whether there are some differences in teachers' access to educational resources controlling by type of school (problems were encountered with teachers' data for *unidocente* schools). The results are presented in Table 8.

³ The index was built as follows. There were 17 items of access to infrastructure, 11 for local services and 6 for school services, so there are two vectors with 11 and 6 components, respectively. The ratio of existent services was taken in each vector (a value between 0 and 1). Local services were weighted by 0.25, and school services by 0.75, thus obtaining the total index for infrastructure.

Table 8. Effects of Unionization on Access to Infrastructure

Regression of Infrastructure index on teacher features
Polidocene schools

Number of obs	482.0
F(5, 476)	53.2
Prob > F	0.00
R-squared	0.36
Adj R-squared	0.35
Root MSE	0.19

	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
Union	0.011	0.018	0.603	0.547	-0.025 0.046
Tenured	0.049	0.031	1.583	0.114	-0.012 0.109
Number classrooms	0.022	0.001	15.289	0.000	0.019 0.024
Male	-0.038	0.018	-2.043	0.042	-0.074 -0.001
Age (years)	0.022	0.012	1.734	0.084	-0.003 0.046
Constant	0.200	0.039	5.182	0.000	0.124 0.276

Regression of Infrastructure index on teacher features
Multigrado schools

Number of obs	382
F(5, 376)	8.28
Prob > F	0.00
R-squared	0.10
Adj R-squared	0.09
Root MSE	0.21

	Coef.	Std. Err.	t	P>t	[95% Conf. Interval]
Union	0.049	0.023	2.135	0.033	0.004 0.094
Tenured	0.001	0.028	0.052	0.959	-0.053 0.056
Number classrooms	0.043	0.007	5.913	0.000	0.029 0.058
Male	-0.001	0.001	-0.537	0.592	-0.004 0.002
Age (years)	-0.001	0.001	-1.001	0.317	-0.003 0.001
Constant	0.084	0.035	2.377	0.018	0.015 0.154

As can be seen, in the case of *polidocene* schools union and tenure status do not seem to play a role in differential access. However, all other variables are significant at 10 percent, implying that female and older teachers have better access. Also, as expected, the number of classrooms (school size) is clearly associated with the quality of infrastructure.

In the case of *multigrado* schools, which are smaller than *polidocentes* and much more likely to be in rural areas (in the MECEP evaluation defined rural-urban location was not available), union status seems to play a role in improving access to infrastructure. This is also true for the number of classrooms or school size (in this case the variation is only within the

multigrado schools). Tenure, age and gender do not have statistically significant coefficients in the regression.

These regression assume causality from unionization to access, an assumption that can be challenged as teachers with better access may have more incentives to become unionized. The use of panel data (with teachers changing union status through time) or finding a good instrumental variable linked to unionization but not to access may help to solve this problem, but these types of data were not available. In this case the only conclusion that can be derived is that there is a positive correlation between unionization and access to infrastructure, but only for *multigrado* schools, which are smaller and more rural. This relationship, however, requires further investigation using more appropriate data.

This section has found empirical evidence about potential factors affecting unionization of teachers and correlations between union status and access to educational infrastructure. This section did not, however, address how unionization may affect the quality of the education service provided by the state. The next section develops a model to assess this issue, and this model is used to test hypotheses regarding the impact of unionization on educational services.

3. A Production Function Model for Assessing the Impact of Unionization on the Provision of Education

3.1. The Production Function Model

In order to consider the potential impact of unionization on the quality of educational services, a production function approach like that of Hoxby (1996) will be used to analyze the impact of teacher unionization on educational services in the United States. The “classroom” will be used as the unit of analysis for the specification. Furthermore, each classroom is mainly associated with one teacher, as the focus is on primary education.

A generic production function for educational services in a given classroom is defined as:

$$y = f(e, r; h) \quad (1)$$

where $f(\cdot)$ is a well defined function; “ y ” is a measure of student achievement; “ e ” represents the effort level supplied by the classroom’s teacher in educational processes; “ r ” are physical inputs used by the teacher and students (books, pedagogical materials, etc.) “ h ” is a vector representing

other geographic, school, teacher, and student characteristics. As usual, it is assumed that $f'_e > 0$, $f''_e < 0$; $f'_r > 0$; $f''_r < 0$; $f'_{er} > 0$; so “e” and “r” are inputs with decreasing returns given any fixed input and are complementary in the production of educational services.

Departing from Hoxby’s model for the United States (where teachers have influence on budget decisions and input allocation), a model is here specified in which the only variable that teachers control is effort level:

$$e = g(w; u, t, v) \quad (2)$$

where w is the implicit cost or disutility of effort for the teacher, u is union status, t is tenure status, and v are specific teacher characteristics.

Equations (1) and (2) have the form of a production function in which effort enters as an input in the production equation, and it depends on prices and institutional variables. As generally effort cannot be directly measured, most studies estimate a reduced form, plugging (2) into (1).

In the present case, however, alternative direct measures of effort will be used in the estimation of equation (1). The output measure is taken from math and language tests applied to a sample of students in the MECEP evaluation.

3.2 Looking for a Direct Measure of Effort

The MECEP evaluation⁴ includes in-class observation data, from which three variables have been taken to approximate teachers’ effort: (i) use of time in class, (ii) good control of the classroom and (iii) students’ opinions about the teacher. Students’ opinions on their teachers’ ability and behavior are drawn from the student survey. The mean of these variables for unionized and non-unionized teachers are shown in Table 9.⁵

⁴ See Annex 1 for a brief description of the MECEP evaluation dataset.

⁵ There were no non-tenured teachers in the sub-sample of 90 classes used for in-class observation, so the tenure variable cannot be used in the analysis.

Table 9. Teacher Behavior in Class

	Non-Union	Union	Total
<i>Use of time in class (minutes)</i>			
Time required	261	266	263**
Time observed	213	203	208**
Lecturing	38	29	33**
Dialog	27	34	31**
Students reading	16	25	21**
Students writing	66	69	68*
Individual work	52	50	51
Group work	47	54	51**
No attention	23	21	22**
<i>Good control of class</i>			
Good Knowledge (1 to 4)	3.12	3.20	3.16**
Clarity (1 to 4)	3.06	3.18	3.12**
Conduct control (1 to 4)	2.80	3.11	2.96**
<i>Students opinion about the teacher</i>			
Answers my questions	90%	90%	90%
Is concerned about my learning	91%	87%	89%**
He/she hits me when I misbehave	51%	40%	45%**
Does not show up to class often	15%	15%	15%
Is late often	21%	18%	19%*
Is good explaining	91%	93%	92%*
Asks for questions in class	86%	85%	86%
<u>Asks us to use books from library</u>	<u>77%</u>	<u>76%</u>	<u>76%</u>

Source: In-class observation and student survey, MECEP Evaluation, sample size: 90 classrooms.

** Means are different at 95 percent; * Means are different at 90 percent.

The means among the two groups (unionized and non-unionized) are statistically different for most variables. However, there are some variables in which differences are not significant, mostly in students' opinions about their teachers.

In terms of the use of time, the duration of daily sessions seems to be smaller for unionized teachers, who have a total of 203 minutes per day versus 213 minutes per day for non-unionized teachers. On average, the sessions amount to 79 percent of the total required time, but

unionized teachers accomplish only 77 percent of the required time versus 82 percent for non-unionized. This may imply that unionized teachers devote less time to teaching.

Despite the absolute time devoted to daily sessions, it is important to consider the use of that time. According to what trained observers report, teachers use about one hour daily for teacher activity as such (lecturing and talking with students). The use of that time is different by unionization status: unionized teachers spend less time lecturing and more time talking with students than non-unionized teachers. It is not clear whether these differences may be important in terms of the quality of teaching, although it seems that unionized teachers seem to involve students more in class activity.

In terms of the second variable, good class control, the observers rate teachers' behavior on a scale from 1 to 4 in terms of knowledge of the matter taught; clarity of explanations and conduct control in class. In all areas items unionized teachers demonstrated better class management.

Students do not express major differences in their opinions of unionized and non-unionized teachers, with the notable exception of teachers' tendency to hit students in class. Among children surveyed, 45 percent stated that teachers sometimes hit them in class, a percentage that is greater for non-unionized teachers (51 percent compared to 40 percent). This is consistent with observers' reports of better class control by unionized teachers. In all other areas, students do not perceive significant differences.

This information suggests that the variables associated with class management are a possible measure of teacher effort in class. The use of this variable as a proxy for effort has two limitations: (i) it is possible that some specific factors related to the children in the classrooms, i.e., a small number of disruptive children, may affect and distort the measure, as in this case a lower control may in fact reflect a higher effort by the teacher; (ii) the observation of how teachers work in class by informed observers can in some way alter teacher behavior. Even considering these two limitations, this variable appears to be the best alternative available from the MECEP evaluation. The observation distortion, also, should not affect the variation between unionized and non-unionized teachers, which is the variation needed for this estimation. In the empirical analysis that follows the sum of the three class control variables will be used as a proxy for teacher effort in class.

4. Production Function Analysis

The dataset used for the estimation consists of 90 classrooms in which math and language test scores were applied to students and in which teacher practices and their use of inputs were observed during three days by specialized observers. This dataset has most of the variables used in equation (1) from the model.

This dataset, however, has some limitations given its relatively small size. Moreover, in only 65 classrooms did evaluators ask about unionization. Within this sample, 15 teachers did not respond to this question, which leaves a total of only 50 classrooms for analysis with the union variable.

An additional feature of the data was that all the teachers in the 90 classrooms sampled were tenured. This is not a bad thing for the estimation, as it prevents confusing union and tenure status effects. Using a dataset in which all teachers are tenured makes it possible to check for pure union impacts. Another important feature of this dataset is that it did not include *unidocente* (mostly rural) schools, so that dimension is excluded from the analysis.

Still, as complete information is available for about the 90 classrooms and teachers when the union variable is not considered, the estimation process will begin by abstracting for a moment from the union variable. The union question will be introduced after estimating the production function for the whole 90-classroom dataset.

4.1. The Production Function without Union Status

Based on equation (1) of the model the following equation is estimated:

$$Y = \alpha + \beta_1 N + \beta_2 C + \beta_3 T + \beta_4 r + \beta_5 e + u \quad (3)$$

where Y is the log of average student achievement or result (standardized test scores) for the classroom, N and C are vectors of student and community characteristics, T represents teacher characteristics (gender, experience) r is input use by teacher (textbooks), and e is effort in teaching measured as the sum of the three class control variables of class control described in Section 4.

Because the sampling scheme used for the MECEP evaluation implies that what are selected are classrooms, the standard errors of the estimation are corrected for by using the software package *Stata*© Version 5.0 with an option for sample design in running regressions (the routine is called *svyreg*). This provides estimations with standard errors which consider the fact that students are clustered in the 90 classrooms. The regression results are presented in Table 10.

Table 10.
Production Function Regression

Math test

Number of obs	2270
Number of strata	1
Number of PSUs	88
Population size	2270
F(8, 80)	10.58
Prob > F	0
R-squared	0.1636

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Effort	0.0772	0.0439	1.7590	0.0820	-0.0100	0.1644
Use of text	0.0344	0.0190	1.8080	0.0740	-0.0034	0.0722
Urban area	0.0394	0.0296	1.3320	0.1860	-0.0194	0.0981
Student works	-0.0522	0.0118	-4.4250	0.0000	-0.0757	-0.0288
School index	0.1967	0.0621	3.1690	0.0020	0.0733	0.3200
Sixth grade	0.0022	0.0201	0.1070	0.9150	-0.0378	0.0422
Experience	-0.0096	0.0103	-0.9340	0.3530	-0.0300	0.0108
Teacher male	-0.0517	0.0256	-2.0200	0.0460	-0.1026	-0.0008
Constant	5.4073	0.1007	53.6820	0.0000	5.2071	5.6075

Language Test

Number of obs	2309
Number of strata	1
Number of PSUs	88
Population size	2309
F(8, 80)	17.09
Prob > F	0
R-squared	0.186

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Effort	0.0901	0.0391	2.3020	0.0240	0.0123	0.1678
Use of text	-0.0653	0.0303	-2.1540	0.0340	-0.1256	-0.0050
Urban	0.0973	0.0291	3.3400	0.0010	0.0394	0.1552
Student works	-0.0456	0.0165	-2.7550	0.0070	-0.0785	-0.0127
School index	0.1360	0.0484	2.8100	0.0060	0.0398	0.2323
Sixth grade	0.0117	0.0197	0.5940	0.5540	-0.0275	0.0509
Experience	0.0000	0.0111	-0.0020	0.9980	-0.0220	0.0220
Teacher male	-0.0488	0.0225	-2.1650	0.0330	-0.0936	-0.0040
Constant	5.3629	0.0874	61.353	0.0000	5.1892	5.5366

As can be seen, most variables are statistically significant and have the expected sign. In particular, teachers' effort, measured as the sum of the three class control variables, has a positive coefficient at the 8.2 percent significance level for the math test, and at the 2.4 percent significance level for the language test, implying that what teachers do in class has a clear impact on student achievement. Textbook use appears to be positive for student achievement in math, but negative for the language test; according to these estimations, it therefore seems that the math textbook is having a better impact on students than the language textbooks.

Among other variables, the fact that a student works has a negative impact on student achievement, both in math and language, whereas the index of school quality favors student achievement in both cases. Teacher experience appears with a coefficient not significantly different from zero, whereas male teachers tend to have a lower performance in math and language tests.

4.2. Production Function with Union Analysis

First estimated is a regression of effort on union status and other teacher and school characteristics, corrected for clustering. Table 11 presents the results, indicating that union status does not play a role in the effort supplied by teachers. School quality and experience appear as variables with a positive impact on effort.

Table 11.
Regression of Unionization on Effort

Number of obs	1329
Number of strata	1
Number of PSUs	50
Population size	1329
F(5, 45)	2.18
Prob > F	0.0734
R-squared	0.1697

	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Union	0.0428	0.0461	0.9280	0.3580	-0.0499	0.1354
Urban	-0.0389	0.0596	-0.6530	0.5170	-0.1587	0.0809
School index	0.2661	0.1394	1.9090	0.0620	-0.0141	0.5462
Experience	0.0725	0.0352	2.0630	0.0440	0.0019	0.1432
Male	0.0272	0.0470	0.5780	0.5660	-0.0673	0.1216
Constant	1.8673	0.1124	16.6170	0.0000	1.6414	2.0931

For testing the direct role of unionization on student achievement, a regression was run on test scores, including union as an independent variable but excluding effort. As can be seen in Table 12, for both math and language, the unionization coefficient does not appear statistically different from zero at the 10 percent significance level. In the case of math scores, the coefficient is positive and significant at 13.2 percent, whereas for language scores the coefficient is negative. The other coefficients display similar behavior to that found in the larger dataset of 90 classrooms, suggesting that the production function specification was not altered by the smaller sample taken (of 50 classrooms).

Table 12.
Production Function Regression with Union Variable

<i>Math test</i>						
	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Number of obs	1283					
Number of strata	1					
Number of PSUs	50					
Population size	1283					
F(8, 42)	5.53					
Prob > F	0.0001					
R-squared	0.1487					
<i>Language Test</i>						
	Coef.	Std. Err.	t	P>t	[95% Conf.	Interval]
Number of obs	1292					
Number of strata	1					
Number of PSUs	50					
Population size	1292					
F(8, 42)	6.6					
Prob > F	0					
R-squared	0.1714					
Union	0.0352	0.0230	1.5330	0.1320	-0.0109	0.0814
Use of text	0.0488	0.0240	2.0340	0.0470	0.0006	0.0970
Urban	0.0266	0.0485	0.5480	0.5860	-0.0709	0.1241
Student works	-0.0458	0.0169	-2.7130	0.0090	-0.0798	-0.0119
School index	0.1778	0.0907	1.9600	0.0560	-0.0045	0.3601
Sixth grade	0.0188	0.0298	0.6310	0.5310	-0.0411	0.0787
Experience	0.0024	0.0141	0.1700	0.8660	-0.0259	0.0307
Teacher male	-0.0728	0.0338	-2.1530	0.0360	-0.1407	-0.0049
Constant	5.5539	0.0588	94.4060	0.0000	5.4356	5.6721

5. Conclusions

This paper has combined two sources of quantitative information in order to answer questions regarding the extent, profile and role of teachers' unionization on the quality of public education in Peru.

An analysis of the cross-section data taken from ENAHO 1999 and the MECEP evaluation study finds evidence compatible with the hypothesis that unionization has been declining in the last three decades, especially during the 1990s due to the hiring of temporary teachers. From rates of 70 percent to 80 percent for teachers who started working in the 1970s, the rate of unionization currently is less than half the teacher population. It is not clear if this trend will continue in the near future, as the current government has begun a process of eliminating temporary teaching positions from public education.

In general, unionized teachers tend to be older and more experienced, and are more likely to be male. Most unionized teachers are tenured, although there is a small set of non-tenured teachers who are members of the union. The presence of the union in rural areas is still important, and is related to the electoral mechanisms for union representation.

In term of access to educational infrastructure, the MECEP evaluation data indicates that unionized teachers do not enjoy access to better infrastructure at the *polidocente* schools, but that they have better access at the *multigrado* schools (which are an intermediate between *polidocente* and *unidocente* or rural schools). This may imply that unionized teachers are more successful in improving their position at this intermediate level, but with no ability to do so for larger schools.

This paper has identified variables directly linked to teacher effort, facilitating the estimation of a reduced form of the traditional production function like Hoxby's. The estimation of the production function for a sample of 90 classrooms without a union indicates that the effort variable works well and that, despite the dataset's small size, the expected signs are found for most of the independent variables. Using the smaller dataset with the union variable, the analysis indicates that unionization does not play a role either in the supply of effort by teachers or in math and language test scores. Thus, in the Peruvian case, this preliminary evidence suggest that unionization may not affect the provision of public education in a definite way.

Annex 1. Description of the MECEP Evaluation Database

At the end of 1995 the Ministry of Education (MOE), Inter-American Development Bank (IADB) and World Bank (IBRD) jointly designed and created a nationwide program (known by its Spanish acronym MECEP) to improve the quality of primary education. The program was designed to achieve improvements in the quality of education through the introduction of new teaching practices, modernization of the administrative process, and the rehabilitation of existing infrastructure.

A team at Instituto Apoyo made a comprehensive evaluation (Instituto Apoyo, 1999 b) of the impact of MECEP throughout Peru. A by-product of the evaluation is a large database, described below, which will allow exploration of the determinants of the quality of education at the primary level and how these relationships are affected by teachers' union status.

The first part of Instituto Apoyo's MECEP database is comprised of teachers' and principals' answers to detailed questionnaires. Of a total of 26,606 education centers throughout Peru, a random sample of 700 was chosen using stratification methodologies that ensure representative samples with respect to geography, size, and MECEP involvement. Furthermore, within the 700 schools, three classrooms (one of each of second, fourth, and sixth grades) were randomly chosen.⁶ The result is a dataset of approximately 2,200 teachers and 700 school directors throughout Peru. A summary of the main variables of interest follows.

- I Geographic Location
 - a. Department
 - b. Province
 - c. District
 - d. Locality
- II School ID
 - a. Nationwide MOE school ID
- III School Characteristics
 - a. Access to basic services (light, water, sewage)
 - b. Government intervention through some social program

⁶ With the exception of single-classroom/single-teacher (unidocente) schools, from which only one sample was extracted

- c. Type of social assistance
- d. Other groups that provide social assistance

IV Teacher Profile

- a. Sex
- b. Age
- c. Educational Level
- d. Years of study
- e. Place of study
- f. Specialty of study
- g. Licensed/not licensed as a teacher
- h. Tenured / contracted teacher
- i. Member / non-member of teacher's union (SUTEP)
- j. Number of years as a teacher
- k. Training under MECEP program
- l. Number of years trained
- m. Place of geographic origin

V Characteristics of teacher's job

- a. Number of grades taught
- b. Number of primary grades taught
- c. Years dedicated to teaching
- d. Years teaching at current school
- e. Attendance of teacher

VI Materials & Curricula

- a. Availability of educational materials
- b. Use of educational materials
- c. Use of consolidated curriculum

VII Teacher Training

- a. Use of methods learned during teacher training
- b. Perception regarding the new methods learned

Furthermore, a subset of 90 classrooms (randomly chosen from 45 of the 700 schools) were selected for a second phase of the evaluation. Standardized tests that will gauge student aptitude in basic language and mathematics skills will be administered to 30 students in each of the 90 classrooms and the corresponding teachers were evaluated as to the use of new pedagogical techniques and practices. A small survey of all 2,700 students obtained information about their socio-economic background and their opinions about their teacher.

The evaluators conducted 3-day *in situ* evaluations of the teachers' techniques, practices and use of educational materials. A detailed analysis of the resources available to the class (blackboards, desks, books, computers, etc.) as well as an assessment of the effort and/or dedication of the teachers was also part of the three-day evaluations. The information from these evaluations is of critical importance for this study, as evaluators attempted to gather information not only on input availability and practices as stated by teachers but also on input use and practice adoption from a more objective point of view. Also, they were able to provide an assessment of teachers' ability in class, a factor rarely available for empirical research. It is clear that the information also has limitations, as the presence of the evaluator may have changed teacher behavior.

The variables of interest from the second phase of the evaluation are presented below:

- I. Classroom Environment & Materials
 - a. Classroom layout
 - b. Availability and condition of blackboards
 - c. Usage of wall space
 - d. Availability and condition of desks and chairs
 - e. Condition of teacher desk
- II. Educational Materials
 - a. Availability and usage of books
 - b. Various observations regarding the use of books in teaching
 - c. Existence and usage of library
 - d. Additional materials (Geometric figures, balances, lab equipment, etc)
- III. Duration of Class

- a. Total duration
- b. Duration of lecture
- c. Duration of dialog and student interaction

IV. Pedagogical Activities

- a. Group work
- b. Form of supervision

V. Teacher Aptitude

- a. Logic/Mathematics
- b. Communication
- c. Language

VI. Teacher disposition (aggression, indifference, authoritarianism, etc)

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