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Segregation effects on educational achievements the case of Chile

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Segregation Effects on Educational Achievements The Case of Chile

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Abstract

Literature has identified several negative segregation effects on individuals' well-being. Based on these findings we propose to study about segregation consequences on educational achievements in Chile. Using an econometric model and the university selection test (PSU) information we have found that segregation has negative impacts.

1 Introduction

The purpose of the article is to understand the consequences of Economic Residential Segregation (RS) on academic achievements in Chile. Our hypothesis is that RS has negative effects on academic performance. This hypothesis is based on the following theoretical and empirical backgrounds. First, literature has shown that segregation can have different negative effects on individual's well-being related variables, such as a greater propensity to joblessness, premature parenthood, bad health, births out of wedlock, drug abuse, criminality, poverty and bad academic performance (Dawkins et al., 2005; Charles et al., 2004; Clapp and Ross, 2004; LaVeist, 2003; Dosh, 2003; Burton, 2003;

Yinger, 2001; Massey, 2001; Madden, 2001; Wilson and Hammer, 2001; Logan and Messner, 1987; Burnell, 1988).

Second, concerning education, Mayer (2002) points out that there are two research traditions which provide theoretical and empirical background regarding RS consequences on academic performance, namely, school finance and neighborhood effects. When schooling is locally financed, mean school municipality income can affect academic outcomes. According to this model as low-income children become concentrated in neighborhoods in which few resources are spent on schooling, their educational outcomes suffer. Benabou (1996), Fernandez and Rogerson (1996) and De Bartolome (1990) belong to this tradition. Sociologists that have studied neighborhoods effects have been focused on the spillovers that affluent residents can generate for their neighbors. These spillovers can be the result of better role models and more useful social networks, and from more effective neighborhood monitoring. Investigations on this aspect of RS effects can be found in Blume and Durlauf (2001), Wilson (1987) and Sampson and Laub (1994). According to Mayer (2002) such mechanisms imply that both rich and poor children benefit from affluent neighbors, because mean neighborhood income affects childrens educational attainment independent of a familys own income due to the fact that mean neighborhood income is a proxy for role models and monitors.

Nevertheless, it is not necessarily clear that RS will have negative effects on educational attainment. First, because as Jencks and Mayer (1990) and Davis (1966) indicate, when disadvantaged children must compete with advantaged children for good grades, good jobs, or social status, they are more likely to lose out. Besides, relative deprivation theory predicts that when the poor compare themselves to the rich, this can lead to unhappiness, stress, and alienation (Davis, 1959). Consequently, an increase in within-neighborhood income inequality would hurt childrens educational attainment because it would exacerbate harmful effects of interpersonal comparisons (Mayer, 2002).

Second, because investigations that have used the US Moving to Opportunity Program (MOP) data have found only negligible RS effects. MOP data are important because this program was designed as an experiment. Cheshire (2007) presents a good review about this subject. Regarding investigations about RS effects on education in other Latin American countries we are aware only of Kaztman and Retamaso (2007) which research on RS consequences on education in Montevideo, Uruguay.

Hence, because what has been discussed above, we believe that there are still some room for research on this important topic in order to cast new light on it.

2 The Chilean Educational System: A brief Review

At the beginning of the 80's Chile started a group of pro-market reforms. These reforms were applied to sectors strongly related to households wellbeing, such as pensions, health and education. Regarding education reform, it has been widely discussed in literature. Good examples of this discussion are Elacqua (2011) and Elacqua (2009). The following description is based on these works.

The first step of this reform was the decentralization of education services, which as devolved to regional and provincial offices, and the administration of public schools was devolved to municipalities. The second step was the implementation of a new financing system, which affected public schools, called municipal schools after the reform, and most private schools. The latter is a group of private schools which do not charge fees to their students (or a very low amount of money). Instead they receive a flat per-pupil voucher. When public school budgets are strongly related to municipalities' budget, then schools located in poorer municipalities will have poorer budgets. Consequently three types of schools emerged: public, private subsidized and fully private schools.

As a result the provision of education gets increasingly privatized. As a matter of fact

between 1981 and 1986 more than 1000 new schools entered to the system, and the subsidized schools had 25 percent of the total enrollment. By 2006 the enrollment in subsidized schools was 44 percent, and 6 percent was the non-subsidized private schools' participation. Hence, 49 percent of Chilean students go to public schools (see Table 1).

Table 1: Distribution of primary school students across schools type

School Type	1999	2000	2001	2002	2003	2004	2005	2006
Public	57.1%	56.4%	55.7%	54.5%	53.4%	52.3%	51.3%	49.7%
Subsidized	35%	35.8%	36.5%	37.8%	39.2%	40.5%	42.4%	44%
Private	7.9%	7.8%	7.8%	7.7%	7.4%	7.2%	6.3%	6.3%
Students (millions)								

Source Elacqua (2011)

In order to have a clear idea about the students' socioeconomic characteristics according to the kind of schools they attend, Elacqua (2011) presents a table with the average vulnerability index (IVE) across public, subsidized and fully private schools. This index is calculated by the National Scholarship and School Aim Board (JUNAEB). This index is constructed on the basis of a parent survey conducted by schools. The aim of this survey is to provide students' socioeconomic information. The IVE has a minimum value of 0 and maximum of 100. If the index is equal to 0 means that the school has 0 percent of students at social risk.¹ Table 2 presents socioeconomic patterns according to the IVE across school type. As it can appreciated in 2006 0% of the private schools' students were at socioeconomic risk, meanwhile 40% of the public schools' students were at

¹ The social risk is defined by The Social Protection Survey, which establishes households' scores depending on their capability for generating income. If the scores is lower than 11,000, the households is considered at social risk.

socioeconomic risk. Table 4, amongst others descriptive statistics, shows the average households member's income per school type. According to these averages, the income per household member of private schools' students is 4.4 times the average income per household member of public schools' students.

Table 2: Vulnerability index across public, subsidized and private schools

School Type	2000	2001	2002	2003	2004	2005	2006
Public	39.1%	41.8%	39.8%	39.9%	39.7%	39.3%	39.6%
Subsidized	20.2%	21.6%	20.6%	21.4%	20.6%	19.7%	20.5%
Private	0.3%	0.7%	0.7%	0.9%	1.0%	0.0%	0.0%
Students (millions)							

Source Elacqua (2011)

As Elacqua (2009) points out, since the country returned to democracy, in 1990, the focus of the education reform has been on improving quality and equity, teachers' salary and infrastructure (libraries, computers, internet access, etc.). The same author indicates that these investments have increased coverage, improved the quality of school's facilities, increased teachers' salary and parents satisfaction, amongst others things. However, it has not been possible to observe significant improvement in the average learning quality, as it has been demonstrated by the poor results achieved on the Trends in International Mathematics and Science Study (TIMSS), the Programme for International Students Assessment (PISA) and the International Civic Education Study (CIVIC). The results are strongly related to the school type: private schools obtain, on average, the best results, and public schools obtain, on average, the worst. Nevertheless, it is important to bear in mind household differences between students coming from different socioeconomic backgrounds.

Summarizing, it is possible to say that there are three different kind of schools: public, subsidized private schools (voucher) and non-voucher fully private schools. Low income students attend mostly public schools, middle income students subsidized, and best-off students go to private school. Hence, schools are stratified in social economics terms. However, the focus of this investigation is on students residential segregation rather than the schools segmentation, and given the fact that they are related, we will implement econometric technics for isolating their effects.

For a further discussion on this subject Contreras and Elacqua (2005) and Mizala and Romagera (2005) present an analysis about quality and equity in the Chilean educational system.

3 Segregation in Chile

Regarding race, Chile is a homogenous country. According to 2002 Census, the Chilean ethnic groups can be composition is as follows: white and white-Amerindian 95.4%, Mapuche 4%, other indigenous groups 0.6%. However in socioeconomics terms the situation is quite different: Chile has the highest level of income inequality amongst the OECD countries with a Gini coefficient of 0.5. Therefore, for understanding segregation issues in Chile, it is more relevant to focus on socioeconomic segregation. It is important to clarify that income inequality and segregation are not synonymous, but given the important level of inequality, any extent of segregation will be related to this variable.

To have an idea of the Chilean residential segregation we have used Santiago, Chile's capital, because is the most important city of the country and it has about the 40% of Chile population. Table 3 shows Santiago's dissimilarity index for 8 different years. This index has been calculated using the CASEN survey (see section 4.3 for CASEN survey description). According to this index if in a city there is a 15% of poor households, every city's neighborhood must have 15% of poor households segregation will be 0. If this were

not the case the dissimilarity index shows the percentage of households that must be reallocated in order to make the two distributions the same (poor and non-poor).

Table 3: Santiago Dissimilarity Index

Index	1992	1994	1996	1998	2000	2003	2006	2009
Dissimilarity Index	0.55	0.48	0.49	0.48	0.43	0.43	0.41	0.37

Source: These authors' calculations

As it can be observed, this index has experienced a reduction between 1992 and 2009. However, it still exhibits a high level of segregation. For instance in 2001 Stockholm has a dissimilarity index of 0.214, Mexico City 0.38 and Buenos Aires 0.268 (Lambiri and Vargas, 2011).

4 Empirical Strategy and Data

We have undertaken two different type of econometric exercises. First, we have run a set of OLS regressions by school type using the University Selection Test (PSU) scores as dependent variables and a vector of socioeconomic controls plus a segregation index as independent variables. Second, in order to deal with the selection bias problem we follow the strategy proposed by McEwan (2001). The first approach is quite direct, however the second one deserve a further discussion.

4.1 The two steps approach

To deal with the potential selection bias problem due to the school selection McEwan (2001) proposes the following methodology. First, to model the typical student achievement as:

$$A_{ij} = X_{ij}\beta_j + \varepsilon_{ij} \quad (1)$$

where, A_{ij} is the i th student achievement in the school type j which is a function of the student and his peer group socioeconomic characteristics, X_{ij} , and a error term, ε_{ij} . Using the estimates β_j , it is possible to predict the achievement of a typical student in each school type. The choice of this student characteristics is arbitrary, but researchers often use the mean characteristics of students in the public school alternative, which it is denoted as \bar{X} . Hence, the predicted achievement of the average public school student in the j th school type is:

$$\hat{A} = \bar{X}\hat{\beta}_j \quad (2)$$

The difference in achievement between two school types is estimated by subtracting one prediction from another. If the independent variables perfectly control for student background, then this method yields unbiased estimates. Nonetheless, it is likely that some variables are imperfectly measured or omitted. For instance, more able or motivated students could select themselves into private schools. As ability and motivation are unobserved, the relative effectiveness of schools could still be confounded with the background of their students. For ameliorating this selection bias, a two steps correction should be applied.

We have considered three types of schools: Public, Subsidized and Private.² Hence, let us now consider the following model:

² Public are those schools that belong to the State and that administrated by municipalities. Subsidized school are private schools which are paid using students vouchers (demand subsidies) and Private school are schools which their fees are fully paid by students.

$$I_{ij}^* = Z_{ij}\gamma_{ij} + v_{ij} \quad (3)$$

where I_{ij}^* is a latent variable, and Z_{ij} is a vector of variables which determine the school choice. Let I a variable that can take values from 1 to 3. A student will attend to the j th school type ($I=j$) if:

$$I_{ij}^* > \max I_s^* \quad (s = 1,2,3 \text{ } s \neq j) \quad (4)$$

If the error term v_{ij} , follows an extreme value distribution, then equation (3) can be estimated as a multinomial logit, which can be used to construct the selectivity term for each observation λ_{ij} which is analogous to the inverse Mills ratio and it is defined as:

$$\lambda_{ij} = \frac{\phi(\Phi^{-1}(P_{ij}))}{P_{ij}} \quad (5)$$

where $\phi(\dots)$ is the standard normal density, $\Phi(\dots)$ is the normal distribution and P_{ij} is the probability that the i th student chooses school of type j which is derived from the multinomial logit.

λ_{ij} is used as independent variable in:

$$A_{ij} = X_{ij}\beta_{ij} + \lambda_{ij}\theta_{ij} + \epsilon_{ij} \quad (6)$$

where θ_{ij} is a parameter that must be estimated. In order to identify the model it is necessary to exclude from X_{ij} one or more variables included in Z_{ij} . In this particular case, we have assumed that an individual probability of choosing a given school type will depend on the number of school of each type in his municipality. Regarding the latter, it is important to clarify that the number of schools is used in order to identify the parameters of the model. However, in the specification (6) we have included others covariates to take

into account the several factors affecting the decision of choosing a given type of school. That is why we have include, among others variables, the per capita family income to reflect the capacity to pay of the student.

4.2 Segregation index

For measuring segregation we have used the exposure index, specifically we have used the interaction index, which measures the probability that members of a given group share a neighborhood with members of another group. For instance, the probability of poor households of sharing a neighborhood with non-poor households. We have calculated this index for each municipality. Specifically we have calculated the exposure to non-poor students. We have defined poor or non-poor categories according to CASON survey, which is explained in the next section.

4.3 Data

We have used two different data base. The first one is the 2009 PSU results data base, which contains, besides each student PSU scores, socioeconomic controls and the student previous SIMCE test scores. The SIMCE is a test that measures education quality. It is compulsory and it is taken in the second school grade, the eight and the second high school grade. The PSU test is given for almost all the student that have finished high school. The maximum PSU possible score is 850 and the minimum is 200.

The second data base is the CASON survey. The CASON survey contains socioeconomic information at the individual level. This survey, in geographical terms, is taken at census tract level. Using this survey we have calculated the exposure index for

each municipality. The exposure index has been calculated for years 2009 and 2006 using the CASEN survey for these same years.

Table 4 presents variables definitions, Table 5 shows some descriptive statistics and figure 1 presents a PSU scores kernel for each school type. As it can be appreciated, on average, students whom have received a private education obtain significant better results than the students coming from subsidized and public school.

Table 4: Variables Definitions

Variables	Definition
PSU	PSU score
dmujer	A dummy variable which takes the value 1 if the individual is a woman
esc_ma	Mother educational achievement in years
esc_pa	Father educational achievement in years
ypc	Income per household member in US\$
nem_1	High school grades
mate	Mathematics SIMCE score
leng	Language SIMCE test score
pre_k	A dummy variable which takes the value 1 if the individual received pre-school education
exposure_06	Individuals municipality exposure index in 2006
exposure_09	Individuals municipality exposure index in 2009

Table 5: Variables means and standard deviations by school type

Type of school		dmujer	esc_ma	esc_pa	ypc	nem_1	mate	leng	pre_k
Public	Mean	0.54279	9.89343	9.98484	108.579	5.48090	253.391	256.393	0.48859
	S.D.	0.49817	3.56037	3.70218	105.716	0.85938	62.0092	49.8690	0.49988
Subsidized	Mean	0.52941	11.1278	11.2627	161.277	5.48448	269.467	267.359	0.63517
	S.D.	0.49914	3.36059	3.54200	149.999	0.87596	59.7995	48.3311	0.48139
Private	Mean	0.47436	14.8064	15.3896	476.556	5.74739	324.69	306.352	0.93215
	S.D.	0.49935	2.48621	2.42533	263.148	0.92233	51.6707	44.8814	0.25150
Total	Mean	0.52918	10.9939	11.1785	169.500	5.51072	269.133	267.153	0.61902
	S.D.	0.49915	3.62548	3.81721	179.724	0.87867	63.2994	50.5672	0.48563

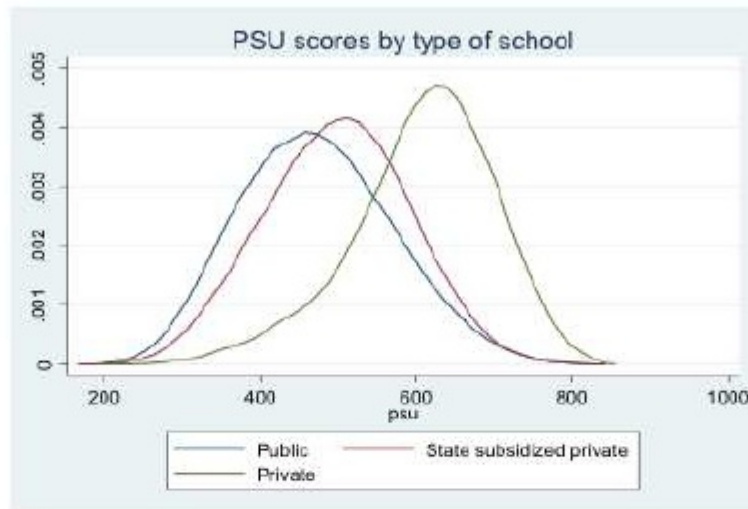


Figure 1: PSU Scores by type of School

5 Regressions Results

Tables 6, 7 and 8 present the OLS regressions results for students from public, subsidized and private schools. All the parameters values are standardized so you can compare them and see which one has a greater effect on PSU scores. The traditional controls used for explaining academic results, such as parents education, household income are significant. High school grades, pre-school education and SIMCE scores in Mathematics and Language are significant as well. Women, on average, obtain lower scores than men. Regarding segregation the lagged exposure index (2006 exposure) is positive and significant at 10% for public schools (table 6). However, the contemporaneous segregation (2009 exposure) is negative but not significant. For student coming public school is significant but negative. In the subsidized school case (table 5), the exposure (lagged) effect is still negative, but it is not significant, at least at a level of significance of 5%. This situation changes for the case of students from private schools (table 8), where the exposure to non-poor households in 2009 is positive and significant (at 1%). This result shows the rich benefits from living close to the rich.

Table 6: Determinants of the PSU scores (2009): Public schools

	Coefficient	Std. Err (clusters-adjusted)	Test t	P-value
dmujer	-0.0428983	0.9233402	-9.46	0
esc_ma	0.055685	0.1326154	11.9	0
esc_pa	0.0645792	0.1265929	13.99	0
ypc	0.069454	9.41E-06	13.11	0
nem_1	0.0949037	1.402813	9.02	0
mate	0.4658251	0.0132236	57.13	0
leng	0.3484216	0.0118982	59.19	0
pre_k	0.0109986	0.833454	2.66	0.008
exposure_06	0.0180153	16.17405	1.81	0.072

exposure_09	-0.0069622	10.35196	-0.73	0.468
N	26,463			
R squared	0.7394			

Table 7: Determinants of the PSU scores (2009): Subsidized schools

	Coefficient	Std. Err (clusters-adjusted)	Test t	P-value
dmujer	-0.046058	0.8975369	-9.54	0
esc_ma	0.0669074	0.1160262	16.51	0
esc_pa	0.0779082	0.1023247	20.52	0
ypc	0.0835051	5.89E-06	15.61	0
nem_1	0.1458259	1.025882	17.31	0
mate	0.4439598	0.0101522	69.41	0
leng	0.3188185	0.0097684	63.61	0
pre_k	0.0170312	0.5780447	5.69	0
exposure_06	-0.0064344	14.29012	-0.75	0.455
exposure_09	0.0046078	10.02181	0.54	0.592
N	43,230			
R squared	0.7116			

Table 8: Determinants of the PSU scores (2009): Private schools

	Coefficient	Std. Err (clusters-adjusted)	Test t	P-value
dmujer	-0.075441	1.0729	-12.06	0
esc_ma	0.0547345	0.2834489	7.27	0
esc_pa	0.0601793	0.332467	7.12	0
ypc	0.0157223	5.15E-06	2.11	0.037
nem_1	0.2492491	1.77908	15.66	0
mate	0.4493686	0.0179155	43.06	0
leng	0.2683436	0.0155204	33.73	0
pre_k	0.0126389	1.9795	2.17	0.032
exposure_06	0.0531996	7.996922	6.52	0
exposure_09	0.0274356	4.52107	3.15	0.002
N	10,291			
R squared	0.7085			

Table 9 and its continuation Table 10 show the multinomial regression for obtaining the selectivity term λ . As this last term is significant, there is evidence of a selection bias problem.

Table 9: Multinomial logit for choice of type of schools

	Coefficient	Std. Err (clusters-adjusted)	Test t	P-value
Public				
dmujer	-0.0158454	0.0385201	-0.41	0.681
esc_ma	-0.0451777	0.0037137	-12.17	0
esc_pa	-0.0319684	0.0028386	-11.26	0
ypc	-5.53E-06	3.74E-07	-14.78	0
ncolmun	0.0664026	0.0242073	2.74	0.006
ncolps	-0.0247126	0.0064341	-3.84	0
ncolpp	0.0073518	0.0061487	1.2	0.232
dr1	-0.2746563	0.4124019	-0.67	0.505
dr2	0.8252785	0.3880392	2.13	0.033
dr3	0.8505607	0.2946639	2.89	0.004
dr4	0.4264792	0.1559909	2.73	0.006
dr5	0.1636536	0.1264297	1.29	0.196
dr6	0.8548062	0.0865036	9.88	0
dr7	0.5258899	0.1419726	3.7	0
dr8	0.5728839	0.1783399	3.21	0.001
dr9	0.0895007	0.2038254	0.44	0.661
dr10	0.621635	0.2777193	2.24	0.025
dr11	0.1321658	0.6400846	0.21	0.836
dr12	0.8489259	0.2043539	4.15	0
Constant	0.6019811	0.1083953	5.55	0

Table 10: Multinomial logit for choice of type of schools (continuation)

Private				
dmujer	-0.1115906	0.0314324	-3.55	0
esc_ma	0.1718412	0.0072384	23.74	0
esc_pa	0.2247985	0.0086309	26.05	0
ypc	7.44E-06	3.05E-07	24.41	0
ncolmun	0.0801226	0.0222842	3.6	0
ncolps	-0.0381183	0.0061229	-6.23	0
ncolpp	0.0691596	0.0102753	6.73	0
dr1	-1.859737	0.1803816	-10.31	0
dr2	-0.6256475	0.2056945	-3.04	0.002
dr3	-0.9860881	0.2821092	-3.5	0
dr4	-0.8496067	0.1479606	-5.74	0
dr5	0.0484999	0.1448223	0.33	0.738
dr6	0.627335	0.2431148	2.58	0.01
dr7	-0.2094035	0.3433119	-0.61	0.542
dr8	-0.0745715	0.2334288	-0.32	0.749
dr9	-0.6677612	0.2447601	-2.73	0.006
dr10	-0.0499918	0.4666354	-0.11	0.915
dr11	-5.563996	1.336459	-4.16	0
dr12	-0.4207761	0.17663	-2.38	0.017
Constant	-8.219375	0.1855384	-44.3	0
N	226735			
Pseudo R squared	0.2208			

In order to correct this problem a new regression has been run including the term λ as it was explained above. The results of this regression are shown in Table 11, which has been run for the complete system. As it can be appreciated the full set of parameters is significant, the unique exception is the exposure index for 2009. Even more important the lagged exposure index (2006 exposure) is again positive and significant at 5%. Hence there is evidence of a clear benefit from living close to the rich.

Table 11: System Determinants of the PSU scores (2009) including selectivity correction

	Coefficient	Std. Err (clusters-adjusted)	Test t	P-value
dmujer	-0.0438885	0.5831688	-15.78	0
esc_ma	0.0584667	0.0938321	18.13	0
esc_pa	0.071528	0.0996105	19.81	0
ypc	0.0537922	0.0000105	5.03	0
nem_1	0.1269286	0.8501196	20.21	0
mate	0.4407039	0.0075563	98.66	0
leng	0.3061581	0.008038	80.11	0
pre_k	0.016878	0.535089	6.81	0
lambda	0.0801284	2.062675	7.17	0
exposure_06	0.0131942	9.059532	2.33	0.02
exposure_09	-0.0010686	4.151522	-0.27	0.788
N	79,943			
R squared	0.7662			

6 Conclusions

The aim of this research has been to test the effect RS has on educational performance. The results of our main regression (the one that corrects for selection bias) show that RS has mainly negative effects (table 11). As segregation measure we have used the exposure to non-poor households. In all regressions we have included the contemporaneous segregation index and a lagged segregation index. In our first econometric exercise, the lagged index is positive and significant for private and public schools, which means that the exposure to non-poor households increases the PSU scores. This result can be interpreted as follow: past segregation determine who I am now. Besides, the fact that this parameter is positive is consistent with what has been discussed in the introduction about the positive effects of the exposure due to the fact that both rich and poor children benefit from affluent neighbors, because of the presence of better role models, more useful social networks, and from more effective neighborhood monitoring. However, contemporaneous exposure to non-poor has a negative, but insignificant, effect in the case of students of public school which are the poorest students of the system. As past segregation has already defined the student current status (PSU test is given after finishing high school), for poor students the exposure to non-poor has a negative effect because, as relative deprivation theory indicates, when the poor compare themselves to the rich, this can lead to unhappiness, stress, and alienation. Moreover, when disadvantaged children must compete with advantaged children for good grades, good jobs, or social status, they are more likely to lose out. The contemporaneous exposure is not significant for those students coming from subsidized schools (middle class students), but it is positive and significant for private school students. The latter is consistent with the hypothesis that says that when better-off individuals live together the relationship and interactions

between them generate positive spillovers which improve their educational performance. However, an interesting question is if these positive spillovers are capable to compensate the negative effects that segregation has in worse-off students. In order to find an answer for this question we have run a regression including all the students. But before that we have corrected the selection bias problem using a two steps regression. Our main result is that exposure to non-poor households increases, on average, the PSU score in 0.21 points. The latter has been found after we have controlled for socio-economic aspects, gender and, as mentioned, selectivity.

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