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The publication of school rankings: A step toward increased accountability?

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ABSTRACT

This paper contributes to the discussion of the effects of the publication of school rankings based on students' scores on national exams. We study the effectiveness of this (low-stakes) accountability mechanism. Our results suggest that the publication of rankings has clear effects upon families and schools in Portugal. After the rankings publication, fewer students enroll in schools that are rated poorly and the probability of closure of these schools increases. These effects are stronger for private schools.

1. Introduction

During the last decade many countries and U.S. states have introduced some form of accountability in schools in an attempt to increase their performance. This movement was at least partly generated by the frustration felt by many countries with the poor results shown by their students on internationally comparable exams, like PISA and TIMMS.

Accountability policies vary considerably, from the so-called low-stakes policies (disclosing information regarding the performance of schools) to high-stakes or consequential systems, whereby the financing conditions of the schools and/or the payments to teachers are adjusted according to the performance of students. The effectiveness of these accountability systems on the learning conditions of students has been studied extensively in the literature.

Using different data sets and methodological tools, several authors have shown that accountability policies, even low-stakes ones, such as the one considered in this paper, have considerable effects on students' behavior. Figlio and Lucas (2004) showed that low-stakes accountability policies have strong effects on parents' choices and are reflected in changes in housing prices. Using data from Florida, where a high-stakes policy was launched, Figlio and Rouse (2006) concluded that the improvements of poorly performing schools were, in fact, very large; Chakrabarti (2008) examined the impact of different incentive schemes and showed that the 1999 Florida accountability program unambiguously improved schools' performance. Chiang (2009) also found persistent gains in performance due to Florida's high-stakes accountability policy; Hanushek and Raymond, (2005)reported increased scores for all students following the introduction of accountability policies in the US, although they found a much weaker impact of low-stakes policies relative to the effects of consequential or high-stakes measures. Using data from PISA 2003 for 27 OECD countries, Schutz, West, and Wobmann (2007) also found a positive relationship between accountability and academic outcomes.[1]

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[1] Positive effects of several accountability systems have been found for several other geographical and institutional settings (see, for instance,

In this paper we analyze the impacts of the public disclosure of school rankings, a low-stakes accountability policy. We consider the case of Portugal, where since 2001 several newspapers have published rankings of every high school (public and private) based on the average scores obtained by students on national exams.[2]

We study the effect of the publication of the rankings in terms of the ability of schools to attract students and of the increased probability of closing for schools that are rated poorly. To identify the effect of the public disclosure of school results, we compare the effects of the rankings before and after their publication. We distinguish between private and public schools, as we expect that there is more flexibility and freedom of choice in the subset of private schools, allowing for a stronger effect of the rankings on these schools.

Our results suggest that the publication of rankings has clear effects upon families and schools. After the rankings publication, fewer students enroll in schools that are rated poorly and the probability of closure of these schools increases. These effects are stronger for private schools.

Our paper also contributes to the growing literature on information and consumer choice; specifically we study the effect of information on school choice. Hastings and Weinstein (2008) analyze two experiments in which parents of students of low performing schools are allowed to choose alternative schools for their children and are given information about the quality of these schools, and find that the provision of information affects parents' choices. Koning and van der Wiel (2013) analyze the effect on school choices of school rankings published by a newspaper in the Netherlands and find that a positive school-quality score increases the number of students choosing a school. Unlike Koning and van der Wiel (2013), we are able to compare school choices before and after the publication of the rankings in the newspaper. It is expected that before publication, at least some parents already had some information on school quality. However, after the publication of school rankings in the newspaper this information becomes available to all parents. Moreover this information is presented in a way that makes it easy to compare different schools. Thus, the fact that we are able to compare the effects of the same school results on school choices for the periods before and after publication allows us to isolate the role of this type of information disclosure on school choices.

The organization of the paper is the following: Section 2 briefly describes the institutional setting of the educational system in Portugal for the period under analysis. Section 3 describes the data. In Section 4 we present our methodology and our results for the effect of rankings publication on students' reallocations. In this section we also study the impact of the published ranking on the probability of school closure. These analyses contribute to a better understanding of the impact and the vehicle through which the publication of rankings affects schools. Section 5 discusses the results and concludes.

Koning and van der Wiel (2012) for the Netherlands, Anghel et al. (2012) for Spain, Rockoff and Turner (2010) for New York City).

[2] Individual students' scores were always disclosed in paper form on the school premises. However, this information was not used to disclose information organized at the school level until 2001.

2. The institutional setting in the period under analysis

The Portuguese educational system did not undergo significant changes from 1998 to 2005. Mandatory schooling starts at the age of six and lasts 9 years.[3] These 9 years are divided into three cycles with durations of 4, 2, and 3 years, respectively. Tracking in general starts at the end of mandatory schooling[4], with the choice between 3 additional years of academic studies aimed at the pursuit of studies at the university level, and vocation-oriented studies. Vocational study tracks can consist of either 2 or 3 years, and transition to academic tracks or to the university is possible. The net rate of enrollment in secondary education was around 60% in the period analyzed. In the discussion below we describe only academic studies, as these are the subject of this paper.[5]

To finish academic secondary school, students must take exams at the national level. Final scores per subject are computed as a weighted average of the school grade and the score obtained at the national exam (with weights of 70% and 30% respectively). The final score of secondary studies is the simple average of all the final scores per subject.

These national exams perform two roles in the educational system. Besides being a requirement for graduation from secondary school, they also determine the conditions for admission to universities. Portuguese public universities have a fixed number of slots for each field of study set by the Ministry of Education, that fall short of demand for places in the most prestigious universities. Candidates to each university are placed (centrally, by the government) according to their candidacy grade. This grade is a weighted average of the final score of secondary studies, calculated as described in the previous paragraph, and again the score obtained in one of the national exams.[6] These rules, which have remained stable since 1998, therefore place a strong weight on the scores obtained in national exams.

Public and private schools co-exist in the Portuguese educational system. The level of autonomy of Portuguese schools is very limited, with teaching contents and learning methods being decided by the government. They are also subject to a set of rules concerning premises, number of students allowed per class, and so forth. Public schools are tightly restricted in their educational supply, and neither choose nor influence the choice of teachers.[7] Private schools have more flexibility

[3] After our period of analysis, some changes occurred, namely the extension of mandatory schooling by 3 years. The first cohort of students affected by this measure entered secondary schools only in 2010.

[4] There are some vocation-oriented paths initiated at the age of 14, but these tracks remained exceptional, accounting for only 4–5% of the schooling population.

[5] Between 1998 and 2005 the population aged 15–19 years old decreased from 718,000 to 584,000. The net rate of enrollment in secondary education ran from 59.1% in 1998 to 59.8% in 2005. Out of these, the percentage of students in academic studies steadily decreased during the period, from 65% in 1998 to 55% in 2005.

[6] The choice of this national exam is left to each university department. On the candidacy grade, the weight of the national exam score is chosen by each university department subject to the constraint that it must lie between 35% and 50%. Some university departments require two national exams instead of one. In this case the constraint on the weights applies to the simple average of the two scores.

[7] The allocation of teachers to public schools is centrally determined by the Ministry of Education.

than public ones in that they can choose teachers and students, and set tuition fees.[8] This asymmetry in school autonomy determines the capacity of schools to react to a changing environment. As a result, we expect the effect of the publication of rankings to be stronger on private schools.

Students can move between schools in each academic year, subject to school vacancies. For public and publicly financed private schools there are some legal restrictions on the specific school where students can enroll, according to the geographic proximity: first, to the family home, and second, to the workplace of the mother or father. Nevertheless, the large movements of students in and out of schools in our data reveal that those legal restrictions were not being strictly enforced.[9]

3. Data description

The publication of school rankings in Portugal occurred for the first time in 2001. The first ranking was published by the newspaper *Público*, following a court decision on a lawsuit by this newspaper, claiming its right to access and disclose the data that were being withheld by the government. [10] Since 2001 the publication of school rankings has drawn a strong interest in Portuguese society, the results appearing on the front pages of newspapers, opening headlines on the main TV channels, and triggering several debates in the media.

The published ranking is the simple ordering that results from calculating the average score on national exams for each school. This average is obtained taking into account a selection of exams that correspond to the courses with the most students at the national level. The choice of which exams to include in this ranking is a decision of the newspaper.[11]

Our dataset consists of the same data disclosed to the media and includes scores for all student-exam pairs for all of the 12th grade national exams since 1998. The exam scores have been published online since 2003 by the Ministry of Education, and may be freely downloaded.[12] The data for the period before the beginning of publication, covering the years 1998–2001, became publicly available only at the end of 2012.

Our main variable of interest is the ranking of each school, RANK. We replicated the school rankings published by the newspaper *Público*, given that our purpose was to analyze the impact of the publication of rankings. For the period before publication we built equivalent rankings based on the students' scores in each school, following the criteria adopted by *Público* in its publication. The variable RANK takes the value 1 for the school with the highest average score and increases as the school average score decreases.

To determine whether the publication of school rankings affects students' choices we first analyze whether the percent change in the number of students in each school depends on previous rankings. As we have no access to the number of students enrolled in each school, we extracted from the dataset described above the number of exams taken at each school in each year. This is our measure of the size of the school, SIZE. The percent change in the number of exams taken at each school in the period under analysis is our dependent variable, $\%\Delta N$.

We then look at the closing of schools. We define a dummy variable, CLOSE, that takes the value 1 if the school has students taking exams in the initial year of the period under analysis and no students taking exams in the final and subsequent years (until 2010), and 0 otherwise.[13]

The dataset also includes information about school characteristics that we use as additional controls: public versus private status, and geographic location. We use this last information to build several variables concerning the availability of high schools in each municipality, and thus, the effective competitive pressure and freedom of choice of school by the students. We considered three alternatives: (i) CHOICE, a dummy that equals 1 if there is more than one high school in the municipality, thus providing the possibility of choice, and 0 otherwise; (ii) NSMUN, the number of high schools in the municipality, and (iii) HH, the Herfindahl-Hirschman Index of concentration of high schools for each municipality.[14]

To take into account that it is probably easier to attend a school in a nearby region, we have also calculated regional rankings. These regional rankings were calculated for each municipality by considering all the schools located in that municipality and in the neighboring ones.

The dataset does not include any information on the socio-economic characteristics of the students, and for the period under analysis this information is not available at the school level, either.

4. The impact of published rankings

Our goal is to study the effect of the publication of the rankings. To capture the impact of the publication of the ranking we estimate linear regression models for the outcome variables with the ranking and other school characteristics entering as explanatory (continuous) variables. As outcome variables we consider the percentage change in the number of students taking exams in each school and the probability of closure of a school.

Since we have data before and after the publication of the rankings, we estimate a pooled model and check for

[8] Some private schools are publicly financed and neither chose their students nor set tuition fees.

[9] There is widespread knowledge that parents report false addresses to gain access to particular schools.

[10] After this, several newspapers started publishing their own rankings, but *Público* remained the main reference on this issue. In 2002 the Ministry of Education also published its own ranking, which took into account some socio-economic characteristics of the school region. The methodology used to calculate this ranking was strongly criticized by the public, and the Ministry discontinued it in subsequent years.

[11] Throughout this period the exams considered in the rankings were Mathematics, Portuguese A, Portuguese B, Biology, Chemistry, Physics, Psychology, and History.

[12] http://www.dgidc.min-edu.pt/jurinacionalexames/.

[13] Schools that merely changed name were considered as being the same school.

[14] The Herfindahl-Hirschman Index is calculated for each municipality as the sum of the squared school shares: $HH = \sum_{i=1}^{NSMUN} (s_i)^2$, where s_i is the share of school i in the municipality, $s_i = \frac{SIZE_i}{\sum_{k=1}^{NSMUN} SIZE_k}$, NSMUN is the number of schools in the municipality and $SIZE_i$ is the number of exams in school i.

differences in how the ranking variable affects the outcome variable in these two periods. If the impact of the ranking is different in the two periods, we conclude that the publication had an impact. For this interpretation to be valid, the main assumption required is that apart from the control variables included in the estimated models, the only difference between the two periods is the publication. In fact, as discussed above, between 1998 and 2005 there were no major changes in the educational system.

To define the periods before and after the publication, it is important to understand the timing of rankings' publication and of students' enrollments. National exams take place in June and students enroll for the following academic year in June and July. Rankings are published at the end of summer, in late August or September, after the exams and the enrollment. The 2001 rankings are thus expected to have affected enrollments for the academic years of 2002/2003 and following. Moreover, although some students change school in the transition to the 12th grade, most of the movements between schools occur in the transition to the 10th grade. For this reason, the impact of the 2001 rankings is expected to appear in the number of students taking exams from 2003 on and, more strongly, in 2005, when secondary school exams are taken by those students who enrolled in the 10th grade in June 2002. We define our periods of analysis taking these timings into account.

We consider the number of exams in 2001 to be an appropriate point of departure for the analysis, as we may expect it to be exogenous relative to the ranking published in 2001, which was the first ranking published. As the first year for which there are data is 1998, we take the period 1998–2001 as the relevant period before publication. In order for the periods before and after publication to have the same length, we set the period after publication as 2001–2004. Although this may weaken our results by excluding 2005, having periods of the same length is needed for the effects identified to be comparable.[15]

We restrict our analysis to schools that in the initial year of analysis had more than 50 exams. This eliminates extreme cases having very large percentage changes due to the low initial number of exams. Fig. 1 shows histograms for SIZE and %Δ N. There are still a few outliers, which were taken into account in the empirical analysis below.

Table 1 lists the main variables and presents some descriptive statistics for the two periods of analysis, 1998–2001 and 2001–2004. Except for %Δ N and CLOSE, there are no noticeable changes in the distribution of the variables. This is in accordance with the stability of the educational system referred to above. [16]

In 1998 there were 569 secondary schools with more than 50 students taking national exams, 99 of which were private and 470 public. Of these, 3 closed before 2001. In 2001 there were 583 schools, 104 private and 479 public. Of these, 11 closed before 2004 and 11 more in 2005.

4.1. The impact of published rankings on the percent change in the number of students

In order to evaluate whether the publication of the rankings affects students' decisions about the school that they choose to enroll in, we regress the percent change in the number of exams taken in each high school on the rank of the school, and test whether there are systematic differences between the periods before and after publication.

We control for the private versus public nature of the school. In order to test whether the impact of rankings is weaker for public schools, we also consider the cross-effect between the rank and the public character of the school, by including the interaction variables RANK×PUB and RANK×PRIV, where the variable PRIV is a dummy that identifies private schools. We also control for the size of the school and for the degree of competition among schools in each region, as stated above. To test if the impact of published rankings is greater for schools subject to stronger competition, we also consider the cross-effect between the rank and the competition measure.

Our benchmark specification is the following pooled regression:

$$\%\Delta N_{it} = \beta_1 + \beta_2 RANK_{it} + \beta_3 AFTER_t + \beta_4 RANK_{it} \times AFTER_t + \alpha' X_{it} + \gamma' D_i + \varepsilon_{it} \quad (1)$$

where i represents the school and t indicates the period (either before or after publication). $AFTER_t$ is a dummy variable equal to one for the period after publication and X_{it} is a vector of controls including the variables described above: PUB, SIZE, CHOICE, NSMUN, or HH. For the period before publication the rank variable is the one implied by school scores in 1998 (which was not public knowledge at that time), and for the period after publication the rank variable is the one published in 2001. In order to analyze whether the effect of the rank before and after publication differs between private and public schools we also include the interactions between *RANK, AFTER,* and *PUB* in some specifications. To check if the impact of the rank is amplified by the availability of high schools in the municipality we include the interactions between *RANK, AFTER,* and the different variables used to capture this availability: *CHOICE, NSMUN,* and *HH.* Finally, D_i is a vector of dummy variables for administrative regions (18 plus the islands) included to control for differences in the evolution of demographic, socio-economic, and other regional characteristics across regions.

Models were estimated by ordinary least squares. Estimation results are shown in Table 2.

For all models the size of the school, SIZE, has a negative impact on the percentage change in the number of exams.[17] The parameters are always significant at the 1% level. When the availability of alternative schools is measured by the variable CHOICE, the estimated coefficient is significant

[15] As mentioned below, we also considered the period until 2005 in order to capture the expected stronger impact until that year, although it requires the use of overlapping periods.

[16] The variable RANK corresponds to the ranking published by *Público,* which includes all the schools, 609 in 1998 and 622 in 2001. Note that because the descriptive statistics in Table 1 concern only schools with more than 50 exams, the minimum value of the rank may be higher than 1 and the maximum may be higher than the sample size.

[17] This result is maintained when the dependent variable is defined as the change in levels instead of percent change, as shown in the Supplementary Materials.

Table 1
Descriptive statistics.

Variable	Description	Mean	Standard deviation	Max	Min
Period before publication (schools with more than 50 exams in 1998): 569 schools					
%Δ *N*	Percent change in the number of exams between 1998 and 2001	−5.03	33.39	356	−100
RANK	Rank in 1998	299.43	171.59	607	2
PUB	Dummy=1 for public schools	0.83	0.38	1	0
SIZE	Number of exams in the school in 1998	375.88	236.48	1531	53
CHOICE	Dummy=1 if there is another school in the municipality in 1998	0.73	0.44	1	0
NSMUN	Number of schools in the municipality in 1998	11.28	18.12	62	1
HH	Herfindahl-Hirschman Index of Concentration in 1998	0.46	0.37	1	0.02
CLOSE	Dummy=1 if the school has no exams from 2001 onwards	0.01	0.07	1	0
Period after publication (schools with more than 50 exams in 2001): 583 schools					
%Δ *N*	Percent change in the number of exams between 2001 and 2004	−1.43	37.16	272	−100
RANK	Rank in 2001	309.93	175.37	620	2
PUB	Dummy=1 for public schools	0.82	0.38	1	0
SIZE	Number of exams in the school in 2001	339.52	221.01	1648	51
CHOICE	Dummy=1 if there is another school in the municipality in 2001	0.72	0.45	1	0
NSMUN	Number of schools in the municipality in 2001	10.52	16.86	60	1
HH	Herfindahl-Hirschman Index of Concentration in 2001	0.47	0.37	1	0.02
CLOSE	Dummy=1 if the school has no exams from 2004 onwards	0.02	0.14	1	0

Table 2
Estimation results of the linear regression model.

	Dependent variable: %Δ*N*, pooled 1998–2001 and 2001–2004							
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
RANK	−0.010	−0.013	−0.026*	−0.003				
s.e.	(0.009)	(0.009)	(0.015)	(0.010)				
AFTER	15.440***	14.942***	16.326***	15.025***	14.502***	13.965***	14.955***	14.036***
s.e.	(3.863)	(3.867)	(3.957)	(3.851)	(3.880)	(3.884)	(4.032)	(3.868)
RANK×AFTER	−0.041***	−0.04***	-0.033***	-0.037***				
s.e.	(0.012)	(0.012)	(0.013)	(0.013)				
PUB	−2.488	−3.683	−2.463	−3.865	−7.733	−8.538	−9.203	−5.425
s.e.	(3.653)	(3.526)	(3.664)	(3.509)	(5.966)	(6.024)	(6.048)	(6.213)
SIZE	−0.020***	−0.024***	−0.020***	−0.024***	−0.019***	−0.023***	−0.019***	−0.023***
s.e.	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)
CHOICE	−3.413		−9.269*		−3.032		−10.774*	
s.e.	(2.630)		(5.622)		(2.647)		(5.653)	
NSMUN		−0.356***		−0.182*		−0.355***		−0.181*
s.e.		(0.080)		(0.103)		(0.080)		(0.105)
RANK×PUB					−0.009	−0.013	−0.026*	−0.005
s.e.					(0.010)	(0.010)	(0.015)	(0.010)
RANK×PRIV					−0.005	−0.007	−0.028	0.012
s.e.					(0.019)	(0.019)	(0.026)	(0.022)
RANK× AFTER× PUB					−0.030**	−0.029**	−0.028**	−0.029**
s.e.					(0.013)	(0.013)	(0.012)	(0.013)
RANK×AFTER ×PRIV					−0.072***	−0.072***	−0.066***	−0.071***
s.e.					(0.019)	(0.019)	(0.022)	(0.021)
RANK ×CHOICE			0.025				0.025	
s.e.			(0.017)				(0.018)	
RANK× AFTER ×CHOICE			−0.017				−0.007	
s.e.			(0.013)				(0.014)	
RANK×NSMUN				0.000				−0.001*
s.e.				(0.000)				(0.000)
RANK×AFTER ×NSMUN				0.000				0.000
s.e.				(0.000)				(0.000)
District Dummies	√	√	√	√	√	√	√	√
Observations:	1152	1152	1152	1152	1152	1152	1152	1152
R^2	0.071	0.086	0.073	0.092	0.079	0.094	0.080	0.098
Adjusted R^2	0.050	0.065	0.051	0.070	0.057	0.072	0.057	0.075
	Wald Test							
$\beta_{RANK\times PUB}+\beta_{RANK\times PUB\times AFTER}-\beta_{RANK\times PRIV}-\beta_{RANK\times PRIV\times AFTER}$					0.037**	0.036**	0.040**	0.025
s.e.					(0.017)	(0.017)	(0.018)	(0.018)

Notes: s.e. stands for robust standard-errors.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

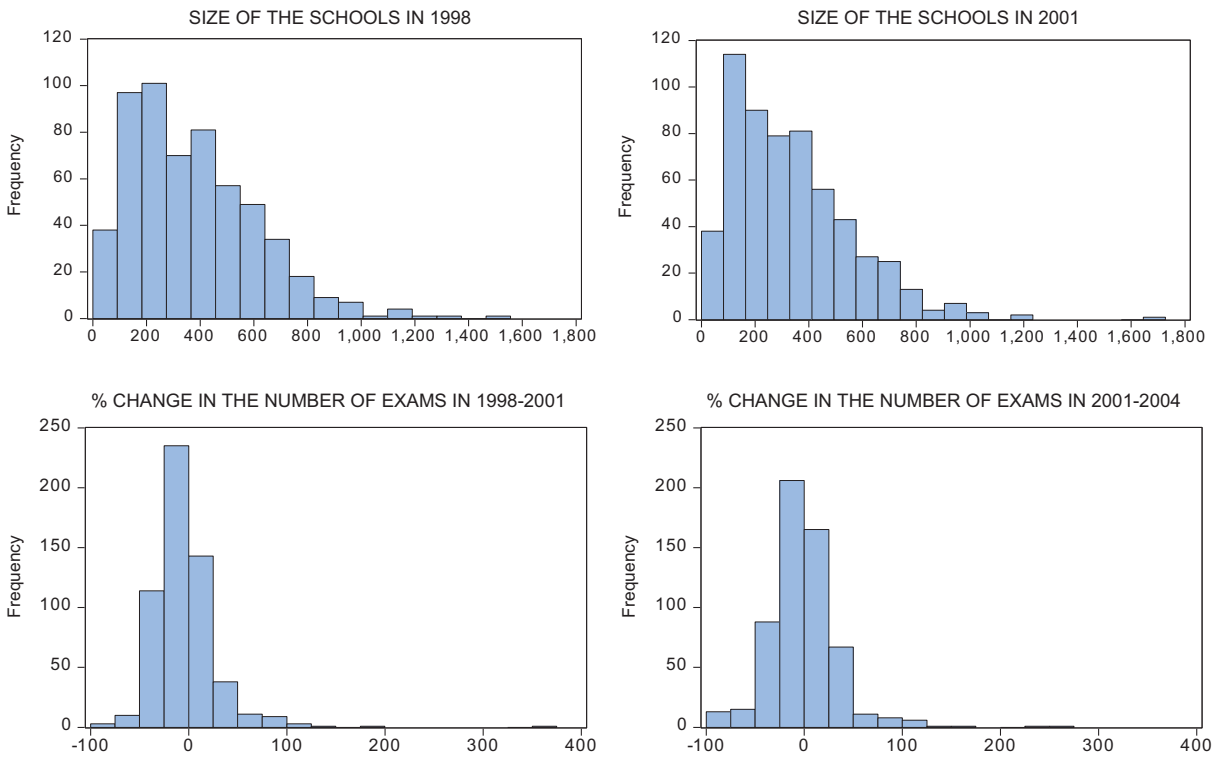

Fig. 1. Histograms of SIZE and $\%\Delta N$ (schools with more than 50 exams in the initial year of each period).

and negative in Eqs. 3 and 7. If it is measured by the number of schools in the region, NSMUN, we find a negative and significant impact on the percentage change in the number of exams in all equations.[18]

Eqs. 1–4 show that the rank has no significant impact in the period before publication. Eqs. 3 and 4 confirm that this result is not affected by the existence of alternative schools in the region, as captured by the non-significance of the parameters associated with variables RANK×CHOICE and RANK×NSMUN.

The coefficient of RANK×AFTER is always significant and negative, showing that the publication of the ranking has a clear impact.[19] This impact is not affected by the existence of alternative schools in the municipality, as shown by non-significance of the coefficients of RANK×AFTER×CHOICE and RANK×AFTER×NSMUN.

Eqs. 5–8 analyze whether the impact of the rank is different for public and private schools. The results suggest that before publication the impact is not significant for either private or public schools. After publication the impact of the ranking becomes significant for both public and private schools. At the bottom of Table 2 we report the Wald Test for the difference in the impact of the ranking between public and private schools after publication, and we conclude that the impact is significantly larger for private schools, in Eqs. 5–7.

Our main finding is that the impact of ranking increases with the publication and has the expected significant and negative impact in the period after publication. An increase in the rank of the school (corresponding to a deterioration of quality) leads to a decrease in the number of exams taken in that school only when the information about rankings is published, and thus, available to everyone. For instance, after publication an improvement of 10 places in the rank leads to an increase of about 0.4 percentage points. The results also show that after publication private schools are more affected by the rank.

To check the robustness of our results we estimated alternative specifications of the basic model, whose results are reported in the Supplementary Materials: first, we estimated the equations considering as dependent variable the change in levels instead of percent changes. Second, in order to allow for different slopes of the control variables for the periods before and after publication we estimated the equations separately for each period. This specification also allows for different fixed effects, thereby accounting for differences in demographic evolutions across regions in the two periods. Then we also checked for different periods: for the period before publication we consider 1998–2002 instead of 1998–2001 and after publication 2001–2005 instead of 2001–2004.[20] In addition, we also estimated linear regressions

[18] We do not show the results with the Herfindahl-Hirschman Index of concentration, as they are qualitatively identical to those shown.

[19] The coefficient of AFTER is always strongly significant. This captures only the change in the intercept of the regression.

[20] It would be interesting to consider other periods as well but we face some limitations as mentioned above. First, there are no data available before 1998. As a consequence, if we extend the period after publication further in time the lengths of the two periods (before and after publication) would be different and therefore not directly comparable. Moreover, the

considering the regional rankings described at the end of Section 3. Finally, the equations in Table 2 were re-estimated excluding the outliers identified in Fig. 1: we kept schools with SIZE<1400 and %ΔN<200. In all of these alternative specifications, the main results remain unchanged: The publication of the rankings has a clear impact on students' movements across schools, especially for private schools.

4.2. The impact of published rankings on the probability of closing

As an important part of the effect of published rankings may be the closing of schools that are rated poorly, we now look at the event of closing. In our analysis a *closed* school is one that presents no students to the national exams from 2001 on, and 2004 on (until 2010) for the periods before and after publication, respectively.

We estimated a linear probability model for the probability that a school i closes as a function of published rankings, considering the same controls as in the previous regressions.[21]

$$CLOSE_{it} = \delta_0 + \delta_1 RANK_{it} + \delta_2 AFTER_t + \delta_3 RANK_{it} \times AFTER_t + \lambda' X_{it} + \mu_{it}$$

The results of the estimation, shown in the Supplementary Materials, suggest that the impact of the publication is not significant, which may be explained by the small time horizon considered: the decision to close a school as a response to a decrease on the number of enrollments could hardly be expected to occur in such a short period of time. Therefore we consider an extended period of analysis: for the period before publication we consider 1998–2002 instead of 1998–2001 and after publication 2001–2005 instead of 2001–2004.The estimation results are shown in Table 3.

For all models, the size of the school has a significant negative impact on the probability of closing. The number of schools available in the region also has a significant impact in almost all the models: the larger the number of alternatives, the greater the probability of closing.

Before publication the impact of the ranking is positive and significant in Model 1 and not significant in Model 2. Model 2 shows that this impact of the rank was not affected by the existence of alternative schools in the region, as captured by the non-significance of the parameter associated with variables RANK×NSMUN. After publication the rank is strongly significant in both models as revealed by the Wald tests. This impact is amplified when the number of alternative schools in the municipality increases, as shown by the coefficient estimated for RANK×AFTER×NSMUN.

Models 3 and 4 analyze whether the impact of the rank is different for public and private schools. We obtain that before publication the impact is significant for private schools, whereas in public schools the effect is not significant. Thus, these results suggest that even before publication the probability of closing was higher for poorly performing private schools. The publication does not affect the probability that a private school closes. For public schools in Model 3 we obtain that the publication increases the effect of the ranking on the probability of closing, as shown by the coefficient estimated for RANK×AFTER×PUB. After publication the impact of the rank is stronger on private schools, as before. In Model 4 we obtain again that the effect of the publication of the rank is amplified by the existence of alternatives.

To check the robustness of our results we estimated alternative specifications for the linear probability model: in order to allow for different slopes of the control variables for the periods before and after publication we estimated the equations separately for the periods before and after publication and show the results in the Supplementary Materials.[22] We also estimated models considering the regional rankings described at the end of Section 3. The results obtained were similar to those obtained before, corroborating our previous findings.

5. Discussion and conclusions

Our findings suggest that the publication of rankings has clear effects upon families and schools in Portugal. After publication the number of students attending schools that are rated poorly decreases and the probability of closure of these schools increases. Different mechanisms may lead to these developments: students will choose better rated schools, or, if these are not available, may decide to change to vocational tracks or even drop out. This result is in line with the empirical literature about the effects of low-stakes accountability policies on the performance of schools measured by scores on national exams. This result is especially interesting given that, at least for public schools, there are typically legal restrictions on enrollment decisions according to the geographic location of the student's home. Even so, students exert some choice over which school to enroll in. We also find that the effect for private schools is stronger, as would be expected given that the freedom of choice between private schools is greater than between public ones.

As several authors have already stressed, school quality measures such as the rankings studied in this paper may be very imprecise measures of school quality. There are several reasons for these weaknesses: (i) rankings of schools are too volatile and imprecise (Chay, MacEwan, and Urquiola (2005), Kane and Staiger (2002)); (ii) rankings reflect factors that are outside the control of schools, especially the socioeconomic background of students' families, and not the better quality of well performing schools (Mizala, Romaguera, and Urquiola (2007)); (iii) public disclosure of schools' results biases schools' and teachers' efforts toward an excessive investment in test-specific skills that are easily observable, at the cost of other school outputs, not so easily measurable (Jacob (2005), Reback (2008), Neal and Schanzenbach (2010)); (iv) accountability systems can be "cheated on" in several ways, so that any reported beneficial effects of accountability may be merely the result of schools gaming or cheating on the

longer the period after publication the higher the risk of capturing effects of other changes that may have occurred in the educational system.

[21] The variable CHOICE does not have enough variability in the sample to allow for its inclusion in this regression. Thus, in this analysis we consider only the variable NSMUN as a measure of competition.

[22] We used periods 1998–2001 and 2001–2004 and 1998–2002 and 2001–2005, respectively. The first estimation avoids overlapping, while the second allows for an extended period of reaction to the publication of the ranking.

Table 3
Linear probability model for the probability of closing.

	Dependent variable: CLOSE×100, pooled 1998–2002 and 2001–2005			
	1	2	3	4
CONST	−1.633	0.675	−7.580***	−4.887*
s.e.	(1.748)	(1.611)	(2.174)	(2.533)
RANK	0.009**	0.004		
s.e.	(0.004)	(0.003)		
AFTER	−1.226	−1.293	−1.094	−1.380
s.e.	(1.676)	(1.655)	(1.562)	(1.556)
RANK×AFTER	0.012*	0.006		
s.e.	(0.007)	(0.006)		
PUB	−0.555	-0.265	8.192***	6.830***
s.e.	(1.746)	(1.780)	(2.054)	(2.448)
SIZE	−0.005***	−0.005***	−0.006***	−0.006***
s.e.	(0.002)	(0.002)	(0.002)	(0.002)
NSMUN	0.222***	0.091	0.215***	0.129**
s.e.	(0.054)	(0.058)	(0.056)	(0.066)
RANK×PUB			0.002	0.000
s.e.			(0.003)	(0.003)
RANK×PRIV			0.028***	0.027**
s.e.			(0.011)	(0.011)
RANK×AFTER×PUB			0.010*	0.006
s.e.			(0.006)	(0.005)
RANK×AFTER×PRIV			0.013	−0.000
s.e.			(0.014)	(0.014)
RANK×NSMUN		0.000		0.000
s.e.		(0.000)		(0.000)
RANK×AFTER×NSMUN		0.001*		0.001*
s.e.		(0.000)		(0.000)
Observations:	1152	1152	1152	1152
R^2	0.102	0.132	0.120	0.143
Adjusted R^2	0.097	0.126	0.114	0.135
	Wald Tests			
$\beta_{RANK} + \beta_{RANK\times AFTER}$	0.208***	0.010**		
s.e.	(0.005)	(0.005)		
$\beta_{RANK\times PUB} + \beta_{RANK\times AFTER\times PUB} - \beta_{RANK\times PRIV} - \beta_{RANK\times AFTER\times PRIV}$			−0.029**	−0.020
s.e.			(0.012)	(0.014)

Notes: s.e. stands for robust standard-errors.
*** Significant at the 1% level.
** Significant at the 5% level.
* Significant at the 10% level.

system, with no real content as far as effective quality evaluation is concerned (Cullen & Reback 2006); (Figlio & Getzler, 2006).

Moreover, the public disclosure of bad outcomes might have perverse consequences for equity due to cream-skimming of both students and teachers, or to motivational effects (Clotfelter, Ladd, Vigdor, and Diaz (2004), Figlio and Lucas (2004), Schutz et al., 2007). The position emphasizing the possible negative effects of the publication of school rankings is shared by politicians in many countries, and calls for the prohibition of public disclosure of school rankings that is seen in Spain and some other European countries (see Anghel, Cabrales, Sainz, & Sanz, 2012).

Our point here is not to state that rankings are a good instrument of policy, but rather to analyze whether their publication has consequences for the educational system, by inducing changes in enrollments across schools. Our conclusion is that it does have consequences, and that the effects are non-negligible. Kane and Staiger (2002) regret that for the US, "school accountability systems have led to little reallocation of students across schools" as they believe this would be an important mechanism to improve school quality. We show that in Portugal people have reacted to school rankings by choosing better rated schools.

In this paper we do not discuss the validity of the ranking as a measure of school quality. A better ranking does not necessarily mean that a school is better in the sense of having a higher value added; it may just have better students. What we show is that there are effects of the publication of school rankings regardless of their informational content.

Our results reinforce the need to verify the type and quality of the information implicit in those rankings. However, as illustrated by Mizala et al. (2007), it may be very hard to produce a ranking of schools that is not too volatile and simultaneously does not just reflect students' socioeconomic status. Further, as mentioned above, the disclosure of this information is independent of any government intervention. Therefore, the issue of the existence of potential benefits stemming from the public disclosure of complementary information gains importance. Allen and Burgess (2013) make an important contribution for the determination of the most useful information that may be made available to parents to support their school choice. They look at the case of England, where students choose schools six years before doing the

exams. We show that it is important to extend this type of analysis to other countries.

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Supplementary Materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.econedurev.2015.07.008.

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