Fighting Corruption in Education: What Works and Who Benefits?[‡]

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We investigate the efficiency and distributional consequences of a corruption-fighting initiative in Romania targeting the endemic fraud in a high-stakes high school exit exam, which introduced CCTV monitoring of the exam and credible punishment threats. We find that punishment coupled with monitoring was effective in reducing corruption. Estimating the heterogeneous impact for students of different ability, poverty status, and gender, we show that fighting corruption led to efficiency gains (ability predicts exam outcomes better) but also to a worrisome score gap increase between poor and non-poor students. Consequently, the poor students have reduced chances to enter an elite university.

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1. Introduction

Equality of educational opportunity for individuals of similar ability is a key ingredient in a society that wants to promote growth and increase social mobility. A meritocratic education system increases the efficiency of how talented individuals are allocated by rewarding ability and not family income. However, in many countries, hurdles such as tuition fees and school and neighborhood segregation may reinforce inequality of opportunities across generations and increase inequality by limiting skill acquisition and access to higher education for poor individuals of high ability. An additional barrier to higher education, mostly prevalent in developing countries, is corruption in education, including bribes taken by teachers to facilitate admission to education or to inflate grades and scores on high-stakes exams. Moreover, corruption in education may act as an added tax, putting the poor students at a disadvantage and reducing, once more, equal access to human capital (see the 2013 Global Corruption Report, GCR).

This paper analyzes the implications of the fight against corruption in a setting of endemic fraud, cheating, and grade selling in the public education system in Romania.[1] Particularly, we investigate the efficiency and distributional consequences of a national anti-corruption campaign targeting the Romanian high school exit exam – the Baccalaureate.[2] The campaign was initiated in 2011 in response to the 2010 Baccalaureate, which marked a peak in corruption for exam grades and generated a media storm after Romanian National Anticorruption Directorate revealed how batches of identical answers had been distributed to students by public teachers (see Borcan, Lindahl and Mitrut, 2014).[3] The campaign consisted of two distinct components: 1) increasing the threat of punishment for teachers and students caught taking/giving bribes and 2) closed-

[1] The prevalence of corruption in the Romanian, as well as many other countries' public education is acknowledged in the World Bank Report Gobal Corruption Report, 2013.

[2] Corruption in this setting refers to the giving of bribes for permission to cheat or for higher scores than deserved.

[3] This exam became known in the media as the "Xeroxed exam," referring to the fact that many students were found to have identical test answers including in essay type exams.

circuit TV (CCTV) monitoring of the exam centers in an effort to eradicate mass cheating and bribes during the examination.[4]

Our aim in this paper is to first evaluate the efficiency of the national anti-corruption campaign and subsequently to understand who the winners (and losers) are, especially in terms of students' poverty status, ability, and gender characteristics. To accomplish our first objective, we evaluate the punishment and monitoring components of the campaign. For teachers, the punishment side of the campaign comprised threats of dismissals and imprisonment, while corrupt students risked being suspended from any retakes for over a year. The commitment to punish teachers and students caught red-handed was demonstrated by the high number of trials related to exam fraud immediately after the 2010 Baccalaureate. The installation of CCTV cameras in exam centers, the second component of the campaign, was an effort to eradicate mass cheating and fraud. This measure was not announced until May 2011, i.e., one month prior to the high-stake Baccalaureate exam. Just over half of the counties had video surveillance in 2011, while the rest installed cameras in 2012 when CCTV surveillance became mandatory. Hence, for the monitoring part of the campaign we have access to quasi experimental variation in camera installation, which we utilize in a difference-in-differences (DD) framework, comparing counties treated with the camera monitoring (some in 2011 and all in 2012) with those not treated (all in 2009-2010 and some in 2011). This yields an estimate of the effect of increased monitoring on high-stakes Baccalaureate scores. The punishment component was implemented across the country at the same time, but because of its strict implementation and since we can use a placebo test as control, we are able to say something about the impact of the monitoring and punishment combined.

Having established that the anti-corruption campaign did have an overall effect in lowering Baccalaureate scores and pass rates, we next investigate who the winners and losers from the campaign are. We analyze the *heterogeneous*

[4] While similar policies are currently discussed in other countries, Moldova and Cambodia have already implemented a similar policy targeting the endemic corruption in connection with the high school exit exam, resulting in 56% and 26% of students passing the exam compared with over 94% and 87%, respectively, in the past.

effects of the anti-corruption campaign for the students: high vs. low ability, high vs. low income (poor), and males vs. females. This will give us an idea of how different groups fare in a more or less corrupt education system. Given that bribing requires economic resources and is an opportunity to circumvent effort and ability in producing high scores, we hypothesize that eliminating or decreasing corruption in relation to the Baccalaureate benefits poor students and makes ability a more important predictor of the Baccalaureate score. As the Baccalaureate score is the only or major admission criteria for higher education in Romania, we expect our results on Baccalaureate outcomes to carry over to the admission to higher education. To corroborate this finding, we have collected additional data to directly investigate the consequences of the (monitoring component of the) anti-corruption policy for admission to higher education at an elite university.

We provide a number of interesting findings. We find that exam outcomes dropped sharply already in 2011 and that the drop came from both the monitored and non-monitored counties, yet it was larger in the monitored ones. By 2012, the average pass rate had almost halved. In the DD analysis we find that the presence of CCTV cameras reduced the Romanian written exam score by 0.12 SD and the probability of passing the Baccalaureate by 8.3 percentage points. We interpret these estimates as the additional effect of introducing monitoring. The analogous analysis of a no-stakes exam, with no scope for corruption (the oral Romanian exam), reveals neither a general drop in scores in 2011 or 2012, nor a decrease in response to monitoring. We interpret this as suggestive evidence that punishment works well, in particular when complemented with monitoring. Moreover, we corroborate this finding with very similar pattern for pass rates at the baccalaureate in Moldova, a country with a very similar educational structure as Romania which introduced harsher punishments in 2012 and CCTV cameras in 2013.

As expected, the campaign increases the importance of ability for exam outcomes, implying efficiency gains. More surprisingly, our findings contradict our original expectation that fighting corruption should close the score gap

between poor and non-poor students. The results indicate that the anti-corruption measures made the already underperforming poor students relatively worse off than non-poor students. The campaign induced an increase in achievement gaps, in that groups performing relatively worse prior to the campaign (low ability, poor, males) became even more worse off relative to the groups performing better. This was likely the result of the structure of corruption and the pre-existing inequalities hidden behind it, as we discuss in section 6. Importantly, we are also able to investigate the consequences of the anti-corruption policy (the monitoring component) for admission to higher education. Using data from an elite university, we show that, while the ability and gender composition of students at this top school was unaffected by the introduction of cameras, the monitoring significantly reduced the chances of admission for poor students, hence confirming most of the results found for the Baccalaureate.

Our paper makes several contributions to the literature on fighting corruption and on the economic consequences of corruption. Economic theory argues that the right combination of increasing the probability of detection (through monitoring) and the threat of punishment may reduce corruption by increasing its costs (Becker and Stigler, 1974). However, evaluation of policies that combine punishment and monitoring has proven to be a challenging task (Hanna et al., 2011; Svensson, 2005). The setting we have for the year 2011 is one where, akin to a Becker-Stigler model of crime, we have a combination of incentives and varying detection probabilities. Counties that installed cameras faced both a stronger incentive (credible punishment threat) and increased monitoring, whereas counties that did not install cameras faced the new punishment threats but no increase in actual monitoring. This allows us to bring additional evidence on the interplay between punishment and monitoring and their effects on exam outcomes. Our research therefore complements the literature on anti-corruption policies, which has so far explored monitoring through official audits (Ferraz and Finan, 2008, 2011; Di Tella and Schargrodsky, 2003) and community-based monitoring interventions (Duflo et al., 2012; Reinikka and Svensson, 2004, 2005; Olken, 2007), and has also analyzed changes in incentives

(Banerjee et al., 2008; Duflo et al., 2012). Some of these studies shed light on the interplay and relative effectiveness of monitoring and incentives in discouraging dishonest practices.[5] Our paper offers evidence that monitoring is effective insofar as it enables incentive schemes to operate better, even in the high-stakes setting of a high school exit exams of crucial importance for future education and success in the labor market. The paper also contributes additional evidence of the effectiveness of monitoring to an emerging literature on the role of CCTV cameras in combating crime (Priks, 2014, 2015; King et al. 2008, Welsh and Farringdon, 2009, 2003).[6]

One important contribution of our paper is the estimated impact of fighting corruption on equality of educational opportunity. While social scientists have argued that (income) inequality is positively correlated with the level of corruption (see, e.g., You and Khagram, 2005; Rothstein and Uslaner, 2005), little is known about the distributional consequences of the various means to fight corruption and particularly how curbing corruption influences inequality of opportunity in a society. This is problematic as corruption might adapt and transform to circumvent new constraints, generating a redistribution of resources and opportunities that could increase inequality. Importantly, empirical evidence on the welfare consequences of corruption remains very scarce.[7] By separating the

[5] Nagin et al. (2002) report on a field experiment which showed that that decreasing the rate of monitoring observable by employees led them to shirk more, independently of how good their alternatives in the labor market were relative to their job. Di Tella and Schargrodsky (2003) examine the effects of wages and audits during a crackdown on corruption in Buenos Aires hospitals. They find that the wages played no role in reducing corruption (inferred from the drop in previously inflated hospital input prices) when the probability of detection was close to 100%, but only when auditing was less frequent. Duflo et al. (2012) show that monitoring with tamper-proof cameras worked in reducing teacher absenteeism insofar as it was instrumental in implementing an incentivizing attendance-based wage scheme. Their model predicts that at the very least, punishment prospects (fear of dismissal) should put a bound on dishonest behavior. Banerjee et al. (2008) follow the punishment approach of incentives and show that credible threats of punishment (through pay cuts and dismissal) were indispensable in getting government nurses in India to come to work, even when camera monitoring was in place. The impact of changing monitoring or incentives of corruption and shirking linked with the education process is also illustrated in Glewwe et al. (2010).

[6] The effectiveness of CCTV cameras in reducing crime is a current topic, with million dollars being spent in this public safety infrastructure. Priks (2014) and Priks (2015) documents the causal effects of CCTV cameras on unruly behaviour and some types of crime, using temporal variation in CCTV installation in Swedish stadiums and underground. King et al (2008) showed that property crime was reduced as a result of CCTV monitoring on the streets of San Francisco.

[7] Exceptions include Ferraz et al. (2012), who explore variation in corruption in education across Brazilian municipalities, showing how more corruption translates into lower scores for the students, thereby assessing the efficiency costs of corruption, and Choe et al. (2013), who show survey evidence from Bangladesh that corruption in education is most taxing for the poor and less educated. Similarly, Hunt (2007) shows evidence from Peru that the victims of misfortune (crime) are also more likely to be victims of bribery.

effects of corruption elimination between low- and high-income students and between low- and high-ability students, we will also infer the consequences of corruption on educational opportunity for students from different backgrounds – a perspective neglected in previous studies. Allocative inefficiencies, for instance in the selection into higher education, can have great consequences for longer-run economic development and economic inequality (Banerjee et al., 2012). Our paper also related to the large literature on how credit constraints (in this paper in the form of bribes) affect continuation to higher education, especially with regard to selection across the ability and family income distribution (see Lochner and Monge-Naranjo, 2012, for a survey).

The paper is structured as follows. Section 2 presents the setting and the anti-corruption initiatives. Section 3 provides the details of our data. Section 4 provides a graphical analysis of the data. Section 5 outlines our empirical strategy. Section 6 presents our main empirical findings. Section 7 presents the effects on admission to university. Our conclusions are presented in Section 8.

2. Background

2.1 The Romanian education system

The Romanian pre-university education starts with elementary school, which is divided into primary school (1st to 4th grade) and secondary school, or gymnasium (5th to 8th grade). Upon graduation from secondary school, i.e., at the end of 8th grade, the students need to pass a national standardized exam. The score from this exam and the student's graduation grade point average (5th to 8th grade) contribute with equal weights to the student's tertiary or high school admission grade. Based on this score and a comprehensive list of ranked high schools, the student is systematically allocated by the Ministry of Education (through a computerized, transparent allocation procedure) to a high school and a specific track at that school: *i)* a theoretical track, which includes humanities and sciences,[8] *ii)* a technological track, which includes technical training, services, and natural resource- and environment protection-oriented education, or *iii)* a vocational

[8] The theoretical track is typically the most popular among high-ability students.

track, which includes arts, military, theology, sports and teaching (for more details on the allocation, see Pop-Eleches and Urquiola, 2013).

Upon completion of high school, students take the Baccalaureate exam. This high-stakes nationwide standardized test is mandatory in order to obtain a tertiary education degree. Admission to university or further training as well as access to the labor market are almost exclusively based on this test.[9] The exam takes place every year in June and consists of a few oral and written standardized tests, with slight alterations across years.[10] The tests within each subject and may have different degrees of difficulties across tracks, but they are standard within one track. The only exception is the written exam in Romanian language and literature, which is the one test that is identical for *all* students regardless of track, and its format has remained unchanged over the years.

2.2 The Baccalaureate and the Anti-corruption Campaign

The pressure of passing the Baccalaureate exam (with high scores) has been constantly rising since about 2002. It was around then that the increase in the number of private universities and the introduction of tuition fees in public higher education began. This made the university admission exams less relevant as the Baccalaureate scores attained increasing shares in the admission criteria (up to 100%), raising the stakes of the high school exit exam. The combination of the high stakes and poor remuneration of public school teachers created an endemic corruption environment surrounding the Baccalaureate exam, as also documented by Borcan, Lindahl, and Mitrut (2014).[11]

[9] All tests and school grades in Romania are scored on a scale from 1 to 10, and to pass a student must obtain a minimum score of 5 on each test. However, to pass the Baccalaureate a student needs at least 5 on each exam and a minimum overall average score of 6.

[10] The most important changes were the exclusion of oral tests from the overall score starting in 2010 and the elimination of the fourth written test. All these tests displayed abnormal score distributions highly concentrated at the top marks.

[11] A 2003 World Bank Report on corruption in Romania reveals that more than 67% of the respondents alleged that all or almost all public officials in Romania are corrupt, while more than 50% of the respondents believed that bribery is part of the everyday life in Romania. The figure was particularly high for the education and health systems, as up to 66% of the respondents confirmed that they were paying the so-called *atentie* (unofficial payments or bribes). According to the Global Corruption Barometer from Transparency International, in Romania in 2010/2011, 37% of respondents believed the education system was corrupt or extremely corrupt, which was above the world average.

The unofficial payments behind the Baccalaureate exam can be summarized as follows:[12] *i*) *Collective bribes* which are funds collected from the students before, or just before the exam. These are voluntary but very common, usually perceived as a norm by all students and are used to "grease the wheels" ("protocol" – meals or, small gifts for the exam committee) or directly given to the exam committee and proctors to turn a blind eye or even help in-class cheating. Because these bribes affect what happens during the exam, it is this type of corruption ("pay to cheat") that the CCTV monitoring can reduce. *ii*) *Individual bribes*, which are large sums (hundreds of euro) transferred privately by the more affluent students to members of the exam committee to increase the student's score, or to replace the exam paper with a correct version.[13] This is usually done with the help of a student's teacher or school principal who act as intermediaries for the bribe transfers. The corruption trials following the 2010 exam illustrate this form of bribing: *"The defendant [school principal, name] claimed and received from the defendants [names] the total amount of 7.000 RON, which she then transferred to the defendant [name]. This money was received in order for the latter, as examiner in Romanian language, to give higher scores for the (contributing) candidates"* (National Anticorruption Directorate Press release No. 473/VIII/3, 2010)**.** Thus, while punishment threats may affect the incidence of individual bribes, CCTV monitoring cannot capture these private deals. The fact

[12] This distinction is based on examples of bribes documented in the court cases and official press releases of the National Anticorruption Directorate (retrieved from www.pna.ro - in Romanian).[13] *"Around the time of the Baccalaureate exam, June 2010, in the exam center [name], the defendants [name] - principal, [name] - deputy principal, [name] - secretary and [name] - teacher, [...] have [...] planned and organized a fraudulent exam, in which students who paid various amounts of money passed the tests. [...] On June 28, 2010, after the written Romanian exam, upon a police search of the high school premises, 56 envelopes containing money and the names of the students [who have contributed] have been identified. In total 91.850 RON (equivalent to 21,360 EUR) and 7,750 EUR have been found. In addition, [the principals] have received 19,000 RON, 1,850 EUR and 8 envelopes containing unspecified amounts from students interested in passing the exam." Press release No. 633/VIII/3, National Anticorruption Directorate, November 29, 2010.*

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that the pass rates of 80-90% until 2009 did not reflect ability but rather mass fraud was common knowledge among teachers, principals, parents, and students.[14]

Following the 2010 Baccalaureate, which was marked by a surge in grade-inflating corruption generated by the 25% public sector wage cut in May 2010, a high number of teachers were brought to trial on allegations of selling grades.

In response to this scandal, the Ministry of Education started a Baccalaureate "cleaning" campaign in 2011. In a first step, the Ministry publicly appealed to all schools and teachers involved in the exam to better enforce the examination rules and threatened to punish teachers caught receiving bribes with a pay cut and/or jail,[15] while also promoting a zero tolerance policy against collective bribes. Additionally, a new rule stipulated that parents and NGOs had the right to enroll as exam proctors in order to increase transparency. In terms of harsher punishments, the new rules also stipulated that students caught cheating would be banned from re-takes for at least one year. On top of these measures, there was a recommendation to organize the exam, when possible, in centers equipped with surveillance cameras. The introduction of CCTV cameras was reinforced in May 2011 through public appeals by the Ministry of Education to the county inspectorates. However, because the request was not binding, each of the 42 county inspectorates decided independently whether or not to install CCTV cameras in the examination centers by the end of May.[16] As a result, twenty-five counties had cameras installed in the examination centers and 17 did not, blaming lack of funds. Where installed, the cameras were placed in the front of the room, or on the hallways, and the camera footages were collected and screened by the county inspectorates. Descriptive statistics (Appendix, Table A3.1) confirm that the counties that did not install CCTV cameras in 2011 were poorer than the others. We discuss the county self-selection later on.

[14] For a more detailed treatment of the state of corruption in Romania, particularly in the education system, see Borcan, Lindahl, and Mitrut (2014). Based on PISA test scores, the authors also document the strong contrast between national exam scores and true ability compared with other European countries.

[15] Threats ranged in severity from being excluded from the examination for a few years to going to jail (following the 2010 example).

[16] *Metodologia de organizare si desfasurare a examenului de bacalaureat, 2011*, Annex 2 of the Ministry of Education's Decision no. 4799/31.08.2010, concerning the organization of the Baccalaureate exam.

Thus, in 2011, counties that installed cameras faced both a credible punishment threat and increased monitoring, while non-implementers faced a credible punishment threat but no additional actual monitoring.[17] Consistent with this, the national average pass rates plummeted to a staggering 44.5% (from around 70% in 2010). Both implementers and non-implementers of the camera policy sustained a drop in the pass rates, but the drop was much larger in the monitored (pass rates decreased to 41%) compared to the non-monitored counties (where pass rates dropped to 51%). In 2012, the Baccalaureate methodology was further modified and CCTV cameras became mandatory in *all* counties, which reduced the pass rates even further to 41.5%.

The gradual introduction of monitoring allows us to compare education outcomes in a corrupt (in 2011 in non-monitored counties and in 2010 and before) and a non- (or less) corrupt system (in 2011 in monitored counties and in 2012 in all counties). This variation sets the foundation for our empirical strategy, as described in Section 4.

3. Data

For the purpose of our empirical investigation we employ several datasets:

i) Administrative data provided by the Ministry of Education and covering the universe of students enrolled at the Baccalaureate exam (typically 200,000 students every year) from 2009 to 2012. From this source we retrieve each student's exam outcome (scores and whether the student passed or not), track (theoretical, technological or vocational), date of birth, gender, and the county, locality, and school of enrollment.[18]

ii) Administrative data covering the universe of students admitted to high schools. This data contains information on each student's high school and

[17] However, the latter counties may have expected a higher rate of monitoring due to the increasing pressure from counties that complied. For instance, counties that decided against the Ministry's recommendation may have feared being targeted with more frequent inspections. Since agents' behavior responds to perceived monitoring, which does not necessarily coincide with objective monitoring (Nagin et al., 2002), we can plausibly assume that the expected detection probability increased also in non-implementing counties, but to a lower extent than in implementing counties.

[18] We opted to use data from 2009-2012 because joining the 2008 Baccalaureate data and corresponding high school admission data (admission in 2004 was somewhat different than in the following years) yielded a slightly lower matching rate, causing a risk of having a selective sample of students in 2008.

secondary school, the average scores in 5th through 8th grade, and the average scores on the 8th grade national standardized exam. We employ data from 2005-2008 of the same students who took the Baccalaureate in 2009-2012 (about 600,000 students, as some postpone high school education). In what follows we will use the average scores of the four years of lower secondary school (gymnasium) as a proxy for ability, as it captures *all* scores in *all* subjects during these four years (see also Pop-Eleches, 2009).[19]

iii) Because the administrative data under i) and ii) does not cover student poverty status, we construct this measure from individual information on the students eligible for the Money for High School (MHS) public program of financial assistance for high school students from poor households, for the cohorts 2009-2012. This data contains information on all eligible students' school and family income for each year when they submitted an application. The MHS (administrated by the Ministry of Education) disbursed a monthly allowance of 180 RON (~53USD) per student. An applicant was eligible if the gross monthly income per family member was not higher than 150 RON in the 3 months prior to applying.[20] This warrants the use of MHS beneficiary status as a proxy for the economic status of the students' families (which we code using an indicator for *poor* students). For further discussion, please see Appendix A2.

When we merge the datasets i), ii), and iii), we obtain our working sample of 553,903 students for whom we have historical school data from grade 5 (beginning of lower secondary) to grade 12 (the end of high school). Additionally, in an attempt to understand the allocation of students to university studies following the anti-corruption campaign, we will merge this data with individual data from the admission to a top Romanian university from 2009 to 2012,

[19] Moreover, the 8th grade exit exam is not a high stake test compared with the Baccalaureate, as *all* students in Romania are admitted to high school, diminishing the incentives to inflate this grade through corruption (for more details on the centralized transition from 8th grade to high school in Romania, see Pop-Eleches and Urquiola, 2013). Finally, following the 2011 anti-cheating initiatives and threats (installing video cameras in schools during the exam, threatening staff with dismissal), the passing rate for the Baccalaureate dropped by more than 45% in 2011 relative to before (see Borcan, Lindahl, and Mitrut, 2014), whereas the drop was much smaller (about 17%) for the 8th grade standardized exam.

[20] Students could reapply at the beginning of every school year. The MHS funds have been disbursed every year since 2004 with no limit on how many times a student can apply as long as they were eligible. However, because of the rising number of requirements, from 2009-2010 a new criterion was introduced demanding that the student have a very good school attendance rate. A little over 100 students were denied the allowance because of low attendance in 2010-2011.

generating a sample of 15,395 students. We discuss this data when we address this issue later in the paper.

Table 1 outlines some key statistics for our main variables, separately by year. We note that the Romanian language written exam scores (the test most amenable to comparison, as it is identical for all students and similar across years) declined from an average of 7.07 in 2009 and 7.32 in 2010 to 6.51 and 6.37 in 2011 and 2012, respectively.[21] The overall Baccalaureate pass rate declined from 85.2% in 2009 and 75.3% in 2010 to 54.9% and 51.9% in 2011 and 2012, respectively.[22] It is important to note the drop in the 2010 pass rates, in spite of the increase in corruption (see also Figure 1 below). The main explanation behind this fall, as also supported by the 2010 official report from the Ministry of Education and Borcan, Lindahl, and Mitrut (2014), lies in a few changes in the exam structure (see Appendix A3, Figure A3.2): *a)* The oral Romanian exam, compulsory for all students, was rendered irrelevant to the calculation of the overall Baccalaureate grade (and passing). Before 2010, 99% of the students passed this exam (a minimum grade of 5), with 50% of the students receiving an implausible score between 9 and 10 (out of 10). *b)* One elective exam was removed in 2010. Before this year around 75% of the students chose physical education for this elective test (of whom more than 90% scored a maximum score of 10).

Table 1 also shows that the share of poor students (as proxied by the MHS recipient status) is relatively stable across years (about 22%), while the number of males taking the exam decreases slightly (from about 50% in 2009 to 45% in 2011). Furthermore, higher ability students, as proxied by students with an above median 5^{th}-8^{th} grade score, seem to be proportionally more numerous in 2011 and 2012. This apparent (positive) change in the composition of test takers indicates that our results could actually be a lower bound of the true effects of the anti-corruption campaign.

[21] The increase in 2010 is discussed in Borcan, Lindahl, and Mitrut (2014) to be a direct consequence of the 2010 public sector austerity measures and the sudden increase in corruption related to the Baccalaureate.

[22] Note that the higher pass rates in our descriptive statistics tables compared with the national averages are due to the fact that we do not include exam re-takes (i.e., instances where a student who has failed the exam in previous years re-takes the exam) in these numbers (or in the estimations). However, when we repeat our analyses including the exam repeats, the results are essentially the same, just slightly larger in magnitude.

4. Graphical Evidence

We start with an illustration of the evolution of exam outcomes over time in Figures 1 and 2. These figures summarize the essence of our findings. Figure 1 shows the 2004-2012 pass rates and written Romanian averages, separately for early and late installers. The notable patterns are: *1)* in both early and late implementers, the Romanian written scores and the overall pass rates dropped quite sharply in 2011,[23] suggesting that the anti-corruption campaign as a whole was effective in both types of counties and that the part of this campaign that included threats of punishment played the largest role; *2)* the drop in performance in early implementation counties is larger in 2011 than in late implementation counties, suggesting that monitoring per se was effective; *3)* while early implementation counties display constant performance levels in 2012 relative to 2011, the score in late implementation counties continue to drop in 2012, reaching levels below the early implementers. This suggests that monitoring had an effect not only if introduced in combination with punishment (as was the case in 2011 for the installing counties), but also in situations where punishment for corruptive behavior had been in place for a year; and *4),* the score for the late implementers continued to drop in 2012, when the objective monitoring was introduced and were reaching levels below the early implementers, even though the late implementers had higher scores in 2010. This may indicate that the late and early implementers may differ along some characteristics, suggesting the need to account for self-selection into treatment.

These patterns are perfectly preserved in Figure 2, which displays the evolution of scores from 2009 to 2012, separated by ability, gender and poverty status (Figures 2A, 2B and 2C, respectively). Figure 2A reveals very similar score evolutions in early and late implementers for high-ability students (above the median 5^{th}-8^{th} grade graduation score). Low-ability students start off at much lower scores and sustain a much sharper drop when corruption-fighting strategies are in place. The same applies for the performance of male relative to female students. The most striking contrast is perhaps between poor and non-poor

[23] As we explain in the data section, there is a drop already in 2010 for pass rates because of changes in the exam structure.

students. The score dip associated with camera monitoring in 2011 is larger for the already worse-off poor students. Overall, the graphs indicate that the camera monitoring was effective in reducing the cheating and fraud opportunities, particularly for groups prone to engage in corrupt behavior. However, the pattern observed is also that the dispersion in exam outcomes between groups increased, and those who performed poorly on the Baccalaureate prior to the corruption-fighting measures did even worse after their introduction. Note also that the patterns across groups are very similar regardless of whether or not we look at the overall change from 2010 to 2012, or if we investigate the pattern related to the installation of CCTV cameras. This suggests that we can potentially use the well identified estimates from the effect of camera installation to draw inference about how groups fare before and after the introduction of corruption-fighting measures.

In what follows we test the camera impact for the entire sample and by groups more formally. It should be noted that later installers were, on average, better off before 2010 and that we observe parallel trends before 2011 in early and late implementers for average pass rates but that the trends converge somewhat for the written Romanian score. We discuss issues of selection into camera treatment in the identification section below. In the estimations we will also add student controls in order to control for possible compositional sample changes over time across treatment and controls. In addition, we will present results from placebo regressions, using outcomes from a no-stakes exam. We argue that if we do not find an effect (of monitoring or of the threat of punishment) on such a low-stakes outcome, it will be a strong indication that our main results are unlikely to be driven by unobservable factors that could have potentially affected achievement even in the absence of anti-corruption measures. Additionally, we will show that possible differential pre-reform trends do not affect our main results.

5. Estimation strategy

To assess more formally the impact of corruption-fighting measures on exam outcomes, we employ a difference-in-differences (DD) strategy. In particular, we

use the variation between counties and over time in the installation of CCTV cameras to separate out the effect of actual monitoring from the effect of harsher punishment captured by the 2011 and 2012 year indicators. The general specification is:

$$y_{ict} = \alpha + \beta T_{ct} + \gamma' X_{ict} + \varphi_t + \theta_c + \varepsilon_{ict} \quad (1),$$

where *i* indexes a student attending a school in county *c* in year *t*. y_{ict} is one of our two main outcomes of interest, i.e., 1) the score on the standardized written Romanian language exam and 2) an indicator equal to 1 if the student passed the Baccalaureate exam and 0 otherwise; T_{ct} is an indicator equal to 1 if the student is CCTV monitored (for all counties in 2012 and for 25 counties in 2011) and 0 otherwise; X_{ict} includes indicators for gender, for whether the student comes from a poor family, for the graduation score prior to entering high school as a proxy for student ability (as described in Section 3), for high school track and for rural area; φ_t includes year indicators; and θ_c includes 41 county indicators. In some of the estimations we replace the county indicators with a full set of school or family indicators. In all regressions we cluster the standard errors at county level, since the treatment implementation is county-wide (resulting in 42 clusters).

The DD estimate, $\hat{\beta}$, will capture the impact of CCTV installation on exam scores, based on the variation in exam outcomes within counties over time (after vs. before camera installation). Since no county had cameras installed in 2009-2010 and some counties installed them in 2011 and the rest in 2012, this estimate will be a weighted average of the exam score effects for those installing cameras in 2011 and 2012, respectively.

The 2011 and 2012 year coefficients are of interest since they capture the shift in exam outcomes relative to earlier years, net of the impact of cameras. However, these indicators can be interpreted causally only under the very strong assumption that the sole source of variation in exam outcomes 2011-2012 relative to before is the corruption-fighting campaign. This is obviously a restrictive assumption as a number of other factors might have changed across years, e.g., different changes as a result of the overall economic situation. To investigate the

plausibility of this assumption, we estimate equation (1) using as outcome the scores from the low-stakes oral Romanian exam. This exam is also part of the Baccalaureate and covers the same topics as our main outcome, i.e., the written exam, but does not count towards the overall grade and there is consequently no scope for corruption. Hence, in our model using performance in this exam as the dependent variable, the year indicators' coefficients can be read as pure year effects. If the estimates for the year indicators and the DD indicator are zero, we believe we can make a reasonably strong argument for an interpretation of the year indicators as saying something about the overall impact of punishment threats. This is especially likely since the changes in exam scores (as shown in Figures 1 and 2) are so large it would be unlikely to find other factors that could explain this whole shift. Yet, we need to be cautious when interpreting the year effects as effects of the anti-corruption policy (see Section 6.1.2 below). Similarly, when we estimate equation (1) separately by sub-groups, we focus on comparing the resulting estimates across these groups. The identifying assumption is then that there are no other factors that could explain, e.g., a diverging pattern.

Finally, the question of self-selection of counties into the CCTV monitoring treatment warrants some discussion. Since the CCTV surveillance was not enforced in 2011, county inspectorates had the final decision on the matter. The choice not to install cameras was typically motivated by lack of funds. Thus, any claim of random assignment into camera treatment would be untenable in this context. To learn more about the selection into exam monitoring, we look at the mean differences in outcomes and controls between early and late installers in the pre-reform years 2009-2010 (Appendix A3, Table A3.1). We learn that student ability or performance does not differ across counties, and neither do our survey-based proxies for corruption norms.[24] Yet, on average, early installment counties seem to have significantly fewer poor students and be slightly larger. This supports the official justifications and also reassures us that the factors affecting

[24] We compute a proxy based on the *share* of people having *an informal network*, at the county level, using the answers to a question from the 2007 Romanian Barometer of Public Opinion: *"Is there anyone (i.e., informal network) that could "help" you solve (i.e., informally): issues in court/trials, medical problems, city hall, police, or issues related to the local authorities."*. We also compute of a proxy for the level of confidence in justice, based on perceived trustworthiness of the justice courts, elicited in the same survey.

the monitoring decision are accounted for in our baseline regressions. Under the assumption that county fixed effects or specific time trends account for any unobserved county-level characteristics related to the camera decision, poverty, and the observed exam outcomes, the DD estimator yields the causal impact of the CCTV monitoring on exam outcomes.

6. Results

Our aim is two-fold. First, we aim to assess the impact of the corruption-fighting campaign and particularly to understand the separate impact of the campaign mechanisms, i.e., monitoring and increased threat of punishment (Section 6.1). Second, we inquire about who benefits and who loses from curbing corruption by looking at the heterogeneous effects of the campaign on the high-stake Baccalaureate exam scores for poor vs. non-poor, males vs. females, and most vs. least able students (Section 6.2). Additionally, we attempt to understand whether the transition from a system with unhindered corruption (2010 and before) to one where corruption opportunities should be drastically reduced (2011 and 2012) by the anti-corruption campaign significantly changed the composition of students admitted at an elite university (Section 7).

6.1. The Overall Impact of the Campaign

6.1.1. The effect of installing CCTV cameras

Table 2 presents results from estimating equation (1) for the scores on the written Romanian exam, a standardized test that has the same structure across years and tracks (columns 1-2), and for the probability of passing the Baccalaureate exam (columns 3-4). In columns (1) and (3) we only include the CCTV monitor indicator, year indicators (base is 2010), and county indicators, while in columns (2) and (4) we add the controls described previously.

We note in column (1) that the written Romanian score decreases by about 0.22 points due to camera monitoring, which is equivalent to a 0.12 SD decrease in scores on the Romanian exam relative to the sample mean. The CCTV camera effect remains very similar in column (2) when we include the rest of our control

variables. For the probability of passing the Baccalaureate exam, the main results show a similar pattern as for the written Romanian exam. In particular, the impact of CCTV camera monitoring lowered the probability of passing the Baccalaureate by around 8.3 percentage points. We also note that, relative to 2010, the 2011 and 2012 year indicators clearly exhibit much lower values.[25] Yet, at this point it is difficult to assess whether these negative coefficients indicate a response to punishment threat or some other changes. We provide details on the effect of the punishment threat on exam outcomes in the next subsection.[26]

There are several concerns related to whether the CCTV monitoring in Table 2 above can indeed be interpreted as the effect of the campaign exclusively due to increasing monitoring. In particular, the negative impact of *monitoring* on test scores may reflect not only corruption fighting per se but (also) test anxiety from the newly introduced CCTV cameras. While we cannot fully dismiss this possibility, we believe that anxiety from monitoring would not account for such a large drop in scores. In the same line, Bertoni et al. (2013) show that the negative impact of the presence of an external examiner on test scores is due to reduced cheating rather than to anxiety. Moreover, the evidence from the psychology literature (Chapell et al., 2005) indicates that females display higher levels of anxiety during tests than males, while we will show in the heterogeneity analysis that males perform worse compared with females following the campaign.

We also address some additional concerns in alternative specifications which introduce tighter controls (county specific trends, school and family fixed effects), all of which leave the results unchanged. To save space, we report and discuss these robustness tests in Appendix 1.

Our results seem to indicate that monitoring lowered the exam scores as a result of reduced ability to engage in petty and mass in-class cheating, which had been possible in the past, as discussed in Section 2.2, subsequent to *collective*

[25] One apparent surprising result is the negative coefficient of the 2009 indicator for the written Romanian exam score. The reason for this pattern is the escalading corruption in relation to the Baccalaureate grades, which, especially for the written Romanian exam, peaked with the 2010 exam following a 25% wage cut for all public school educators as shown in Borcan, Lindahl, and Mitrut (2012).

[26] We also note that the 2009 year indicator is positive when we look at the probability of passing the Romanian exam. This is because the probability of passing drops already in 2010 due to additional changes in the exam structure/passing requirements as discussed in Section 2.

bribes being paid to the exam committee members. Yet, we cannot fully exclude that, even in the presence of CCTV monitors, some students would resort to *individual bribes* (before/after the exam takes place). We will return to this point in our heterogeneity analysis.

6.1.2. Can we separate out the punishment from the overall effect of the campaign?

We have shown that the CCTV monitoring part of the campaign indeed had an impact on curbing corruption as it resulted in statistically significant lower test scores and pass rates. Interpreting the year effects in Table 2 as showing the effects of the threat of punishment, net of increased monitoring, is much more problematic. To convincingly establish that the threats of prosecution for teachers and re-take restrictions for students were credible enough to reduce corruption, we would ideally like to contrast the written exam with a no(low)-stakes exam with no scope for fraud and thus no impact of the anti-corruption campaign on the scores. This test would be more compelling if this exam's intrinsic features were comparable to the high-stakes exam that it is compared against. Conveniently, the Romanian language is tested both via an oral and a written exam during the Baccalaureate, both covering the same topics.[27] However, since 2010, the oral exam has been rendered irrelevant for the calculation of the overall Baccalaureate score and converted to an objective aptitude test, which students cannot fail, but in which they can qualify as an "excellent," "good," or "sufficient" language user (performance levels are marked by a score of 3, 2, and 1, respectively). As the same skills are required for the two exams but the written one is a high-stakes while the oral is a no-stakes, the oral exam is the ideal placebo test described above. To make the Romanian written and oral exams comparable we start by translating the latter exam scores, available only on a non-cardinal scale, into percentile ranks using the data from 2010-2012.[28] Next, we standardize both the

[27] The Romanian language exam covers the same topics from all four high school years; the oral exam takes place a couple of weeks before the written.

[28] We use percentile ranks since the oral exam is expressed on an ordinal scale. This is a useful transformation because if, for instance, the distribution of scores is such that there are relatively few students with a level 3

percentile rank oral Romanian scores and the written Romanian scores (mean zero, standard deviation one) for the 2010-2012 cohorts.

We report the results from this exercise in Table 3. Note that the structure of Table 3 is somewhat different from Table 2. In columns 1-4 we show results for the written Romanian exam and in columns 5-8 for the oral Romanian exam, both standardized.[29] Columns 1 and 5 show results from a simple specification with only (except for county fixed effects) an indicator variable equal to 1 in 2011 and 2012 (*After11*), when the corruption-fighting campaign was in effect, and zero in 2010, when it was not.[30] In column 1, we find that the scores on the written Romanian exam decreased sharply in 2011-2012 relative to 2010, which is line with the graphical evidence in Section 4. The drop is equivalent to about one-third of a standard deviation. When we look at the oral exam (column 5) we find instead a small *increase* in scores. This suggests that the impact of the overall campaign in curbing corruption is real.

Next, in columns 2 and 6 we also add the camera indicator in an attempt to tease out the effect of increased monitoring from the overall effect of the campaign. In these specifications, we argue that the 2011-2012 indicator captures the impact of the threats of punishment for the written Romanian exam. In column 2 we see that the monitoring did make up a non-trivial part, about one-third, of the overall campaign effect. The DD estimate is statistically insignificant and very small when we look at the oral exam. We also estimate the model allowing for separate year effects (as in Table 2) and see again that the 2011 and 2012 year indicators for the oral exam have the opposite sign and are much smaller in magnitude than those for the written exam, confirming that performance was not negatively affected by a general year trend; if anything, scores may have actually increased, in which case the 2011 effect for the written

score, then these students get a higher rank score. Note also that, since we also want to compare the estimates for the year indicators, we rank the scores using all three years combined.

[29] Because the oral Romanian exam is a no-stake exam, the use of CCTV cameras was optional (even in 2012), and actually very few schools monitored this exam. We do not know which schools had CCTV cameras during the oral Romanian exam.

[30] We experimented with an regression discontinuity design using birth months as running variable, hence just adding month of birth to the specification in columns 1 and 5. This generated similar results for the 2011-2012 treatment dummy. However, the sensitivity analysis revealed problems with endogenous location around the cutoff due to a very non-strict rule of when during the year a pupil could start school.

exam may be underestimated. By association with the baseline findings, these results tell us that the year effects do not seem to explain the negative 2011 change in written exam scores.

Overall, these results lend support to our hypothesis that the increased threat of punishment brought by the campaign has curbed corruption, as seen in the drop in scores. Importantly, the drop in scores in non-monitored counties supports this hypothesis, but this does not imply that the incentive effect is independent from that of monitoring. Given that these counties would have plausibly also perceived a higher detection risk, even in the absence of cameras, the punishment threat came into effect because it was enabled by enhanced monitoring. The campaign was even more effective when the probability of detection was even higher, in the presence of CCTV monitoring.

6.1.3. Additional evidence on the effectiveness of monitoring combined with punishment

The setup we have does not include a situation where monitoring increases in the absence of punishment. However, as theory and a few empirical studies suggest, increasing the probability of detection is unlikely to work without increasing the costs to being detected, and equally, punishment is ineffective if the chances it will be applied are very low. To offer additional evidence that monitoring and punishment are most effective if combined, we take advantage of a similar policy in Moldova, a neighbor country with a very similar education system as Romania,[31] facing similar corruption problems in connection with the high-stake Baccalaureate exam. Inspired by the Romanian anti-corruption policy, a crackdown on Baccalaureate corruption in Moldova started in 2012, when the Ministry of Education obliged students to sign a special document just before the exam confirming that they are free of any additional source of cheating (mobile phones, books) during the exam and if caught with any source of cheating they would be banned from the exam for at least a year, regardless of whether they used the source or not. If caught taking bribes or letting the students cheat,

[31] In Moldova more than 76% of the population speak Romanian as their native language, and the Baccalaureate, which is very similar to the one in Romania, includes also a Romanian language written test.

teachers would also be punished.[32] In addition to these punishment threats, a new methodology prescribed mandatory installation of CCTV cameras in all exam centers in 2013.[33] This roll-out is similar to the Romanian anti-corruption campaign, but with a one-year lag; yet the threat of punishment in 2012 in Moldova was not as credible as it was in the 2011 Romanian case (due to Romania's unprecedentedly high number of trials related to the 2010 exam fraud). Therefore, we expect a less significant drop in pass rates in 2012 in Moldova relative to the large drop in 2011 in Romania.

Figure 3 shows a comparison of the evolution of pass rates in the two countries from 2007 to 2013. The Moldavian pass rates were still anchored at above 90% until 2012, while in Romania, where the campaign was well underway in 2011, the pass rates were drastically reduced to 44%. Moldavian pass rates sustained a mild drop in 2011 and 2012, reaching 88.3% in 2012. However, when the CCTV cameras were introduced in 2013, we note a 20% drop in pass rates in Moldova (reaching 68.3%). The figure suggests that the intended effects of the anti-corruption campaign were felt in both countries when a high level of monitoring coupled with punishment was reached (in 2011 and 2012 in Romania and in 2013 in Moldova).

We conclude that monitoring and punishment interact with each other and, more specifically, that monitoring enables and enhances the effectiveness of punishment.

6.2. Heterogeneous Effects of the Anti-Corruption Campaign

After having established that the campaign had a drastic effect on the test scores and probability of passing the Baccalaureate high-stake exam for the average student, in this section we focus on the efficiency and distributional side effects of curbing corruption and, in particular, look at the heterogeneous impact for

[32] There was no clear rule but the methodology stipulated that the punishment would be according to the Moldavian Labor Code. In addition, in 2012 the methodology introduced a recommendation to install CCTV cameras, but this recommendation was not followed ("The video cameras *may* be introduced in exam centers"). (Source: The Baccalaureate Methodology for the organization of the 2012 Baccalaureate exam, section IV, article 50.)

[33] The Baccalaureate Methodology for the organization of the 2013 Baccalaureate exam, section IV, article 48.

students who differ in ability, poverty and gender. We already saw from the evolution of scores in Figures 2a-2c that the groups particularly affected by the camera policy are the same groups for which the exam outcomes dropped the most from 2010 to 2012: poor, low-ability, and male students.

To lend additional credibility to these findings we now turn, in Table 4, to a regression analysis using the DD approach as specified in equation (1), but now applied to sub-samples of students that differ in background characteristics: ability (columns 1 and 4), poverty status (columns 5 and 8), and gender (columns 9 and12).[34] We estimate separate regressions for low- and high-ability,[35] poor and non-poor,[36] and male and female students, respectively. To save space, we only show results for the full specification, including the camera and year indicators, as well as additional controls. The estimates for the camera and year indicators from specifications that do not include controls for background variables are almost identical. This is reassuring as it means that mean-reversion is not driving the differences in results across groups.

Focusing on the camera effect, we find larger negative effects for low-ability students than for their high-ability peers. For the written Romanian exam (columns 1-2), the exam monitoring resulted in 0.354 unit lower test scores (about one-sixth of a standard deviation), which is three times as large of a drop as seen for high-ability students; for the pass rates we also see difference between high and low-ability students, but it is smaller and not statistically significantly different. Next, the results for poor and non-poor students confirm again the graphical analysis from Section 4: as a result of the camera policy, poor students' test scores decreased twice as much and pass rates about 50% more compared with non-poor students. For males and females we see a smaller difference, although the directions of the effects reconfirm that those doing worse pre-campaign lose more.

Next, we attempt to draw some inferences about changes over time, from a fully corrupt (in 2010) to a less corrupt system (in 2012 when the anti-corruption

[34] Results with school indicators are very similar.
[35] We divide students into high and low ability, according to an average graduation score above/below the median 8.81.
[36] Poor students are defined according to MHS recipient status; see the discussion in Appendix A2.

policy was fully implemented). We use a similar placebo test as in Table 3 for the years 2010-2012. Table 5 shows results separately by ability (Panel A), poverty (Panel B) and gender (Panel C) for the low-stakes oral and the high-stakes written Romanian exam. As in Table 3, for comparability, both outcomes are standardized results. The magnitudes of the differences in the estimates across groups are qualitatively similar as in Table 4, although here expressed in standard deviation units. The pattern of estimates for the oral exam is quite striking, as the estimates for the camera indicator and the year indicators are very similar across groups regardless of whether we compare high and low ability, poor and non-poor, or males and females. The only exception is for the oral exam in 2012, where low-ability students scored lower than high-ability students (conditional on camera implementation). However, this difference is still half as big as the difference for these groups on the high-stakes exam. This is very reassuring and suggests that the difference in year effects across groups for the Romanian written exam can credibly be said to reflect the overall effect of the campaign, as there are no comparable differences between pre- and post-campaign years for the low-stakes exam.

From the estimates reported in Table 5 we can therefore conclude that the drop in Baccalaureate high-stakes exam scores caused by i) the camera installation is about 0.18 SD larger for the low-ability students, 0.13 SD units larger for poor students, and about 0.08 SD units larger for males; ii) the corruption-fighting initiatives, such as threat of punishment (net of the CCTV monitoring), is about 0.20 SD larger for the low-ability students, 0.06 SD units larger for poor students, and about 0.05-0.10 SD units larger for males; iii) the combined effects of the anti-corruption campaign one year after implementation (in 2012 vs. 2010) is about 0.43 SD larger for the low-ability students, 0.19 SD units larger for poor students, and about 0.18 SD units larger for males.[37] Hence, both the monitoring and the punishment component of the anti-corruption campaign reduced the corruption opportunities in the high-stakes tests more for

[37] We do not show specifications with only year effects for 2012, but the total effects of the campaign in 2012 vs. 2010 can simply be obtained from the table by adding the camera and year 2012 estimates for each group and then comparing these sums across groups.

poor and low-ability students, driving their larger drop in scores between 2010 and 2012. We conclude that our estimates show that disadvantaged students became even worse off following the corruption-fighting initiatives. While in the case of ability the campaign revealed the true standing of students, in the case of poor students the campaign may have had adverse effects – an issue explore further below.

Figure A3.1 (Appendix A3) provides an alternative way of presenting the heterogeneous effects, by displaying the written Romanian exam score distributions separately by group (and by subgroup), for 2010 (unhindered corruption) compared with 2012 (little or no corruption). The distribution by ability (in Figure A3.1[a]) shows the high-ability students to the far-right of the distribution scores; the score distribution for this group is slightly flatter in 2012 than in 2010. In contrast, the low-ability students' score distribution becomes flatter and also less spread out, with a larger spike at 5 (the passing threshold) in 2012 relative to 2010. Figure A3.1(b) shows that males are worse off in 2010 and their situation further deteriorates in 2012. Next we consider the differences between poor and non-poor students. The score distributions by poverty status (Figure A3.3[c]) display a large frequency shift from high to low scores in 2012 relative to 2010 for both poor and non-poor, but more pronounced for the already disadvantaged poor students.

To conclude, the heterogeneity results shown in this section indicate some interesting findings. First, in line with our initial hypothesis, the high-ability students, even after controlling for their poverty status, seem to benefit relatively more from a system with little or no corruption. This is not surprising as high-ability students should be less reliant on cheating or paying bribes to pass the exam. The differences in CCTV monitoring and the year effects between students of different abilities are quite large and statistically significant, hinting that the low-ability students had relied to a larger extent on cheating and/or other means of fraud before the campaign.

Secondly, we show that the poor students may perform worse in a less corrupt system. This is actually not in line with our prior that, while both poor and

non-poor students would benefit from collective bribes and cheating, the non-poor would additionally benefit from individual bribes as this form of corruption requires sizeable bribes (money) and access to the corruption networks (see discussion in Section 2.2). Intuitively, the non-poor should be able to afford the required payments, as well as gifts and private tutoring with in-class teachers. Moreover, those from a privileged economic background typically also enjoy a high social standing, which should grant them easy access to the nepotistic networks.[38] Overall, if the campaign would eliminate both forms of corruption, we would expect the non-poor students to lose more in a non-corrupted environment.

So what could explain the wider score gap between poor and non-poor students? One potential concern is that the proxy for poverty reflects not only socioeconomic status but also some potential effect of the MHS program (used to define poverty status) on the recipients. In order to ensure that this is not the case, we compare students just below with students just above the cutoff income for receiving MHS in 2005-2006, which was the only year when funds were short of the demand and some eligible students did not receive the money (to save space, the details on the data and strategy for this test are shown in Appendix A2). The RD estimate of the treatment effect is insignificant, indicating that a potential MHS treatment is not a concern here. We therefore proceed to discuss some other potential channels leading to the observed increased score gap:

i) Increased private tutoring or parental investment for the non-poor. To rule out the private tutoring channel we consider additional data from the 2010-2012 Romanian Household Budget Survey and observe no increase in private tutoring for high school students in 2010-2012. It is also possible that parents of non-poor students may have substituted bribes for more time spent working on homework or exam preparation. This is less likely to have generated a large effect in 2011, as the camera policy was implemented in May, leaving very little time for extra preparation. However, in 2012 this behavioural effect could partly account for our result.

[38] Note that this is also in line with the generally lower performance of poor students relative to non-poor before 2011.

ii) Stronger cheating norms for the poor. One way to dismiss this channel is to look at the share of students eliminated from the exam (caught cheating) (see Table A3.2), which before 2011 shows no difference between rich and poor students.

iii) *Collective vs. individual bribes.* We believe that one key to understanding the detrimental effects of the campaign on the poor lies in the various mechanics of the bribing process. If poor cheat as much as rich, without being able to afford bribes, the poor students' ability to take part in the fraud can only come as a result of free-riding. A good candidate explanation for this opportunity lies in the mechanism of collective bribing, which is essentially used to provide a "public good." If some students contribute, the benefit is *collective* and everyone, including poor students, can take advantage of the slack proctoring. Given some level of ability, the annihilation of cheating practices (likely coupled with particular unobserved traits, like motivation and the educational investment of poor students throughout high school) generates lower results for the poor students. This implies that monitoring and punishment reveal wide pre-existing inequalities, previously concealed by corruption. A complementary explanation may lie in that only richer students can afford *individual bribes*. Recognizing the existence of a well-developed market for bribes, the poor student could not afford the required amounts or services. Moreover, following the implementation of the anti-corruption campaign it is likely that teachers could have substituted collective for more individual bribes, pricing out the poor students.[39] It is unlikely that monitoring and punishment threats can fully eradicate this form of corruption, as revealed by further anecdotal evidence from crackdowns on corruption in some exam centers in 2012 and 2013.

7. The Short-Term Impact of the Anti-Corruption Campaign: Preliminary Evidence from Admission into an Elite University

As revealed in the heterogeneity analysis, the corruption-fighting campaign led to a separation of ability types and a reshuffling of the students in the score

[39] This displacement effect has been documented in the CCTV and crime literature. See Priks (2015).

distribution, by income. These changes may have direct implications for the selection of students into higher education.[40] In this section we document the short-term consequences of the anti-corruption campaign by using admission data from an elite university in Romania.[41] This university admits about the same number of students every year; all admitted students are ranked according to an overall score and the top 55 to 65% are exempt from the tuition fee (*la buget*), while the rest pay a monthly fee.[42] We have the following information for the admitted students at this elite university from 2009 to 2012: the overall Baccalaureate grade, the overall high school grade, name and date of birth, the county and school they come from, whether or not they are tuition exempt, and home department at the university. We merge this information with our main data by name, date of birth, gender, county and the Baccalaureate grade and end up with a sample of 15,395 admitted students with a full education history.[43] In what follows we label the group of tuition-exempt students "top students" and the group of tuition-paying students "good students."

To understand whether there is any change in the composition of students admitted in the elite higher education due to corruption-reducing measures, in Table 6 (Panel A – all students; Panel B – top students; Panel C –good students), we provide estimates from regressions based on equation (1), but where the dependent variable is student's *ability* (columns 1-3), *poverty* (columns 4-6), and *male* (column 7). We cannot infer anything from the changes in these outcomes

[40] The total number of students in higher education (university) decreased from 775,319 in 2009 to 464,592 in 2012. The biggest drop took place at the private universities (from more than 300,000 to less than 100,000 students in four years), while the number of students enrolled (regardless of year of study) at public universities decreased from about 452,892 in 2009 to 364,916 in 2012.

[41] This is one of the oldest and highly regarded universities in Romania, with a long tradition of attracting elite students from all over the country. Students admitted here are usually in the top 15% of the overall high school scores and Baccalaureate grades. The proportion of accepted students coming from CCTV-monitored counties is about 77%.

[42] The number of students admitted to the university was relatively constant across years: 4,742 (in 2009), 3,792 (in 2010), 4,937 (in 2011), and 4,648 (in 2012); students are exempt from the tuition fee (*la buget*) contingent on the Ministry of Education's budgetary allocation each year; the remaining students need to pay a tuition fee of roughly 85 USD/month.

[43] We cannot fully merge the two data sets because of some duplicates. We do not have the Baccalaureate (they are from older cohorts), the poverty and/or ability measure for about 2,400 students. The attrition rate is however fairly constant across years, at less than 10%. Note that our final sample of 15,395 students includes 660 students who took the Baccalaureate before the university admission year (i.e., about 85% took the Baccalaureate in 2009 and 2010 and applied in 2011 and 2012, respectively). This may signal that our results are contaminated with students who got accepted with inflated Baccalaureate grades. In the regressions below we control for these students, although the results are very similar if we exclude them from the regressions.

across years for two reasons. First, since the mean 5^{th}-8^{th} grade score, which we, as before, use as a proxy for ability, increased from 2010 to 2012, there is an increased likelihood that among those admitted to the elite university, we will observe a higher mean ability score over time. The same argument holds when we look at the changed composition of the top 20% Baccalaureate performers below. There is also a slight change in the fractions of poor and males over time. Second, the admission rules changed slightly every year.[44] We therefore standardize the ability score to have mean zero and SD one for each year in the estimations. Hence, we can only credibly separate out the effect of camera monitoring on the composition of admitted students.

The insignificant camera estimate in column 1 (Panel A) indicates that the admitted students are on average of the same ability, regardless of whether or not they were treated with additional monitoring (in addition to punishment threat). This holds both for poor and non-poor students (columns 2-3). Admitted CCTV-monitored students are 3.3% less likely to be poor than those not monitored (column 4), while a breakdown of this effect by groups below and above the 50th ability percentile (columns 5-6) shows that the disadvantage of poor students arises mainly in the low-ability group. The composition in terms of gender has not changed (column 7).

Interestingly, the results in Panel B for the top students show a clearer pattern, especially for the composition in terms of ability (column 1): the admitted students from CCTV-monitored counties seem to have a higher ability, for both poor and non-poor students (columns 2-3), even though the results are less precise for the poor due to small sample size. Also, similar to Panel A, among the top admitted students, those who were CCTV-monitored are less likely to be poor

[44] While the Baccalaureate grade remains the most important piece of the final admission score, its share changed from 50% of the admission score (in addition to 25% high school grades and 25% the university's own admission exam) in 2009 and 2010 to 67% (and 33% high school grades) in 2011 and 100% of the admission score in 2012. This change implies that the 2011 and particularly the 2012 admission scores were far less inflated than earlier, due to both the anti-corruption policy and the change in admission rules, reflecting the true composition of students. This should have led to a better composition in terms of admitted students' ability. However, another effect works in the opposite direction: the elimination of the very competitive own admission exam (potentially to attract more students) may have meant that lower ability students stood a better chance to be admitted. This may bias the camera and the 2011 and 2012 year effects downwards.

(column 4). This effect comes from the lower ability poor students (column 5). The results in Panel C for good students mirror the results in Panel A, but are not significant.

As an additional exercise, we run the same regressions on a subsample of Baccalaureate students who were in the top 20% of the final Baccalaureate scores each year. We expect these students to be the top contenders for elite universities. The estimates, displayed in Table 7, convey the same effects of the campaign on student composition that we see for the university admission sample (particularly the top, tuition-exempt students). The results reassure that monitoring contributed to an improvement in ability, but also confirm that the poor students' chances to snag the top places were significantly reduced.

Taken together, these estimates strengthen the finding that the anti-corruption campaign resulted in increased inequality between poor and non-poor students. The poor students with low-ability had significantly reduced chances of entering higher education, especially those with tuition-exempt status. Interestingly, the ability is more important now, especially for the non-poor students admitted on a tuition-exempt basis.

8. Conclusions and Discussion

This paper adds a new building block to the understanding of corruption in two dimensions. Firstly, it provides additional evidence that punishment coupled with monitoring are effective in reducing corruption even in settings where the potential gains from corruption are very large. Second, it analyzes the ramifications of fighting corruption from a distributional perspective – an issue largely overlooked in previous studies.

We make use of a setting where corruption in education is rampant and has large gains for students, i.e., the Romanian national school-leaving exam, the Baccalaureate. We exploit a nationwide anti-fraud campaign that began in 2011 featuring both increased credible threat of punishment (for teachers and students) and increased monitoring during the exam. We make use of the variation across years and counties in closed-circuit TV (CCTV) exam monitoring to calculate the effect of the campaign on Baccalaureate exam scores. Our results indicate that the

campaign was more effective when the probability of detection was higher, i.e., in the presence of CCTV monitoring. While the punishment component was implemented in the whole country at the same time, because of its strict implementation and the use of a placebo exercise, we can say that increased punishment brought about by the campaign has curbed corruption, as seen in the drop in test scores. We conclude that monitoring and punishment interact with each other and, more specifically, monitoring enables and enhances the effectiveness of punishment.

After having established that the campaign had a drastic effect on the test scores and on the average student's probability of passing the Baccalaureate high-stake exam, we show the efficiency and equity side effects of curbing corruption and, in particular, look at the heterogeneous impact by students' ability, poverty and gender. Not surprisingly, we find that high-ability students seem to benefit relatively more from a system with little or no corruption, as the low-ability students relied to a larger extent on cheating and/or other means of fraud before the campaign. Yet, when it comes to the poor, disadvantaged students, we show that they perform even worse in a non-(less) corrupt system, an ex-ante unexpected pattern.

Finally, we also look at the composition of students at an elite university. The results strengthen the finding that the anti-corruption campaign revealed a greater inequality between poor and non-poor students than the apparent pre-campaign level. More exactly, we find that poor students' (with low ability) chances of entering higher education went down significantly, especially with regard to tuition-exempt admission.

An important lesson from these results is that anti-corruption programs are not a cure for all ills. In terms of inequality of opportunity, the finding that poor students do worse in a non-corrupt state is especially important for policy makers. This result uncovers the wide pre-existing inequalities between the poor and the well-off students, which corruption had only concealed. The implication is that, in addition to maintaining the anticorruption strategies, there is a need for more in-depth investigation of the differences in achievement between poor and non-poor.

The implications of these findings extend to other countries, such as Moldova or Cambodia, where, similar anti-corruption measures for high-stake exams are currently being discussed and implemented, and where the initial inequality level is already very high.

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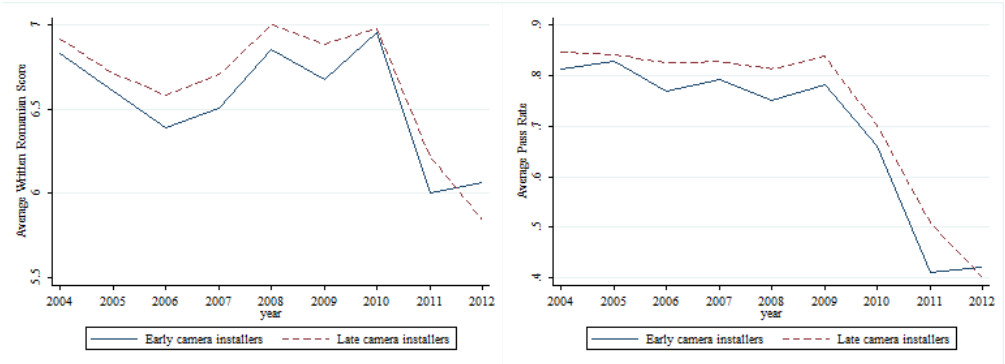
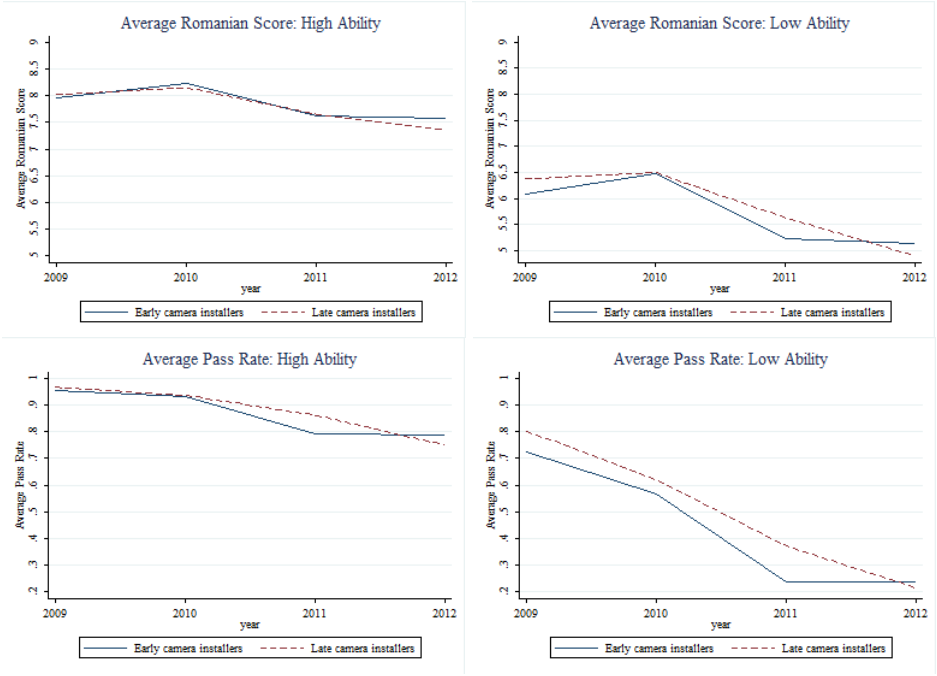
FIGURES

Figure 1. Baccalaureate score evolution 2004-2012, by early and late camera installation

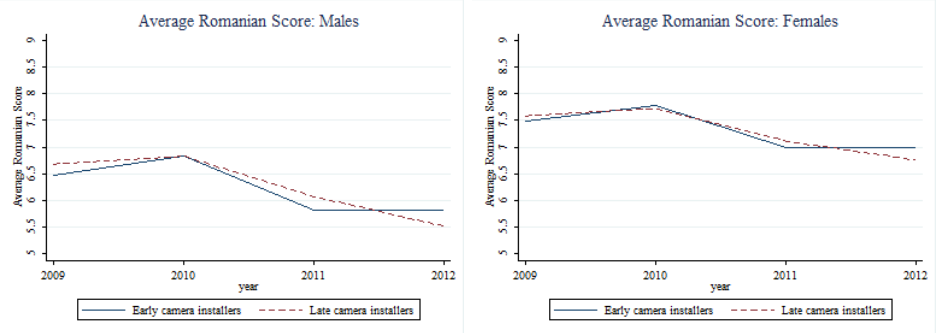


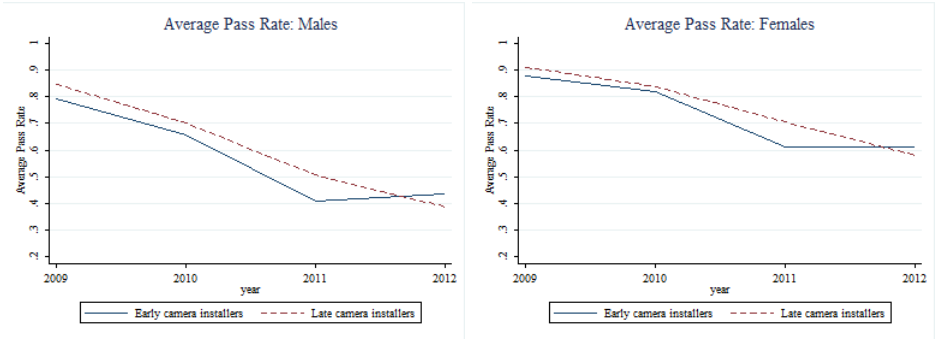
Notes: The figure displays the average Romanian written exam scores (left) and overall pass rates (right) separately for counties that did and did not implement the camera in 2011. The average scores are displayed on the y-axis, while the x-axis displays the years from 2004 to 2012.

Figure 2. Baccalaureate average scores, by early and late installation, and by groups (2A) By Ability

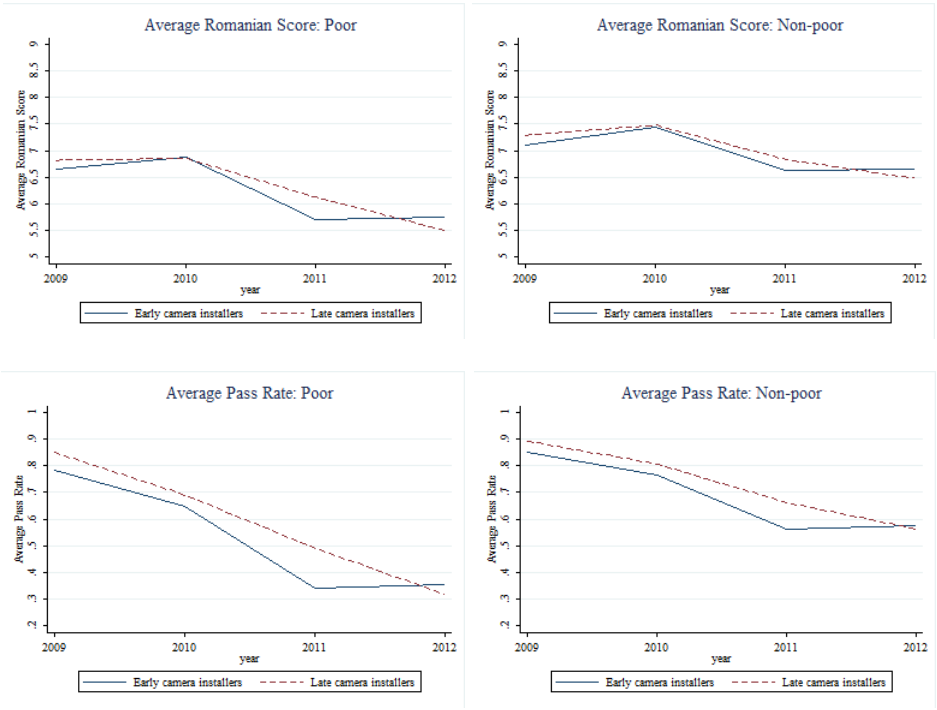


(2B) By Gender



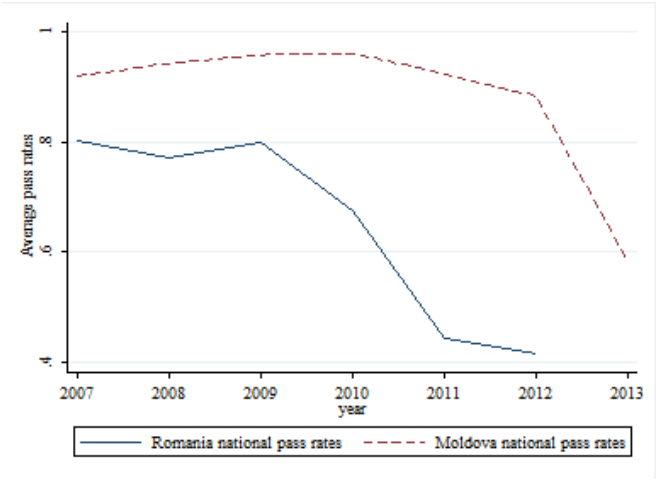


(2C) By Poverty Status



Notes: The figures display the average Romanian written exam scores (top) and overall pass rates (bottom) by groups (by ability – Figure 2A, by gender – Figure 2B, and by poverty status – Figure 2C) and separately for counties that did and did not implement the camera in 2011. The average scores are displayed on the y-axis, while the x-axis displays the years from 2009 until 2012.

Figure 3. Baccalaureate National Pass Rates in Romania and Moldova, 2007-2013



Notes: The figure displays the average national pass rates in Romania 2007-2012 (blue) and Moldova 2007-2013 (red dashed). The figures for Moldova are retrieved from the government website www.bloguvern.md. The figures for Romania are the authors' own calculations using the available individual-level datasets (hence the 2013 figure for Romania is missing). The average pass rates are displayed on the y-axis, while the x-axis displays the years from 2007 to 2013.

TABLES

Table 1. Summary statistics

	2009		2010		2011		2012	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Written Romanian score	7.073	1.769	7.323	1.570	6.510	2.007	6.377	2.065
Pass	0.852	0.354	0.753	0.431	0.549	0.498	0.519	0.500
Oral Romanian score			2.545	0.661	2.584	0.654	2.560	0.672
Percentile rank oral **			-0.038	1.007	0.033	0.998	0.006	1.002
Percentile rank written **			-3.202	0.131	-3.265	0.153	-3.273	0.153
Poor	0.200	0.400	0.222	0.415	0.229	0.420	0.227	0.419
Ability (Score 5-8th grade)	8.635	0.927	8.619	0.939	8.650	0.934	8.732	0.897
Male	0.455	0.498	0.466	0.499	0.465	0.499	0.451	0.498
Theoretical track	0.509	0.500	0.485	0.500	0.501	0.500	0.530	0.499
Rural	0.043	0.202	0.048	0.214	0.051	0.220	0.053	0.223
*N**	146,576		143,380		136,902		127,045	

Notes: The table displays descriptive statistics by year for the overall sample. *****The number of observations for the Romanian written and oral exams is slightly smaller; **Standardized numbers

Table 2. The impact of the anti-corruption campaign: main results; 2009-2012 academic years

	Written Romanian		Baccalaureate pass	
	(1)	(2)	(3)	(4)
Camera	-0.222**	-0.237***	-0.083***	-0.084***
	(0.088)	(0.084)	(0.026)	(0.025)
Year12	-0.719***	-0.888***	-0.151***	-0.180***
	(0.068)	(0.057)	(0.021)	(0.018)
Year11	-0.667***	-0.707***	-0.150***	-0.158***
	(0.051)	(0.052)	(0.015)	(0.014)
Year09	-0.253***	-0.297***	0.099***	0.090***
	(0.051)	(0.056)	(0.009)	(0.009)
Male		-0.483***		-0.039***
		(0.015)		(0.002)
Poor		-0.299***		-0.061***
		(0.018)		(0.004)
Ability		1.038***		0.184***
		(0.019)		(0.007)
Theoretical		0.602***		0.186***
		(0.030)		(0.010)
Rural		-0.163***		-0.037**
		(0.048)		(0.015)
County FE	Yes	Yes	Yes	Yes
Observations	547,447	547,447	553,903	553,903
R-squared	0.061	0.497	0.102	0.376

Notes: The table displays the estimates from the baseline Difference-in-Differences specifications for the changes in the Romanian exam scores and exam pass probability when the students were treated with the camera monitoring, relative to before the monitoring was introduced. Standard errors are clustered at county level. *** p<0.01, ** p<0.05, * p<0.1

Table 3. Placebo test: Written vs. oral Romanian score, standardized; 2010-2012 academic years

	High-stakes exam - Written Romanian exam				No-stakes exam - Oral Romanian exam			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Camera		-0.119***	-0.090***	-0.093***		-0.012	0.013	0.007
		(0.030)	(0.030)	(0.029)		(0.018)	(0.020)	(0.020)
After11	-0.328***	-0.230***			0.059***	0.069***		
	(0.017)	(0.026)			(0.010)	(0.019)		
Year 12			-0.271***	-0.284***			0.033	-0.032
			(0.026)	(0.027)			(0.025)	(0.026)
Year 11			-0.236***	-0.240***			0.064***	0.053***
			(0.025)	(0.025)			(0.019)	(0.019)
Male				-0.280***				-0.152***
				(0.008)				(0.010)
Poor				-0.217***				-0.150***
				(0.010)				(0.012)
Ability				0.789***				0.474***
				(0.016)				(0.014)
Theoretical				0.287***				0.164***
				(0.016)				(0.024)
Rural				-0.141***				-0.092***
				(0.020)				(0.030)
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	400,088	400,088	400,088	400,088	400,088	400,088	400,088	400,088
R-squared	0.065	0.067	0.067	0.315	0.025	0.025	0.025	0.296

Notes: The table displays the estimates from the baseline Difference-in-Differences specifications for the Romanian written exam performance (columns 1-4) and the Romanian oral exam performance (columns 5-8). Both dependent variables are expressed in standardized percentile rank scores, using data from 2010-2012. The variable *After11* is an indicator equal to 1 for years 2011-2012 and 0 for 2010. Standard errors in parentheses are clustered at county level.*** p<0.01, ** p<0.05, * p<0

Table 4. Heterogeneous effects of the anti-corruption campaign

	Written Romanian		Baccalaureate Pass		Written Romanian		Baccalaureate Pass		Written Romanian		Baccalaureate Pass	
	High Ability	**Low Ability**	**High Ability**	**Low Ability**	**Poor**	**Non-Poor**	**Poor**	**Non-Poor**	**Male**	**Female**	**Male**	**Female**
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Camera	-0.117*	-0.354***	-0.076***	-0.095***	-0.423***	-0.189**	-0.122***	-0.078***	-0.294***	-0.187**	-0.080***	-0.088***
	(0.060)	(0.110)	(0.017)	(0.032)	(0.092)	(0.083)	(0.025)	(0.024)	(0.101)	(0.072)	(0.028)	(0.022)
Year12	-0.591***	-1.124***	-0.084***	-0.269***	-0.990***	-0.854***	-0.236***	-0.159***	-1.012***	-0.787***	-0.207***	-0.157***
	(0.044)	(0.076)	(0.011)	(0.025)	(0.066)	(0.060)	(0.024)	(0.017)	(0.075)	(0.048)	(0.022)	(0.015)
Year11	-0.493***	-0.901***	-0.066***	-0.246***	-0.783***	-0.688***	-0.202***	-0.143***	-0.778***	-0.647***	-0.187***	-0.133***
	(0.040)	(0.062)	(0.008)	(0.019)	(0.056)	(0.052)	(0.017)	(0.014)	(0.062)	(0.045)	(0.016)	(0.013)
Year09	-0.231***	-0.364***	0.024***	0.152***	-0.275***	-0.296***	0.118***	0.085***	-0.353***	-0.245***	0.124***	0.062***
	(0.039)	(0.074)	(0.004)	(0.014)	(0.071)	(0.055)	(0.015)	(0.009)	(0.065)	(0.050)	(0.011)	(0.008)
Poor	-0.497***	-0.305***	-0.088***	-0.067***					-0.320***	-0.274***	-0.073***	-0.051***
	(0.020)	(0.019)	(0.005)	(0.006)					(0.018)	(0.019)	(0.005)	(0.005)
Male	-0.671***	-0.619***	-0.060***	-0.069***	-0.561***	-0.461***	-0.061***	-0.032***				
	(0.016)	(0.018)	(0.004)	(0.004)	(0.015)	(0.015)	(0.003)	(0.003)				
Theoretical	0.875***	1.011***	0.178***	0.301***	0.533***	0.606***	0.207***	0.176***	0.650***	0.558***	0.195***	0.179***
	(0.041)	(0.044)	(0.011)	(0.014)	(0.047)	(0.028)	(0.015)	(0.009)	(0.029)	(0.030)	(0.011)	(0.010)
Rural	-0.353***	-0.340***	-0.084***	-0.065***	-0.119**	-0.227***	-0.029*	-0.053***	-0.196***	-0.128**	-0.035**	-0.039**
	(0.044)	(0.065)	(0.019)	(0.017)	(0.056)	(0.051)	(0.016)	(0.018)	(0.052)	(0.049)	(0.014)	(0.018)
Ability					0.921***	1.076***	0.160***	0.192***	0.952***	1.136***	0.175***	0.194***
					(0.016)	(0.020)	(0.005)	(0.007)	(0.017)	(0.023)	(0.006)	(0.008)
County FE	Yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Obs.	276,905	270,542	277,618	276,285	118,812	428,635	121,374	432,529	250,222	297,225	254,360	299,543
R-squared	0.200	0.244	0.137	0.294	0.449	0.500	0.384	0.365	0.451	0.468	0.370	0.355

Notes: The table displays the estimates from baseline Difference-in-Differences specifications for the Romanian written exam and exam pass probability, for different subgroups of students, divided by: ability (columns 1-4), poverty status (columns 5-8), gender (columns 9-12). Standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Placebo test by ability, poor, and gender. Written Romanian vs. percentile rank oral Romanian score, standardized; 2010-2012 academic years

	High-stakes exam		Low-stakes exam	
	Written Romanian exam		Oral Romanian exam	
	(1)	(2)	(3)	(4)
PANEL A: Ability				
	High ability	**Low ability**	**High ability**	**Low ability**
Camera	-0.046	-0.228***	0.053	0.086
	(0.042)	(0.066)	(0.039)	(0.071)
Year12	-0.331***	-0.581***	-0.041	-0.150**
	(0.045)	(0.067)	(0.044)	(0.074)
Year11	-0.271***	-0.445***	0.017	0.008
	(0.032)	(0.047)	(0.030)	(0.050)
Poor	-0.222***	-0.120***	-0.141***	-0.168***
	(0.014)	(0.018)	(0.014)	(0.018)
Ability	0.787***	0.502***	0.389***	0.504***
	(0.017)	(0.011)	(0.021)	(0.019)
Theoretical	0.283***	0.304***	0.174***	0.170***
	(0.018)	(0.020)	(0.022)	(0.035)
Male	-0.283***	-0.211***	-0.142***	-0.167***
	(0.009)	(0.010)	(0.009)	(0.013)
County FE	Yes	Yes	Yes	Yes
Observations	202,032	198,056	202,032	198,056
R-squared	0.289	0.341	0.082	0.134
PANEL B: Poverty				
	Poor	**Non-poor**	**Poor**	**Non-poor**
Camera	-0.273***	-0.146***	-0.000	0.012
	(0.048)	(0.039)	(0.027)	(0.019)
Year 12	-0.466***	-0.402***	-0.055	-0.029
	(0.038)	(0.031)	(0.035)	(0.025)
Year 11	-0.378***	-0.328***	0.054**	0.050***
	(0.036)	(0.031)	(0.025)	(0.018)
Ability	0.509***	0.588***	0.490***	0.472***
	(0.008)	(0.009)	(0.009)	(0.017)
Theoretical	0.281***	0.315***	0.131***	0.174***
	(0.023)	(0.015)	(0.023)	(0.027)
Male	-0.291***	-0.232***	-0.229***	-0.131***
	(0.009)	(0.008)	(0.015)	(0.008)
County FE	Yes	Yes	Yes	Yes
Observations	89,375	310,713	89,375	310,713
R-squared	0.476	0.522	0.274	0.286

PANEL C: Gender	**Male**	**Female**	**Male**	**Female**
Camera	-0.216***	-0.140***	0.014	0.002
	(0.048)	(0.036)	(0.026)	(0.016)
Year12	-0.471***	-0.370***	-0.036	-0.032
	(0.037)	(0.029)	(0.033)	(0.023)
Year11	-0.366***	-0.310***	0.062**	0.044***
	(0.037)	(0.030)	(0.025)	(0.015)
Poor	-0.184***	-0.152***	-0.201***	-0.126***
	(0.010)	(0.010)	(0.013)	(0.011)
Ability	0.523***	0.619***	0.476***	0.474***
	(0.008)	(0.010)	(0.015)	(0.014)
Theoretical	0.342***	0.287***	0.194***	0.138***
	(0.015)	(0.015)	(0.026)	(0.024)
County FE	Yes	Yes	Yes	Yes
Observations	182,943	217,145	182,943	217,145
R-squared	0.485	0.488	0.272	0.265

Notes: The table displays the estimates from the baseline Difference-in-Differences specifications for the Romanian written exam performance (columns 1-4) and the Romanian oral exam performance (columns 5-8), for different subgroups of students, divided by: ability (Panel A), poverty status (Panel B), and gender (Panel C). Both dependent variables are expressed in standardized percentile rank scores, using data from 2010-2012. Standard errors in parentheses are clustered at county level.*** p<0.01, ** p<0.05, * p<0.1

Table 6. Composition of cohorts admitted to an elite university 2009-2012.

	Ability (Standardized)			Poor			Male
	All	Poor	Non-poor	All	Low ability	High ability	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: ALL ADMITTED STUDENTS							
Camera	0.057	0.059	0.058	-0.033***	-0.051**	-0.016	-0.025
	(0.049)	(0.198)	(0.045)	(0.012)	(0.024)	(0.020)	(0.022)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	15,395	813	14,582	15,395	7,762	7,633	15,395
R-squared	0.039	0.085	0.040	0.039	0.048	0.039	0.019
Panel B: TUITION-EXEMPT STUDENTS (the top students)							
Camera	0.130***	0.161	0.128**	-0.035**	-0.060**	-0.019	-0.040
	(0.045)	(0.154)	(0.048)	(0.013)	(0.024)	(0.022)	(0.029)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	9,777	546	9,231	9,777	3,973	5,804	9,777
R-squared	0.045	0.079	0.046	0.038	0.052	0.037	0.020
Panel C: TUITION-PAYING STUDENTS (good students)							

Camera	0.082	-0.015	0.086	-0.032	-0.038	-0.023	-0.042
	(0.086)	(0.470)	(0.072)	(0.027)	(0.036)	(0.038)	(0.040)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	5,618	267	5,351	5,618	3,789	1,829	5,618
R-squared	0.027	0.207	0.026	0.059	0.064	0.080	0.023

Notes: The table displays the baseline Difference-in-Differences specifications for the composition of admitted university students in terms of ability (columns 1-3), poverty status (columns 4-6) and gender (columns 7). The estimates for the changes in composition in terms of ability are further divided by poverty status (columns 2 and 3) the estimates for the changes in terms of poverty status are further divided by students' ability (columns 5 and 6). All regressions include a dummy indicator for students who took the Baccalaureate before the year of university admission. Results are similar if we do not include this indicator. Standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.10.

Table 7. Composition of students in the top 20% of the final Baccalaureate score distribution.

	Ability Standardized			Poor			Male
	All	Poor	Non-poor	All	Low ability	High ability	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Camera	0.047**	0.092***	0.038*	-0.023***	-0.020***	-0.024	-0.008
	(0.020)	(0.030)	(0.020)	(0.007)	(0.007)	(0.018)	(0.008)
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
County FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Obs.	108,461	11,681	96,780	108,461	100,383	8,078	108,461
R-squared	0.030	0.041	0.028	0.046	0.043	0.074	0.003

Notes: The table displays the baseline Difference-in-Differences specifications for the composition of students in the top 20% of the Baccalaureate final score distribution, in terms of ability (columns 1-3), poverty status (columns 4-6) and gender (columns 7). The estimates for the changes in composition in terms of ability are further divided by poverty status (columns 2 and 3) the estimates for the changes in terms of poverty status are further divided by students' ability (columns 5 and 6). Results are similar if we do not include this indicator. Standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.10.

APPENDIX – FOR ONLINE PUBLICATION

APPENDIX A1: *Robustness and further tests*

Table A1.1 demonstrates (in columns 1-5 for the written Romanian test and columns 6-10 for the probability of passing the Baccalaureate) that our results in Table 2 are robust to different specifications. First, since we saw some evidence from the graphical analysis that there was a tendency for the written Romanian exam scores to converge between 2009 and 2010, we want to investigate if controlling for this pattern changes the conclusions. Columns (2) and (7) include the county-specific trends, which does not change the main results (shown in columns 1 and 6). This accounts for potential selection of counties due to pre-campaign performance or corruption trends (assuming these would be linear). Columns (3) and (8) add a placebo camera indicator (equal to 1 in 2010 for the counties that were first monitored in 2011 and in year 2011 for the counties that were first monitored in 2012, and 0 otherwise), which is not significant, while the magnitude of the main coefficients does not change, even though the camera indicator in column (3) is not statistically significant.

We also exclude observations in 2010 and hold as benchmark the year 2009. This is done to rule out concerns about the estimates of interest being driven by the contrast to the exceptional events in the 2010 "Xeroxed exam." The results shown in Table A1.2 confirm that this is not the case. Moreover, when restricting the sample to 2011 and 2012 (hence the variation in monitoring comes only from late implementers), we find that counties that implemented the camera later sustained a larger drop in scores than the early implementers.

Second, one might worry that our controls are not sufficient to adjust for compositional differences between counties that were early or late camera implementers. In columns (4) and (9) we replace the county indicators with school indicators and find that the estimates and standard errors are almost identical to the baseline ones. Lastly, using the location, family name, and father's initial, we detect a sample of about 90,000 sibling students. In this sample, the exogenous variation in scores stems from a monitored and an un-monitored sibling, after netting out everything common to the siblings (e.g., family investment in

children's education).[45] The estimates shown in columns (5) and (10) do not depart from the baseline results, supporting that the pre-2011 scores were artificially inflated and that the sharp drop in scores is the impact of the anti-corruption intervention.

We have also checked whether our results are affected by the fact that our main sample excludes exam re-takes (47,910 observations) and students for whom we do not have ability as proxied by the 5^{th}-8^{th} grade scores (201,000 observations). Including re-takes and repeating the analysis without controlling for ability yield similar results as our baseline analysis.

[45] Based on intra-class correlations of 5^{th}-8^{th} grade performance, we keep the groups of two assumed siblings (for whom the intra-family correlation is 30%, a typical estimate from the literature on sibling correlations in educational achievement; see Björklund and Jäntti, 2012). Thus, the most popular surnames (seemingly yielding larger groups of siblings) are automatically excluded, thereby increasing the likelihood that we indeed identify siblings. A critique to this approach is that the exclusion of most popular names could entail the systematic exclusion of low-income students. We therefore face a trade-off between precision of sibling pairing and the extent to which the sibling sample is representative. Yet, the analysis using the extended sample of siblings (allowing for up to four students per "family") yields very similar results. At worst we have a random sample of students, and the results should be similar to the baseline estimates if the anti-corruption campaign had an effect on exam outcomes.

Table A2.1. Sensitivity analysis

	Written Romanian exam					Baccalaureate pass				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Camera	-0.237***	-0.321***	-0.205	-0.244***	-0.288**	-0.084***	-0.101***	-0.108***	-0.088***	-0.102**
	(0.084)	(0.083)	(0.142)	(0.084)	(0.137)	(0.025)	(0.023)	(0.039)	(0.024)	(0.042)
Placebo camera			0.024					-0.018		
			(0.063)					(0.025)		
Year12	-0.888***	-0.692***	-0.904***	-0.888***	-0.867***	-0.180***	-0.123***	-0.168***	-0.181***	-0.167***
	(0.057)	(0.074)	(0.083)	(0.057)	(0.100)	(0.018)	(0.016)	(0.023)	(0.018)	(0.036)
Year11	-0.707***	-0.593***	-0.720***	-0.707***	-0.661***	-0.158***	-0.127***	-0.148***	-0.161***	-0.144***
	(0.052)	(0.065)	(0.075)	(0.052)	(0.094)	(0.014)	(0.014)	(0.024)	(0.014)	(0.029)
Year09	-0.297***	-0.352***	-0.281***	-0.296***	-0.282***	0.090***	0.071***	0.078***	0.091***	0.084***
	(0.056)	(0.030)	(0.080)	(0.054)	(0.095)	(0.009)	(0.011)	(0.019)	(0.010)	(0.016)
Male	-0.483***	-0.483***	-0.483***	-0.480***	-0.508***	-0.039***	-0.039***	-0.039***	-0.036***	-0.042***
	(0.015)	(0.015)	(0.015)	(0.012)	(0.030)	(0.002)	(0.002)	(0.002)	(0.002)	(0.006)
Poor	-0.299***	-0.298***	-0.299***	-0.224***	-0.236***	-0.061***	-0.060***	-0.061***	-0.053***	-0.064***
	(0.018)	(0.018)	(0.018)	(0.011)	(0.042)	(0.004)	(0.005)	(0.004)	(0.003)	(0.012)
Ability	1.038***	1.039***	1.038***	0.854***	1.035***	0.184***	0.184***	0.184***	0.134***	0.182***
	(0.019)	(0.019)	(0.019)	(0.026)	(0.035)	(0.007)	(0.007)	(0.007)	(0.005)	(0.012)
Theoretical	0.602***	0.601***	0.602***	0.348***	0.602***	0.186***	0.185***	0.186***	0.116***	0.187***
	(0.030)	(0.029)	(0.030)	(0.029)	(0.048)	(0.010)	(0.010)	(0.010)	(0.010)	(0.016)
Rural	-0.163***	-0.161***	-0.163***			-0.037**	-0.036**	-0.037**		
	(0.048)	(0.049)	(0.048)			(0.015)	(0.015)	(0.015)		
County FE	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No
County trends	No	Yes	No	No	No	No	Yes	No	No	No
School FE	No	No	No	Yes	No	No	No	No	Yes	No
Family FE	No	No	No	No	Yes	No	No	No	No	Yes
Observations	547,447	547,447	547,447	547,447	89,967	553,903	553,903	553,903	553,903	90,915
R-squared	0.497	0.510	0.497	0.543	0.819	0.376	0.388	0.377	0.439	0.759

Notes: The table displays the estimates from alternative specifications for the Romanian written exam and exam pass probability. Columns 1-3 and 6-8 include county fixed effects. Columns 2 and include county specific linear time trends. Columns 3 and 8 include a placebo camera indicator equal to 1 in 2010 for the counties that were first monitored in 2011 and in year 2011 for the counties that were first monitored in 2012, and 0 otherwise. Columns 4 and 9 include school fixed effects. Columns 5 and 10 include family fixed effects. Standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.1.

Table A1.2. Sensitivity check: the main results without the 2010 academic year

	Written Romanian			Baccalaureate pass		
	(1)	(2)	(3)	(4)	(5)	(6)
Camera	-0.230**	-0.229**	-0.239**	-0.092***	-0.090***	-0.093***
	(0.098)	(0.095)	(0.095)	(0.026)	(0.025)	(0.025)
Year12	-0.457***	-0.607***	-0.605***	-0.241***	-0.265***	-0.266***
	(0.093)	(0.094)	(0.093)	(0.022)	(0.021)	(0.020)
Year11	-0.407***	-0.414***	-0.413***	-0.243***	-0.243***	-0.245***
	(0.080)	(0.084)	(0.084)	(0.019)	(0.019)	(0.019)
Male		-0.504***	-0.500***		-0.037***	-0.034***
		(0.018)	(0.015)		(0.002)	(0.002)
Poor		-0.326***	-0.240***		-0.068***	-0.056***
		(0.019)	(0.011)		(0.004)	(0.003)
Ability		1.099***	0.897***		0.186***	0.135***
		(0.021)	(0.029)		(0.006)	(0.005)
Theoretical		0.643***	0.369***		0.205***	0.130***
		(0.032)	(0.032)		(0.010)	(0.010)
Rural		-0.169***			-0.040**	
		(0.059)			(0.018)	
County FE	Yes	Yes	Yes	Yes	Yes	Yes
School FE	No	No	Yes	No	No	No
Observations	405,046	405,046	405,046	410,523	410,523	410,523
R-squared	0.044	0.491	0.542	0.114	0.397	0.456

Notes: The table displays estimates from the baseline Difference-in-Differences specifications, for the written Romanian exam scores and Baccalaureate pass probability, excluding the year 2010. Standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.1.

APPENDIX A2: *How good is our poverty proxy?*

In this digression we scrutinize the quality of our poverty proxy. Firstly, we need to clarify what part of the income distribution the MHS status represents. Using the Romanian Household Budget Survey we have identified these students in households situated in the 10%-40% quantiles. This means that our analysis does not capture students living in extreme poverty, nor Roma children of the age of these cohorts, since these are the most likely to be high school dropouts. This is bound to slightly reduce the external validity of our finding.

Secondly, we try to rule out the concern that the effects of the MHS program on the beneficiaries' performance might confound our interpretation of the interaction estimates. We extract some evidence from a special feature of the MHS program. The disbursement of MHS funds has been carried out every year since 2004. However, in the beginning of the program, the funds fell short of the demand. This meant that from a total of about 76,500 eligible students (income below 150 RON, equivalent to 35 EUR, per household member) in the academic year 2005-2006, 31,547 were omitted from the program.[46] Some of these students applied and received the MHS funds in subsequent years, but 19,743 students never benefitted from the MHS. We therefore use a regression discontinuity design to estimate the treatment effect of receiving money on exam scores, for the marginal student just receiving money, relative to the marginal student who never received the money The cutoff for receiving the money was set within each county, but varied only marginally around 30 RON. However, this means that as long as we include county fixed effects in the regression, we are able to use a sharp RD design. Hence, we estimate the effect for a weighted average of marginal students just receiving money, where the weights are given by the number of students at each cutoff. In order to capture all targeted students' exam outcomes (i.e., students who were eligible and applied for MHS in 2005-2006), we make use of the 2006-2010 Baccalaureate sample. The drawback with this sample is that we do not have corresponding data about the 5^{th}-8^{th} grade score, nor other background variables, apart from high school track.

We estimate the following equation:

$$Y_{ict} = \alpha + \beta_0 NMHS_{ict} + \beta_1 inc06_{ict} + \gamma' X_{ict} + + \theta_c + \varepsilon_{ict} \,, \qquad (2)$$

[46] In our sample, these students who were not allotted the MHS in 2005-2006 despite being eligible, report incomes between 30 and 150 RON per family member, and the mean income is 82.6 RON. In the subsequent years the funds allocated from the national budget for MHS were adjusted at the beginning of each year in response to the demand, leaving no more eligible requests unsatisfied. The schools where the applications were registered had to submit their lists of applicants to the Ministry, which disbursed the funds, and typically they ranked the students by income, drawing the line according to the funds available. However, because of rising demands, from 2009 to 2010 a new criterion was introduced demanding that the student must have a very good school attendance rate. A little over 100 students were denied the allowance because of low attendance in 2010-2011.

where $NMHS_{ict}$ is an indicator equal to 1 if the student is a non-beneficiary, $inc06_{ict}$ is the family income in 2006, and X_{ict} is an indicator for theoretic track. The coefficient of interest, which yields the effect of the program, is β_0.

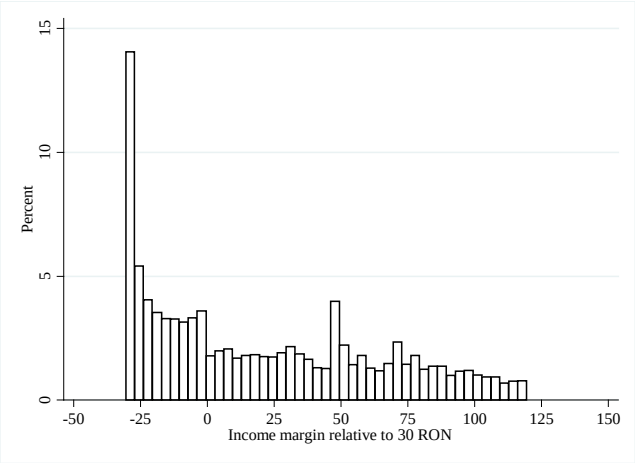
When we estimate this model, we get virtually no effects from the program once we control for income (Table A2). We interpret this as evidence that the MHS program did not affect the performance of the recipients relative to their comparable peers, and thus it can be used as a proxy for poverty status. The caveat is that some students may have underreported income, making some sorting around the cutoff a possibility (see Figure A2). The results hold also when we exclude those with close to or zero income, the easiest to misreport. Nonetheless, we interpret the RD estimate as suggestive rather than causal here.

Table A2. The MHS treatment effect. RD regressions

	Written Romanian		Baccalaureate pass	
	(1)	(2)	(3)	(4)
NMHS	0.146***	-0.020	0.021***	-0.002
	(0.023)	(0.042)	(0.005)	(0.008)
Income 2006		0.210***		0.029***
		(0.044)		(0.010)
County FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Track control	Yes	Yes	Yes	Yes
Observations	64,506	64,506	64,511	64,511
R-squared	0.159	0.160	0.180	0.180

Notes: The table displays estimates from a sharp Regression Discontinuity in exam scores around the cutoff of income below which students are treated with the "Money for Highschool" financial support. NMHS is an indicator equal to 1 if the student did not receive the financial support. Standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.1

Figure A2. Income margin density of the MHS applicants.

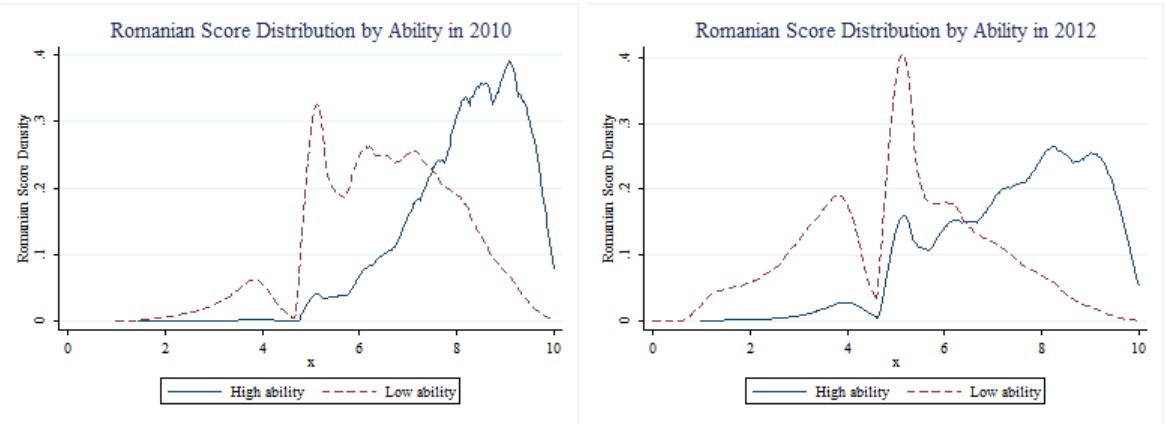


Notes: The figure displays the density bar chart of the MHS applicants' income margin relative to the 30 RON cutoff in 2005-2006. The figure excludes applicants who reported 0 income.

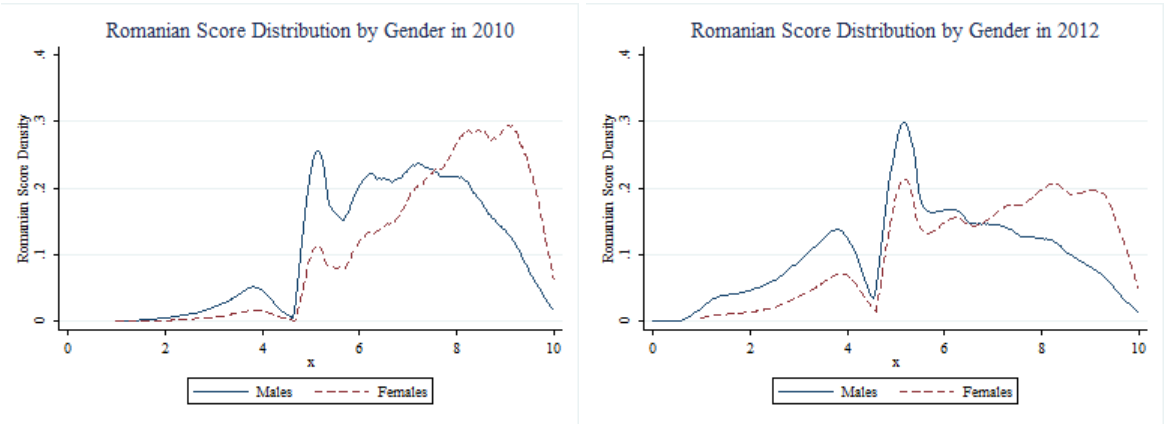
APPENDIX A3: *Supplementary Figures and Tables*

Figure A3.1 Romanian written exam scores density 2010 vs. 2012

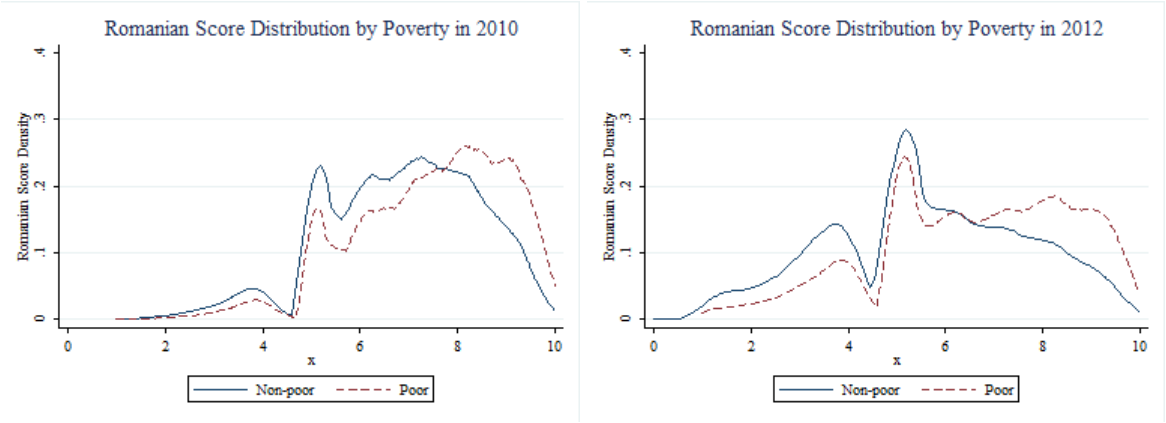
(a) by ability



(b) by gender



(c) by poverty status



Notes: The figure displays written Romanian exam score distributions in 2010 (left) and 2012 (right), for different subgroups of students, divided by: ability, gender and poverty status.

Figure A3.2 Changes at the 2010 exam. All test score distributions in 2009 and 2010

Notes: The figures display the score distributions for each written test in 2009 (blue) and 2010 (red dashed): 1) the written Romanian exam (top-left); 2) the track-specific exam (top-right); 3) the first elective exam (bottom-left); and 4) the second elective exam (bottom-right). Note that the second elective was removed in 2010, and before that, around 75% of the students chose physical education as their second elective test.

Table A3.1. Self-selection into camera treatment

	Early installation	Late installation	Difference	County clustered SE p-value
Pass	0.791	0.828	-0.037	0.220
Romanian exam score	7.175	7.239	-0.064	0.593
Ability	8.632	8.618	0.014	0.742
Male	0.459	0.462	-0.003	0.618
Poor	0.184	0.263	-0.079	0.033**
Theoretical	0.504	0.483	0.021	0.387
Rural	0.038	0.060	-0.022	0.247
Log county population	13.343	12.957	0.386	0.040**
Trust in justice	1.866	2.032	-0.166	0.103
Corruption BOP	0.558	0.379	0.179	0.331
Unemployment April	8.02	9.019	-0.999	0.348
County share Romanians	0.852	0.802	0.050	0.367
N	191970	97986		

Notes: The figure displays individual and county summary statistics for the joint years 2009-2010, separately by early and late camera installation. The trust in justice variable is an average county score calculated by us using the answers to the question "Can justice courts be trusted?", from the Romanian Barometer of Public Opinion 2007, Soros Foundation. The variable Corruption BOP is a proxy developed by our calculations using the same Public Opinion Barometer. We use the question: "*Is there anyone (i.e., informal network) that could "help" you solve (i.e., informally): issues in court/trials, medical problems, city hall, police, or issues related to the local authorities?"* P-values are based on standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.1.

Table A3.2: Share of students eliminated from the exam due to in-class cheating

	Share of Eliminated Students			
	(1)	(2)	(3)	(4)
Camera	0.003***	0.003***	0.003***	0.003***
	(0.001)	(0.001)	(0.001)	(0.001)
Year12	-0.002**	-0.002**	-0.002**	-0.002**
	(0.001)	(0.001)	(0.001)	(0.001)
Year11	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Year09	0.000	0.000*	0.000*	0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
Male		0.000***	0.000***	0.000***
		(0.000)	(0.000)	(0.000)
Poor		-0.000	-0.000	-0.000
		(0.000)	(0.000)	(0.000)
Poor x Camera			0.001	0.000
			(0.001)	(0.001)
Poor09			0.000	0.000
			(0.000)	(0.000)
Poor11			-0.000	0.000
			(0.000)	(0.000)
Poor12			-0.000	-0.000
			(0.001)	(0.001)
Ability		-0.001***	-0.001***	-0.000***
		(0.000)	(0.000)	(0.000)
Theoretical		-0.000	-0.000	0.000
		(0.000)	(0.000)	(0.000)
Rural		0.001	0.001	
		(0.001)	(0.001)	
County FE	yes	yes	yes	no
School FE	no	no	no	Yes
Observations	553,903	553,903	553,903	553,903
R-squared	0.002	0.003	0.003	0.020

Notes: The table displays estimates from the baseline Difference-in-Differences specifications, for the probability to be eliminated from the exam due to cheating. In addition to the standard specifications in columns 1 and 2, columns 3 and 4 display the estimated parameters of all treatment interactions with poverty status. Standard errors clustered at county level. *** p<0.01, ** p<0.05, * p<0.1.