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What makes up a central exit examination?

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What makes up a central exit examination?[*]

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Abstract

A large number of econometric studies have examined the impact of central exit examinations on student attainment and repeatedly found a positive effect. This paper contributes to clarify the term *central exit examination* by distinguishing between *central assignment* and *central grading*. For this purpose, I use a study from Birkenfeld und Hanafy (2008), who have gathered the relevant information for the 16 German federal states. First econonometric analyses show, that the distinction between central assignment and central grading is indeed fruitful.

JEL Classifikation: I21; I28
keywords: central exit examination, school systems

1 Introduction

Different countries' school systems vary in a number of characteristics. The support in early childhood is relevant for later school attainment as well as the initial and further training of teaching staff or institutions regulating the operation of schools. Within the latter, various studies have found the existence of central exit examinations to be of major importance.

Bishop (1999, 354f) and Bishop und Wößmann (2004, 14-16) state three channels, by which central exit examinations lead to improved student attainment.

1. greater reward for students' effort: The grade now allows comparing yourself with all students who took the same exit examination, not only with your class-mates.

2. less peer-pressure to prevent students from learning and participating in class: If the teacher is responsible for the exit examination, it can be rational for weaker students by disturbance to keep the level of teaching low.

3. better surveillance of teachers and schools: Just as the disturbed teaching will no longer lead to easier exams, also a weak teacher will no longer be able to compensate bad teaching with generous grading.[1]

In the principal-agent-model formulated by Bishop und Wößmann (2004), all three channels lead to higher student effort – and to higher government spending for schools.[2] Both will again lead to better school quality.

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[1]For the German federal state of North Rhine-Westphalia (no central exit examinations in 1998), an investigation showed, that about 10% of the *Abitur*-tests were graded too generous (Voss, 1998, 5).

[2]The government acts as principal, the (homogeneous) students as agents. Government spending depends positively on student effort, due to a Cobb-Douglas production function with arguments ability, effort, and government spending. Therefore higher spending is worth more when student effort is higher.

Whenever teachers grade their students differently, comparability within a larger group is reduced. On the other hand, differentiated grading might be helpful to increase student effort. Zubrickas (2008) shows within a principal-agent-model that teachers give better grades when they assume the average performance to be low. In this way they want to motivate the students. Another aspect of central exams is their low frequency due to high costs. Therefore the students' day's form is rather influential, which makes central exams a little less reliable (De Paola und Scoppa, 2008).

In a survey, Bishop (1997) discusses three studies, which each for itself shows, that exit examinations which are oriented at external curricula go with higher student attainment.

In Sweden, a system of central exit examinations was abolished in the 1970s. Bishop (1999) uses this reform to show that Swedish students afterwards took less demanding courses[3] and did worse in international comparisons later on. Furthermore, Bishop (1999) analyzes various countries and Canadian provinces by looking at four student assessment studies.[4] He finds, that students who finish their school career with a central exam do comparably better.

Wößmann (2003, 140) uses TIMSS-data and finds large differences in the attainment of students from countries with and without central exit examinations. His definition "some kind of centralized examination in the sense that a central decision-making authority has exclusive responsibility or gives approval of the content of examinations" seems rather wide. However, only 15 of the 30 countries fulfill it.

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[3]Many students took courses, which should prepare them for vocational training instead of courses meant to prepare for university. The universities however had to treat both types of courses equally for admission.

[4]The *Third International Math and Science Study* (TIMSS), the *International Association of Evaluation of Educational Achievement* literacy study, the *International Assessment of Educational Progress* (IAEP) and school data of 13-year-olds from nine Canadian provinces.

Fuchs und Wößmann (2007) analyze the impact of central exit examinations on student attainment in the fields of mathematics, reading and science with PISA-2000 data. There is a significantly positive effect only for maths. (Fuchs und Wößmann (2007) derive their distinction of countries from Bishop (2006).)

In a country-level analysis Jürges und Schneider (2004) only find a small and contradictory influence of central exit examinations. Yet they are aware, that the analysis of student attainment on this aggregated level might be severely influenced by outliers. Concerning the distinction of countries, they refer to Bishop (1999).

Using TIMSS- and PISA-data, Wößmann (2005) investigates the influence of central exit examinations on student attainment. His main findings are that central exit examinations are more valuable for good than for bad students, that they reduce the disadvantages of immigrant and working class children and they are complementary to a high level of school autonomy.

Within the German educational federalism such differences can also be identified. As many of the other macro variables are identical within Germany, the German federal states are ideal for this evaluation.

With a differences-in-differences approach, Jürges et. al. (2005) use TIMSS-data on the level of German federal states and find a positive effect for German lower secondary schools, amounting to about a third of a school year. They do so by comparing results in maths (partly central exit examinations) and sciences (no central examination).

Büchel et. al. (2004) extend the approach of Jürges et. al. (2005) by a signaling-model. They find that grades are closer to the real attainment, when standards are defined centrally. Therefore, grades from a federal state with central exams are a better signal for potential employers. Instead of grades (which are not in the data), Büchel et. al. (2004) refer to the student's self-estimation. However, this should not question their results.

Backes-Gellner und Veen (2006) also use a signaling model (Backes-Gellner und Weckmüller, 1998) to follow the hypothesis that the ratio of students

taking the *Abitur*[5] will increase stronger over time in federal states without central exams. They argue that this should be due to ever decreasing requirements. Data from the federal statistical office from 1970 to 2002 support the hypothesis.

Furthermore, they expect higher wages for students who took the *Abitur* in a federal state with central examinations, since such a certificate signals a higher level of ability and/or attainment. However, this hypothesis is not supported by the data which means that German employers are not able or not willing to use this signal.

Wößmann (2007) uses macro variables and aggregated PISA-2000-data on the level of German federal states to estimate the influence of central exit examinations, age of selection into different school tracks, and the share of students at private schools. Central exams improve student attainment but do not influence equality[6].

Whenever studies simply state that Germany is a country with central exit examinations, the authors leave unused a lot of variation within this variable. A distinction must be made between the federal states as well as between the (up to) three German school tracks.[7] Moreover, studies which simply allocate German federal states to two groups (one with and one without central exit examinations) fall short.[8] The first (greater reward) and the second channel (less peer-pressure) described by Bishop (1999) might work with central assignment of tests alone. But for the third one (better surveillance), central grading of the tests is inevitable.

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[5]The *Abitur* is the school leaving certificate of the most demanding school track in Germany.

[6]A strong influence of family background is defined as inequality.

[7]The three school tracks in Germany (in increasingly demanding order) are: *Hauptschule*, *Realschule* and *Gymnasium*. Four federal states have completely amalgamated Hauptschule and Realschule but all states still offer the three different school leaving certificates.

[8]Bade und Strebe (1993) give a short survey on the differing use of the term *central Abitur*. They especially show the differences between Baden-Wurttemberg and Bavaria.

2 Data

An overview concerning central assignment and central grading at exit examinations in German federal states is provided by Birkenfeld und Hanafy (2008). Tables 1 to 3 show their results for 2000, 2003 and 2006. The columns show whether the respective school leaving certificate is at least partially based on a central test. For each of the three certificates, the first column stands for central assignment and the second column stands for central grading. I say the grading is central, when the final decision about the grades is in the hand of an expert who is not working at the school where the respective student was taught.

2.1 Results from PISA as a measure

In order to be able to make statements about the impact of central grading of external exit examinations we need an unbiased measure; a variable that can be used as regressand. Average grades of school leaving certificates obviously cannot be used, as they are not comparable across federal states' borders. Instead, I will use data from two PISA studies. As the tested students were 15-year-olds, this measure is rather close to the school leaving age.

For the years 2000, 2003 and 2006 there are results available in four areas (mathematics, reading, sciences, not in 2000: problem-solving) for about 5000 German students[9] from the respective PISA-studies. In the extended German study PISA-E there are even 45000 and 50000 students.[10]

However, comparisons between the federal states are impossible with these data. Neither in the OECD's international nor in the PISA-E dataset are the individual federal states made public.

For 2000 and 2003 at least averages for the federal states were published.[11] The values for the 2006 test will be available in autumn 2008.

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[9]Artelt et. al. (2001, 6), Prenzel et. al. (2007, 4)

[10]Artelt et. al. (2001, 6), Prenzel et. al. (2005b, 4)

[11]Baumert et. al. (2003b, 61), Prenzel et. al. (2005a, 60, 88, 106, 128)

	Hauptschule		Realschule		Gymnasium	
	assign.	grading	assign.	grading	assign.	grading
Baden-Wurttemberg	yes	no	yes	yes	yes	yes
Bavaria	no	no	yes	no	yes	no
Berlin	no	no	no	no	no	no
Brandenburg	no	no	no	no	no	no
Bremen	no	no	no	no	no	no
Hamburg	no	no	no	no	no	no
Hesse	no	no	no	no	no	no
Mecklenburg-Western Pomerania	no	no	yes	no	yes	no
Lower Saxony	no	no	no	no	no	no
North Rhine-Westphalia	no	no	no	no	no	no
Rhineland-Palatinate	no	no	no	no	no	no
Saarland	no	no	no	no	yes	no
Saxony	no	no	yes	no	yes	no
Saxony-Anhalt	no	no	yes	no	yes	no
Schleswig-Holstein	no	no	no	no	no	no
Thuringia	no	no	yes	no	yes	no

Table 1: Central exit examinations 2000

	Hauptschule		Realschule		Gymnasium	
	assign.	grading	assign.	grading	assign.	grading
Baden-Wurttemberg	yes	no	yes	yes	yes	yes
Bavaria	no	no	yes	no	yes	no
Berlin	no	no	no	no	no	no
Brandenburg	yes	no	yes	no	no	no
Bremen	no	no	no	no	no	no
Hamburg	no	no	no	no	no	no
Hesse	yes	no	yes	no	no	no
Mecklenburg-Western Pomerania	no	no	yes	no	yes	no
Lower Saxony	no	no	no	no	no	no
North Rhine-Westphalia	no	no	no	no	no	no
Rhineland-Palatinate	no	no	no	no	no	no
Saarland	yes	no	yes	no	yes	no
Saxony	no	no	yes	no	yes	yes
Saxony-Anhalt	no	no	yes	no	yes	no
Schleswig-Holstein	no	no	no	no	no	no
Thuringia	no	no	yes	no	yes	no

Table 2: Central exit examinations 2003

	Hauptschule		Realschule		Gymnasium	
	assign.	grading	assign.	grading	assign.	grading
Baden-Wurttemberg	yes	no	yes	yes	yes	yes
Bavaria	no	no	yes	no	yes	no
Berlin	no	no	yes	no	yes	yes
Brandenburg	yes	no	yes	no	yes	no
Bremen	yes	no	yes	no	yes	no
Hamburg	yes	no	yes	no	yes	no
Hesse	yes	no	yes	no	yes	yes
Mecklenburg-Western Pomerania	no	no	yes	no	yes	no
Lower Saxony	yes	no	yes	no	yes	no
North Rhine-Westphalia	yes	no	yes	no	yes	no
Rhineland-Palatinate	no	no	no	no	no	no
Saarland	yes	no	yes	no	yes	no
Saxony	yes	no	yes	no	yes	yes
Saxony-Anhalt	no	no	yes	no	yes	no
Schleswig-Holstein	no	no	no	no	no	no
Thuringia	no	no	yes	no	yes	no

Table 3: Central exit examinations 2006

2.2 Estimations

The distribution of students over the three different school tracks varies widely between the German federal states (Schnepf (2002, 26-29), Birkenfeld und Hanafy (2008)). To take account of this difference, the dummies from tables 1 and 2 shall be weighted with the number of students that finished the respective track in the respective year. The explaining variables *central assignment* and *central grading* will therefore not be dummies but ratios. Table 4 displays the results.

The higher the proportion of students who finish school with a central exit examination, the higher the federal state's average PISA score should be.

The ratio of students attending the most advanced secondary school track (Gymnasium) shall be added as a control variable. Table 5 shows that this *Abiturienten*[12]*-ratio* varies from 20,0 (Bavaria) to 32,8 per cent (Berlin) between the federal states.[13] There might be some causal negative dependency between central *Abitur* and the ratio of *Abiturienten* (Backes-Gellner und Veen, 2006). Nevertheless, the Abiturienten-ratio will also be influenced by the more or less restrictive admission to *Gymnasium*. In some federal states the parents decide about the track, in others teachers do (Birkenfeld und Hanafy, 2008).

As the students' ability can well be influenced strongly by their socio-economic background (especially for Germany: Schütz et. al. (2008)), suitable control variables need to be employed. For 2003, there are averages available on the federal state level on socio-economic status, father's employment, education of parents and migration background (Prenzel et. al. (2005a), Wößmann (2007, 29)). For 2000, only migration background (Baumert et. al., 2003b, 247) and mother's employment (Baumert et. al., 2003b, 381) are available.

In order to include both PISA years in the analysis, I use data which are in close relation to those published by Baumert et. al. (2003b) and Prenzel

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[12]School leavers at Gymnasium are called Abiturienten.

[13]"School leavers as proportion of the overall residents of the same age" (Kultusministerkonferenz, 2007, 367)

	2000		2003		2006	
	assign.	grad.	assign.	grad.	assign.	grad.
Baden-Wurttemberg	1.00	0.65	1.00	0.64	1.00	0.24
Bavaria	0.60	0.00	0.62	0.00	0.65	0.00
Berlin	0.00	0.00	0.00	0.00	0.75	0.40
Brandenburg	0.00	0.00	0.69	0.00	1.00	0.00
Bremen	0.00	0.00	0.00	0.00	1.00	0.00
Hamburg	0.00	0.00	0.00	0.00	1.00	0.00
Hesse	0.00	0.00	0.70	0.00	1.00	0.28
Mecklenburg-Western Pomerania	0.77	0.00	0.79	0.00	0.80	0.00
Lower Saxony	0.00	0.00	0.00	0.00	1.00	0.00
North Rhine-Westphalia	0.00	0.00	0.00	0.00	1.00	0.00
Rhineland-Palatinate	0.00	0.00	0.00	0.00	0.00	0.00
Saarland	0.28	0.00	1.00	0.00	1.00	0.00
Saxony	0.87	0.30	0.86	0.27	1.00	0.31
Saxony-Anhalt	0.87	0.00	0.86	0.00	0.85	0.00
Schleswig-Holstein	0.00	0.00	0.00	0.00	0.00	0.00
Thuringia	0.79	0.00	0.78	0.00	0.85	0.00

Table 4: Central exit examination as proportion of all exit examinations

	avg.	std.dev.	min.	max.
centr. assign.	0.42	0.42	0.00	1.00
centr. grading	0.06	0.17	0.00	0.65
Abiturienten-ratio	27.8	3.6	20.0	32.8
GDP per cap.	24878	7289.4	16437	44980
employment ratio men	69.67	4.82	60.8	78.5
city state	0.19	0.4	0	1
east-Germany	0.38	0.49	0	1
ratio cons. party	46.2	9.22	32.3	69.1

Table 5: Descriptive statistics (30 observations in 2000 and 2003)

	math	reading	science	problem-solving
constant	430.68**	401.37***	437.08***	464.73***
centr. assignment	5.57	0.94	5.38	−5.44
centr. grading	5.39	13.25	8.41	7.91
2003	8.89*	7.47$^{(*)}$	12.65*	–
Abiturienten-ratio	−1.33*	−0.66	−1.03	−1.98*
GDP per capita	0.85	0.45	1.06	1.37
employment-ratio	0.50	0.66	0.51	0.56
city state	−10.51	−5.50	2.41	−0.84
east Germany	15.71	6.07	7.13	26.59$^{(*)}$
ratio cons. party	0.70**	0.78**	0.72**	0.38
N	30	30	30	16
R^2	0.809	0.708	0.775	0.725
corr. R^2	0.723	0.577	0.674	0.411

***: significant at the 1%-level, **: significant at the 5%-level, *: significant at the 10%-level,

(*): significant at the 11%-level

Table 6: Estimations

et. al. (2005a): GDP per capita and employment of males (see also Gundlach und Wößmann (2004, 44)). Table 5 shows the respective control variables.

To account for possible further relevant differences in the populace between the federal states, I include dummies for the three city states and the six east German states. Furthermore, a relationship between a conservative attitude and a positive valuation of education is often assumed. As conservative governments might prefer central exit examinations, the true influence of this policy might be overestimated. I therefore introduce a control for the electorate's conservative attitude (share of votes for the conservative party CDU/CSU as part of votes for both big parties (CDU/CSU plus SPD) at the last nationwide election).

The variables are in line with the literature and especially with Wößmann (2007).

Table 6 shows the results of the regressions for the four parts of the PISA tests. There are only 30 observations, since Berlin and Hamburg are missing

in 2000. Problem-solving was not tested in 2000, therefor this regression covers only 16 observations (and no 2003 dummy).

Neither the central assignment, nor the central grading have a significant influence on the average student attainment in a federal state.

The controls do lead to a high degree of collinearity. The explaining variable *central grading* however does not suffer from this: The variance inflation factor (Belsley et. al., 1980, 93) for *central grading* is always smaller than 4 (Fox, 1997, 339 and 343). For *GDP* and *employment ratio* it is way above this threshold. For dummies, this number is not suitable. In the principal components analysis, the condition index is 33, 43 and 147 respectively for the three last components. These values are rated as high (Belsley et. al., 1980, 96 and 105). The rule of thumb stated by Belsley et. al. (1980, 117) which indicates collinearity when several variables load with more than 0.5 on a component with high condition index also suggests that only controls are affected.

Still, the coefficients point in the expected direction: Central grading (which only exists in line with central assignment) seems to be more important than central assignment alone.

These results explicitly contradict those of Wößmann (2007, 37). He had *central assignment* highly significant in various models. When comparing his variable with the values in table 2 of this paper, it becomes clear that Wößmann (2007, 36) is merely referring to the central Abitur, which should not influence the attainment of students in the two lower tracks Hauptschule and Realschule. I therefore suppose, that an omitted variable has a stronger influence in his work than in mine. Maybe this is because the values of central assignment here are often smaller than in Wößmann (2007). For Bavaria in 2003 (central assignment at Realschule and Gymnasium, though not at Hauptschule) my value is 0.62 and not 1.00.

Teachers and students in the three different German school tracks are not necessarily influenced and impressed equally by central exit examinations. I therefore analyze the impacts separately for the respective tracks. Controls stay the same.

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	math	reading	science	problem-solving
constant	$562,80^{***}$	$550,89^{***}$	$585,92^{***}$	$628,70^{***}$
centr. assign.	$1,90$	$-0,85$	$2,78$	$-8,44^{*}$
centr. grading	$0,71$	$7,69$	$8,22$	$7,73^{(*)}$
2003	$12,47^{***}$	$4,20^{(*)}$	$17,63^{***}$	$-$
Abiturienten-ratio	$-2,11^{***}$	$-0,72$	$-1,41^{(*)}$	$-1,70^{**}$
GDP per capita	$0,33$	$-0,49$	$-1,77^{(*)}$	$0,75$
employment-ratio	$0,52$	$0,47$	$0,27$	$-0,68$
city state	$-0,41^{**}$	$4,10$	$14,11^{*}$	$2,03$
east-Germany	$10,40$	$-7,21$	$-3,49$	$8,04$
ratio cons. party	$0,41^{(*)}$	$0,48^{*}$	$0,50^{*}$	$0,68^{**}$
N	32	32	32	16
R^2	0,824	0,672	0,757	0,835
corr. R^2	0,752	0,538	0,658	0,646

***: significant at the 1%-level, **: significant at the 5%-level, *: significant at the 10%-level,

(*): significant at the 11%-level

Table 7: Estimations (Gymnasium only)

2.2.1 Gymnasium

As central *Abitur* appeared to be significant in Wößmann (2007), Gymnasium shall be analyzed first. Average PISA scores are available for all federal states (Baumert et. al. (2003b, 69), Prenzel et. al. (2005a, 77, 97, 117, 136)).

The explaining variable is no longer a ratio but a dummy, as I am dealing with a single school track now. The dependent variable is federal state averages in PISA-2000 and -2003.

The ratio of student taking the Abitur stays in the regression. If some federal states have tighter admission regulation than others, this should increase their average score in the highest track.

Table 7 displays the results. There is a significant impact (11%-level) of central grading[14] on student attainment in problem-solving. However this model has only 16 observations. The significance of the different controls is deceptive due to collinearity.

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[14]2003: Baden-Wurttemberg and Saxony

As for the average over all tracks, it can also be stated for the Gymnasium that a proof for the importance of central grading is hard to find. A positive sign on an insignificant coefficient is all there is.

2.2.2 Realschule

As far as I know, there are no official data available for federal state averages in PISA-scores for the school track of Realschule. However, the Association of German Realschule-teachers (Verband Deutscher Realschullehrer, VDR) has published such numbers for 2003 on its website.[15] Moreover, the numbers for Bavaria in 2000 are available at BRLV (2002, 20).

For Saarland, Saxony, Saxony-Anhalt and Thuringia, there are no values given, as according to the VDR in these federal states no distinct Realschulen are in Operation. All federal states enter the regression. There will be dummy (SSST) introduced for the above mentioned.

Table 8 shows the results. Again the point estimates are insignificant but have the expected sign.

There was no central grading at the lowest track (Hauptschule).

3 Conclusions

Only first econometric indications could be found for the hypothesis that central grading via increased teacher and student effort should lead to better student attainment: Insignificant coefficients, which do possess the expected sign however. Collinearity does not affect this statement (Belsley et. al., 1980, 116).

The levels of significance for central grading at Gymnasium are at 12% for reading and at 11% for problem-solving. At Realschule, not a single coefficient reaches the 50%-level. The low variance of the explaining variables (tables 4 and 5) which is due to my using averages on the level of the federal states has its share in these insignificant coefficients.

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[15]www.vdr-bund.de/PDF-Download/PISA-2003_Vergleich_der_Laender.pdf

	math	reading	science	problem-solving
constant	514.15***	503.64***	553.60***	513.55***
centr. assign.	−8.51	−12.50	−12.24	−13.49
centr. grading	3.83	8.30	8.35	0.72
Abiturienten-ratio	−4.08*	-2.94	−3.86*	−3.73*
GDP per capita	0.73	0.77	0.52	0.96
employment-ratio	0.38	−0.17	−0.17	0.57
city state	−1.15	−4.17	−2.63	−3.04
east-Germany	19.84	5.33	5.00	19.29
ratio cons. party	1.11*	1.50*	1.24	0.85
SSST-Dummy	−19.24*	−26.22*	−18.46	−26.69**
N	16	16	16	16
R^2	0.890	0.889	0.882	0.889
corr. R^2	0.724	0.724	0.705	0.723

***: significant at the 1%-level, **: significant at the 5%-level, *: significant at the 10%-level,

(*): significant at the 11%-level

Table 8: Estimations (Realschule 2003)

At least an indication that a central exit examination should also include central grading can be found as a result. However, this is way more likely for the highest school track (Gymnasium) than for the middle one (Realschule). It would be very helpful to use micro data for this kind of analysis. In connection with the categorization in tables 1 to 3, this would lead to higher variance of the explaining variables and might thus increase the coefficients' significance. There is a dataset, which additionally to each student and her family background also contains the federal state and the school track. This dataset should be made accessible to researches. Maybe the presented categorization will then be used for further work.

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