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Human Capital Formation in Poland. Where Does Educational Quality Come From?

Theory and empirical literature relate educational quality to two main explanatory factors: family education (intergenerational transfer of human capital) and the quality of schools. The model proposed in this paper is intended to verify the significance of these factors in explaining territorial disparities in educational quality in Poland.

The dependent variable is the test score of sixth grade pupils in 2002, averaged at municipality level. The test results prove to be strongly correlated with human capital stock in the municipality's adult population, which points to the key role of intergenerational transfer for educational quality. On the other hand, the role of school resources (understood as expenditure on education) is rather small.

Average test results differ significantly between Poland's historical divisions. Surprisingly, the more urbanised and relatively affluent regions, like Greater Poland (Wielkopolska), Pomerania (Pomorze) and the so-called Regained Territories (ziemie odzyskane) reveal a substantially lower educational quality than the territories in the east and south-east of the country, generally less developed and with a significant share of agriculture in the economy. These differences can only be partly explained by an additional environmental factor, related to the prevalence of state-owned economy before 1990 (e.g. state farms – PGRs) and today's high structural unemployment. Interestingly, the dissimilarities between the historical regions are not only illustrated by average test score levels, but also by parameters of the determining functions for these results. It can be concluded therefore that location in a historical region has a substantial impact on the flexibility of educational outcomes with regard to different explanatory factors.

Earlier research has revealed that there exists a significant correlation between achievements at school and performance at work (Bishop 1992), and, at the macro level, between international test scores and the level of economic development (Bishop 1989; Hanushek and Kim 1995; Barro 1998).

These results suggest that not only the 'quantity' but also the quality of education should be taken into account while evaluating the human capital in a given community. For instance, Hanushek and Kim (1995) estimate on the basis of panel data from 100 countries that one standard deviation change in average cognitive skills tests score translates into one percentage point change in an annual rate of growth. This is a much stronger effect than one caused by a similar change (i.e. one standard deviation) in the average years of schooling, a measure typically used to evaluate human capital stock.

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It can be expected therefore that identification of factors determining the quality of education in the territorial perspective can help to design an effective, pro-development policy in underdeveloped regions.

This papers uses the results of the first standardised tests conducted in Polish primary schools in 2002. In its approach, it is based on a regression model which explains the differences in the scores by a number of independent variables. Specification of the model follows Lee and Barro's (1997) approach to educational quality, substantially expanded by additional explanatory factors and applied to the examination of the existing disparities from a local perspective, rather than cross-country. The aim of the study is to address the following issues:

- To what extent does educational quality depend on local human capital stock accumulated by the family (the parents' generation) and the neighbourhood?
- To what extent does educational quality depend on the quality of schools?
- Are there regional disparities in educational quality?
- What is the role of economic conditions?

Conceptual framework

According to Lee and Barro (1997), the general model explaining educational quality is the following:

$$Q = Q(f, r)$$

where '*f*' and '*r*' refer, respectively, to family factors and level of school resources. The authors used the model to explain the differences in averaged test scores between individual countries. In this paper, it is applied to study averaged educational outcomes at the level of Polish municipalities. The original model was extended as follows:

$$Q_l = g(f_l, r_l, s_l, p_l) + \varepsilon_l$$

where: Q_l denotes an average test score in the final primary school exam (sixth grade) in 2002 in l municipality; f_l – human capital stock in the parents' generation; r_l – quality of local schools measured by the level of school resources; s_l – school quality measured by 'value added' by the local school system, and p_l – location of the municipality (the regional factor).

The educational quality, Q, is measured by an averaged score in the final primary school exam in the 2001/2002 school year. The mean includes the scores of all pupils in the schools located in the municipality l.

The variables operationalising all the model's explanatory factors are shown in Table 1, and one of them needs an additional explanation. Most studies dealing with the economy of education look at educational quality as the availability of school resources, measured by per pupil expenditure on education, pupil/teacher ratio, average class size, average teacher qualifications and

salaries (cf. Wilson 2002, Lee and Barro 1997). These measures are grossly insufficient because they leave out what we intuitively refer to as 'value added' by the school, and what is intrinsically connected with the abilities and commitment of teachers, the school's educational policy, personality of the principal, etc. Especially in the Polish conditions, where the statistics describing public expenditure on education, formal qualifications of teachers and their earnings refer to systemic arrangements rather than actual differences in the policy of local authorities or competences of school personnel, focusing on the level of school resources seen as the only measure of the school quality seems inadvisable.

It is commonly acknowledged by pedagogical literature that not all of pupils' abilities depend on the performance of the school to the same extent. For instance, Popham (1999) points out that achievements in mathematics are strongly correlated with school quality. Very few parents teach their children algebra or how to prove mathematical theorems. At the same time, overall competence in the humanities, as well as reading and writing skills are largely inherited from home and shaped by the child's immediate environment. In view of the above, a simple measure of value added by schools in a given municipality can be constructed by dividing the standardised average test score in mathematics and natural sciences by the average standardised result of the test in humanities:

$$S_{VA} = \frac{Q_{ml}/\overline{Q}_{ml}}{Q_{hl}/\overline{Q}_{hl}}$$

For obvious reasons, we cannot use the data coming from the same school tests both as an independent and dependent variable. The explanatory variable is the averaged score in the primary school final exam in a given municipality. For these reasons, while calculating the value added measure, we will use the results of a similar final exam conducted at the end of the *gimnazjum* – the lower secondary school, on the assumption that the performance of the school is a feature of a local school system, that is, in a locality with better quality gimnazjums primary schools will also probably be better.

Table 1. Variables used in the model

Factor	Variable
Dependent variable	Average 6th grade test score
Family factor	Average education (years of schooling) in adult population (1988)
School quality	Municipal expenditure on education per pupil
	Measure of schools' value added
Location of municipality	Nominal variables determining location in historical regions
Additional environmental factor	Unemployment rate, December 2001
	Share of land collectively owned (former state farms – PGRs, farming cooperatives) in the total area of the municipality in 1992

In addition to the factors described above while presenting the general model, Table 1 includes an additional environmental factor. It has been added as a result of preliminary observations concerning the spatial distribution of educational outcomes in Poland (cf. Herczyński and Herbst 2002; Herbst 2004). The significance of this factor and the related variables is discussed in further sections of the paper.

The equation showing the educational quality model would have the following linear form:

$$Q_l = \beta_0 + \beta_1 V_{1l} + \beta_2 V_{2l} + \beta_3 V_{3l} + \beta_4 V_{4l} + \gamma_l \quad (1)$$

where Q_l represents an average test score in municipality l, ${}_iV_i$ is a vector of explanatory variables representing factor $i = 1$ to 4, and M_l is a random component (residual).

The findings from preliminary research (cf. Herczyński, Herbst 2002) indicate that despite intensive training for examiners offered by the Central Examination Board, there were marked differences in the level of assessing (scoring) the tests between individual Regional Examination Boards (OKE). Apart from the negative consequences this may have for pupils themselves and for the very idea of external examinations, it may also negatively affect this study owing to overestimation or underestimation of selected factors for average school results in a given area. To reduce the impact of different scoring behaviours by the regional boards we will assume that the random component in equation (1) consists of two elements: standard equation residual $_l$, and term $\acute{\imath}_r$, representing the measurement error reflecting the failure to apply similar scoring rules by the eight regional examination boards.

$$\gamma_l = \varepsilon_l + \nu_r \text{ for } r = 1 \text{ to } 8$$

Therefore, instead of equation (1), the following equation will be estimated:

$$Q_l = \alpha_r + \beta_1 V_{1l} + \beta_2 V_{2l} + \beta_3 V_{3l} + \beta_4 V_{4l} + \varepsilon_l \quad (2)$$

where:

$\alpha_r = \beta_0 = \nu_r$

In other words, the intercept in equation (2) may have eight values, each different for the municipalities coming under the eight Regional Examination Boards. In this way, the difference in the scores between the individual boards which is not related to explanatory factors included in the model will hopefully be captured.

Data

The results of the externally assessed tests taken by sixth grade pupils in the 2001/2002 school year represent the dependent variable in the model. The

average scores at the municipality level were provided by the Central Examination Board (CKE). The impact of the family factor is expressed by average education among the municipality's adult population, converted into averaged years of schooling. In the model, the data from the 2002 National Census were used.

The concept and the construction of the measure of value added in the local school system was explained above, and the required data concerning the gimnazjum final exams in the 2001/2002 school year were provided by CKE.

The data on the unemployment rate by poviats (counties) in December 2001, the area of state farms and other forms of collective land ownership in 1992, municipalities' expenditure on primary schools and the number of pupils in such schools in the years 1996–2001 come from the Central Statistical Office (GUS).

In addition to the above, also a number of nominal (zero-one) variables were used in the analysis, which was to help isolate the permanent effects connected with:

- The municipality's location in an area covered by one of the Regional Examination Boards;
- The municipality's location in one of Poland's historical provinces – the areas formerly under Prussian, Russian and Austrian rule (between 1773 and 1918);
- Type of municipality – urban, urban-rural, rural.

Descriptive statistics concerning the continuous variables used in the analysis are shown in Table 2.

Table 2. Descriptive variable statistics

Variables	Average	Standard deviation
Average test score*	28.9	1.8
Value added of schools**	1.0	0.1
Municipal expenditure on education per pupil*	2 997.1	598.9
Averaged years of schooling in the municipality's adult population in 2002	9.1	0.8
Unemployment rate in December 2001	20.1%	6.8%
Share of farming land collectively owned (former state farms and farming cooperatives) in the total area of the municipality in 1992	12.3%	12.7%

* later in the analysis the variable's natural logarithm was used

** later in the analysis the standardised variable was used

Table 2 indicates that the variation of the test score among municipalities is rather low. The standard deviation for this variable is about 6 per cent of the mean. The differences in value added and average years of schooling remain at a similar (slightly higher) level. It should be observed at this point that the mean for the latter variable has an extremely low value (9.1), while the majority of adult Polish citizens spent at least eight years in primary school alone. This result is due to the adopted method of calculation, according to which basic vocational school was treated as a form of apprenticeship and was not taken

into account as upgrading one's level of education. This was intended to produce distinct differences in the values of the variable for basic vocational and secondary school leavers.

Table 2 also takes into account two variables representing the additional environmental factor. Both variables reveal strong differences throughout the country. The average unemployment rate in December 2001 was 20 per cent, with the standard deviation close to 7 per cent. As far as the share of collective land ownership is concerned in the municipality's total area in 1992 (12 per cent on average), marked differences throughout the country are quite understandable. In addition to differences between the regions which have historical underpinnings, discussed in more detail further in the paper, it is due to the fact that rural and urban-rural municipalities, as well as cities, were included in the sample. In the latter, farming areas, regardless of their form of ownership in the late 1980s and early 1990s, represent a tiny fraction of their overall area.

Territorial disparities in educational quality

Some authors, including Gorzelak (1998), indicate that territorial disparities in development processes in Poland are particularly well visible in two spheres. The first one is the division into urban and rural areas. A large part of rural areas in Poland is suffering from an underdevelopment of technical infrastructure and a low level of human capital, as compared to cities. Secondly, socio-economic development has strong historical determinants. Both the level of infrastructure, personal incomes, enterprise and social activity indicators reach higher values in the areas formerly (prior to World War I) under Prussian and Austrian rule than in the former Congress Poland (under Russian rule).

Table 3. Average variable values in cities, rural and rural-urban municipalities

Average value for Polish municipalities =100	Cities	Rural municipalities	Urban-rural municipalities
Average test score*	103.0	99.6	99.0
Value added of schools**	95.5	102.0	97.1
Municipal expenditure on education per pupil*	79.2	107.2	90.1
Average years of schooling in the municipality's adult population in 2002	115.7	96.9	102.8
Unemployment rate in December 2001			
Share of farming land collectively owned (former state farms and farming cooperatives) in the total area of the municipality in 1992	71.5	91.1	136.6

* later in the analysis the variable's natural logarithm was used
** later in the analysis the standardised variable was used

For the purposes of this paper, the above two aspects will provide the basis for an analysis of territorial disparities in educational outcomes.

As could be expected, Table 3 reveals that average test scores in cities are higher than in rural municipalities. However, the difference between the two

average values of approximately 3.5 per cent does not confirm the popular view that there is an educational hiatus between rural and urban areas. On the other hand, the value added indicator for schools is higher in rural municipalities than in cities. Taking into account the composition of this indicator, it means that while children in cities achieve definitely better results in the humanities, the differences in the mathematics and natural science test scores are rather insignificant. It should be emphasised at this point that the variable in question will acquire the characteristics of a value added measure only in the regression model, where its impact will be assessed while simultaneously controlling the level of local human capital and school resources.

Definitely the highest per pupil expenditures on primary schools are recorded in rural municipalities, which is mainly due to the typically smaller school and class size than in the city, which implies a less effective use of the available resources. According to GUS data for 2002, an average class in rural areas had 18 pupils, as compared to about 25 in cities.

It is not surprising that rural areas are characterised by a relatively low level of adult education (years of schooling). In this case, the mechanism is quite simple: the educational infrastructure is found in the cities, so the more 'urbanised' the municipality, the higher the average level of education of its inhabitants. It should be noted at this point that the differences in the potential related to human capital between rural and urban areas have been dramatically increasing in the recent years. If Table 3 was to include, instead of the education level in 2002, an increase in its value in the years 1988–2002, it would turn out that the increase in average level of education in cities as compared to the national average (100) reached as many as 257 points, as compared to 133 in urban-rural municipalities and only 65 points in rural municipalities. This variable is not shown in Tables 1 to 3 because owing to its being strongly correlated with the overall education level (years of schooling), it does not appear in the estimated regression equations.

Finally, as regards the scale of collective land ownership in the late 1980s and early 1990s, it is interesting to observe that its share in the total area of the municipality is higher in the case of urban-rural municipalities than in rural municipalities. This is probably partly due to a high number of urban-rural entities in the west and north of the country, where state farms (PGRs) played a dominant role in agriculture.

A glimpse at the map showing the test scores leads to striking observations. As we can see in Figure 1, municipalities situated in former Congress Poland (east) achieve significantly better results than those situated in the areas formerly under Prussian rule (west, north-east). At the same time, there are no substantial differences between Congress Poland and Galicia (south-east). In the west and north of Poland an average score of 30 points is reached almost exclusively in the metropolitan areas of Wrocław, Tricity and – the least so – of Poznań. Moreover, unlike many socio-economic indicators, average educational outcomes seem only slightly better in the western territories which

were part of Poland in the inter-war period (mid-west) than in the so-called Regained Territories (west).

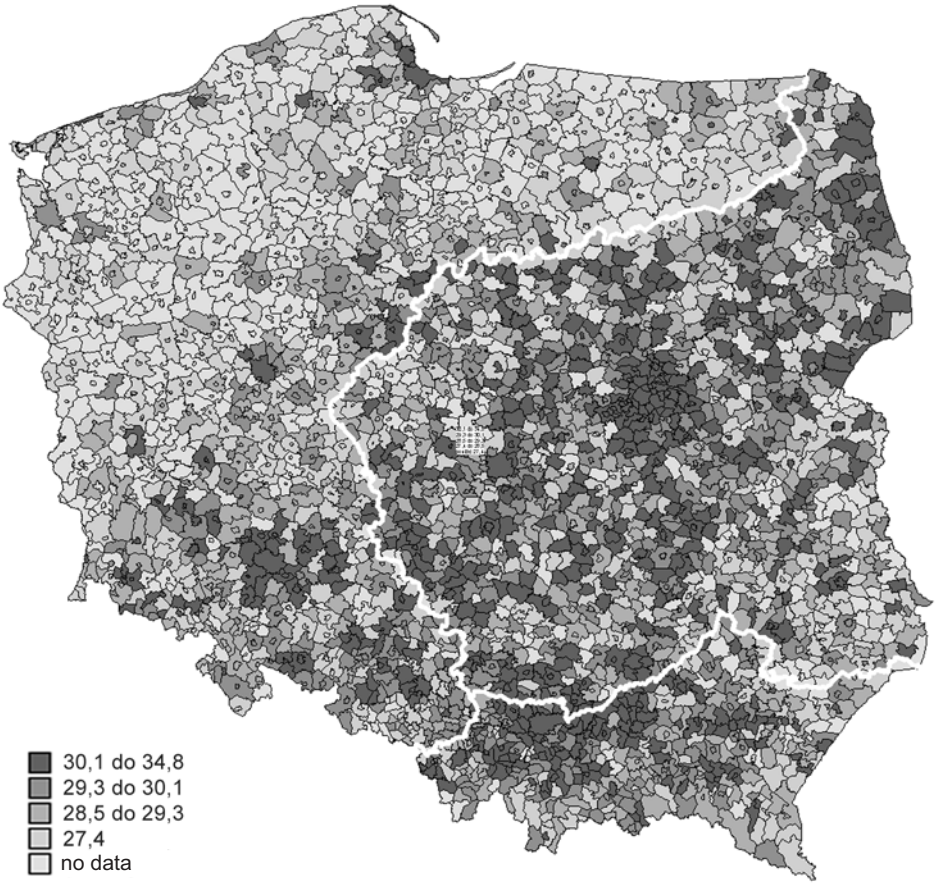

Figure 1. Average test scores in municipalities by areas formerly under Russian (east), Austrian (south-east) and Prussian (west and north-west) rule

Significantly, the historical underpinnings of the differences in the test scores are also visible in areas covered by one regional examination board (e.g. OKE in Łomża, comprising Warmińsko-Mazurskie and Podlaskie voivodships). This precludes an interpretation suggesting that the territorial distribution of results mainly reflects the division into regional examination boards and is due to their adopted assessment criteria.

Table 4 shows average variable values broken down by historical provinces. To ensure the comparability of data (different urbanisation levels in the regions), only rural municipalities were taken into account.

The obtained results corroborate initial observations made on the basis of Figure 1. An average test score in Congress Poland and Galicia is higher than in the case of pupils in western and northern territories by about 5 per cent,

Table 4. Average variable values in rural areas by historical provinces

Averaged value for Polish municipalities = 100	Congress Poland	Great Poland and Pomerania	Regained Territories	Galicia
Average test score*	101.6	96.8	90.7	101.9
Value added of schools**	103.8	94.5	93.2	101.2
Municipal expenditure on education per pupil*	100.6	98.5	120.0	97.4
Averaged years of schooling in the municipality's adult population in 2002	98.1	102.0	100.9	102.9
Unemployment rate in December 2001	87.7	117.4	130.3	88.1
Share of farming land collectively owned in the total area of the municipality in 1992	33.3	157.1	214.3	47.6

even though the inhabitants of the rural areas formerly under Russian rule have a lower average education level than rural population in western Poland. In Galicia and Congress Poland, relatively high schools' value added figures can be observed, in addition to a relatively lower unemployment rate than in the other regions. The latter observation draws the attention to areas suffering from high structural unemployment in western and northern Poland (mainly post-PGR areas) as a likely explanation for poor average educational outcomes in the region. This invites the question whether educational quality in former state farms areas is lower mainly due to low educational level of parents or whether a poor financial situation and lack of career prospects negatively affect the level of education regardless of family impacts, for example owing to a lack of positive patterns to follow, lack of motivation, pathologies at school, etc. To explain this problem, the model discussed in this paper is estimated in variants taking into account two variables supplementing the initial data: share of farming land collectively owned in 1992 (state farms, farming cooperatives) and unemployment rate in December 2001. It should be pointed out that these variables were shown in Table 1 as ones representing the so-called additional environmental factor.

The drawback of the measure of the burden of state farms legacy, reflecting the problems of the local community arising from the previous economic structure, is that it mainly refers to rural areas. For this reason, the unemployment rate was used as an alternative variable. Unemployment is measured at the poviat level, and therefore does not give a fair picture of the situation in municipalities. However, it certainly reflects the impact of the environmental factor in cities more accurately than the ownership structure of farmland.

Estimation results

On the basis of equation 1 in Table 5 we can conclude that family factor (intergenerational transfer) is the most important determinant of educational quality at the municipal level. An increase by 1 in the average years of schooling in a municipality is translated, *ceteris paribus*, into an approximately

Table 5. Results of the model's estimates

Variable	1		2		3	
Log of value added	**0.040**	(4.01)	**0.041**	(4.16)	**0.042**	(4.32)
Adult education 2002	**0.028**	(14.5)	**0.029**	(14.4)	**0.026**	(12.5)
Share of collective land ownership 1992			**–0.074**	(–5.16)	**–0.060**	(–4.98)
Unemployment rate					**–0.128**	(–6.35)
Log of municipality's per pupil expenditure on education	0.009	(1.30)	0.011	(1.67)	0.009	(1.24)
Great Poland and Pomerania	**–0.041**	(–7.62)	**–0.032**	(–5.96)	**–0.031**	(–5.78)
Regained Territories	**–0.067**	(–11.5)	**–0.055**	(–8.91)	**–0.048**	(–7.88)
Congress Poland	–0.007	(–1.81)	**–0.008**	(–2.03)	**–0.011**	(–2.84)
Rural municipalities	0.007	(1.37)	**0.010**	(1.96)	0.005	(1.10)
Urban-rural municipalities	0.000	(0.09)	0.005	(1.17)	0.002	(0.43)
Number of intercepts allowed	8		8		8	
Historical regions in the sample	all		all		all	
N	2394		2371		2371	
F(r, df)	79.42	(15.2378)	78.5	(16.2354)	77.91	(17.2353)
R^2	0.33		0.35		0.36	

* heteroscedasticity-adjusted *t*-statistics in parentheses

3 per cent increase in the average test score in primary schools. Although statistically significant, the impact of school quality expressed by the value added measure is considerably weaker. An increase in its value by one standard variation (0.13) is correlated with an improvement of educational outcomes by a mere 0.5 per cent. On the other hand, the level of school resources measured by educational expenditure per pupil seems to be statistically irrelevant. This result is produced regardless of inclusion (or not) of the value added measure, which could 'compete' with the resources measure, in the specification. This result should not be completely surprising; it corroborates to some extent the findings from educational quality research in other countries. The dominant role of the family capital and insignificant impact of school resources on pupils' performance was already discussed by such authors as Coleman et al. (1966), Hanushek (1986), Betts (1999) and Marlow (2000).

It was already mentioned that individual expenditures on education in rural and urban areas tend to differ considerably owing to a smaller average size of rural schools. This could be the reason for the lack of significance of the school resources level for the results achieved in school tests. Therefore, and in order to ensure comparability of data between regions, estimations in the further sections of the paper (equations 4 to 7) will be made on a set including solely rural municipalities. However, we should also quote at this point the opinion that is frequently expressed in the literature of the subject that the main reason for the irrelevance of traditional variables referring to school resources in explaining pupils' educational outcomes is the weak connection between these measures and the actual quality of a given school. This opinion is corroborated by the findings from this study, in which school quality,

expressed by the value added measure, has a statistically relevant impact on the test scores.

Other variables included in model 1 indicate that the differences in the level of family and school resources do not help to explain the differences between the educational outcomes in Poland's historical regions. What is more, if we take into account the educational level of the adult population (the family factor) and expenditure on education (school resources), we will see that the difference between those areas can be even greater than that visible to the naked eye. If the average educational quality in former Galicia (as in equation 1) is adopted as the frame of reference, the results of schools in the Regained Territories will be – apart from other variables – more than 6.5 per cent lower, whereas the results in Great Poland and the part of Pomerania which belonged to Poland before World War II – by 4 per cent lower. At the same time, there will be no statistically significant differences in the quality of education between Galicia and former Congress Poland.

The aim of equations 2 and 3 is to verify the hypothesis on the impact of high unemployment and social pathologies related to the collapse of state-owned enterprises (particularly PGRs) on the results of final exams in primary schools. The working hypothesis assumes that the occurrence of such phenomena in a given area will impair average pupils' performance irrespective of other factors such as human capital in the parents' generation or the level of school resources. The results of estimation 2 corroborate this thesis. The variable specifying the share of farmland collectively owned in the total area of the municipality in 1992, included in the model's specification, has proved statistically significant. The equation coefficient shows that in the case of two municipalities with a similar education and school resources profile, the municipality with no collectively owned land would note an average educational outcome by about 3.7 per cent better than the municipality in which PGRs and other forms of collective ownership represented a half of all the farmland. This is a significant correlation, especially in view of the fact that the inclusion of a new variable has at the same time resulted in a distinct reduction of the absolute value of coefficients in the case of nominal variables specifying location in the historical regions. The negative impact of the municipality's location in the Regained Territories on educational outcomes was reduced (as compared to Galicia) from 6.7 per cent do 5.5 per cent, and of locations in Great Poland and Pomerania – from 4.1 per cent to 3.2 per cent. Therefore, it can be said that the structural problems of the economy in western and northern Poland after the collapse of communism can largely explain the relatively low educational quality in these areas – although, on the other hand, they fail to explain them in more than one fourth. It should be noted at this point that the introduction of a new variable reveals slight differences between educational outcomes in Congress Poland and Galicia, in favour of the latter.

The aim of specification 3 is to find out whether the local unemployment rate will help to better understand regional differences in the school test results.

As compared to the variable describing the share of collective ownership, the advantage of the unemployment measure is that it better reflects the structural problems of the economy which are not related to agriculture, for example those observable in cities. The modelling results indicate that the autonomous impact of unemployment (not connected with PGRs) on educational quality is significant, particularly in some regions. It can be expected that an increase of the unemployment rate in the poviat (county) by nearly 10 percentage points will produce, *ceteris paribus*, a decrease in the average test score in the poviat's municipalities by 1.3%. The regional coefficients will also be further reduced (although rather unevenly), as compared to equation 2. The municipality's location in the Regained Territories is correlated with an average test result lower by 4.8 per cent than in Galicia (i.e. by 0.7 points less than in equation 2), in Great Poland and Pomerania – by 3.1 per cent (only 0.1 point less than in equation 2), and in Congress Poland – by 1.1 points less.

To sum up, it can be said that the additional environmental factor introduced into the model considerably affects the differences in the municipalities' educational outcomes. On the other hand, however, its presence helps to explain merely one fourth of the difference between average pupils' results in the historical regions. This invites the question on other reasons for such differences. Finding an answer to this question would require extensive research and certainly exceeds the scope of this study. Nevertheless, it seems that three options which are not mutually exclusive should be taken into account.

The first, 'conspiracy' one, assumes that the conditions in which the final exams in primary schools were held were not the same in particular regions of the country. It is not the work of the Regional Examination Boards that is questioned (this has been taken into account in the model's specification), but the conditions in which the test was conducted in schools. Following the publication of reports on the 2002 test results, opinions were expressed that the surprisingly good results of schools in eastern Poland were partly effects of a lenient attitude of teachers to cheating during the exam, or even helping pupils with answers. After all, the results of the first external exam were expected to assess the abilities of pupils *and* to compare the quality of schools' performance. In experts' discussions, central and eastern Poland was juxtaposed with Great Poland where, as the argument ran, the tolerance for such practices was much lower.

This hypothesis cannot be verified without additional, detailed studies. However, the following fact can be seen as its corroboration. If we calculate the correlation coefficient between the average test scores in the municipality and the rate of pupils repeating a year in the 2000/2001 school year separately for each of the historical regions, we will see (cf. Table 6) that the received figures are statistically significant only in the case of Great Poland and Pomerania. In other words, only in these regions the result of the externally assessed test is correlated (though not very strongly, either) with the assessment of the pupils performance made earlier by the school itself. It should be added

that the significance of this observation is made lesser by the fact that very few pupils in Polish schools actually repeat a year. In the 2000/2001 school year this rate was 0.6%.

Table 6. Correlation coefficient between average test score and rate of pupils repeating a year

	Great Poland and Pomerania	Regained Territories	Congress Poland	Galicia
Pearson coefficient	–0.23*	–0.08	–0.01	–0.07

* Significance of result at a level of 0.05.

The second hypothesis asserts that factors affecting the results achieved by pupils not only include the level of family and school resources, but also various kinds of 'composition effects' one can encounter at school. They include differences in the pupils' community within individual schools, policy of dividing pupils into classes, choice between maintaining small, 'family-sized' schools and economic rationalisation of the school network, etc. The composition effects have been investigated – if not earlier – since the famous Coleman report (1966), which concludes that in American schools the so-called peer pressure is the second crucial factor, after family capital, which explains pupils' academic achievements. Also Thrupp, Lauder and Robinson (2002) offer a valuable review of more recent research on composition effects in schools.

In Poland, there are, as yet, no data concerning schools, pupils and their families which would allow to make such analyses. It was observed however (Herczyński, Herbst 2002) that the average sixth-grade pupils' test scores are strongly negatively correlated with the standard deviation for the result of this test. This means that where the differences between the scores are higher, the average results are lower. At the same time, the most pronounced differences in terms of both the test results and the school resources and the educational level of the adult population can be observed in western and northern Poland, where a high level of enterprise and higher than average education level indicators in some areas frequently co-exist with poverty and high unemployment. Such observations emphasise the need for more thorough studies of the impact of composition effects on educational quality, when the necessary data are available.

Finally, the third hypothesis refers to different cultural conditions relating to education in the analysed regions. These dissimilarities may relate to such aspects as propensity to invest (also time and effort) in education, as a result of the different labour market value of formal education or traditional importance of learning and education. Also, differences in the system of training and remunerating teachers can also prove to be important, just as the effectiveness of spending the available resources or, speaking more generally, of the quality of school management and local school systems. Unfortunately, as in the case of the two previous hypotheses, detailed data about Polish schools and Polish pupils would be required for its verification, and such data are unavailable as

yet. At the current stage of research, however, it would be good to see whether the coefficients of the function determining educational quality, estimated in this paper, differ in any significant way in the individual historical regions. Such differences would testify to different sources for schools' strengths or weaknesses and could serve as a preliminary confirmation of territorial disparities between educational outcomes in Poland.

The result of the Chow test, confronting the quality of the model estimated for all the municipalities in Poland with a set of four separate models, each for a different historical region, confirmed that the differences in the values of the individual coefficients are significant and justify the application of four different samples. The results of the modelling in individual regions are shown in Table 7.

Table 7. Results of model estimation for rural municipalities in four historical regions

Variable	4	5	6	7
Ln (value added)	–0.008 (–0.27)	0.002 (0.10)	**0.055** (3.73)	0.039 (1.69)
Adult education 2002	**0.037** (5.00)	**0.031** (3.31)	**0.018** (4.21)	**0.046** (7.21)
Share of collective land ownership 1992*	**–0.120** (–6.20)	–0.027 (–1.26)	**–0.079** (–2.98)	**–0.087** (–3.30)
Ln (per pupil expenditure on education)	0.020 (1.12)	0.019 (0.92)	0.009 (0.70)	0.042 (1.91)
Number of intercepts allowed	5	5	7	2
Historical regions in the sample	Great Poland and Pomerania	Regained Territories	Congress Poland	Galicia
N	253	265	777	247
F(r,df)	14.21 (8.244)	19.36 (8.256)	8.60 (10.766)	11.81 (5.241)
R^2	0.32	0.38	0.10	0.20

As we can see, the estimated regional functions considerably differ. The family education capital is the only factor which remains statistically significant in all the specifications, but its impact is strongly differentiated. It is the least distinctly translated into pupils' achievements in former Congress Poland. One more year of schooling among the adult population is here correlated with a 1.8 per cent increase in the test score, *ceteris paribus*. The strongest correlation between the educational level of adults with the pupils' performance can be observed in Galicia, where one more year of schooling in the measure of the average education period is translated into a nearly 4.6 per cent improvement in the test results. Finally, this coefficient reaches a value of 3.7 per cent in Great Poland and Pomerania, as compared to 3.1 per cent in the Regained Territories.

We have a similar situation in the estimation for the entire population of the Polish municipalities. In this case, too, in all the regional models the level of school resources is not a factor that significantly affects the level of pupils' academic achievements. Limiting the set of data to rural municipalities did not result in any substantial change, although, as could be expected, the values of

the coefficients in the case of the variable describing the level of expenditures on education were in this case much higher than in equations 1 to 3. It should be observed, however, that the area formerly under Russian rule is one of the four areas distinguished in this study, where the quality of schools expressed by the value added measure plays a perceptible role. An increase of the measure's value by one standard variation is accompanied by an increase in the average test score by 0.8 per cent. This, coupled with a relatively low sensitivity of the test to the level of education in the generation of parents leads to the conclusion that school results in former Congress Poland are determined at the school level to a greater extent than in other regions. On the other hand, the lowest coefficients of variables related to schools' value added can be observed in the areas formerly under Prussian rule (negative coefficient) and in the Regained Territories.

The additional environmental factor, expressed by the share of collective land ownership in 1992, had a particularly strong impact on school results in Great Poland and Pomerania. The respective equation coefficient for this region is –12.3 per cent, which means that the municipality where a half of farmland was formerly owned by PGRs or farming cooperatives will have an average educational result by 6 per cent lower than the municipality where all farmland was owned by individual farmers, irrespective of other factors included in the model. Such an impact should be regarded as very strong. This factor plays a lesser role (though still significant) in Congress Poland and Galicia, where the equation coefficient reached nearly –8 per cent. On the other hand, in the Regained Territories, where collectively owned farms were the most common, the 'PGR' variable proved to be statistically insignificant. This is only apparently a paradoxical result, because, with a high average share of PGRs in the total farmland area in this region, this is a factor that does not strongly differentiate the municipalities covered by the research.

The above observations are rather general in nature and are insufficient to fully verify the reasons for the differences in educational quality between Poland's historical regions. We can state, however, that these differences do not only refer to the level of pupils' achievements, but also to the actual impact of individual factors on such achievements. The determination function for academic achievements runs differently for different areas of the country. This conclusion, and the hypotheses put forward in this paper, can provide a starting point for further studies, which will not only analyse traditional factors, but also composition effects and cultural determinants of school performance.

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