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Can State Language Policies Distort Students' Demand for Education?

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Abstract

We exploit a recent natural experiment in Ukraine's school system to study how stricter requirements for proficiency in the state language affect linguistic minority students' demand for education. The reform obligated linguistic minority students to take a standardized school exit test in Ukrainian, thus denying them access to translated versions of the test. We study the implications of this reform for students in schools with Hungarian and Romanian/Moldovan languages of instruction. Using school-level data and employing difference-in-difference estimation techniques, we find that the reform resulted in a decline in the number of subjects taken by minority students. They particularly withdrew from linguistically-demanding subjects such as History and Biology, taking more Math instead. Given the implications for minority students' fields of future study, the reform may have affected their educational outcomes in a distortive way.

JEL classification: I28, J15.
Keywords: language policy, linguistic minorities, education, Ukraine.

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1. Introduction

Language policies, which promote or discourage the use of a particular language or set of languages, have been common in many countries throughout history (Spolsky 2004). A prominent example is France, whose language policies date back to the early 16th century and have been "central to the history of state and nation-building" (Jacob and Gordon, 1985, p. 106). More recent examples of language policies include New Zealand's government support of the revival of Maori (Spolsky 2003), the promotion of French in Quebec at the expense of English (MacMillan 2003), the introduction of Basque and Catalan as school languages of instruction in the Basque country and Catalonia (Aspachs-Bracons et al. 2008), restrictions on the use of Russian in the public sphere in Estonia and Latvia (Hughes 2005) and policies of multilingualism in the European Union (Gazzola 2006).

Until recently, the economic consequences of language policies have received relatively little scholarly attention. This is despite numerous links between languages and economic outcomes established in the economics of language literature, which dates back to Marschak (1965). For example, there is extensive evidence that immigrants' proficiency in the dominant language strongly affects their labor market outcomes (McManus, Gould, and Welch 1983; Chiswick 1991; Dustmann and Fabbri 2003; Bleakley and Chin 2004). A growing body of related literature analyzes the effects of language proficiency for native-born bilinguals (Fry and Lowell 2003; Henley and Jones 2005; Chiswick and Miller 2007). Furthermore, a number of studies from the business literature also suggest that languages play an important role; for example, in advertising and corporate communication (e.g. Puntoni, de Langhem, and van Osselaer 2009; Krishna and Ahluwalia 2008; Marschan-Piekkaria, Welch, and Welch 1999). On the macro-level, there is evidence that linguistic distances affect international trade (Hutchinson 2005; Melitz 2008; Isphording and Otten 2013; Melitz and Toubal 2014).

Similarly, the evaluation of language policies has rarely been conducted using the tools of modern economics that emphasize the issues of identification and measurement (Grin 2003, 2006). Recent important contributions to this field include Angrist and Lavy (1997), Ginsburgh, Ortuño-Ortin and Weber (2005), Fidrmuc and Ginsburgh (2007) and Clots-Figueras and Masella (2013), among others. In particular, Angrist and Lavy (1997) study the effect of changing the language of instruction from French to Arabic in Moroccan schools, finding that the elimination of instruction in French led to a sizeable reduction in the returns to schooling for Moroccans. Ginsburgh et al. (2005) and Fidrmuc and Ginsburgh (2007)

suggest that language policies should balance the benefits of linguistic "standardization" on the one hand and the costs of "disenfranchisement" of linguistic minorities on the other and propose a framework for choosing an optimal language policy for the European Union, which would balance the cost of translation into multiple official languages and the cost of disenfranchisement of some linguistic groups. Exploiting the 1983 reform of education in Catalonia, which strengthened the use of Catalan in schools, Clots-Figueras and Masella (2013) find a significant effect of the compulsory language policy on the development of schoolchildren's individual identity, as well as their political preferences.

In this paper, we take advantage of a recent natural experiment in Ukraine's secondary education system to study the potential side effects of language policies that impose stricter requirements for proficiency in the state language. The reform that we consider was planned for the 2009/2010 academic year and obligated all linguistic minority students, including those studying in public schools with a full cycle of education in minority languages, to take a standardized school exit test (which is also a university entry test) in Ukrainian, the state language, thus denying them access to translated versions of the test. Although the reform was retracted at the very last moment, just a few weeks before the test, it may have nevertheless affected minority students' decisions about future studies as such high-stake decisions are made well in advance. Therefore, we investigate the effect of this (cancelled) reform on linguistic minority students' demand for and opportunities to pursue further studies at the university level, as measured by the results of the standardized school exit test.

Our empirical analysis uses school-level data from the 2009 and 2010 standardized tests and employs the difference-in-difference estimator, a common tool in program evaluation studies. Although a key issue in the language policy of modern Ukraine is the status of Russian (the most widely spoken minority language), for data availability reasons we focus on the performance of schools with Hungarian as well as Moldovan and Romanian languages of instruction relative to the performance of Ukrainian schools. On the positive side, the omission of Russian schools helps purify our experiment and improves identification as Russian is closely related to and easily mixed with Ukrainian, which is not the case with the other languages mentioned.

Our main findings are as follows. We do not find evidence of changes in intent to pursue post-secondary studies among minority students. In particular, the number of minority students taking part in the test did not fall as a result of the reform. However, we find fairly strong evidence that the change in the language policy resulted in a decline in the number of subjects taken by minority students at the school exit test. There is also a notable shift in the

take-up of particular subjects, with fewer exams taken by minority students in more linguistically-demanding subjects such as History and Biology and more exams taken by them in Math. This has immediate consequences for minority students' opportunities in terms of choosing universities and fields of study, given that different universities and fields require tests in different subjects. For example, admission for the study of Psychology typically requires tests in History and Biology, while admission for the study of Management requires a test in Math (in Ukraine, students apply to specific departments of universities with very limited opportunities to change the department – and the field of study – once admitted). Therefore, the withdrawal of minority language students from the otherwise preferred fields of study may indicate distortions in human capital accumulation. In addition to this result, we also find some evidence that minority students improved their proficiency in Ukrainian between 2009 and 2010 (although this effect is not necessarily fully attributable to the specific policy change analyzed and may reflect other policies aimed at Ukrainization since the country's independence in 1991).

We believe that our paper is far more than a case study of a particular reform in a particular country. By documenting important side effects of strict language policies, it provides a general contribution to the economics of language literature. Further strengths of our paper are related to the identification strategy. In particular, the uniqueness of our setup allows us to analyze the effect of language policies in the non-immigrant environment and in the absence of large cultural differences between the title nation and linguistic minorities. Furthermore, the use of the difference-in-difference estimation technique enables estimating the causal effect of language policies on the education outcomes of minority students.

Our study is directly related to the rapidly growing strand of the economics literature that analyzes languages and language policies (e.g. Wickström 2005; Ortega and Tangerås 2008; Aspachs-Bracons et al. 2008; Fidrmuc, Ginsburgh, and Weber 2009; Ginsburgh and Weber 2011; Ginsburgh and Prieto-Rodriguez 2013). It is also related to the education literature in that it examines the issues of bilingualism and of languages of instruction and testing in schools (e.g. Ovando 2003; Parker, Rubalcava, and Teruel 2005, Menken 2008; Wiley, Lee, and Rumberger 2009). The paper also adds to the political science, economics, and education literature studying the turbulent post-Soviet region (e.g. Smith et al. 1998; Hughes 2005; Leping and Toomet 2008; Hazans, Trapeznikova, and Rastrigina 2008).

The remainder of the paper is organized as follows. Section 2 provides the necessary background by discussing the ethnic and linguistic composition of Ukraine's population, as well as reviewing the main trends in the country's language policy since the 1991

independence. Section 3 describes the 2007-2010 change in the language policy in schools. In Section 4, we describe the methodology of the study. Section 5 discusses the data, Section 6 presents our empirical results and Section 7 concludes.

2. Ethnic and linguistic diversity and language policies in Ukraine

With a territory larger than Metropolitan France and a population over 45 million people, Ukraine is characterized by considerable ethnic diversity. According to the 2001 census, the country had 10 ethnic groups with populations exceeding 100 thousand people. Importantly, almost the entire population of Ukraine is native, with only a tiny fraction comprising immigrants who came to the country after its independence in 1991. Ukrainians are by far the largest ethnic group constituting 77.8% of the population (see Table 1). Russians are the second largest ethnic group, amounting to 17.3% of the population. The other large minorities include Belarusians, Moldovans, Crimean Tatars, Bulgarians, Hungarians, Romanians, Poles and Jews. Many ethnic groups are spread across Ukraine, such as Belarusians, but many are localized in certain areas; for example, most Hungarians and Romanians live close to the borders with Hungary and Romania, respectively.[1]

An interesting feature of the country is the disproportional use of Russian by ethnic Ukrainians and other ethnic minorities, a heritage of the explicit and implicit Russification that occurred over most of the 19th and 20th centuries and is well documented in the literature (see, e.g. Pavlenko 2008).[2] In particular, numerous surveys in Ukraine in the early 2000s revealed that only half of ethnic Ukrainians chose Ukrainian as their language of interview, 17.9% were indifferent between Ukrainian and Russian and 32.0% preferred Russian (Khmelko 2004). A strong preference for Russian is also documented among other ethnic groups. Based upon such evidence, Kulyk (2010 p. 85) suggests that "Ukraine can be considered a rather atypical country, at least for Europe, in view of a discrepancy between linguistic and ethnic identities of the population and between each of these identities and patterns of everyday language use."

Against this background, promotion of the Ukrainian language in government institutions, education, science and culture has been the main component of the state language policy since independence in 1991. It was regarded as an essential element of nation-state

[1] Source: http://www.ukrcensus.gov.ua/eng/ as of August 20, 2012.

[2] Bilinsky (1981, p.320) provides a curious example from the late USSR period: Ukrainian schoolchildren in Ukraine were taught Russian from a textbook titled "The Native Language", while they studied Ukrainian, their true native language, from textbooks called "The Ukrainian Language".

building.[3] Indeed, from 1991 to 1995, during the early period of Ukraine's independence and presidency of Leonid Kravchuk (in office 1991-1994), the government pursued a policy of "speedy Ukrainization", which was later admitted as a mistake. It was followed by a gradualist approach (under President Leonid Kuchma, in office 1994-2005) aimed at "evolutionary transformation in favor of the Ukrainian language" (Stepanenko 2003).

The first decade of promoting Ukrainian brought visible results, such as dramatic changes in the linguistic landscape of cities (Pavlenko 2010) and a substantial increase in the share of schools with Ukrainian language of instruction (Stepanenko 2003).[4] However, as noted by Stepanenko (2003), the shaky balance between the two main languages largely remained intact.

The presidency of Victor Yushchenko, who succeeded Leonid Kuchma following the 2004 Orange Revolution, saw a dramatic shift in the language policy in favor of rather aggressive Ukrainization. The radical decisions taken by the new government included the requirement to conduct broadcasting in Ukrainian only (Kulyk 2010), the banning of cinemas showing movies in foreign languages (including Russian) without dubbing into Ukrainian or providing Ukrainian subtitles (Pavlenko 2008) and tougher language policies in schools. For example, in the latter case, the government attempted to obligate school teachers to use Ukrainian outside the classroom in all publicly funded educational establishments.[5] The official policy between 2005 and 2009 was that the Ukrainian language was in danger and needed to be defended.

The Ukrainization policies, whether soft or more aggressive, faced considerable opposition on the part of ethnic and linguistic minorities, including some Russophone Ukrainians, and were accompanied by extensive debates in the country (see, e.g. Fournier 2002; Seals 2009). Unsurprisingly, language policy was one of the key political issues in Ukraine and an essential element of all electoral campaigns, both presidential and parliamentary, following the 1991 independence. A key issue was whether Russian should be

[3] D'Anieri (2002, p.5) provides a good illustration of these ideas: "The Ukrainian national identity … should be defined in terms of Ukrainian ethnicity and language… To the liberal argument in favor of toleration of ethnic and linguistic pluralism (and hence, acceptance of the Russian language, perhaps, even as an official language), two responses are made. First is the argument … that a single identity is required for the state to thrive, and that construction of such an identity is a historical norm. Second is an argument concerning historical justice: For the Ukrainian state to now adopt a liberal policy that freezes in place the results of past Russification efforts is to reward past oppression and to ensure its success. On the contrary, it is argued, historical justice requires that the oppression be reversed".

[4] According to Pavlenko (2009), in Kyiv, a largely Russian-speaking city, only six Russian-language schools remain out of 129 that existed in 1991. This does not even follow the ethnic makeup of the population, as ethnic Russians constitute 13.1% of the city's population, according to the 2001 census.

[5] Resolution of the Cabinet of Ministers of Ukraine N. 1033 of September 5, 2009, revoked by the Constitutional Court on February 2, 2010.

given the status of a second state language, some other official status in the whole country or, at least, in the predominantly Russian-speaking regions. The fate of other minority languages also remained high on the agenda. In summer 2012, after fights in the parliament and street protests, Ukraine passed a law granting an official status to a minority language in a particular administrative territory (region, city or district) if it is spoken by at least 10% of the local population.[6] Overall, the language issue has been one of the key components of the many divides observed in modern Ukraine, with linguistic variables appearing among important determinants of socio-economic outcomes in empirical studies (see, e.g. Brück et al. 2010; Constant, Kahanec, and Zimmermann 2011, 2012).[7]

3. Language policies in education and the 2010 reform

The contemporary educational system of Ukraine comprises four levels: preschool, school (embracing primary and secondary education), higher, and postgraduate education. Secondary education (involving 11 years of schooling) has recently been made compulsory for all pupils. The overwhelming majority of schools in Ukraine are public schools that are government funded. Private secondary education occupies only a limited space in the country. All schools are classified into several types: regular schools, advanced learning schools (e.g. lyceums, gymnasiums, and specialized schools), and special schools (usually for disabled children). Importantly, there are linguistic minority schools/classes funded by the state in eight languages: Bulgarian, Crimean Tatar, Hungarian, Moldovan, Polish, Romanian, Russian, and Slovak.[8] In these schools, all or most subjects are taught in one of the minority languages while Ukrainian is a compulsory subject and taught from the beginning of the study. Detailed statistics on the language of instruction in the 2008/9 academic year are shown in Table 2.

Access to higher education in Ukraine is via a nationwide standardized test called "External Independent Testing", the EIT, gradually introduced since 2004, and fully operative since 2008. Participation in the EIT is voluntary, and required only of those who intend to acquire higher education (the test plays the role of an entry exam to universities and colleges).

[6] Law № 5029-VI "On the Principles of State Language Policy" signed by President Yanukovich on August 8, 2012. The parliament's attempt to repeal this law after the flight of Victor Yanukovich from Ukraine in February 2014 was one of the main drivers of the recent turmoil in Eastern Ukraine.

[7] For example, Constant et al. (2012) find a sizeable earnings gap between ethnic Russians and Ukrainians in Ukraine with Russians appearing to be better off than otherwise similar Ukrainians. Importantly, the authors claim that "language, rather than nationality, is the key factor behind this ethnic premium favoring Russians".

[8] This is largely a heritage of the USSR: Ukraine had a considerable number of schools with instruction in minority languages (other than Russian) before its independence in 1991.

Registration for the EIT usually starts in December and ends in March, and the exams take place from the beginning of May to the beginning of June.[9]

All tests (apart from those in the Ukrainian language and literature) can be taken in six minority languages. When registering for the EIT, students can request translated tests in Crimean Tatar, Hungarian, Moldovan, Polish, Romanian, and Russian.[10] The translation ensures that test results portray students' content knowledge rather than its combination with students' proficiency in Ukrainian.

Table 3 provides a list of subjects included in the EIT between 2008 and 2011. The number of subjects varied from 8 to 11 with 2009 and 2010 being the only two years with the identical subject lists. In turn, a student could take no more than five different tests (no more than three in 2008). The Ukrainian language and literature test was compulsory during the whole period; starting in 2010 students were required to take a second compulsory test, which could be in either Math or History.

In Ukraine's university system, it is essential that students have to choose the field of study (department within a university) at the time of application. Mobility between university departments is severely restricted. A student's options in choosing the field of study depend on the subjects taken at the EIT. To provide an example, Table 4 shows the list of EIT tests required for admission to specific departments (fields of study) at the Kyiv National University. In particular, a student who did not take a test in Math could not apply to the department of Economics. Similarly, entering the department of Psychology is impossible without having passed tests in History and Biology. A student may apply to a maximum of five universities and a maximum of three specializations (departments) in each. The number of subjects chosen at the EIT thus affects the variety of fields of study available to students.

The official language of instruction in universities of Ukraine is Ukrainian, apart from a small number of private universities and institutes (e.g. the Kyiv School of Economics, which teaches in English). Very few public universities maintain education in minority languages in specific departments (e.g. the Uzhhorod National University has the Department of Humanities and Natural Sciences which uses Hungarian as the language of instruction). There is also substantial casual evidence that Russian remains widely used in the university classroom, instead of Ukrainian.

[9] For example, the opening and closing dates for registration for the 2009(2010) EIT were 1(15) December 2008 (2009) and 1(15) March 2009 (2010).

[10] No translation into Bulgarian and Slovak is provided due to the small number of pupils in schools with these languages of instruction.

Importantly, universities cannot discriminate between applicants based upon the language chosen at the EIT. What matters in the admission process are the test scores on the required subjects. A test in Biology with 160 points taken in Romanian has the same value as a test with 160 points taken in Ukrainian. Therefore, in principle, minority students may enter tertiary education with low grades in the Ukrainian language and literature test (this test is compulsory), but high grades in the required subject tests, which they can take in the native language. Naturally, this raises the question of minority students' adaptation to university study in Ukrainian. In particular, does their lack of proficiency in Ukrainian lead to underperformance and high drop-out rates? Unfortunately, systematic evidence regarding this issue is completely missing for Ukraine. However, many casual sources suggest that such adaptation is not a big issue when minority students find themselves in a Ukrainian-speaking university environment. For example, the minister of education of Ukraine claimed that minority students were ready to obtain higher education in Ukrainian due to the considerable time allocated to the study of the Ukrainian language and literature at school.[11] A dean of the Uzhhorod National University (located in the Hungarian-speaking region of Ukraine) maintained that, once entering the university, minority students quickly improved their Ukrainian skills and in the second year of study were proficient in the state language. Similarly, a vice-rector of the Chernivtsi National University (located in the Romanian-speaking region) suggested that it took only half a year for Romanian-speaking students to adapt to teaching in Ukrainian.[12]

An important element in the education of minority students is the translation of the school exit tests into minority languages. It was challenged after the appointment of Yulia Timoshenko's 2nd government (in power between December 18, 2007 and March 04, 2010). In particular, on December 25, 2007, one week after the government had assumed office, the minister of education issued Order No. 1171 stating that, from 2008 on, all tests would have to be taken in Ukrainian, while pupils from minority schools would be allowed to use a basic Ukrainian-mother tongue dictionary, if they requested so during EIT registration. Importantly, no additional means allocated to the minority schools were envisaged. As the decision caused protests across the country, a month later, on January 24, 2008, the minister issued Order No. 33, which established a two-year transitory period between 2008 and 2009, during which minority students would be provided with translated tests. The end of the transitory period in 2010 was re-confirmed in Order No. 570 of June 26, 2009. Thus, by the beginning of the

[11] Source: http://echo.msk.ru/programs/beseda/669320-echo/ as assessed on July 9, 2014.
[12] Source: http://podrobnosti.ua/podrobnosti/2010/06/09/692365.html as accessed on July 9, 2014.

2009/2010 academic year, minority students knew that they would have to take the 2010 EIT in the state language rather than in their mother tongues.

Timoshenko's second government fell after the victory of Victor Yanukovich in the 2010 presidential elections. A new government, headed by Yanukovich's ally Nikolay Azarov, was appointed on March 11, 2010. Two weeks after the appointment of the new government, on March 25, 2010, the new minister of education issued Order No. 238 stating that the EIT could again be taken in the six minority languages. Thus, Timoshenko's government language policy was reversed. Importantly, it was retracted in the very last moment, 10 days after the closing date for the 2010 EIT registration and just a few weeks before the test itself.[13]

Although the language policy was reversed at the very last moment, it may nevertheless have affected minority students in a number of ways. This is because preparation for testing takes time and students make high-stake decisions well in advance about their participation in the EIT, as well as about test subjects. In particular, we expect that the (reversed) reform may have affected minority students' test participation rates as some of them may have decided, during their final year at school, not to take part in the EIT and thus not to pursue further studies at the university level (as the testing in Ukrainian put them at a clear disadvantage vis-a-vis native Ukrainians and thus undermine their chances in entering tertiary education). The reform may have also had an impact on the quantity of subjects chosen by minority students. Facing language constraints, they may have decided to concentrate on a smaller number of subjects during their final years at school, which would restrict their choice of future fields of study in colleges and universities. Furthermore, the mix of subjects chosen by minority students could have also been affected. In particular, minority students may have switched to subjects with milder requirements for proficiency in Ukrainian. Finally, anticipating the policy change, minority students may have invested more time and effort in learning Ukrainian; therefore, one may expect an improvement in their scores in the Ukrainian language and literature test. These are the key predictions that we test empirically in the rest of the paper.

4. Methodology

[13] According to Order No. 238, all students who requested a mother tongue-Ukrainian dictionary during the registration for the 2010 EIT, would be allowed to use translated tests. Additionally, all students were given the right to request a change in the language of the EIT until April 8, 2010.

Our empirical strategy rests on a key assumption that the (announced but not implemented) policy change should have affected minority schools but not Ukrainian ones. Furthermore, we use the fact that the essential conditions of the EIT (such as the number and list of subjects) did not change between 2009 and 2010.[14] These particular features allow us to use the difference-in-difference (DiD) estimator for evaluating the effect of the 2010 language policy change, which was intended to impose Ukrainian as the only language in the EIT.[15] Specifically, we consider changes in the performance of minority schools (treatment group) between 2009 and 2010 relative to changes in the performance of Ukrainian schools (control group) during the same period. In the most general form with two periods, one pre- and one post-treatment, the regression equation can be written as follows:

$$Y_{it} = \beta_0 + \beta_1(G_i T_t) + \beta_2 G_i + \beta_3 T_t + \mathbf{X}_{it}\boldsymbol{\gamma} + \varepsilon_{it}, \quad (1)$$

where Y_{it} is an outcome variable, such as the performance of schools in the EIT, variable G_i is a treatment group dummy that equals 1 if a school was affected by the experiment (policy change) and 0 otherwise, T_t is a time dummy that equals 1 in the post-treatment period, G_iT_t is the interaction of the treatment group dummy and the time dummy, $\mathbf{X}_{it}$ is a vector of additional control variables, and ε_{it} is a random disturbance. Subscripts i and t index schools and time respectively, with t taking two values, 0 and 1, for the pre- and post-treatment periods, respectively. The parameter of interest is β_1, which captures the average change in the outcome due to the treatment.

The dependent variable, Y_{it}, differs from specification to specification depending on the hypothesis being tested. For example, it may measure the overall participation in the EIT, take-up rates for specific subjects, or average scores in the Ukrainian language and literature test. The treatment group dummy, G_i, takes a value of 1 if the language of instruction in the school is different from Ukrainian. The inclusion in the econometric model of vector $\mathbf{X}_{it}$ can be justified by efficiency reasons if the respective variables measure factors that account for a part of the variation in the performance of schools not attributable to the treatment itself. Vector X_{it} may include, for example, characteristics of school location and school type.

As some of the important characteristics of schools may be unobserved, we consider an extended model that includes school fixed effects:

[14] The EITs in 2009 and 2010 are the most similar among any pair of years, as Table 3 suggests. The only difference is the introduction of a second compulsory subject, either History or Math, in 2010. We do not see any reasons why this change could have differential effects on Ukrainian and minority students.

[15] The DiD estimator is a commonly used empirical estimation technique in program evaluation studies. It estimates the causal effect of an experiment (such as a policy change) as the average change in the outcome in the treatment group minus the average change in the control group over the course of the experiment. An important virtue of the DiD estimator is that it remains consistent even if treatment is correlated with the initial level of outcome before the experiment.

$$Y_{it} = \beta_1(G_i T_t) + \beta_2 T_t + \mathbf{X}_{it}\boldsymbol{\gamma} + u_i + \varepsilon_{it}, \quad (2)$$

where u_i denotes time-invariant unobserved characteristics of school i (school i fixed effect). By controlling for such unobserved characteristics of schools, we ensure consistency of regression estimates. Note that all time-invariant characteristics of schools in specification (2), including G_i, are subsumed in the school fixed effects u_i. Therefore, the coefficients on the respective time-invariant variables cannot be estimated.

Whenever we deal with grouped data, such as a take-up rate of a particular subject by students from a particular school, we employ analytic weights in the regression analysis. This adjusts for differences in the number of observations giving rise to the relevant average. In other words, the weights are based upon the number of students in each school participating in the testing. Finally, our inference is based upon cluster-robust standard errors with clustering on schools.

Last but not least, the DiD estimator rests on the parallel trend assumption implying that, had the reform not occurred, the change in outcomes between 2009 and 2010 would have been the same for minority language schools as for Ukrainian schools. While this assumption cannot be directly tested, older data are often used to check for parallel trends before the treatment. We provide such evidence in Section 5, after describing the data.

5. Data

We have access to the official results of the EIT published by the Ministry of education and science of Ukraine (http://www.vintest.org.ua/statistics.aspx, the link is valid as of July 9, 2014). The data are available for four years, from 2008 to 2011, and structured by regions, districts, schools and subjects. They contain information on the name, location and type of each school (e.g. ordinary secondary, gymnasium, lyceum, etc.), number of students taking tests in each of the subjects offered and the distribution of grades obtained by students in each subject by 10 categories. Because the test in Ukrainian language and literature is compulsory, the number of pupils taking this particular test is equal to the total number of pupils participating in the EIT.

The data concerning the results of each test are aggregated into 10 categories, from 100 (the lowest test score) to 200 (the highest test score). Specifically, the first category encompasses scores from 100 to 123.5 and is officially regarded as failure on the test, the second category ranges from 124 to 135.5, and the third from 136 to 150. Category nine includes scores in the range from 195.5 to 199.5, and category 10 corresponds to 100% correct answers on the test questions (the test score is equal to 200). Knowing the distribution

of students across these categories, we can approximate the average score for each school and each subject. We do so (e.g. for the Ukrainian language and literature test) by taking the mid-points of each of the first nine intervals and 200 for the top category. Thus, we assume the score of 111.75 for category 1 and 129.75 for category 2, 197.5 for category 9, and 200 for category 10.

Overall, the available data allow us to construct the following dependent variables for the DiD regression analysis: the number of students taking part in the EIT (Number of pupils), the average number of subjects chosen by students (No. subjects per pupil), the percentage of students taking the test in a particular subject (Takeup_Subject)[16] and the average score and failure rate in the (compulsory) Ukrainian language and literature test (Score_Ukrainian and Failed_Ukrainian, respectively).

The official data contain no information about the language of instruction at schools, except when this is indicated in the name of the school (e.g. "Secondary school with Hungarian language of instruction named after Ferentz Rakotsi, village Vari, Berehovo district, Zakarpattia oblast"). Minority language schools should thus be identified from open sources, often at the level of regions and districts. The task of identifying more than 1,000 schools with Russian language of instruction from the total of over 20,000 schools (see Table 2) proved virtually impossible as Russian schools are spread across the whole country and there is usually little or no systematic information about the language of instruction in the regions and districts in which both Ukrainian and Russian are spoken. This is the main reason why we have chosen schools with Hungarian and Romanian/Moldovan[17] languages of instruction, as the next most common minority languages in Ukrainian schools (see Table 2). The identification of these schools is quite straightforward, given that these schools are localized in two regions of the country, Chernivtsi and Zakarpattia oblasts,[18] and that Hungarian and Romanian/Moldovan communities at the regional and district levels are very active.[19] The location of these regions on the map of Ukraine is shown on Figure 1.

[16] This is computed as the number of students taking the test in, say, Biology, divided by the number of students taking the Ukrainian language and literature test (which, as explained above, is equal to the total number of students participating in the EIT).

[17] The latter two languages are closely related; in fact, Moldovan is often regarded as a dialect of Romanian. Henceforth, we will refer to this/these language/s as Romanian/Moldovan.

[18] These territories border Romania and Hungary and were acquired by Ukraine in 1939-1940. Their current (Census 2001) ethnic composition is as follows. In Chernivtsi oblast (0.922 mln. people), Ukrainians constitute 75.0%, Romanians 12.5%, Moldovans 7.3%, and Russians 4.1% of the population. In Zakarpattia oblast (1.258 mln. people), the share of Ukrainians is 80.5%, 12.1% of the population are Hungarians, 2.6% are Romanians, and 2.5% are Russians.

[19] In particular, we rely on official documents by local governments (at the region and district levels) and school web-sites.

There is also a more substantive argument against using Russian schools as the treatment group in the study. Russian and Ukrainian are closely related and are easily mixed, giving rise to the so-called "surzhik" (see, e.g. Bernsand 2001, Bilaniuk 2004). In particular, as summarized in Bilaniuk and Melnyk (2008, p.70), "Ukrainian and Russian are both East Slavic languages, and share many grammatical and lexical features (see Bilaniuk, 2005: 203-208 for a brief comparison). In lexicon, Ukrainian and Russian differ by 38%; the 62% of the lexicon that these languages have in common comprises 44% morphemically identical and 18% morphemically similar terms (Radchuk, 2002, citing research by Tyshchenko, 2000: 266-267). In comparison, Spanish and Portuguese differ by 25%, Spanish and Italian by 33%, and German and Dutch by 25% (ibid)." In contrast, Romanian/Moldovan and Hungarian are unrelated or loosely related to Ukrainian as they are from different linguistic branches and even families (like Estonian and Finnish, Hungarian belongs to the Uralic family of languages rather than the Indo-European one; Romanian and Moldovan are Indo-European languages of the Romance branch, which is loosely related to the Slavic branch, to which Ukrainian belongs). To summarize, while studying the effect of the language policy on Russophone students may be more important from Ukraine's policy perspective (as Russian is the most widely spoken minority language), focusing on Romanian/Moldovan and Hungarian schools may be more interesting and relevant from the perspective of research and international policy.

After an extensive search in all publicly available sources, we first identified all secondary schools with instruction in Hungarian language (35 schools), as well as Romanian/Moldovan language (52 schools). Some of these schools turn out to be mixed schools and thus we excluded them from analysis (they are too few to constitute a separate treatment group). These schools comprise our treatment group (74 schools in total).[20] Subsequently, we identified and excluded from the data a handful of Russian and Russian-Ukrainian schools remaining in these regions. Again, these schools are too few to become another treatment group in our study. This provides us with a list of Ukrainian schools located in Chernivtsi and Zakarpattia oblasts, which constitute our control group.

For one of the robustness checks, we also create another control group that includes Ukrainian schools from the neighboring Ternopil oblast. The main idea is to mitigate the effect of sorting of some minority students into Ukrainian schools located in Chernivtsi and

[20] Note that the corresponding number of observations for 2009 and 2010 is less than 148 (74 schools times 2 years) because some of the schools had no students taking part in the EIT in one of the two years (presumably due to the absence of graduate classes in a particular year) and are therefore not in the dataset.

Zakarpattia oblasts. Indeed, the presence of minority students may affect the performance of these schools (think, for example, of the school's average test score in the Ukrainian language and literature test), which complicates the interpretation of DiD results. In contrast, Ternopil oblast is very homogenous in terms of the ethnic and linguistic composition (with Ukrainians constituting 97.8% of the population and Ukrainian being native for 98.3% of the inhabitants) and has no minority schools at all. In addition, Ternopil oblast is not only close to the two treatment group regions geographically, but also economically; for example, regarding the overall economic development and shares of urban and rural populations.

In terms of control variables, we create three dummies for the size of settlements in which schools are located (variable Village, base category, for small settlements with less than 30 thousand inhabitants, variable Town for settlements with 30-100 thousand inhabitants, and variable City for larger towns) and five dummies for school types (Regular school, base category, standing for regular schools, Gymnasium, Lyceum, Specialized school, and Special school). There is another dummy for Boarding schools, which are present in small numbers among all five school types. We hypothesize that the quality of schools may be higher in larger settlements. There may also be strong effects of school types, with gymnasiums, lyceums and specialized schools performing better in comparison with regular schools, and particularly in comparison with special schools. Note that because all these variables are time-invariant, they drop in the specifications with school fixed effects.[21]

Descriptive statistics of the 2009 data are shown in Table 5, which presents the means, standard deviations, minimums, medians and maximums of the variables for the treatment and control groups, as well as the equality of means test results. As anticipated, schools from the treatment and control groups are similar in many dimensions. Nevertheless, there is some between-group variation. In particular, the average number of students taking part in the EIT is considerably larger in Ukrainian schools as compared with minority language schools, which probably reflects a smaller size of minority schools (as already mentioned, we have no information on school size). This interpretation is perfectly consistent with the fact that very few Hungarian and Romanian/Moldovan schools (only 5%) are located in cities with a population above 100,000. There are also more lyceums in the treatment group as compared with the control group. Traditionally, lyceums provide better educational services, although in the case of minority schools the name "lyceum" may simply indicate advanced study of the

[21] The number of control variables available to us is limited. In particular, we have no information on the size of schools, number of teachers, student-to-teacher ratios, and size of graduating cohorts. We believe, however, that our school fixed effects specifications control for these and other similar factors which are unlikely to change much during a two-year period.

minority language. Table 5 also shows dramatic differences between the treatment and control group schools in the Ukrainian language and literature test results. In particular, the difference in the failure rate (unweighted average) amounts to almost 30%: The test is failed by 40.4% of students in minority schools but only by 11.5% of students in Ukrainian schools. The difference in the average scores is also large, exceeding 18 points (on the scale of 100 to 200 points), and is statistically significant. However, these huge discrepancies are only typical of the Ukrainian language and literature test; indeed, the differences in the other subjects between minority and Ukrainian schools are considerably smaller and often statistically insignificant.[22]

We also take advantage of the availability of data from other periods (in particular, 2008) to assess the parallel trend assumption that underlies the DiD estimator. In doing so, we have to deal with two problems: the different composition of the EIT in different years and the establishment of new schools and the closure and changes in the status of old ones. The most serious challenge is that the composition of the EIT in 2008, which is important for assessing the parallel trend assumption, is very different from both 2009 and 2010. For example, History in 2009 is not the same as History in 2008 because in the latter year the EIT included several other social sciences, in particular, World History. Foreign languages were not part of the test prior to 2009. Moreover, the maximum number of tests was restricted to three in 2008 (five in both 2009 and 2010). Therefore, we focus on three indicators that we consider the most reliable: the average number of tests per student, the take-up rate of Math (the least linguistically-demanding test) and the average score in the Ukrainian language and literature test (the most linguistically-demanding one). To address the second issue (school composition), we focus on schools that are present in all four waves of the data, from 2008 to 2011.

Figure 2 shows the trends in the selected variables over 2008-2011.[23] All three panels suggest important effects of the change in the language policy: the positive change in the number of subjects taken by minority students between 2009 and 2010 was smaller than that among Ukrainian students; minority students took relatively more Math in 2010; and their performance in the Ukrainian language and literature test improved relative to Ukrainian students. Importantly, nether of the three panels suggests violations of the parallel trend

[22] These results are available from the authors on request. One interesting feature is that the differences in the average scores between minority and Ukrainian schools are much more pronounced than the differences in the failure rates. In other words, minority students tend to pass the exams but with lower grades than Ukrainian students.

[23] As in the regression analysis that follows, the data are weighted by the number of students in each school who take part in the EIT.

assumption. Indeed, between 2008 and 2009, the trends for minority and Ukrainian students are remarkably similar for all three variables considered, in sharp contrast to the differential trends between 2009 and 2010. We take these results as indicating the validity of DiD approach in the specific setup of our study.[24]

6. Empirical results

6.1 Main results

We start with the estimation of the effect of the language policy on minority students' participation in the EIT and the number of subject chosen. Table 6 shows the DiD estimates for these two outcome variables with and without controlling for school fixed effects. In particular, the dependent variable in the regressions reported in columns 1 and 2 is the number of students from each school participating in the EIT. In the regressions reported in columns 3 and 4, the dependent variable is the average number of subjects chosen by students at the test. The regressions in odd columns are estimated by OLS, whereas the regressions in even columns are obtained using the fixed effects estimator. In Table 6, variable Minority is a dummy indicating minority language schools and captures the difference between the treatment and control group at the baseline. Variable Year2010 is a dummy for the year 2010 and shows the time effect. Variable Minority*Year2010 represents the interaction of variable Minority with variable Year2010 and is the main variable of interest capturing the effect of the treatment.

The results in columns 1 and 2 do not suggest any decrease in the EIT participation rate among minority students. On the contrary, we rather observe some increase in the number of minority students taking the EIT (roughly two students more per school). However, this result is only statistically significant at the 10% level in OLS specification. We also observe a large and highly statistically significant baseline difference between Ukrainian and minority schools (variable Minority, Column 1), possibly reflecting the difference in school sizes. There is also a strong downward trend in the number of students taking the EIT, as suggested by the coefficient on variable Year2010. This may be related to the demographic developments in the country, with strongly declining birth rates during the 1990s, which was a time of deep recession.

[24] Note that Figure 2 does not suggest reversal of the initial treatment by 2011. One possible interpretation of this fact is that minority students, who faced considerable uncertainty regarding future language policies of the state, including possible reversal to aggressive Ukrainization, may try to minimize potential risks of such policy changes by adjusting their behavior ex ante.

The results also indicate that the number of pupils participating in the EIT is larger in cities and towns as compared with smaller settlements (this may be due to larger classes in schools located in urban areas)[25], as well as in gymnasiums and lyceums (this may be related to better educational standards rather than larger classes in these types of schools).

Regressions reported in columns 3 and 4 show a sizeable and statistically significant decline in the number of subjects chosen by students from minority schools as opposed to students from Ukrainian schools. The magnitude of the coefficients on variable Minority*Year2010 implies that a group of ten minority students took, on average, two exams fewer compared with a group of ten Ukrainian students. As the average number of exams (including the compulsory exam in Ukrainian) is equal to 2.5, the effect implies an 8% reduction in the take-up rate for minority students. The estimates also indicate no statistically significant difference at the baseline between Ukrainian and minority schools in terms of the average number of subjects chosen by pupils. The large and statistically significant coefficient on variable Year2010 (the time trend) reflects the shift from one to two compulsory exams between 2009 and 2010 (Ukrainian only in 2009 as compared with Ukrainian plus either History or Math in 2010).

Table 7 shows estimates of the effect of the language policy on the performance of minority students in the Ukrainian language and literature test. Here, we consider two (closely related) dependent variables for each school: the percentage of pupils failing the Ukrainian language and literature test, variable Failed_Ukrainian; and the average score in that test, variable Score_Ukrainian. As before, we show results obtained with and without controlling for school fixed effects.

The results in Table 7 show a large discrepancy between Ukrainian and minority schools at the baseline (variable Minority), whereby the failure rate in Ukrainian is substantially higher for minority schools. Specifically, after controlling for a number of characteristics of schools and weighting the data by the number of pupils participating in the EIT, the failure rates in this subject differ between Ukrainian and minority schools by 26% (Column 1). Note that the data in Table 5 show an even larger unconditional and unweighted difference of 29%. Similarly, the average score on the Ukrainian language and literature test is substantially lower in minority schools as compared with Ukrainian schools. The estimated difference is 18 points on the 100 to 200 scale (Column 3). This is similar to the raw difference reported in Table 5.

[25] Again, we have no data on either the size of schools or number of graduating students.

Table 7 also suggests some improvement in minority students' results in the Ukrainian language and literature test (see the coefficient on variable Minority*Year2010). The failure rates among minority students declined and the average scores rose, although these results are only statistically significant in OLS regression. The results imply that about 12% of the initial gap (the calculation relates the coefficient on variable Minority*Year2010 to the coefficient on variable Minority) was closed between 2009 and 2010.[26]

Overall, this analysis provides some evidence of improvements in the Ukrainian language and literature test results for minority students. The huge baseline difference between Ukrainian and minority schools is remarkable and alarming, especially if it is driven by inadequate quality of teaching in minority schools, of which there is some, albeit fragmented, evidence (e.g. Bilaniuk and Melnyk 2008).

Table 8 shows the results for the take-up of specific subjects. The dependent variables are the percentages of students (among those participating in the EIT, that is, among those taking the Ukrainian language and literature test) choosing a particular subject. The results in Panel A are obtained using OLS without controlling for school fixed effects, while the corresponding results with school fixed effects are shown in Panel B. The estimates in Panel A indicate a substantial drop in the take-up rates for History and Biology among minority students. For these subjects, the coefficients on the interaction of the treatment and time dummies, Minority*Year2010, are negative and statistically significant at the 1% level. There is also a negative coefficient in the regression for Physics, although it is only marginally statistically significant at the 10% level. In addition, we observe a positive (and statistically significant at the 5% level) coefficient in the regression with the Math take-up rate as the dependent variable. Finally, there is no effect of the reform on the take-up of Geography and Foreign language. Overall, the results suggest that when deciding which subjects to take at the 2010 EIT, minority students preferred subjects that were less demanding in terms of the proficiency in Ukrainian (compare Math with Biology, for example).

The results in Panel B of Table 8, which are obtained controlling for school fixed effects, are qualitatively similar, except for the large and statistically significant coefficient on the Geography test. In sum, the reduction in the number of subjects taken by minority students, which is documented in Table 6, is largely due to their withdrawal from History and

[26] This result, in combination with Figure 2 that shows similar trends among Ukrainian and minority students in the Ukrainian language and literature test between 2008 and 2009, suggests that the reform had a strong effect on minority students' proficiency in Ukrainian. A caveat is due, however. The presidency of Victor Yushchenko (in office between 2005 and 2010) was marked by aggressive policies aimed at Ukrainization of linguistic minorities (see Section 2). It is therefore possible that a part of the effect estimated in the regressions in Table 7 is due to these other policies, which started to bring some results by 2010.

Biology. In contrast, minority students do not withdraw from Foreign Language and take more Math.

6.2. Robustness checks

In order to check the robustness of our main results, we conducted a number of additional tests. First, we changed the control group by replacing Ukrainian schools in Chernivtsi and Zakarpattia oblasts with Ukrainian schools from the neighboring Ternopil oblast, as discussed in Section 5. The results of this exercise are similar to those discussed above.[27] In particular, again we observe a decline in the number of subjects taken by minority students relative to Ukrainian students. The result is even stronger for this second control group. Again, it is driven by the reduction in the take-up rates of more linguistically-demanding subjects among linguistic minorities, such as History. Additionally, the estimates suggest a marginally statistically significant increase in the take-up rates of Foreign Language (where proficiency in Ukrainian is largely irrelevant).[28] As might be expected, the minority students' catch-up in the Ukrainian language and literature test is more pronounced when the control group comprises Ukrainian schools from Ternopil oblast.

Second, we re-estimated the regressions after excluding schools located in cities. This exercise aims to obtain better matches for the treatment group schools, most of which are located in rural areas. Indeed, almost all of the sampled schools that are located in cities are Ukrainian; schools in cities are also known for providing better educational services. They may thus be regarded as bad matches for minority schools. However, the estimates resulting from this exercise prove very similar to those previously reported. Some of the relationships become stronger, including minority students' improved performance in the Ukrainian language and literature test.

Third, we checked for possible differences between the two minority groups studied. For this purpose, we split the treatment group into two, one group consisting of Hungarian schools and the other one consisting of Romanian/Moldovan schools. After re-estimating the regressions, we found that our main conclusions regarding the effect of the language policy change hold for both sub-groups, although there are some differences between Hungarian and Romanian/Moldovan schools. In particular, the improvement in the Ukrainian language and literature test seems to be driven by Romanian/Moldovan students. This is unsurprising given

[27] The results of the robustness checks are available from the authors on request.

[28] When interpreting this result, it is useful to recall the overall decline in the number of subjects chosen by minority students. On the background of such a decline, the shift of minority students' preferences towards foreign languages is even more apparent.

that learning Ukrainian should be easier for Romanians/Moldovans compared with Hungarians, whose native language does not belong to the Indo-European family of languages. In contrast, the result for Math appears to be driven by Hungarian students. Additionally, we find that Hungarian students are more likely to withdraw from History, while Romanian/Moldovan students tend to withdraw from Biology as a result of the reform.

Fourth, we analyzed changes in the performance of minority students (measured by the average scores and failure rates) in all test subjects. This complements our analysis of the performance of minority students on the Ukrainian language and literature test. While we obtain some statistically significant coefficients in this exercise, they do not suggest any clear pattern, possibly due to selection effects.[29]

Fifth, we searched for evidence of "general equilibrium effects" by comparing schools from the main control group (Zakarpattia and Chernivtsi oblasts) with those from the auxiliary control group (Ternopil oblast). The idea is that students graduating from Ukrainian schools located in Zakarpattia and Chernivtsi oblasts may have anticipated the effect of the language policy change on minority students and thus adjusted their behavior accordingly. For example, if they anticipated more minority students choosing the test in Math (which, ceteris paribus, would result in a tougher competition in science departments of local colleges and universities), they might have switched from Math to other subjects. Our general equilibrium exercise rests on a rather strong assumption of no interregional migration among students. In other words, students are assumed to apply to colleges and universities in the same regions in which they finish school. The empirical results provide only weak evidence of such general equilibrium effects. Indeed, students graduating from Ukrainian schools in Zakarpattia and Chernivtsi oblasts seem to avoid the test in Math (this is the strongest result, both economically and statistically, in this exercise). However, they also seem to avoid History and opt for Foreign Language, which is at odds with the general equilibrium effects hypothesis. The observed inconclusive pattern may stem from a relatively small share of minority students in the regions under study, as well as the significant interregional migration of students.

Finally, we conducted several falsification tests by re-estimating the regressions using alternative pre-treatment and post-treatment periods. The results of these tests are in line with our main findings. For example, when we conduct a difference-in-difference placebo analysis

[29] For example, minority students who are relatively good in Math may focus on this subject and improve their test scores; however, there may also be minority students who are relatively weak in Math but nevertheless take it in order to avoid more linguistically demanding tests in History and Biology.

using the data from 2010 ("pre-treatment") and 2011 ("post-treatment"), the results are mostly statistically insignificant. Between 2010 and 2011, minority schools were experiencing essentially the same changes in the number and mix of subjects as Ukrainian schools.

Overall, the main and additional results suggest that the language policy under consideration affected the accumulation of human capital by minority students. The withdrawal of minority students from the otherwise preferred fields of study is consistent with the idea of distortions and efficiency losses as a result of the policy. However, a caveat is due. Theoretically, owing to externalities associated with educational choices of students, their decision-making is in a "second-best" framework from the very beginning, in which case the introduction of an additional constraint may have an ambiguous effect on efficiency (Lipsey and Lancaster 1956). Therefore, we do not draw any strong conclusions about efficiency implications of the language policy studied.

Another related issue is that our analysis only captures short-term effects of the language policy observed at the time when the transition cohort students make (high-stake) decisions regarding post-secondary studies. However, from the research and policy perspectives, it is important to understand the longer-term outcomes of minority students, from both the transition and younger cohorts, such as their performance in universities and/or the labor market, under different language policies, e.g. in the spirit of Angrist and Lavy (1997). What if minority students who are not fully proficient in Ukrainian pass the EIT in the mother tongue, enter the university system but subsequently drop out due to their inability to study in Ukrainian (tertiary education in Ukraine is not provided in minority languages)? Alternatively, what if they face difficulties in the labor market upon completing their studies? Unfortunately, the school-level data at hand are not suitable for investigating such medium- and long-term effects. As already noted in Section 3, there is casual evidence that minority students' lower grades in Ukrainian are not a serious obstacle for their study in Ukrainian universities. However, the important issue of longer-term effects of language policies can and should be addressed with the help of richer data collected at the individual level.

7. Conclusions

In this paper, we take advantage of a recent natural experiment in Ukraine's secondary education to study the effect of stricter requirements for proficiency in the state language on educational outcomes of linguistic minority students. While such policies are typically expected to result in an improvement in minority students' proficiency in the dominant language, there may also be important side effects. Examples include higher drop-out rates

among minority students, as well as their sorting into less linguistically-demanding subjects with implications for their fields of future study. As a result, state language policies might induce distortions in the accumulation of human capital by linguistic minorities.

The reform that we consider was planned for the 2009/2010 academic year and obligated all minority students, including those studying in public schools with a full cycle of education in minority languages, to take a standardized school exit test (which is also a university entry test) in Ukrainian, the state language, thus denying them access to translated versions of the test. Our empirical analysis is based upon school-level data from the 2009 and 2010 standardized school exit tests and employs the DiD estimation framework in which schools with Hungarian and Romanian/Moldovan languages of instructions are placed in the treatment group and schools with Ukrainian language of instruction constitute the control group.

We find fairly strong evidence that the change in the language policy has resulted in a decline in the number of subjects taken by minority students at the school exit test. There is also a notable shift in the take-up of particular subjects, with fewer exams taken by minority students in more linguistically-demanding subjects such as History and Biology and more exams taken in Math. This has immediate consequences for minority students' access to further education at the university level, given that entry to different universities and different fields of study require tests in different subjects. We also find some evidence that minority students improved their proficiency in Ukrainian between 2009 and 2010, but this result may at least partly reflect a general trend towards better proficiency in Ukrainian among linguistic minority group as a result of the Ukrainization efforts during 2005-2010.

Although our paper is a case study of a particular reform in a particular country, it may have broader relevance. Indeed, our findings are in line with the literature suggesting a relationship between immigrant children's proficiency in the official language and their career choices. For example, the data reported in a recent study by Black et al. (2006) show that students of Asian origin in the US (whose parents are unlikely to speak English at home) tend to choose college majors that are less language intensive. In particular, Engineering is chosen by 29.75% of Asian origin students and only by 12.72% of White students. For Education, the respective numbers are 2.39% for Asian origin students versus 8.10% for White students.

Our study contributes to the small but rapidly growing literature at the intersection of economics, education and linguistics, as well as providing some policy lessons. In particular, policy-makers advocating the aggressive promotion of state languages among linguistic minority groups (which, ceteris paribus, should improve socio-economic outcomes of these

groups and is therefore beneficial for society and the economy) should also consider potential negative effects, at least in the short-run, associated with the reaction of linguistic minorities to such policies. Possible distortions in the accumulation of human capital by minority groups are a case in point.

References

Angrist, Joshua D. and Lavy, Victor (1997) The Effect of a Change in Language of Instruction on the Returns to Schooling in Morocco, Journal of Labor Economics, 15(1): S48-76.

Aspachs-Bracons, Oriol, Irma Clots-Figueras, Joan Costa-Font, and Paolo Masella (2008) Compulsory Language Educational Policies and Identity Formation, Journal of the European Economic Association, 6(2-3): 434-444.

Bernsand, Niklas (2001) Surzhyk and National Identity in Ukrainian Nationalist Language Ideology. Berliner Osteuropa Info, 17: 38-47.

Bilaniuk, Laada (2004) A Typology of Surzhyk: Mixed Ukrainian-Russian Language. International Journal of Bilingualism, 8(4): 409-425.

Bilaniuk, Laada (2005) Contested Tongues: Language Politics and Cultural Correction in Ukraine. Ithaca, NY: Cornell University Press.

Bilaniuk, Laada and Svitlana Melnyk (2008) A Tense and Shifting Balance: Bilingualism and Education in Ukraine. International Journal of Bilingual Education and Bilingualism, 11(3-4): 340-72.

Bilinsky, Yaroslav (1981) Expanding the Use of Russian or Russification? Some Critical Thoughts on Russian As a Lingua Franca and the "Language of Friendship and Cooperation of the Peoples of the USSR". Russian Review, 40(3): 317-332.

Black Dan, Amelia Haviland, Seth Sanders, and Lowell Taylor (2006) Why Do Minority Men Earn Less? A Study of Wage Differentials among the Highly Educated. Review of Economics and Statistics, 88(2): 300-313.

Bleakley, Hoyt and Aimee Chin (2004) Language Skills and Earnings: Evidence from Childhood Immigrants, Review of Economics and Statistics, 86(2): 481-496.

Brück, Tilman, Alexander M. Danzer, Alexander Muravyev, and Natalia Weisshaar (2010) Poverty during Transition: Household Survey Evidence from Ukraine. Journal of Comparative Economics, 38(2): 123-145.

Chiswick, B. R. (1991) Speaking, Reading, and Earnings among Low-skilled Immigrants', Journal of Labor Economics, 9(2): 149–70.

Chiswick, Barry R. and Paul W. Müller (2007) The Economic Cost to Native-born Americans of Limited English Language Proficiency. In: Barry R. Chiswick and Paul W. Müller "The Economics of Language: International Analyses," New York: Routledge.

Clots-Figueras, Irma and Masella, Paolo (2013) Education, Language and Identity. Economic Journal, 123(570): F332-F357.

Constant, Amelie, Martin Kahanec, and Klaus F. Zimmermann (2012) The Russian-Ukrainian Earnings Divide. Economics of Transition, 20(1), 1-35.

Constant, Amelie, Martin Kahanec, and Klaus F. Zimmermann (2011) The Russian-Ukrainian Political Divide. Eastern European Economics, 49(6), 103–115.

D'Anieri, Paul (2002) Introduction: Debating the Assumptions of State-Led Nation Building in Ukraine. In: Taras Kuzio and Paul D'Anieri, "Dilemmas of State-led Nation-state Building in Ukraine", Praeger Publishers, Westport, CT. Paul.

Dustmann, Christian and Francesca Fabbri (2003) Language Proficiency and Labour Market Performance of Immigrants in the UK, Economic Journal, 113(489): 695-717.

Fidrmuc, Jan and Victor Ginsburgh (2007), Languages in the European Union: The Quest for Equality and Its Cost, European Economic Review 51, 1351-1369.

Fidrmuc, Jan, Victor Ginsburgh, and Shlomo Weber (2009) Voting on the Choice of Core Languages in the European Union, European Journal of Political Economy, 25(1): 56-62.

Fournier, Anna (2002) Mapping Identities: Russian Resistance to Linguistic Ukrainianisation in Central and Eastern Ukraine, Europe, Asia Studies, 54(3): 415 33.

Fry, Richard and B. Lindsay Lowell (2003) The Value of Bilingualism in the U.S. Labor Market. Industrial and Labor Relations Review, 57(1): 128-141.

Gazzola, Michele (2006) Managing Multilingualism in the European Union: Language Policy Evaluation for the European Parliament. Language Policy, 5(4): 393–417.

Ginsburgh, Victor and Juan Prieto-Rodriguez (2013) Is there a Gender Bias in the Use of Foreign Languages in Europe? Kyklos, 66(4): 552-566.

Ginsburgh, Victor, and Shlomo Weber (2011) How Many Languages Do We Need? The Economics of Linguistic Diversity. Princeton, NJ: Princeton University Press.

Ginsburgh, Victor, Ignacio Ortuno-Ortin, and Shlomo Weber (2005) Disenfranchisement in Linguistically Diverse Societies. The Case of the European Union. Journal of the European Economic Association, 3(4): 946-964.

Grin, François (2003) Language Planning and Economics. Current Issues in Language Planning, 4(1): 1-66.

Grin, Francois (2006) Economic Considerations in Language Policy. In: Ricento, Thomas (Ed.) An Introduction in Language Policy. Maiden/Oxford: Blackwell.

Hazans, Mihails, Ija Trapeznikova, and Olga Rastrigina (2008) Ethnic and Parental Effects on Schooling Outcomes before and during the Transition: Evidence from the Baltic Countries, Journal of Population Economics, 21(3): 719-749.

Henley, Andrew and Rhian Eleri Jones (2005) Earnings And Linguistic Proficiency In A Bilingual Economy, Manchester School, 73(3): 300-320.

Hughes, James (2005) 'Exit' in Deeply Divided Societies: Regimes of Discrimination in Estonia and Latvia and the Potential for Russophone Migration. Journal of Common Market Studies, 43(4): 739-762.

Hutchinson, William K. (2005) "Linguistic Distance" as a Determinant of Bilateral Trade, Southern Economic Journal, 72(1): 1-15.

Jacob, James E. and David C. Gordon (1985) Language Policy in France. In: Beer, William R. and James E. Jacob (Eds.) Language Policy and National Unity. Totowa, New Jersey: Rowman & Allanheld Publishers.

Khmelko, Valery (2004) Ethno-linguistic structure of Ukraine: Regional features and tendencies of changes during independence. Unpublished manuscript, Kyiv Institute for Sociology. Retrieved on November 1, 2010 from http://www.kiis.com.ua/txt/pdf/ing-ethn.pdf

Krishna, Aradhna and Rohini Ahluwalia (2008) Language Choice in Advertising to Bilinguals: Asymmetric Effects for Multinationals versus Local Firms. Journal of Consumer Research, 35(4): 692-705.

Kulyk, Volodymyr (2010) Ideologies of Language Use in Post-Soviet Ukrainian Media. International Journal of the Sociology of Language, 201(1): 79 - 104

Isphording, Ingo Eduard and Otten, Sebastian (2013) The Costs of Babylon—Linguistic Distance in Applied Economics, Review of International Economics, 21(2): 354-369.

Leping, Kristian-Olari and Toomet, Ott (2008) Emerging Ethnic Wage Gap: Estonia during Political and Economic Transition. Journal of Comparative Economics, 36(4): 599-619.

Lipsey, Richard and Kelvin Lancaster (1956) The General Theory of the Second Best, Review of Economic Studies, 24(1): 11-32.

MacMillan, Michael (2003) Federal Language Policy in Canada and the Quebec Challenge. In: Pierre Larrivee (Ed.) Linguistic Conflict and Language Laws: Understanding the Quebec Question. New York: Palgrave MacMillan.

Marschak, Jacob (1965) Economics of Language. Behavioral Science, 10(2): 135-140.

Marschan-Piekkaria, Rebecca, Dennis Welch, and Lawrence Welch (1999) In the Shadow: The Impact of Language on Structure, Power and Communication in the Multinational. International Business Review 8(4): 421–440.

McManus, Walter, William Gould, and Finis Welch (1983) Earnings of Hispanic Men: The Role of English Language Proficiency. Journal of Labor Economics, 1(2): 101-30.

Melitz, Jacques (2008) Language and Foreign Trade. European Economic Review, 52(4): 667-699.

Melitz, Jacques and Toubal, Farid (2014) Native Language, Spoken Language, Translation and Trade. Journal of International Economics, 93(2): 351-63.

Menken, Kate (2008) English Learners Left Behind: Standardized Testing as Language Policy. Clevedon: Multilingual Matters.

Ministry of Education and Science of Ukraine (2009) On the Results of Development of School, Pre-school and Out-of-school Education in the 2008/2009 Academic Year and Goals for the 2009/2010 Academic Year. Information-analytical materials of the Debriefing Board of the Ministry of Education and Science of Ukraine, August 26, 2009 Retrieved on November 1, 2010 from http://www.mon.gov.ua/newstmp/2009_1/19_08/inf.doc (in Ukrainian).

Ortega, Javier and Thomas P. Tangerås (2008) Unilingual versus Bilingual Education: A Political Economy Analysis. Journal of the European Economic Association, 6(5): 1078-1108.

Ovando, Carlos J. (2003) Bilingual Education in the United States: Historical Development and Current Issues. Bilingual Research Journal, 27(1): 1-24.

Parker, Susan W., Rubalcava, Luis, and Teruel, Graciela (2005) Schooling Inequality and Language Barriers. Economic Development and Cultural Change, 54(1): 71-94.

Pavlenko, Aneta (2008) Multilingualism in Post-Soviet Countries: Language Revival, Language Removal, and Sociolinguistic Theory. International Journal of Bilingual Education and Bilingualism, 11(3-4): 275-314.

Pavlenko, Aneta (2009) The Status and Use of Russian in the Post-Soviet Space. Voprosy Fililogii, 32(2): 27-35.

Pavlenko, Aneta (2010) Linguistic Landscape of Kyiv, Ukraine: A Diachronic Study. In: Elana Shohamy, Eliezer Ben-Rafael, and Monica Barni (Eds.) Linguistic Landscape in the City, Multilingual Matters, Tonawanda, NY.

Puntoni, Stefano, Bart de Langhem, and Stijn M. J. van Osselaer (2009) Bilingualism and the Emotional Intensity of Advertising Language. Journal of Consumer Research, 35(6): 1012-1025.

Radchuk, Vitaliy (2002) Language in Ukraine: State, Functions, Perspectives. Language Studies (Movoznavstvo), 2-3: 39-45; www.radchuk.novamova.com.ua (in Ukrainian).

Seals, Corinne (2009) From Russification to Ukrainisation: A Survey of Language Politics in Ukraine. The Undergraduate Journal on Slavic and East/Central European Studies, UCLA, Volume 2, 2009, http://www.international.ucla.edu/languages/slavicjournal/.

Smith, Graham, Vivien Law, Andrew Wilson, Annette Bohr, and Edward Allworth (1998) Nation Building in the Post Soviet Borderlands: The Politics of National Identity. Cambridge, UK: Cambridge University Press, 2000.

Spolsky, Bernard (2003) Reassessing Māori Regeneration. Language in Society, 32(4): 553-578.

Spolsky, Bernard (2004) Language Policy. Cambridge University Press, Cambridge, UK.

Stepanenko, Viktor (2003) Identities and Language Politics in Ukraine: The Challenges of Nation-State Building. In: Farimah Daftary and Francois Grin (Eds.) Nation-Building, Ethnicity and Language Politics in Transition Countries. Open Society Institute, Budapest.

Tyshchenko, Kostyantin (2000) Metatheory of Language Studies. Kyiv: Osnovy (in Ukrainian).

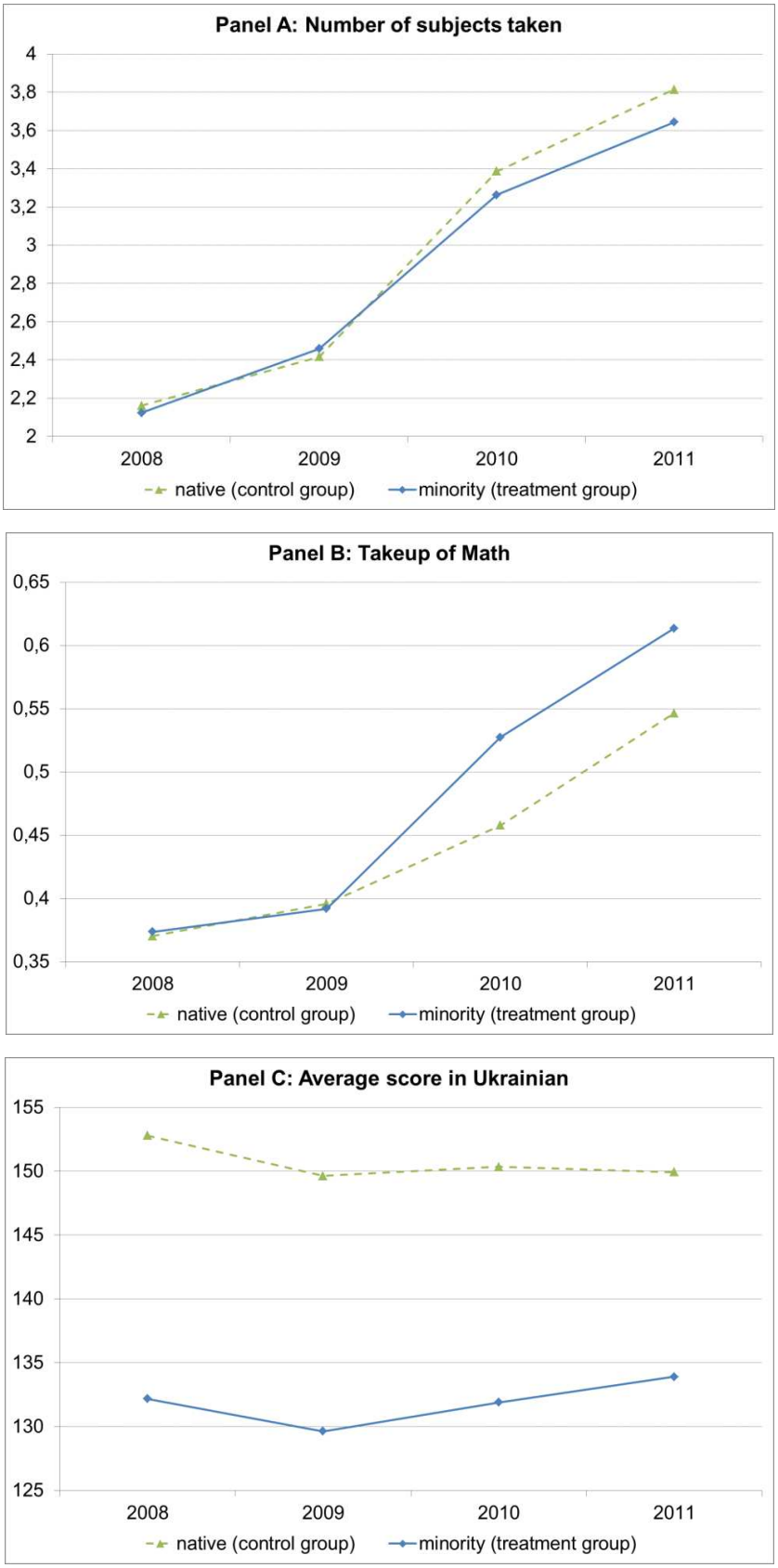
Wickström, Bengt-Arne (2005) Can Bilingualism be Dynamically Stable? A Simple Model of Language Choice. Rationality and Society, 17(1): 81–115.

Wiley, Terrence J., Jin Sook Lee, and Russell W. Rumberger, R. (2009) The Education of Language Minority Immigrants in the United States. Multilingual Matters: Bristol, UK.

Figure 1. Regions selected for the study on the map of Ukraine.

Note: Chernivtsi and Zakarpattia oblasts, from which we select the treatment group as well as our main control group, are marked by a shaded pattern. Ternopil region, from which we draw an alternative control group, is marked by a checkered pattern.
Source: The background map is taken from http://upload.wikimedia.org/wikipedia/commons/thumb/9/93/Ukraine_location_map.svg/800px-Ukraine_location_map.svg.png, the text and color are added by the authors.

Figure 2. Trends in the selected variables during 2008-2011.



Notes: Based on the data from the balanced panel of schools observed in all four years, 2008 to 2011. Weights based upon the number of students in each school participating in the testing are applied.

Table 1. Main ethnic groups of Ukraine, self-identification, census data.

Self-declared ethnicity	Number, ths. in 2001	Percent in 2001	Percent in 1989
Ukrainians	37,541.7	77.8	72.7
Russians	8,334.1	17.3	22.1
Belarusians	275.8	0.6	0.9
Moldovans	258.6	0.5	0.6
Crimean Tatars	248.2	0.5	0.0
Bulgarians	204.6	0.4	0.5
Hungarians	156.6	0.3	0.4
Romanians	151.0	0.3	0.3
Poles	144.1	0.3	0.4
Jews	103.6	0.2	0.9
Armenians	99.9	0.2	0.1
Greeks	91.5	0.2	0.2
Tatars	73.3	0.2	0.2

Source: Census 1989, 2001.

Table 2. Schools with minority languages in Ukraine, 2008/9 academic year.

Language/ ethnic group	Schools with this language of instruction	% of all schools	Pupils in schools with this language	% of all pupils	Pupils studying this lang. as subject	Pupils studying this lang. as elective
Bulgarian	—		80		9,592	1275
Gagauz	—		—		1,400	—
Hebrew and Yiddish	—		—		1,292	114
Crimean Tatar	15	0.1%	484	0.0%	17,725	5,153
Moldovan	6	0.0%	4,756	0.1%	1,590	434
Russian	1,199	6.0%	779,423	17.6%	1,292,518	165,544
New Greek	—		—		3,073	248
Polish	5	0.0%	1,389	0.0%	6,889	4,443
Romanian	89	0.4%	21,671	0.5%	683	—
Slovak	—		79	0.0%	224	202
Hungarian	66	0.3%	16,407	0.4%	1,337	278

Note: In the 2008/9 academic year, Ukraine had 20,045 schools with 4,438,383 pupils in total. Not all minority schools offer complete secondary education in minority languages (leading to the EIT in those languages). Some schools only offer incomplete secondary or primary education in minority languages.
Source: Ministry of education and science of Ukraine (2009).

Table 3. List of subjects offered at the EIT, 2008-2011.

	2008	2009	2010	2011
Ukrainian Language and Literature	Compulsory	Compulsory	Compulsory	Compulsory
Math	Choice	Choice	Semi-comp	Semi-comp
History of Ukraine	Choice	Choice	Semi-comp	Semi-comp
Foreign Language (English or German or French or Spanish)		Choice	Choice	Choice
Chemistry	Choice	Choice	Choice	Choice
Physics	Choice	Choice	Choice	Choice
Biology	Choice	Choice	Choice	Choice
Geography	Choice	Choice	Choice	Choice
Law	Choice			
Economics	Choice			
World Literature	Choice			
World History	Choice			
Russian Language				Choice
Maximum Number of Subjects	3	5	5	5
Translated	Yes	Yes	No/Yes	Yes

Note: In 2010 and 2011 students had to choose either History of Ukraine or Math as a second compulsory subject.

Table 4. EIT tests required for applying to different departments (fields of study) of the Kyiv National University in 2010.

EIT test / Department	Ukrainian Language and Literature	Math	Ukrainian History	Foreign Language	Chemistry	Physics	Biology	Geography
History	X		X					
Philosophy	X		X					
Psychology	X		X				X	
Political Science	X		X	X				
Law	X		X	X				
Economic Theory	X	X						
International Economics	X	X	X					
Management	X	X						
Chemistry	X				X			
Biology	X						X	
Geography	X							X
Physics	X	X				X		
Social Work	X		X				X	

Note: This is an extract from the full list of departments and specialties of the university, which is available at http://www.vstup.info/2010/i2010i80b.html accessed on August 20, 2012.

Table 5. Descriptive statistics, 2009.

	Treatment group (TG)					Control group (CG)					TG-CG
	mean	sd	min	p50	max	mean	sd	min	p50	max	Diff/Sign
Number of pupils	15,14	10,89	1,00	14,50	66,00	25,53	17,00	1,00	22,00	108,00	-10,39***
No. subjects per pupil	2,51	0,60	1,50	2,36	5,33	2,48	0,43	1,63	2,41	5,23	0,03
Stand. secondary school	0,82	0,38	0,00	1,00	1,00	0,90	0,30	0,00	1,00	1,00	-0,08*
Gymnasium	0,07	0,25	0,00	0,00	1,00	0,07	0,25	0,00	0,00	1,00	0,00
Lyceum	0,11	0,31	0,00	0,00	1,00	0,02	0,15	0,00	0,00	1,00	0,09***
Specialized school	0,00	0,00	0,00	0,00	0,00	0,01	0,09	0,00	0,00	1,00	-0,01
Special school	0,00	0,00	0,00	0,00	0,00	0,01	0,08	0,00	0,00	1,00	-0,01
Boarding school	0,03	0,16	0,00	0,00	1,00	0,03	0,16	0,00	0,00	1,00	0,00
City	0,05	0,23	0,00	0,00	1,00	0,12	0,33	0,00	0,00	1,00	-0,07*
Town	0,08	0,27	0,00	0,00	1,00	0,06	0,24	0,00	0,00	1,00	0,02
Village	0,86	0,34	0,00	1,00	1,00	0,81	0,39	0,00	1,00	1,00	0,05
Takeup-Ukrainian	1,00	0,00	1,00	1,00	1,00	1,00	0,00	1,00	1,00	1,00	0,00
Takeup-Biology	0,30	0,24	0,00	0,24	1,00	0,25	0,17	0,00	0,22	1,00	0,05**
Takeup-Physics	0,08	0,12	0,00	0,02	0,56	0,06	0,08	0,00	0,03	0,54	0,02**
Takeup-Geography	0,11	0,17	0,00	0,06	1,00	0,17	0,18	0,00	0,13	1,00	-0,06***
Takeup-Chemistry	0,08	0,15	0,00	0,00	1,00	0,07	0,08	0,00	0,05	0,47	0,01
Takeup-History	0,34	0,24	0,00	0,34	1,00	0,37	0,20	0,00	0,36	1,00	-0,03
Takeup-Languages	0,11	0,18	0,00	0,00	1,00	0,09	0,12	0,00	0,06	0,88	0,02*
Takeup-Math	0,37	0,24	0,00	0,34	1,00	0,39	0,19	0,00	0,39	1,00	-0,02
Score-Ukrainian	129,57	9,68	111,75	129,04	159,25	148,02	9,48	123,96	147	180,52	-18,45***
Failed-Ukrainian	40,41	23,91	0,00	36,93	100,00	11,53	10,72	0,00	9,68	58,06	28,88***

Notes: Treatment group includes minority schools with Hungarian (N=33) and Romanian (N=41) languages of instruction from Chernivtsi and Zakarpattia oblasts (N=74). Control group consists of Ukrainian schools from the same regions (N=457, mixed schools are excluded. Asterisks denote significance levels: *** - significant at 1%, ** - significant at 5% and * - significant at 10%.

Table 6. The effect of the language policy change on EIT participation and number of subjects taken, OLS and FE estimates.

	Participation		Number of subjects	
	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)
Minority*Year2010	1.736*	1.528	-0.210**	-0.205**
	(0.982)	(0.944)	(0.091)	(0.088)
Minority	-10.388***		0.075	
	(1.576)		(0.083)	
Year2010	-4.247***	-4.246***	0.960***	0.951***
	(0.443)	(0.432)	(0.021)	(0.020)
Town	10.146***		0.155***	
	(2.524)		(0.040)	
City	12.930***		0.143***	
	(2.765)		(0.037)	
Gymnasium	10.877***		0.026	
	(3.069)		(0.044)	
Lyceum	9.006***		0.200**	
	(3.083)		(0.097)	
Specialized school	6.613*		0.011	
	(3.532)		(0.125)	
Special school	0.970		-0.240***	
	(7.684)		(0.081)	
Boarding school	-9.379**		0.142	
	(3.988)		(0.088)	
Intercept	22.546***	24.312***	2.364***	2.424***
	(0.751)	(0.276)	(0.017)	(0.014)
R-squared	0.21	0.92	0.67	0.87
No. obs.	1071	1044	1071	1044

Notes: The dependent variable in columns 1 and 2 is the number of students from each school participating in the EIT. The dependent variable in columns 3 and 4 is the average number of subjects chosen by students in each school. Variable Minority is a dummy indicating minority language schools and captures the difference between the treatment and control group at the baseline. Variable Year2010 is a dummy for the year 2010 and captures the time trend. Variable Minority*Year2010 is the interaction of variable Minority with variable Year2010 and shows the treatment effect. Cluster-robust standard errors are reported in parentheses. Asterisks denote significance levels: *** - significant at 1%, ** - significant at 5% and * - significant at 10%.

Table 7. The effect of the language policy change on the failure rates and average scores in the Ukrainian language and literature exam, OLS and FE estimates.

	Failure rates		Average scores	
	OLS	FE	OLS	FE
	(1)	(2)	(3)	(4)
Minority*Year2010	-4.689**	-2.750	1.989*	1.363
	(2.333)	(2.287)	(1.015)	(0.969)
Minority	26.212***		-17.861***	
	(2.086)		(1.131)	
Year2010	-0.317	-0.390	0.383	0.351
	(0.528)	(0.519)	(0.353)	(0.341)
Town	-4.330**		7.302***	
	(1.831)		(1.574)	
City	-5.844***		9.203***	
	(0.902)		(1.004)	
Gymnasium	-8.671***		14.432***	
	(0.856)		(1.400)	
Lyceum	-4.150**		6.511***	
	(1.862)		(2.011)	
Specialized school	3.250		-2.272	
	(6.656)		(5.773)	
Special school	-4.689**		5.161***	
	(1.997)		(1.735)	
Boarding school	4.571*		-4.444	
	(2.470)		(3.544)	
Intercept	13.832***	13.492***	145.455***	148.013***
	(0.595)	(0.256)	(0.460)	(0.161)
R-squared	0.38	0.80	0.54	0.90
No. obs.	1,071	1,044	1,071	1,044

Notes: The dependent variable is the percentage of students failing the test in Ukrainian language and literature (Failed_Ukrainian) and the average score in that test (Score_Ukrainian) for each school. Variable Minority is a dummy indicating minority language schools and captures the difference between the treatment and control group at the baseline. Variable Year2010 is a dummy for the year 2010 and captures the time trend. Variable Minority*Year2010 is the interaction of variable Minority with variable Year2010 and shows the treatment effect. Cluster-robust standard errors are reported in parentheses. Asterisks denote significance levels: *** - significant at 1%, ** - significant at 5% and * - significant at 10%.