School Choice and Student Achievement. Evidence from Poland

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Abstract

The impact of school choice on education quality is one of the most hotly contested issues in education economics. We contribute to the debate by investigating the effect of concentration of local education markets and the number of schools in the city on the average achievements of 9^{th} grade students in Polish middle schools. We find the evidence that the increased availability of choice leads to higher performance, although this relationship holds only until a certain threshold is reached. As the number of schools in the city reaches four, the marginal benefit from further widening of the market falls to zero, or even becomes negative. Besides the influence on the average achievement in the city, the increased school choice leads to higher differentiation among schools. In contrast to the previous result, here we do not observe any threshold, and the effect seems to be independent of scale.

Keywords: school choice, school competition, educational quality, school differentiation

Introduction

The impact of school choice on education quality is one of the most hotly contested issues in education economics. On the one hand, proponents of market-oriented mechanisms argue that without competition, public schools become complacent and tend to waste enormous resources allocated to them by the post-industrial nations. The extreme version holds that, in order to improve quality, public schools should be forced to compete against each other, and that the best way to achieve this is to introduce some form of school vouchers. On the other hand, researchers and practitioners alike argue that education is by nature a cooperative endeavor, and that promotion of quality can be achieved through introduction of national standards and through improvement of teacher qualifications, rather than through cut-throat competition.

The discussion has many dimensions of which the most visible refers to the legal and institutional framework governing education, especially the school finance. The two opposite attitudes mentioned above favor very different legal solutions and very different allocation systems, and the choice often becomes an important political issue at the local level, for the managers of local public education systems (eg. school districts in US, LES's in UK, gminas in Poland).

The crucial element of the debate is the research into school performance, because it is here that the hopelessly entangled social and political arguments may be clarified and some basic degree of consensus reached, with useful lessons for both legislation and local school practice.

There are two basic and quite different types of competition which are investigated in empirical (mostly American) research. First, the competition from non-public, or more generally, selective schools. Do non public schools compete among themselves, or do they also drain resources and skim the best students from the public schools? Or maybe they provide public education system an incentive to use the resources more effectively and increase productivity?

Secondly, the competition within the public school sector. Do the schools belonging to one school district or to one local government compete against each other? Does availability of choice for parents and pupils leads to better average performance of local schools? Does more schools necessarily means more segregation?

Poland is an interesting case because it allows for both types of competition. Since the end of communism, Poland had developed a robust if rather limited non public school sector, and moreover the state provides financial support to those schools at the level of per student expenditures in analogous public schools. The non public schools are essentially located only in the cities and, contrary to what can be expected, only a small proportion of them are confessional (Catholic). In the year 2001/2002 about 2% of students of gymnasium, the lower secondary school serving the grades 7 to 9, attended non public schools.

At the same time, Poland allows the students and parents a degree of choice between the public schools. For municipalities with more than one public school, the city must by law establish school catchment areas (rejon szkolny). All students residing in the catchment area have the right to attend the local school (and the school must accept them), but the school may also accept the students from outside its catchment area, if there are places. The decision is taken by the school headmaster, and with the demographic decline, the availability of places in the schools becomes quite common. The parents and students do exercise this right of choice, for instance in 2001/2002 15,3% of all students attended the middle school other than their local one. Of course, this migration between neighboring catchment areas is severely limited in rural areas, partly due to distances involved and absence of convenient transportation, and partly to lower interest of the parents in obtaining good education for their children in rural areas. Thus, in the cities[3] the share of students attending the school outside the official catchment area is higher than national average, namely 17,8% . In Polish context it seems therefore reasonable to restrict the analysis of school choice to the urbanized areas.

Apart from inter-catchment area migration of students, we need also consider the inter-municipal migration. Here it is important to understand that Polish household, unlike, for example, the American ones, move very rarely, and only in exceptional cases would such a move be related to search for a good school. However, the parents can and do send their children to schools in another municipality. Usually, this involves the migration of children from villages to urban schools, but not only. Among the 360 cities with only one middle school available in 2002, on average 6,5% of pupils did not attend this unique facility, and had to attend the school in another municipality. However the competition of municipalities for students is still an unrecognized phenomenon.

[3] Polish primary and lower secondary education is fully decentralized to nearly 2,500 municipalities (gminas), see Levitas, Herczyński (2002). Of them, about 1,600 are rural, 300 are urban and the remaining ones are mixed, comprising both a city and surrounding villages. In the present paper by cities we mean any municipality which is either urban or includes an urban area as its center. In 2002, Poland had 895 cities.

Another good reason to study Polish experience is the availability of uniform, nationally administered test of student achievements. Since the introduction of those tests in 2002, it is possible to examine the impact of availability of choice among public schools on education attainment of students.

In studying school choice, it is necessary to consider what competition in the education sector may mean. It seems that three necessary conditions must be fulfilled so that local educational market could be described as offering choice, or competitive. First, parents and pupils need to be able to choose between different schools in the municipality. This means not only that such choice should be allowed by the regulations, but there need also exist real schools to choose between. This is indeed the case in most Polish cities.

Second, instructional quality (real or perceived, based on rumors or on past student achievements) should be considered by parents an important criterion for school selection. That is, for example, they have to be willing to choose better school even if there are other facilities located closer to their home. We may consider a simple model of school choice made by parents and/or pupils, where the weight p_i $(0 < p_i < 1)$ is attributed to the distance from home to school by the family *i*, and the weight $1 - p_i$ reflects the importance of school quality measure, so that:

$$s_{ij} = p_i * d_{ij} + (1 - p_i) * q_j$$

where s_{ij} is family *i*'s overall rank of school *j*, d_{ij} is the inverse distance (appropriately normalized) from school *j* to family *i*'s home and q_j is some measure of school quality. If average *p* for the municipality is large, students will in general attend the closest school, and the competition effect is negligible. For local educational market to be competitive, average *p* should to be small enough to put schools under the pressure of Thiebout-type sorting of students. It is worth noting that this model assumes *d* to be exogenous (fixed), so that families do not move to the neighborhoods where good schools are located, but are only allowed to send children to the schools in other districts. Such assumption naturally reduces the potential competitiveness of the market, but corresponds better to Polish reality. Indeed the mobility of population in Poland is very low as compared to that of U.S., where most of the research on educational markets competition are conducted. On the other hand, it is relatively easier for Polish students to choose to attend any school in the municipality, subject only to availability of places and to the decision by the school head.

Finally, if schools are to compete, their 'utility' should be directly or indirectly related to their ability to attract pupils. Otherwise there would be no incentive to improve instructional quality and other school characteristics. It is however hard to evaluate to what extent this condition is fulfilled in Polish reality with respect to gymnasia, the subject of the present article. The gymnasia are administered by local municipal authorities, responsible for setting school budgets (in particular, for establishing employment levels), as well as for hiring school headmasters. Obviously, one of the criteria for evaluating the work of headmaster refers to student achievements. However, no standardized system of school evaluation by the municipal authorities exists. Some of them may attach more importance to average achievements, other to holding budget discipline or reintegration of disadvantaged pupils. It would be wrong to say that the system of school financing rewards education quality in any standardized way. Local authorities obtain so called education subvention (block grant) from the central government. This subvention is based on weighted students, taking into account both the actual number of physical pupils in a given area, and the number of those belonging to some 'special' categories, such as handicapped pupils, students attending rural schools and so on. Thus, during the allocation of education block grant from the central to local governments, the funds follow the pupils, creating a basis for competitive market. However, apart for a few rather exceptional cities such as Kwidzyn and Swidnik, see Herczyński, Kiersztyn (2005), no such direct relationship exists between allocation of funds to individual schools and their enrollment. Usually, school budgets are determined on the historical basis (with incremental adaptations), or by some informal procedures. Thus usually the funding does not promote competitive market mechanisms.

In sum, of the three conditions necessary for the competition on local education market, two seem to be at least partially satisfied. Poland has 528 cities (out of nearly 9 hundred) with more than one lower secondary school, so they were offering parents some possibility of choice. Also, parents and pupils do exploit this possibility and make their choices felt. Of certain doubt is a competitive character of school financing system, that depends to large extent on local policies.

Empirical literature review

Most of the research on the competition in educational markets is focused on high schools, rather than elementary or middle tiers of education. This is because the competitiveness of educational market is expected to increase along with the age of students.

The mobility of children attending elementary schools in response to the perceived differences in school quality is limited, as distance to school plays crucial role in parents' choices. As children grow, parents become more willing to consider further school locations in the search for higher instructional quality.

In empirical estimations a pressure from private schools is usually proxied by the percent of pupils attending those schools measured at the level of administrative unit, e.g. county. If competition is to exert positive influence on educational quality, the increase in private schooling should improve the performance of public schools in the neighborhood. However, as explained by Dee (1998), this reasoning has two weaknesses if considered literarily. One concerns the existence of omitted variables bias. The demand for private schooling is affected by several dimensions of SES that are themselves correlated with student achievement. Thus, the impact of competition may be easily overestimated, as private schools are more common in the areas of higher SES. To avoid the bias, good control for parents SES is needed.

A second problem is that the demand for private schooling is not independent on the quality of public schools. The better public schools are, the lower is the incentive to send children to private schools. This in turn may lead to underestimation of the role competition exerts on educational quality. To solve this problem, some American researchers applied instrumental variables (2SLS) approach instead of simple OLS, introducing the population concentration of Catholics as an additional instrument for the percent of pupils in private schools. They used a fact that large part of U.S. non-public schools are Catholic which implies it is easier and less expensive to set up private school in the area with large share of Catholics in the population. At the same time there is no direct link between religion and school achievements, which makes the share of Catholics in local population a valid instrument for private school competition.

Following this approach Hoxby (1994a) demonstrated that greater private school competitiveness significantly raised the quality of public schools, as measured by the educational attainment, wages and graduation rates. In addition it is shown that, in reaction to the pressure from private sector, public schools increase teacher salaries.

Dee (1998) uses data on 4488 school districts in 18 states of USA. He shows that the presence of nonpublic high schools in a district improves the grade completion rate in public education. As the share of private school pupils increases by ten percentage points, the completion rate in public schools raises by 2,5 point.

The effect of private competition on public schools estimated in the research of Greene and Kang (2004) is not that clear. They examine database on high school districts in New York State, outside New York City, for the school years 1989/1990 to 1992/1993. Private competition shows positive effect on average performance at the math and science Regent examinations (calculated as the number of pupils passing the exam divided by the average enrollment in grade 9-12) and negative effect on dropout rates until the percentage in private schools exceeds 7,6% and 26,3% respectively. The average value of private percentage in the sample is 7,3% and maximum value is 22,7%. In contrast, the percentage of private enrollment has negative impact on the percent of students receiving a high quality statewide Regents diploma. The negative effect reveals as the private enrollment exceeds only 1,1% of total enrollment in a county.

The undesired effects of the competition between selective and non-selective schools are demonstrated also by Dee and Fu (2004). Their research concerns the impact of charter schools in Arizona and neighboring states. It relies on panel based evaluations using data from 1994/1995 and 1999/2000 school years. The results suggest that the introduction of charter schools skimmed white non-Hispanic student and lowered the amount of resources available to conventional public schools.

Beside the interactions between private and public schools, some research investigate the effects of competition within public sector or simply the implications of easier choice among schools, without distinguishing the sectors or organizational forms. The usual measure of the competitiveness of local education market applied in U.S. research is Herfindahl index of market concentration. It can be defined as $H_i = \sum_{j=1}^{n} p_j^{\,2}$, where p_j is relative enrollment in school *j*, so that $p_j = \frac{E_j}{E_i}$, with E_j being actual enrollment in school *j*, and $E_i = \sum_{j=1}^{n} E_j$ being total student enrollment in the area *i* (*n* is the number of schools).

Interestingly, in the American research H is usually calculated at county level ('j' refers to the counties) with 'i' referring to school districts, so that the index measures the competitiveness between school districts rather than among individual schools. Alternatively, the strength of competition is measured by the number of competitors (school, districts) in a given administrative unit or, if the research is conducted at school level, as a distance from a given school to it's closest competitors.

Hoxby (1994b) applies instrumental variables technique to isolate the exogenous variation of Herfindahl index of school district concentration among metropolitan areas of

U.S. She derives instruments from natural boundaries (rivers) that partially determine district size. Then she proves that variation in H has strong influence on school functioning. As she concludes, easier choice leads to greater productivity. Areas with more opportunities for school choice have lower per student costs, lower teacher salaries and larger class size . The same areas have better average student achievements, as measured by test scores and attainment rates. Finally, Hoxby finds strong evidence that in areas with higher competition among public schools a smaller share of students attend private schools.

Zanzig (1997) measures the competitiveness of educational market by Herfindahl index of school district concentration and, alternatively, number of districts per county. The author explains that as additional districts are added comparison among them becomes easier, resulting in more effective parental monitoring and thus higher test scores. At some point however, the benefit of additional district is expected to become negligible and more competition has no effect on achievements. At this point local educational market is said to be completely competitive. Zanzig use 1970 data for California school districts. Instead of assuming any functional form of competition effect on performance, the author splits the number of districts and Herindahl index into four variables: District1-M, DistrictM+, Herfindahl 0-N and Herfindahl N+, where M and N are 'critical levels' of districts number and H, respectively. It is expected that additional district will have positive, significant impact on achievements only below threshold number M and above critical value N of Herfindahl index. Critical values are then found by repeating regressions with different values of N and M until the obtained statistics match the assumed pattern.. The results of the research reveal that only three to five districts are needed to achieve a completely competitive educational market.

As noted by Bradley, Johnes and Millington (2001), in England parental choice matters to schools because their funding is driven by pupil numbers. Each Local Education Authority has designed a formula for the funding of schools within its jurisdiction. These formulae, approved by central government, are based mainly on the age-weighted number of students in each school. UK has therefore a quasi voucher scheme for both primary and secondary education. Millington and Bradley (1998) showed that greater degree of competition between non-selective (public) schools improved average school performance. They also demonstrated a cream-skimming effect of non-public schooling as the presence of selective schools in the catchments area of a non-selective school depressed the achievements of the latter.

Bradley, Johnes and Millington (2001) emphasize that schools have multiple outputs, not only exam performance. They apply DEA (Data Envelopment Analysis) to capture this multi-product nature of schools and assume what school maximizes is the weighted sum of products instead of one measure of performance. They find that non-selective (public) school efficiency depends positively on the number of competitors (other non-selective schools) in the proximity. It also depends negatively on the distance between competing schools as the regression coefficient referring to competitors located within 1 km radius is six times greater than the one for schools between 3 and 5 km away. In contrast to earlier research by Millington and Bradley (1998), this time the authors find little systematic evidence that cream skimming by selective (non-public) schools reduces the efficiency of non-selective schools. Although the respective coefficients are negative, the are generally insignificant.

Finally, in one of the recent papers Greene and Kang (2004) examine database on high school districts in New York State (outside New York city) for the school years 1989/1990 to 1992/1993. They use quadratic specification of Herfindahl index and find unambiguously positive impact of competition on school performance. As the Herfindahl index rises, the average district score of math and science Regent examinations drops significantly. This happens until the index reaches 0.28, and only 3,5% of the observations posses an index greater than this. Moreover, public competition has a significant negative effect on dropout rate over the entire sample range.

Conceptual framework and data

What may be the consequences of increased competition among schools? Hoxby (1994b) speaks about three theoretically possible effects:

i) More competition should force schools into higher productivity and lead to higher average student achievements
ii) Easier choice between schools leads to increased sorting of students. This may be undesired if advantaged students gain at the expense of disadvantaged ones.
iii) Higher competition among public schools gives parents less incentive to send children to private schools

In this paper we focus on verifying the first two effects. We do not distinguish between private and public schools, but rather investigate how the availability of choice among schools affects the average performance and the inequality of achievements among different schools in a given area. Although the impact of private competition on public schooling is an important topic that appears in many works on education markets, it would be very difficult to adapt those works to Polish conditions. The main problem refers to endogeneity of a demand for private schooling. As explained in the previous section this demand is partially determined by the performance of public schools in the neighborhood. Differently than with American data, for Poland the problem cannot be solved by using instrumental variables related to religious structure of the local population. First, over 90% or Poles consider themselves as Catholics and the variation of such variable among localities would be very small. Even more importantly, only a small fraction of Polish private schools are religious schools. This makes religion completely useless as an instrument for private education measure.

Addressing the first of the problems listed above, we estimate the model of school performance using as dependent variable the city's average test score in mathematics and science achieved by 9^{th} grade students of lower secondary schools. In further part of the analysis we change the dependent variable to the inter-school standard deviation of the average test score, measuring the differentiation among schools within a city. We focus on middle schools, because it is the highest tier of public education in Poland, for which a standardized, externally evaluated tests are conducted at the final grade. Such tests are to be applied in higher schools only since 2005.

The sample covers all Polish municipalities including a city, that is, all purely rural municipalities, of which vast majority maintain only one middle school, are excluded. This makes over 800 out of total number of 2500 municipalities left for the analysis. About 300 of them are simply larger or smaller cities, and the rest can be described as mixed rural-urban units, consisting of the city and surrounding rural area. For simplicity, wherever a term 'city' is used in this article, it refers to the city or mixed rural-urban municipality.

We consider the following simple model of educational performance:

$$Q_i = Q(f_i, r_i, c_i)$$

where Q_i is the average student achievement in municipality 'i' (average test score in mathematics and science), f_i states for the average level of family education, r_i refers too

city's average level of school resources and c_i measures the availability of school choice. In further analysis the model takes the following general form:

$$V_i = Q(f_i, r_i, c_i)$$

so that instead of average performance we model the differentiation of student achievements among schools, as measured by inter-school standard deviation of the test score: $V_i = \sqrt{\frac{1}{n}\sum_{j=1}^{n}(Q_j - Q_i)^2}$, where Q_j refers to the average test score in school *j*, and *n* is the number of schools in a city.

For both dependent variables, the source of data is Centralna Komisja Egzaminacyjna (CEC, Central Examination Commission), administering the externally evaluated school tests. We use the data from academic year 2001/2002.

The level of family education is approximated at city level by the average years of schooling in adult population. The data come from national census conducted in 2002 by the Central Statistical Office (CSO).

The variables expressing the level of school resources used in our analysis are: average teacher salary, average non-teacher school employee's salary and average class size. Former two were taken from 2001 obligatory report EN-3, prepared by the schools. The latter comes from the 2002/2002 S02 database on schools. Both EN-3 and S02 reports are designed by Polish Ministry of Education and Sports and administered by CSO.

The control variable of city population number in 2001 is taken from Regional Data Bank, maintained by CSO.

Finally, the availability of school choice is approximated in two ways. First, a Herfindahl index of city education market concentration is calculated as $H_i = \sum_{j=1}^{n}\left(\frac{E_j}{E_i}\right)^2$, where E_j is enrollment in school *j* and E_i is total enrollment in all city schools. A city with only one lower secondary school (fully concentrated market) will be assigned H=1. If there are two middle schools of equal size, the index will be equal to 0,5, and so on.

Another variable reflecting the availability of school choice is simply the number of schools in a city, applied in the specification as a set of dummies, each indicating certain quantity of schools, from one to six, with the last variable accounting for the cities maintaing seven or more schools. The data on school enrollment and the number of schools in 2001/2002 are taken from S02 database.

The descriptive statistics for all the variables used in the analysis are presented in Table 1.

(Table 1 here)

Results

As discussed above, we use two measures of public school choice available to students: the Herfindahl index of school concentration, and the number of public schools in a given local (municipal) school system. The equations in Table 2 provide estimates of impact of those two measures on student achievements on mathematical and scientific part of tests administered in 2002 to graduates of gymnasia (lower secondary schools) in Poland. Average salaries of teachers, and non-teacher school employees, average years of schooling in adult population, average class size and city population are used as control variables of the model.

(Table 2 here)

We note that the Herfindahl index has a significant and negative impact on student achievement. The greater the choice of public schools, as measured by lower Herfindahl index, the higher the test results. However, one may suspect that this result is mainly due to the difference between cities with only one gymnasium and those with more than one (over 41% of Polish cities have only one, they are often smaller and poorer cities). This is directly related to the nature of Herfindahl index. For single school municipalities H is naturally equal to 1, meaning absolute concentration of education market and no choice available for the children and parents (attending middle school outside home municipality is very rare). If instead of one school, two smaller, equally sized facilities were established, the Herfindahl index would rather dramatically drop to 0,5. Creating further schools however would have much smaller effect on H. It is therefore possible, that high statistical significance of the index reflects only the gap in educational quality between smallest (one school) education systems and the more complex ones, saying little about how school choice affects the quality within the group of larger cities, where variation in H is much lower. In order to check this, in Equation 2 the sample is restricted to the municipalities with more than one school. We can see that even in this restricted sample the negative impact of Herfindahl index is significant and negative. Moreover, the regression coefficient by H is even higher for multi-school

municipalities than for unrestricted sample. Assuming linear relationship between H and education performance, the coefficient close to -0,12 (Equation 1) suggests that of two hypothetical municipalities similarly endowed with human capital and school resources, the one with two equally sized middle schools would achieve the average test score about 6% higher than the one with single school. In turn, three school system would be by 2,4% more effective than two-school one. This is a very significant impact.

A more detailed results on the effects of school choice on student performance are provided by Equation 3, where, instead of Herfindahl index we use the measure of the number of middle schools in a municipality. We note that the student achievement grows as the number of schools increases to four, and then stabilizes (the further variables are still significant, but the coefficients are lower than by for 'four school' dummy.) This suggests, that although the policy of creating very large schools, often serving the whole local student population, does not lead to best examination outcomes, the availability of choice improves students results only till certain number of schools is reached. The estimated coefficients indicate that local education market with four or five lower secondary schools is already sufficiently competitive.

One important issue here is that in large cities, those with many gymnasia, there may be some additional factors that tend to improve student learning chances, such as greater availability of out of school education resources. This is partially but not completely accounted for by the use of the parental education level (proxied by average years of schooling received by the adult population of the city). That is, the impact of school choice on student performance might be overestimated. Although there is no direct correlation between student test score and city population (coefficient equal to 0,03), we decided to include the latter variable as a control factor in all three equations. Interestingly, the population size shows significant and negative impact on average school outcome, indicating that, at least for school achievements in mathematics and science, the hypothetical advantage of large cities may be related to family education or teaching quality, but rather not to wider benefits of living in metropolis. On the contrary, social pathologies of large cities may have a stronger influence than additional education resources.

Increased choice available to students of public schools, as measured either by school concentration or by the number of schools in a given city, is associated with higher student achievement, when the relevant social factors, such as education level of adult population, are controlled. The exact way through which this influence arises is an important open problem. However, we do know that this is not related to the number of students actually exploiting the

opportunity of increased school choice, that is students who decided to attend a gymnasium which is not their local school[4]. We know, indeed, that this share of *migrating students*, is not correlated with the average student achievement at municipal level. Thus if there is a pressure on the schools to operate more efficiently and to provide better education for their students, this pressure is not induced by the students voting with their feet. The actual mechanism of how choice influences quality is therefore more complex.

Besides the effect on average school productivity, the other frequently discussed result of school choice availability is sorting of students. Differently than increased average performance this is rather undesired and provide arguments for the opponents of competition on the education market.

In the specifications presented in Table 3, we use a crude measure of differentiation of average school achievement within a municipality, namely the standard deviation of school level scores, that is a measure indicating how the local schools differ between them in their average test results.

(Table 3 here)

The results of Equations 4 and 5 are in stark contrast to the estimates presented in Table2. We note that neither the average teacher or non teacher salaries, nor education level of the parents, have significant impact on how the schools differ from each other. However, Herfindahl index significantly and negatively influences the standard deviation of school averages. This means that if more school choice is available, the schools will become more different. That is a strong endorsement of a prediction made on theoretical grounds by Hoxby (1994b), as described earlier in this article.

Even more interesting is equation 5, where in place of Herfindahl index we use the number of schools. As we can see, the larger the number of schools, the greater the differentiation between them. However, unlike the marginal average achievement (see Equation 3, Table 2), the marginal differentiation, that is the increase of standard deviation as a result of adding one additional school, remains strictly positive for any number of schools. Table 2 allowed us to conclude that local school market system becomes fully 'saturated' as the number of gymnasia reaches four, and that adding more schools will not improve the

[4] As described in the introductory part, in Poland each school is assigned a district to cover. The school is obliged to accept the application of a student leaving in it's district, however students are allowed to choose a school outside a district.

average student test scores. In contrast, the more schools there are, the higher is the differentiation among them, and this relationship does not seem to weaken as education market grows.

Results discussion and conclusions

We have reviewed the evidence from Polish cities about the impact of school choice on student achievement. The findings are generally in agreement with the theoretical predictions and empirical results reached in a very different social and political context by Hoxby (1994b), Zanzig (1997), Bradley, Johnes and Millington (2001) or Greene and Kang (2004), namely that greater choice among public schools contributes both to the increase of average student achievement (average in the city) and to heightened differences between the schools (as measured by standard deviation of school averages). Interestingly, the impact on average student achievement has a threshold, and as the number of gymnasia reaches four, the marginal effect of competition on student performance becomes insignificant and additional schools do not contribute to further increase of student test results. The school differentiation, in contrast, becomes more and more pronounced with every added facility.

Do these results imply that the observed increase in average school productivity is really a consequence of competition for students? Certainly, there is no easy answer to this question. One may argue that such *market oriented* interpretation does not reflect the realities of local education systems in Poland. Schools do not really compete with each other, and if they did, this would not be for students, but rather for additional resources from the city, their owner and the provider of their budgets. However, in allocating the funds to schools city officials must take into account, though not always directly or exclusively, the number of students. Thus the competition for resources becomes in fact competition for pupils, even if the economic (market) nature of this competition remains unrealized by the headmasters.

A strong motivation to improve education quality may be provided by the fear of school closures. In the face of demographic decline, present in Polish education for over 3 years now and set to continue for many more years, the schools do compete for the chance to stay open, to avoid closures. Indeed, it seems that in the few Polish cities, such as Swidnik and Kwidzyn, which did introduce a voucher-type funding scheme (setting the schools budgets proportional to enrollment, and letting schools compete directly for students), the vouchers had little effect until the demographic decline came, and then produced amazingly intense competition for each additional student, largely in the effort to stay in business (see

Herczyński, Kiersztyn 2005). While in most Polish cities no such cut-throat competition takes place, the school directors are aware that with decreasing student numbers some decisions about school closures will have to be taken. Now, when a local school system is dominated by a few relatively large schools, the motivation to improve teaching methods is very weak, both in the large schools, which know they will continue to operate, and in the small schools which have little hope of staying open for very long. In more deconcentrated systems, and in systems with many schools, cities have more freedom in deciding which facilities to close, and the schools run more equal risk of being chosen for the axe. So all school directors are strongly motivated to improve the test results of their students, and to prove thus that their schools have a good right to stay in business.

From the point of view of the parents and pupils, availability of more schools means more choice and therefore better chance of finding a school matching their specific needs. Thus, the observed positive impact of school choice on average performance should not be a surprise. Nevertheless, the number of schools parents are able to monitor, visit and compare before making decision where to send their children is clearly limited. At a certain point having one more option will not help them make the optimal choice, but rather increase the informational noise they have to filter and analyze. If we accept the idea that the positive effect of school number on city's average educational performance is mainly due to the increased possibility of choice for the parents and pupils, then our research suggests that the number of options the parents are able to consider is four, since fifth school in the municipality is the first that doesn't improve the average student achievements.

An alternative explanation of our results, although not contradictory to the above, is related to the role of city administration and it's managerial power over local education system, rather than to the competition among schools or to greater choice for parents. With few schools, or with the local system dominated by one very large school, the chances for dialogue and discussions, between the city education department and the school headmasters are limited, and will be influenced by one or two loud voices. Unless those voices belong to very reasonable and open minded school headmasters, the city will be making less then optimal decisions about where to allocate scarce resources, how to react to the difficulties of particular schools, or how to monitor and assess school performance. With less concentration, and more schools, the relative position of the city education department becomes stronger and the management of the sector may be more focused on ensuring quality for all students. On the other hand, it is obvious that managing large system, consisting of many schools is more difficult and reduces the possibility of direct supervision over the activity of particular

schools. Thus, as the number of schools exceeds a certain threshold, the negative scale effects of the system may offset the benefits from the strong managerial position of city education department. Again, our results suggest that such threshold is equal to about four schools.

Turning back to the competitive pressure put on schools, we can propose two mechanisms through which schools adapt to this pressure. Again, these are not contradictory, but rather coexisting strategies. First, in the presence of competition schools may concentrate on enhancing their teaching quality and learning conditions which should result in improving the average performance, as observed in our research. At the same time however, the more schools operate in a given area, the more attractive it becomes for them to adapt their pedagogical offer to specific groups of students, instead of simply competing in test results. As a consequence, deconcentration of local educational market leads to differentiation of schools in terms of student achievements. This interpretation is supported by our consistent finding of the impact of Herfindahl index, measuring exactly market concentration, on inter-school standard deviation within a city. Also the number of schools shows an increasing positive effect on the differentiation of average schools test scores.

Although we offered here several possible interpretations of the obtained results, the precise mechanisms through which the availability of more schools, and deconcentration of educational market influence student performance remain an open question. To complicate it even more, we conclude by stressing that our discussions centered on issues of quality and on student achievements, and ignored completely the problems of the costs of providing education. The findings of our paper touch the dilemma of either pursuing the school quality though better student outcomes, or rationalizing the school operations through consolidation and closure of small schools. Indeed, the advice to maintain a minimum number of schools will in many cases mean the advice to maintain small schools, that is schools with relatively large per student expenditures. Formulation of a successful policy with respect to local school systems, which will include both shrewd financial management and the pursuit of excellence, remains a challenge.

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Table 1. Descriptive statistics

Variable	N	Mean	Minimum	Maximum	Std. Dev
Log of average math&science test score	867	3,302	2,981	3,726	0,124
Log of city population	894	9,751	7,151	13,697	0,917
Herfindahl index	881	0,653	0,024	1,000	0,317
Log of average teacher salary	891	10,073	8,644	10,822	0,136
Log of average non teacher salary	838	9,572	8,266	10,430	0,204
Average class size	894	25,218	16,000	32,667	1,991
Average years of schooling in adult population	895	9,972	8,878	12,961	0,639
Inter-school standard deviation of the test score	552	3,637	0,001	15,531	2,447
Number of middle schools	866	3,428	1,000	69,000	5,644

Table 2. Impact of school choice on the log of average math&science test score

Variable Equation	1		2		3	
Constant	3,611	(10,3)	3,552	(6,94)	3,486	(9,53)
Log of teacher salary	-0,049	(-1,49)	-0,048	(-1,03)	-0,060	(-1,80)
Log of non teacher salary	-0,015	(-0,71)	0,002	(0,07)	-0,011	(-0,53)
Average class size	0,004	(1,80)	0,005	(2,03)	0,003	(1,30)
Average years of schooling	0,071	(9,45)	0,069	(8,22)	0,067	(9,35)
Log city population	-0,041	(-4,84)	-0,051	(-4,74)	-0,023	(-2,51)
H index	-0,116	(-5,21)	-0,180	(-4,18)		
2 schools					0,011	(0,82)
3 schools					0,040	(2,71)
4 schools					0,053	(3,02)
5 schools					0,051	(2,42)
6 schools					0,041	(1,82)
More than 6 schools					0,047	(1,94)
Selection criteria	Urbanized areas (municipalities)		Urbanized areas (municipalities) with more than one school		Urbanized areas (municipalities)	
F(r,df)	21,54	(6,794)	13,5	(6,480)	10,53	(11,797)
R^2	0,14		0,14		0,13	
N	801		487		809	

Heteroscedasticity adjusted t-statistics are reported in parentheses

Table 3. Impact of school choice on interschool standard deviation of score

Variable Equation	4	5
Constant	13,57 (1,33)	13,66 (1,40)
Log of teacher salary	-1,057 (-1,22)	-0,890 (-1,09)
Log of non teacher salary	-0,177 (-0,27)	-0,096 (-0,16)
Average class size	0,007 (0,12)	0,076 (1,22)
Average years of schooling	0,377 (1,71)	0,257 (1,29)
Log of population	-0,041 (-0,18)	-0,749 (-3,16)
H index	-2,393 (-2,48)	
3 schools		0,855 (3,06)
4 schools		1,487 (4,22)
5 schools		1,853 (4,48)
6 schools		2,303 (4,65)
More than 6 schools		3,302 (6,66)
Selection criteria	Urbanized areas (municipalities) with more than one school	Urbanized areas (municipalities) with more than one school
F(r,df)	4,42 (6,465)	6,618 (10,461)
R^2	0,05	0,13
N	472	472

Heteroscedasticity adjusted t-statistics are reported in parentheses