DISCUSSION PAPER SERIES

IZA DP No. 6073

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Thomas K. Bauer
Barbara S. Grave

October 2011

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

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Thomas K. Bauer
RWI, Ruhr-Universität Bochum and IZA

Barbara S. Grave
RWI

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IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 6073
October 2011

ABSTRACT

Performance-related Funding of Universities: Does More Competition Lead to Grade Inflation?*

German universities are regarded as being under-financed, inefficient, and performing below average if compared to universities in other European countries and the US. Starting in the 1990s, several German federal states implemented reforms to improve this situation. An important part of these reforms has been the introduction of indicator-based funding systems. These financing systems aimed at increasing the competition between universities by making their pubic funds dependent on their relative performance concerning different output measures, such as the share of students obtaining a degree or the amount of third party funds. This paper evaluates whether the indicator-based funding created unintended incentives, i.e. whether the reform caused grade inflation. Estimating mean as well as quantile treatment effects, we cannot support the hypothesis that increased competition between universities causes grade inflation.

JEL Classification: H52, I21, I22

Keywords: grade inflation, higher education funding, university competition

Corresponding author:

Barbara S. Grave
RWI
Hohenzollernstraße 1-3
45128 Essen
Germany
E-mail: barbara.grave@rwi-essen.de

* We are grateful to Ronald Bachmann, Christoph M. Schmidt and the participants of the Micro Seminar at the ANU, Canberra. - All remaining errors are our own.

1 Introduction

Education policies increasingly rely on incentive schemes to improve the quality of teaching. These schemes include, among others, performance-related pay systems for teachers and schools, where the salary of the teachers or public funds allocated to schools depend on the performance of a class or a school measured by standardized tests. Performance-based allocation of public funds is also increasingly used to give incentives for performance improvements in the higher education system. However, it is well known that performance-related pay schemes may result in unintended or undesired (strategic) reactions of the agents if these schemes are designed poorly. In the case of the educational system, these schemes may, for example, result in agents teaching to the rating or even circumventive behavior. Empirically, the evidence on the effects of performance-related pay-systems is rather mixed. While Kingdon and Teal (2007), Atkinson, Burgess, Croxson, Gregg, Propper, Slater, and Wilson (2009), and Lavy (2009) find positive effects of these payment schemes on student performance for India, England, and Israel, respectively, Martins (2010) finds a decline in student achievement and an increase in grade inflation for Portugal. However, empirical evidence points to undesirable strategic reaction such as teaching to the rating (e.g. Burgess, Propper, Slater, and Wilson, 2005; Jacob, 2005; Reback, 2008) or cheating (e.g. Jacob and Levitt, 2003a,b).

In Germany, the reforms of the funding system for universities has been started in the early 1990s, when the federal states (*Bundesländer*) became increasingly aware of the inefficiency and lack of performance of German universities (e.g. Joumady and Ris, 2005; Kocher, Luptacik, and Sutter, 2006). For example, in 2008 the graduation rate in tertiary education, i.e. the number of graduates relative to the age-specific population, was 36% in Germany compared to 48% in the OECD average and 47% in the US (OECD, 2010). These reforms aimed to implement managerial instruments in public institutions (called *New Public Management*, NPM) in order to increase the universities' efficiency and performance. An important element of these reforms has been a change of the allocation system of public funds to the universities. In the traditional funding system, the universities' budget was determined by simply carrying forward the previous year's budget. Neither was this budget related to the universities' performance, nor did the universities compete for the funds. Furthermore, the universities had only little financial autonomy, because the public funds were strictly apportioned to specific expenditures. In contrast, the new funding system does not only offer the universities more flexibility in using their budget. It should also generate incentives to increase performance and efficiency via a more intense competition between the universities by making parts of the fund depending on a set of performance indicators.

Similar to the incentive-based payment and funding schemes at schools, the indicator-based funding system for universities may also generate wrong incentives. For example, by rewarding the number of graduates, the university may react by decreasing quality standards, e.g. inflating grades, rather

than increasing teaching quality. The empirical evidence on the effects of performance-orientated funding schemes on university behavior is scarce. The theoretical model developed by Warning and Welzel (2005) suggests that public funding that is linked to the number of students supports grade inflation.[2] Grade inflation in turn is problematic, because it affects the correlation between grades and students' ability. As grades become more compressed, they lose their function as a signal of otherwise unobserved ability for the students themselves (internal signal) and for potential employers (external signal). Sabot and Wakeman-Linn (1991) and Bar, Kadiyali, and Zussman (2009) find that grade inflation leads to a distortion of students' allocation across courses and disciplines. Furthermore, grade inflation may lead to either underinvestment or overinvestment in human capital (Eaton and Eswaran, 2008). Schwager (2008) argues that employers may use social origin as a signal for productivity if grades are less than fully informative. Bagues, Labini, and Zinovyeva (2008) show that there is, if any, a negative correlation between high-grading departments and labor market outcomes. They further argue that the existing Italian funding scheme, which rewards universities with higher value added measured by students' academic performance, favors universities with lower standards.

This paper contributes to this literature by analyzing whether the introduction of the indicator-based funding system for German universities generated unintended strategic reactions, in particular, whether it has been accompanied by grade inflation. In order to assess the causal effect of the German funding reform on average grades, and hence on grade inflation, we rely on a difference-in-differences approach utilizing the different timing of the introduction of indicator-based funding systems across the federal states. The empirical results suggest that these funding systems did not affect mean grades significantly. To provide a more complete picture of the treatment effect, we also apply quantile regressions in order to evaluate the effects of the funding reform on the entire grade distribution. Here, we do not observe any evidence for grade inflation either.

The remainder of this paper is organized as follows. Section 2 gives an overview on the funding reform and section 3 presents the data and the empirical strategy. The results are presented in section 4. Section 5 concludes.

2 The funding reform

In Germany, the majority of tertiary education institutions are public (about 63% in 2011). Despite some general rules that are determined by the federal government to ensure comparability (*Federal Framework Act on Higher Education - Hochschulrahmengesetz*), such as the admission of students,

[2]However, there are also other reasons for grade inflation discussed in the literature, e.g. the improvement of teaching evaluations (Siegfried and Fels, 1979; Nelson and Lynch, 1984; Krautmann and Sander, 1999), the attraction of more students in general (Warning and Welzel, 2005) or too poorly attended courses (e.g. Dickson, 1984), the competition among departments for students (Freeman, 1999; Anglin and Meng, 2000) or an institution's effort to improve teaching quality, research productivity, or both (Love and Kotchen, 2010).

the federal states are responsible for higher education. Because of an increasing awareness of inefficiencies in the German university system as well as a lack of performance if compared to universities in other countries, several reforms have been implemented starting in the early 1990s. Based on instruments of the *New Public Management* (NPM), a new system of university steering was implemented. Managerial instruments were introduced that aimed to emulate a market-like environment through the introduction of competition, emphasis on performance reporting and the increase of autonomy of the universities.

As a part of the reform, the reformulation of the *Federal Framework Act on Higher Education* regularized the idea of a funding system that is based on performance indicators in 1998. Following this change in law, the federal states were obliged to reform their higher education system in line with these general principles. Especially the change in the funding system caused substantial debates, mainly because universities are to a large extend financed by public funds. In 1993, for example, the share of public funds in the budget of the universities was 63%, while third-party funds reached only a share of 8% (Statistisches Bundesamt, 2009).[3] Several inefficiencies marked the pre-reform funding system (in the remainder called "traditional system"). The universities received public funds based on the previous year's budgets that were simply carried forward. The budget was strongly need-oriented and depended mainly on the output a university was supposed to produce, i.e. the number of students that should be taught. It was not related to the output actually produced by the university. Additionally, the budget was apportioned to specific expenditure categories ("line-item budgeting"). The transferability of budget apportions between expenditure categories and budget years was limited, which strongly reduced a university's capability to allocate their resources efficiently. One well-known problem of this funding scheme was the incentive to universities to spend the public funds not used by the end of the budget year quite randomly in order to prevent a cutback in their budget for the next year ("December fever").

The funding reforms aimed to make the budgeting system for universities more flexible. In particular, the transferability between expenditure categories as well as between budget years was made possible. Some states even ceased to apportion the public funds to detailed expenditure categories and introduced lump-sum budgets. The increased financial autonomy gained by the universities was accompanied by an increase in the autonomy of the universities concerning their organization and their strategic planing as well as by new steering and controlling instruments that have been implemented by the federal states. In addition to contracts that apply to all universities, the latter also includes university-specific target agreements.[4] A main part of the new budget system has been, however, the

[3] The remaining 39% were due to operating income. Note that the composition of the university budgets vary substantially between the federal states.

[4] Target agreements or university contracts are concluded between the federal state, i.e. the respective Ministry of Education, and the universities. These contracts lay down certain institutional policies and goals as well as funding for achievement of institutional goals.

introduction of an indicator-based funding system, making the budget of a university dependent on a set of performance indicators. These indicators can be both, input- (e.g. number of academic staff or students) or output- (e.g. number of graduates or amount of third-party funds) oriented.

Because of the federalistic organization of the German higher education system, a variety of funding reforms developed across the federal states, including different years of introduction, different proportions of public funds that are allocated based on indicators, different scopes of competition, different performance benchmarks and different sets of indicators. In the following analysis we evaluate the funding model that has been introduced in North-Rhine Westphalia (NRW) between 1993 and 1997. The case of NRW is particularly interesting, because it was the first state that made public funding dependent on universities' performance. Since we do not observe North-Rhine Westphalian technical colleges in our data, we concentrate on the model introduced at universities.

Table 1: Funding allocation model at North-Rhine Westphalian universities (1993-1997)

	1993	1994	1995	1996	1997
Share on total public funds (%)	0.1	0.5	1	2	3
Indicators (Share in %):					
Relative number of students (1.-4. semester)	-	-	-	20	20
Relative number of graduates	100	100	70	35	35
Relative amount of third party funds	-	-	24	20	20
Relative number of graduates with doctoral degree	-	-	6	5	5
Relative number of academic staff	-	-	-	20	20

Notes: For the indicator students, the most recent data is used. For all other indicators, an average over the last three years is used. All indicators are weighted by field of study. Since 1996, the graduates are additionally weighted by duration of study. - The university's performance is measured relative to the performance of the other North-Rhine Westphalian universities.
Source: Ministerium für Wissenschaft und Forschung des Landes Nordrhein-Westfalen (n.d.)

Table 1 summarizes the development of the indicator-based funding system in NRW. In 1993, the amount of public funds allocated on the basis of indicators was relatively small (about 0.1%), but increased to 3% until 1997.[5] At first, only one indicator – the number of graduates relative to the other North-Rhine Westphalian universities – was used to allocate the performance-related part of the budget. The relative amount of third-party funds and the relative number of graduates with doctoral degree has been introduced as additional indicators in 1995. In 1996, the model was enlarged by using the relative number of students and academic staff as indicators. As this paper is concerned with the issue of grade inflation, we concentrate on indicators that may affect grades, i.e. the number of graduates and the number of students. In the period under study, these two indicators accounted for 55% to 100% of the funds that were dependent on performance-indicators.

[5]The total sum of public funds for North-Rhine Westphalian universities and technical colleges was 2,647 million Euros in 1993 and 3,128 million Euros in 1998 (Statistisches Bundesamt, 2004).

3 Data and identification strategy

The following empirical analysis employs the *Student Survey 1983-2007*, a representative sample of German university students that has been collected by the AG Hochschulforschung at the University of Konstanz.[6] The survey started in the Winter Term 1982/1983 and has been repeated every two- or three years since. In every wave, between 7,000 and 10,000 German students at specific universities were asked about different topics related to their study, e.g. their learning behavior and attendance, the quality of teaching, as well as some socio-demographic characteristics. The main strength of this dataset is the long time period and its combination of data on students' academic achievement with study and student characteristics.

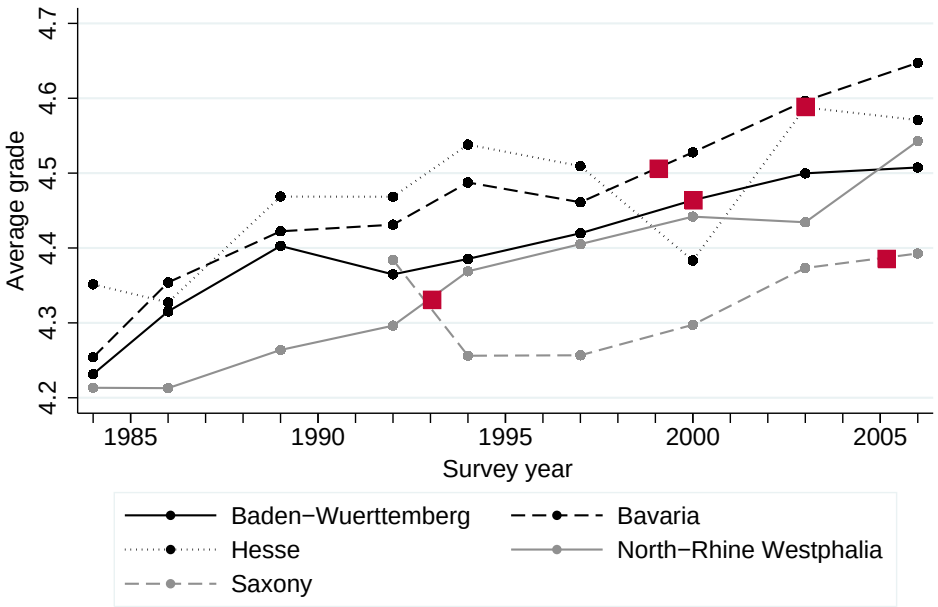
Even though the dataset is unique, it is limited on the regional and yearly dimension. In particular, only 13 out of 16 federal states are included and in each of the federal states students of at most four different universities are surveyed in every wave. Choosing students enrolled at universities in North-Rhine Westphalia as treatment group, our sample comprises students at the universities of Bochum and Essen. Both universities are located in the Ruhr Area. Students enrolled at universities in Baden-Wuerttemberg and Bavaria represent the control group. These universities consist of Freiburg and Karlsruhe in Baden-Wuerttemberg and the University of Munich and the technical colleges of Coburg and Munich in Bavaria. The choice of the treatment and control group was forced by several characteristics of our data as well as differences in the higher education system across the federal states. As shown in Table A1 in the Appendix, most of the states cannot be used as treatment or control group because of the limited number of available observations (Brandenburg, Mecklenburg-West Pomerania, Rhineland-Palatinate, Saxony-Anhalt, Schleswig-Holstein, and Thuringia). The city states Berlin and Hamburg are also ineligible, since their higher education system is different to those of the other federal states. In particular, since the density of universities is higher in city states, the competition, e.g. for students, may be of a different nature. Furthermore, these universities often attract a large amount of students from neighboring federal states. Of the remaining states, the treatment and control group is selected considering the development of the outcome measure, i.e. average grades the students earned during their whole study (see Figure 1) as well as the timing of the reforms (see Table A1 in the Appendix).

Since the introduction of the funding reform can be treated as a natural experiment, we rely on a difference-in-differences approach (DD) to assess the question whether the introduction of indicator-based funding at German universities led to grade inflation.[7] In particular, our empirical strategy

[6] See Simeaner, Dippelhofer, Bargel, Ramm, and Bargel (2007) for a documentation. The dataset is distributed by the GESIS-ZA Central Archive for Empirical Social Science (*Zentralarchiv für empirische Sozialforschung*) or by the AG Hochschulforschung at the University of Konstanz.

[7] For a further discussion on the difference-in-differences strategy see e.g. Bauer, Fertig, and Schmidt (2009) and Lechner (2010).

Figure 1: Development of average grades for possible treatment and control states



Note: Squares indicate the time of the reform's introduction. − The grades range from1 (worst) to 6 (best).
Source: Student survey 1983−2007, AG Hochschulforschung.

exploits the fact that the indicator-based funding scheme was not introduced simultaneously in all federal states. The idea of the DD is to compare the development of an outcome variable over time between a treatment group and a well-defined control group. This comparison can be used to remove any bias due to changes over time that are common to both groups.

Using students from North-Rhine Westphalia as treatment and students from Baden-Wuerttemberg and Bavaria as control group, the DD approach is implemented by estimating the following regression model using pooled OLS:

$$Y_{it} = \gamma_1 T_t + \gamma_2 Post_t + \eta_1 NRW_i + \delta(Post_t \times NRW_i) + X'_{it}\beta + \varepsilon_{it}, \quad (1)$$

where Y_{it} is the outcome variable, i.e. the average grade[8] of student i at time t they have earned during their undergraduate study. ε_{it} is an idiosyncratic error term. **X** is a vector of covariates that includes variables on student and study characteristics. In particular, we control for socio-demographic characteristics of the students by including age and gender. As proxies for ability, we incorporate the final high school grade[9] as well as both parents' education, distinguishing between less than vocational degree, vocational degree and tertiary degree. Different characteristics of the course of study are measured by the length of study, a binary variable indicating whether the student

[8]The German grade scale ranges from 1 to 6 with 1 being the best and 6 the worst grade. In order to pass an exam, a grade of 4 or better is necessary. We transform the grade (by subtracting it from 7) such that 1 is the worst and 6 is the best grade to attain that a positive sign in the estimation output indicates an improvement in grades.

[9]The final high school grade is transformed in the same way as the final high school grade such that 1 is the worst and 6 is the best grade.

changed the university or major and proxies for the university quality assessed by the students, i.e. the teaching quality, the performance requirements and the way the course of study is structured. The students' perception of quality is aggregated on faculty level and measured on a scale from 0 to 6, with a higher number indicating a higher quality. Additionally, we include the field of study and the university. A description of the variables used in the analysis is provided in Table A2 in the Appendix.

T_t is a trend variable that is incorporated to control for a general trend that is similar for both groups. $Post_t$ is a dummy variable that takes a value of one for observations after the reform (1994 and 1997) and zero otherwise. By including $Post_t$ in the regression, time-specific variations in grades affecting both groups similarly are taken into account. The binary variable NRW_i indicates the treatment group and the interaction term ($Post_t \times NRW_i$) takes the value 1 for observations after the reform in the treatment group and zero otherwise. The coefficient of interest, δ, measures the mean treatment effect on the treated, i.e. the effect of the funding reform on students' average grades. A positive and significant δ would show that the reform led to better grades in the treatment group. Assuming that the proxies for university quality included in $\mathbf{X}$ are sufficient to rule out improved grades due to better quality, a positive sign can be interpreted as evidence for grade inflation.

Since we observe treatment and control group at two points in time after the reform, we additionally allow the treatment effect to differ by post-reform years. This is reasonable, since one of our indicators of interest, the number of graduates, is based on lagged values, i.e. the number of graduates is averaged over the last three years. In particular, we estimate the regression model:

$$\begin{aligned} Y_{it} &= \gamma_1 T_t + \gamma_2 Post1994_t + \gamma_3 Post1997_t + \eta_1 NRW_i \\ &\quad + \delta_{1994}(Post1994_t \times NRW_i) + \delta_{1997}(Post1997_t \times NRW_i) + X_{it}'\beta + \varepsilon_{it}, \end{aligned} \tag{2}$$

where $Post1994_t$ and $Post1997_t$ indicate the respective post-reform year. The coefficients of interest are now δ_{1994}, estimating the reform's effect one year, and δ_{1997}, measuring the effect four years after the reform. All other variables are similar to those used in equation (1).

Analyzing the reform's effect in terms of changes in the mean only may provide an incomplete and misleading picture. To evaluate whether the reform led to grade inflation, changes in the whole distribution of grades are of interest, since grade inflation can lead to a compression of the grade distribution. On the one hand, the grade distribution may become compressed at the upper end, if all students get better grades but the best students cannot obtain better grades. On the other hand, the compression may occur at the lower tail of the grade distribution if just the achievement requirements for passing an exam are decreased and hence more students pass an exam.

In order to evaluate the effect of the funding reform on the entire grade distribution, we augment our analysis to the estimation of quantile treatment effects (QTE), which gives us the treatment

effect at specific quantiles of the grade distribution. We estimate the conditional QTE as proposed by Froelich and Melly (2010). They state that under the following two assumptions, the conditional exogenous QTEs can be estimated by the classical quantile regression estimator proposed by Koenker and Bassett (1978). The first assumption requires that the outcome vaiable Y is a linear function in the controls X and the treatment variable D. The second assumption requires exogeneity of both, X and D. Using these assumptions, we can estimate the conditional quantile treatment effects for $D = Post_t \times NRW_i$. Hence, averaging again over both post-reform years, we estimate:

$$Q^\tau(Y_{it}|X_{it}) = \gamma_1^\tau T_t + \gamma_2^\tau Post_t + \eta_1^\tau NRW_i + \delta^\tau(Post_t \times NRW_i) + X_{it}'\beta^\tau + \varepsilon_{it}^\tau, \tag{3}$$

where $Q^\tau(Y_{it}|X_{it})$ is the grade at the τth quantile, conditional on the set of control variables $\mathbf{X}$. T_t again is a trend variable, and $Post_t$ and NRW_i indicate the post-reform period and the treatment group, respectively. $\mathbf{X}$ is the same set of control variables as in the mean effect estimation and ε_{it}^τ is the i.i.d. error term. The treatment effect at quantile τ is measured by δ^τ. Assuming that in the case of grade inflation, instructors give all students better grades and that the best students cannot obtain better grades, we would expect positive and significant δ^τ at all quantiles. This is because the distribution is shifted to the right, i.e. towards better grades, as well as compressed at the upper tail of the distribution. If instructors just reduce the requirements to pass an exam, we would observe grade compression at the lower end of the grade distribution. Evidence pointing in this direction are positive and significant δ^τ for lower quantiles.

Allowing for year-specific treatment effects, equation (3) is also estimated including dummy variables and their interaction for both the post-reform years:

$$\begin{aligned} Q^\tau(Y_{it}|X_{it}) \;=\; & \gamma_1^\tau T_t + \gamma_2^\tau Post1994_t + \gamma_3^\tau Post1997_t + \eta_1^\tau NRW_i \\ & + \delta_{1994}^\tau(Post1994_t \times NRW_i) + \delta_{1997}^\tau(Post1997_t \times NRW_i) \\ & + X_{it}'\beta^\tau + \varepsilon_{it}^\tau. \end{aligned} \tag{4}$$

The coefficients of interest are δ_{1994}^τ and δ_{1997}^τ that measure the quantile treatment effect in year 1994 and 1997, respectively, at quantile τ. $Post1994_t$ and $Post1997_t$ again indicate the two post-reform years. All other variables included are similar to those incorporated in equation (3). The crucial identification assumption of our approach is, however, that the difference in the outcome measure, i.e. average grades, between treatment and control group would have stayed stable in the absence of the funding reform. Unfortunately, this assumption cannot be tested because the counterfactual is unobservable. A further requirement in estimating an unbiased reform effect is that no other reform or change took place in the same period that influenced treatment and control group differently. We

are not aware of any significant reform or trend that may interfere with the funding reform. The general trend in increasing grades over time has a similar pattern for all federal states (see Figure 1) and can therefore be controlled for by including a trend variable.

The *Student Survey 1983-2007* is a cross-sectional survey of all enrolled students at a specific university. We therefore observe students of all semesters, leading to two types of treated students. The first type consists of students that started their degree some time after the reform was implemented and thus studied under the new regime only. The second type of students started before the reform, but is observed some time after the reform. Those students studied under both regimes and their average grades are some combination of grading standards before and after the reform, because we only observe the average grade of the students over their entire study up to the survey date. To account for these two types of students, we define two different treatment groups: (i) only students that started their university education after the implementation of the reform ("full treatment group") and (ii) the full treatment group and students that studied before and after the reform ("full and partial treatment group"). For students with partial treatment the treatment dummy is weighted by the relative duration of treatment.

We exclude all students with graded intermediate exams from the analysis, since for them, neither the date of the intermediate exam nor information on average grades is provided by the data.[10] Students studying for 31 semesters or more as well as students that started their study when being older than 40 years are excluded. Furthermore, all students with average university grades equal to six and those with final high school grades worse than the maximum exam passing grade (grade 4) are excluded, as this is a clear indication of measurement error. The final sample including only students with full treatment comprises 9,496 observations; the sample including all students contains 10,307 observations. Summary statistics for the treatment and control group before and after the reform are shown in the Appendix in Table A3.

4 Results

To give a first impression on how average grades changed with the reform, Table 2 reports the grades of the treatment and control group before and after the reform.[11] Panel 1 compares the difference between pre- and post-reform grades for the treatment group with the respective difference for the control group. Here, we distinguish between the average grades over both post-treatment years, i.e. 1994 and 1997 ((2)-(1)), and grades for each of the two post-reform years separately ((3)-(1) and

[10] Before the introduction of the Bachelor and Master degrees, in most degree programs the students complete a two year period of initial studies to attain an intermediate exam (Vordiplom/ Zwischenprüfung). After passing this intermediate exam the students gain access to the main course of study (Hauptstudium) that leads to the final university degree.

[11] For sake of brevity, here, we only present the results for the full treatment group.

(4)-(1), respectively). Another way to calculate the unconditional treatment effect is to compare the difference between treatment group and control group before the reform with the difference between these groups after the reform ((A)-(B)). Again, we calculate this difference for both post-reform years together as well as for each of the post-reform years separately. The unconditional treatment effect on the treated is 0.01 in the case of averaging over both post-reform years, and -0.071 for the year 1994 and 0.059 for the year 1997, respectively. In Panel 2 of Table 2 the treatment group is compared to only Baden-Wuerttemberg (BW) as control state; in Panel 3 only Bavaria (BY) is used as control state. Using only one of the two states as control group yields similar results of positive effects in the year 1997, while in 1994 a negative effect is apparent. However, the effect averaged over both treatment years is positive only when comparing North-Rhine Westphalia with Bavaria.

Table 2: Average student grades for treatment and control group

			1994,1997		1994		1997	
		Pre	Post		Post		Post	
		(1)	(2)	(2)-(1)	(3)	(3)-(1)	(4)	(4)-(1)
Panel 1								
(A)	Treatment group	4.245	4.327	0.082	4.222	-0.022	4.391	0.146
		(0.012)	(0.030)	(0.032)	(0.047)	(0.050)	(0.039)	(0.040)
(B)	Control group	4.338	4.410	0.072	4.386	0.049	4.425	0.087
		(0.009)	(0.020)	(0.023)	(0.031)	(0.036)	(0.025)	(0.029)
(A)-(B)		0.093	0.083	0.010	0.164	-0.071	0.034	0.059
		(0.015)	(0.035)	(0.041)	(0.056)	(0.063)	(0.045)	(0.051)
Panel 2								
(A)	Treatment group	4.245	4.327	0.082	4.222	-0.022	4.391	0.146
		(0.012)	(0.030)	(0.032)	(0.047)	(0.050)	(0.039)	(0.040)
(C)	Baden-Wuerttemberg	4.319	4.407	0.088	4.392	0.072	4.420	0.100
		(0.013)	(0.028)	(0.032)	(0.043)	(0.046)	(0.038)	(0.042)
(A)-(C)		0.075	0.080	-0.005	0.169	-0.094	0.029	0.046
		(0.018)	(0.041)	(0.046)	(0.064)	(0.068)	(0.054)	(0.058)
Panel 3								
(A)	Treatment group	4.245	4.327	0.082	4.222	-0.022	4.391	0.146
		(0.012)	(0.030)	(0.032)	(0.047)	(0.050)	(0.039)	(0.040)
(D)	Bavaria	4.352	4.412	0.060	4.379	0.026	4.429	0.077
		(0.013)	(0.027)	(0.034)	(0.042)	(0.056)	(0.034)	(0.041)
(A)-(D)		0.108	0.085	0.022	0.156	-0.048	0.038	0.069
		(0.017)	(0.040)	(0.047)	(0.063)	(0.075)	(0.051)	(0.057)

Notes: Standard errors in parentheses. - The numbers refer to the full treatment group.
Source: Student survey 1983-2007, AG Hochschulforschung, own calculations.

The estimated average treatment effects of the funding reform are shown in Table 3.[12] Columns (1) to (3) present the results when we consider only those students, who studied completely under either the old or the new funding regime. Columns (4) to (6) show the results when we additionally consider students with a partial treatment. i.e. students who studied under both regimes. Panel A of Table 3 presents the mean treatment effect pooled over both post-reform years, while Panel B differentiates between the two post-reform years.

[12]The full table including all controls is presented in Table A4 in the Appendix.

Table 3: Average university grades, Difference-in-differences estimation: mean treatment effects

	Full treatment			Full and partial treatment		
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A						
$\delta^{mean}_{1994,1997}$	0.0073	0.0136	-0.0332	-0.0238	-0.0244	-0.0344
	(0.0597)	(0.0602)	(0.0421)	(0.0500)	(0.0510)	(0.0404)
Trend	-	X	X	-	X	X
Controls	-	-	X	-	-	X
$\bar{R}^2$	0.006	0.012	0.285	0.008	0.013	0.295
N	9,728	9,728	9,496	10,553	10,553	10,307
F	3.91	8.69	124.38	13.06	11.54	241.08
PANEL B						
δ^{mean}_{1994}	-0.0781	-0.0713	-0.0589	-0.1105 *	-0.1030 *	-0.0492
	(0.0784)	(0.0779)	(0.0486)	(0.0591)	(0.0596)	(0.0451)
δ^{mean}_{1997}	0.0585	0.0653	-0.0175	0.0379	0.0446	-0.0168
	(0.0654)	(0.0660)	(0.0513)	(0.0635)	(0.0637)	(0.0496)
Trend	-	X	X	-	X	X
Controls	-	-	X	-	-	X
$\bar{R}^2$	0.006	0.012	0.285	0.009	0.014	0.294
N	9,728	9,728	9,496	10,553	10,553	10,307
F	7.13	7.84	257.38	8.63	8.42	240.73

Notes: Clustered standard errors in parentheses. - In Panel A the treatment effect is averaged over both years and in Panel B the treatment effect is allowed to differ by year. - Controls include age, gender, duration of study, final high school grade, parents education, change of university or major, the university's quality, field of study and universities. - * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Source: Student survey 1983-2007, AG Hochschulforschung, own calculations.

Regardless of whether we use only students with full treatment or all students, whether we estimate the raw treatment effect or include control variables, or whether we estimate an average treatment effect over both treatment years or allow the effect to be different for the two post-reform years, we do not find any statistically significant effect of the reform on average grades. The only exception is found for the year 1994 using all students and including either only the treatment variables (column (4) in Panel B) or the treatment variables and a trend variable (column (5) in Panel B). These two specifications suggest that the reform resulted in lower average grades, at least in the year following the reform. Note, however, that these coefficients are also only statistically significant on a 10%-level.

Table 4 shows the estimated quantile treatment effects we obtain by estimating model (3) and (4), respectively. The QTE are estimated including the whole set of control variables for the 10-th, 25-th, 50-th, 75-th, and 90-th quantile. Similar to the average treatment effects shown in Table 2, the QTE are estimated for both definitions of the treatment group, i.e. including only students with full treatment (left part of Table 4) and including students with full and partial treatment (right part of Table 4). In Panel A, the QTE are estimated over both post-reform years 1994 and 1997, while Panel B shows the QTE for both the post-reform years separately.

As evidence for grade inflation we would expect positive and significant coefficients either for all quantiles or at lower quantiles only. While the former supports evidence for a shift of the grade distribution and a grade compression at better grades, the latter induces grade compression at the lower end of the grade distribution. However, we do not find any evidence of grade inflation caused by the introduction of the indicator-based funding reform.

We perform several robustness checks. Firstly, the multiple points in time before the introduction of the reform that we observe in the data can be used to test whether the universities in North-Rhine Westphalia anticipated the reform, i.e. whether our estimates suffer from an Ashenfelter's dip-problem, by including dummy variables for the years 1992 and 1989 in the regression. The results do not give an indication that the universities changed their grading policy in anticipation of the reform. Secondly, we estimate the treatment effect including only one of the control states, i.e. either Baden-Wuerttemberg or Bavaria. Again, the results are not affected by this change.

5 Conclusion

The performance of a higher education system depends on both the sufficient supply of financial resources and the efficient use of these resources. Starting in the early 1990s, several reforms were implemented in the German higher education system to increase the universities' efficiency and performance. The German federal states, who are responsible for the organization of the higher education system, followed a different pace in implementing these reforms, whose goal was the introduction of managerial instruments in publicly funded institutions (*New Public Management*). In this paper,

Table 4: Average university grades, Difference-in-differences estimation: Conditional quantile treatment effects

	Full treatment (N= 9,496)					Full and partial treatment (N=10,307)				
	τ_{10}	τ_{25}	τ_{50}	τ_{75}	τ_{90}	τ_{10}	τ_{25}	τ_{50}	τ_{75}	τ_{90}
Panel A										
δ^{τ}	-0.0454	-0.0254	-0.0264	-0.0088	-0.0224	-0.0752	-0.0251	-0.0221	-0.0221	-0.0398
	(0.0562)	(0.0399)	(0.0414)	(0.0423)	(0.0532)	(0.0532)	(0.0399)	(0.0386)	(0.0379)	(0.0477)
Panel B										
δ^{τ}_{1994}	-0.0878	-0.0516	-0.0712	-0.0708	-0.0458	-0.1018	-0.0312	-0.0381	-0.0735	-0.0542
	(0.0848)	(0.0637)	(0.0667)	(0.0656)	(0.0845)	(0.0771)	(0.0575)	(0.0549)	(0.0493)	(0.0663)
δ^{τ}_{1997}	-0.0033	0.0009	-0.0059	0.0066	-0.0165	-0.0069	0.0024	-0.0044	0.0061	-0.0300
	(0.0687)	(0.0511)	(0.0534)	(0.0527)	(0.0672)	(0.0644)	(0.0495)	(0.0483)	(0.0446)	(0.0602)

Notes: Robust standard errors in parentheses. - In Panel A the treatment effect is averaged over both years and in Panel B the treatment effect is allowed to differ by year. - All regressions include as control variables a trend, age, gender, duration of study, final high school grade, parents' education, change of university or major, the university's quality, field of study and universities. - * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Student survey 1983-2007, AG Hochschulforschung, own calculations.

we focus on the instrument of performance-based funding as it was an important part of these reforms. In contrast to the traditional funding system in which the budget of a given year was based on past budgets and the outcome a university should produce, the new funding system takes the actual performance of a university into account. The university's performance is measured by a set of indicators, e.g. the number of graduates or the amount of third party funds. Additionally, the university's performance is compared to the performance of other universities.

However, such a funding system is only able to increase university quality if they provide the right incentives. Existing evidence shows that a funding system that concentrates on a few output indicators may lead to wrong incentives. Using for example the number of graduates as an indicator to determine the amount of public funds a university receives, the university may reduce quality standards to increase the amount of graduates rather than increasing teaching quality. In such a case, the reform may lead to grade inflation while the goal of increasing teaching quality is not reached.

In this paper we analyze whether the new funding system indeed caused wrong incentives to German universities. In particular, we assess the influence of the indicator-based funding system on the students' average grades to identify whether the funding reform led to grade inflation. The case of Germany, with the federal states being responsible for higher education, provides the possibility to apply a difference-in-differences approach. However, due to data restrictions only short time effects can be investigated. We choose North-Rhine Westphalia as the treatment state and Baden-Wuerttemberg and Bavaria as the control states that we are able to observe for the years 1984 to 1997.

Since in NRW the indicator-based funding scheme was introduced in 1993, we observe two post reform points in time, i.e. the years 1994 and 1997. The amount of states' higher education funds that was allocated based on indicators, however, was small. At the beginning of the reform, 0.1% and later on 3% of public funds were allocated based on universities' performance. The allocation

model incorporated several indicators that changed over the years. The two indicators that may lead to grade inflation, i.e. the number of students and the number of graduates, account for 55% to 100% of the performance based allocated funds.

Evaluating the funding reform at the mean of average grades in a first step, we do not find evidence for grade inflation. In a second step, we consider the entire grade distribution to evaluate the effects of the reform by estimating quantile treatment effects. If grades are inflated, the grade distribution either is shifted towards better grades and becomes compressed at the upper tail or it becomes compressed at the lower end of the grade distribution. In the former case, all students get better grades. For students with the best grades, the grades cannot become better resulting in a compression at the upper tail of the distribution. In the latter case, the achievement requirements for passing an exam are decreased and the distribution becomes compressed at the lower tail. Estimating quantile treatment effects, we do not find evidence for grade inflation either.

Our results can be interpreted in two ways. On the one hand, the share of funds that is allocated based on indicators may be too small to provide an incentive to the universities to inflate grades. However, this in turn raises the question whether this low amount of indicator-based funding is able to achieve improvements in the universities' efficiency and performance. On the other hand, our results may suggest that the universities did not inflate grades to get more funds. It should be also stressed, that we are only able to estimate short term effects of the reform. It might well be the case, that this short time period is not sufficient for the reforms to reach their full impact.

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Appendix

Table A1: Number of observations by pre- and post-reform period, federal state, and year

	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Baden-Wuerttemberg	1,036 (2)	-	945 (2)	-	-	806 (2)	-	-	566 (2)	-	499 (2)	-
Bavaria	1,414 (3)	-	1,220 (3)	-	-	1,018 (3)	-	-	661 (3)	-	552 (3)	-
Berlin	445 (1)	-	423 (1)	-	-	334 (1)	-	-	286 (1)	-	251 (1)	-
Brandenburg	-	-	-	-	-	-	-	-	96 (1)	-	111 (1)	-
Hamburg	1,150 (2)	-	1,002 (2)	-	-	829 (2)	-	-	696 (2)	-	635 (2)	-
Hesse	773 (2)	-	675 (2)	-	-	650 (2)	-	-	511 (2)	-	427 (2)	-
Mecklenburg-West Pomerania	-	-	-	-	-	-	-	-	258 (2)	-	143 (2)	-
North Rhine-Westphalia	1,076 (2)	-	990 (2)	-	-	938 (2)	-	-	820 (2)	-	635 (2)	-
Rhineland-Palatinate	134 (1)	-	142 (1)	-	-	107 (1)	-	-	99 (1)	-	84 (1)	-
Saxony	-	-	-	-	-	-	-	-	357 (2)	-	387 (2)	-
Saxony-Anhalt	-	-	-	-	-	-	-	-	216 (2)	-	121 (2)	-
Schleswig-Holstein	121 (1)	-	98 (1)	-	-	103 (1)	-	-	82 (1)	-	76 (1)	-
Thuringia	-	-	-	-	-	-	-	-	79 (1)	-	63 (1)	-

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Baden-Wuerttemberg	-	466 (2)	-	-	481 (2)	-	-	606 (2)	-	-	443 (2)
Bavaria	-	538 (3)	-	-	687 (3)	-	-	980 (4)	-	-	515 (3)
Berlin	-	173 (1)	-	-	219 (1)	-	-	224 (1)	-	-	166 (1)
Brandenburg	-	146 (1)	-	-	195 (1)	-	-	190 (1)	-	-	127 (1)
Hamburg	-	505 (2)	-	-	506 (2)	-	-	569 (2)	-	-	458 (2)
Hesse	-	368 (2)	-	-	318 (2)	-	-	611 (3)	-	-	638 (3)
Mecklenburg-West Pomerania	-	204 (2)	-	-	315 (2)	-	-	256 (2)	-	-	255 (2)
North Rhine-Westphalia	-	491 (2)	-	-	507 (2)	-	-	543 (2)	-	-	416 (2)
Rhineland-Palatinate	-	52 (1)	-	-	69 (1)	-	-	226 (2)	-	-	179 (2)
Saxony	-	514 (2)	-	-	604 (2)	-	-	605 (2)	-	-	527 (2)
Saxony-Anhalt	-	126 (2)	-	-	224 (2)	-	-	221 (2)	-	-	201 (2)
Schleswig-Holstein	-	60 (1)	-	-	68 (1)	-	-	232 (2)	-	-	178 (2)
Thuringia	-	78 (1)	-	-	92 (1)	-	-	105 (1)	-	-	75 (1)

Note: The federal states of Bremen, Lower Saxony, and Saarland are not included in the sample. - The lighter gray cells indicate the pre-reform and the darker gray cells the post-reform period. - Number of universities in parentheses.
Source: Student survey 1983-2007, AG Hochschulforschung, own calculations.

Table A2: Description of variables

Variable	Description
Average university grade	Grades range from 1 (worst) to 6 (best).
North Rhine-Westphalia	Dummy variable: 1 for students that study in North-Rhine Westphalia, 0 otherwise.
Age	Age in years.
Male	Dummy variable: 1 for males, 0 otherwise.
Final high school grade	Grades range from 1 (worst) to 6 (best).
Father: < vocational degree	Dummy variable: 1 for fathers with less than vocational degree, 0 otherwise.
Father: Vocational degree	Dummy variable: 1 for fathers with vocational degree, 0 otherwise.
Father: Tertiary degree	Dummy variable: 1 for fathers with tertiary degree, 0 otherwise.
Mother: < vocational degree	Dummy variable: 1 for mothers with less than vocational degree, 0 otherwise.
Mother: Vocational degree	Dummy variable: 1 for mothers with vocational degree, 0 otherwise.
Mother: Tertiary degree	Dummy variable: 1 for mothers with tertiary degree, 0 otherwise.
Duration of study	Duration of study in semesters.
Change of university or major	Dummy variable: 1 for students that changed the university or the major, 0 otherwise.
Quality of teaching	Quality of teaching from 0 (worst) to 6 (best).
Performance requirements	Level of performance requirements from 0 (worst) to 6 (best).
Structure of study	Quality of study's structure from 0 (worst) to 6 (best).
Cultural sciences, sports	Dummy variable: 1 for Cultural sciences, sports, 0 otherwise.
Law, Economics, Social Sciences	Dummy variable: 1 for Law, Economics, Social Sciences, 0 otherwise.
Natural Sciences	Dummy variable: 1 for Natural Sciences, 0 otherwise.
Medicine	Dummy variable: 1 for Medicine, 0 otherwise.
Engineering	Dummy variable: 1 for Engineering, 0 otherwise.
Arts, others	Dummy variable: 1 for Arts, others, 0 otherwise.
Baden-Wuerttemberg	Dummy variable: 1 for students that study in Baden-Wuerttemberg, 0 otherwise.
Bavaria	Dummy variable: 1 for students that study in Bavaria, 0 otherwise.
University of Bochum	Dummy variable: 1 for students that study at the University of Bochum, 0 otherwise.
University of Essen	Dummy variable: 1 for students that study at the University of Essen, 0 otherwise.
University of Freiburg	Dummy variable: 1 for students that study at the University of Freiburg, 0 otherwise.
University of Karlsruhe	Dummy variable: 1 for students that study at the University of Karlsruhe, 0 otherwise.
University of München	Dummy variable: 1 for students that study at the University of München, 0 otherwise.
Technical college of Coburg	Dummy variable: 1 for students that study at the Technical college of Coburg, 0 otherwise.
Technical college of München	Dummy variable: 1 for students that study at the Technical college of München, 0 otherwise.

Table A3: Summary Statistics: Treatment (North-Rhine Westfalia) and control group (Baden-Wuerttemberg/ Bavaria)

	Pre-reform (1984-1992)		Post-reform (1993-1997)			
			Full treatment		Full and partial treatment	
	Treatment group	Control group	Treatment group	Control group	Treatment group	Control group
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
Average university grade	4.244 (0.639)	4.342 (0.680)	4.318 (0.638)	4.411 (0.611)	4.378 (0.641)	4.440 (0.645)
North Rhine-Westphalia	1.000 (0.000)	0.000 (0.000)	1.000 (0.000)	0.000 (0.000)	1.000 (0.000)	0.000 (0.000)
Age	24.272 (3.638)	23.670 (3.306)	23.933 (3.656)	22.949 (3.205)	25.380 (4.187)	24.003 (3.814)
Male	0.615 (0.487)	0.626 (0.484)	0.509 (0.500)	0.619 (0.486)	0.528 (0.500)	0.590 (0.492)
Final high school grade	4.311 (0.606)	4.638 (0.641)	4.467 (0.645)	4.837 (0.652)	4.419 (0.628)	4.817 (0.643)
Father: < vocational degree	0.056 (0.230)	0.061 (0.239)	0.076 (0.265)	0.044 (0.205)	0.060 (0.237)	0.044 (0.204)
Father: vocational degree	0.646 (0.478)	0.488 (0.500)	0.608 (0.489)	0.428 (0.495)	0.618 (0.486)	0.441 (0.497)
Father: tertiary degree	0.298 (0.458)	0.451 (0.498)	0.317 (0.466)	0.529 (0.499)	0.322 (0.467)	0.515 (0.500)
Mother: < vocational degree	0.189 (0.392)	0.236 (0.425)	0.149 (0.357)	0.140 (0.348)	0.144 (0.351)	0.141 (0.348)
Mother: vocational degree	0.722 (0.448)	0.591 (0.492)	0.711 (0.454)	0.585 (0.493)	0.723 (0.448)	0.589 (0.492)
Mother: tertiary degree	0.089 (0.285)	0.173 (0.378)	0.140 (0.347)	0.275 (0.447)	0.134 (0.340)	0.271 (0.445)
Duration of study	5.867 (4.368)	4.922 (4.030)	3.610 (2.316)	3.194 (2.059)	6.226 (4.549)	4.887 (3.838)
Change of university or major	0.233 (0.423)	0.276 (0.447)	0.204 (0.404)	0.225 (0.418)	0.243 (0.429)	0.277 (0.448)
Quality of teaching	3.425 (0.337)	3.573 (0.175)	3.381 (0.330)	3.585 (0.188)	3.377 (0.332)	3.573 (0.181)
Performance requirements	4.008 (0.728)	4.128 (0.553)	3.885 (0.755)	4.211 (0.551)	3.811 (0.745)	4.125 (0.566)
Structure of study	3.024 (0.495)	3.055 (0.379)	2.927 (0.471)	3.143 (0.362)	2.895 (0.454)	3.073 (0.382)
Cultural Sciences/Sports	0.276 (0.447)	0.253 (0.435)	0.333 (0.472)	0.198 (0.398)	0.379 (0.485)	0.250 (0.433)
Law/Economics/Social Sciences	0.290 (0.454)	0.281 (0.450)	0.326 (0.469)	0.293 (0.456)	0.316 (0.465)	0.312 (0.463)
Natural Sciences	0.120 (0.325)	0.158 (0.365)	0.101 (0.302)	0.200 (0.400)	0.092 (0.289)	0.159 (0.366)
Medicine	0.077 (0.266)	0.083 (0.277)	0.050 (0.219)	0.079 (0.270)	0.036 (0.185)	0.067 (0.250)
Engineering	0.193 (0.395)	0.184 (0.388)	0.149 (0.357)	0.208 (0.406)	0.137 (0.344)	0.181 (0.385)
Arts/Others	0.045 (0.207)	0.039 (0.195)	0.041 (0.199)	0.022 (0.146)	0.041 (0.198)	0.032 (0.175)
Baden-Wuerttemberg	0.000 (0.000)	0.452 (0.498)	0.000 (0.000)	0.521 (0.500)	0.000 (0.000)	0.480 (0.500)
Bavaria	0.000 (0.000)	0.548 (0.498)	0.000 (0.000)	0.479 (0.500)	0.000 (0.000)	0.520 (0.500)
University of Bochum	0.553 (0.497)	0.000 (0.000)	0.495 (0.501)	0.000 (0.000)	0.522 (0.500)	0.000 (0.000)
University of Essen	0.447 (0.497)	0.000 (0.000)	0.505 (0.501)	0.000 (0.000)	0.478 (0.500)	0.000 (0.000)
University of Freiburg	0.000 (0.000)	0.251 (0.434)	0.000 (0.000)	0.232 (0.422)	0.000 (0.000)	0.239 (0.427)
University of Karlsruhe	0.000 (0.000)	0.201 (0.401)	0.000 (0.000)	0.289 (0.454)	0.000 (0.000)	0.241 (0.428)
University of München	0.000 (0.000)	0.395 (0.489)	0.000 (0.000)	0.308 (0.462)	0.000 (0.000)	0.359 (0.480)
Technical college of Coburg	0.000 (0.000)	0.051 (0.220)	0.000 (0.000)	0.061 (0.240)	0.000 (0.000)	0.051 (0.221)
Technical college of München	0.000 (0.000)	0.103 (0.304)	0.000 (0.000)	0.109 (0.312)	0.000 (0.000)	0.109 (0.312)
N	2,731	5,368	436	961	786	1,422

Source: Student survey 1983-2007, AG Hochschulforschung, own calculations.

Table A4: Average university grades, Difference-in-differences estimation: mean treatment effects

	Full treatment						Full and partial treatment					
	(3)			(3')			(6)			(6')		
North Rhine-Westphalia	-0.0774	**	(0.0357)	-0.0772	**	(0.0357)	-0.0747	*	(0.0374)	-0.0750	*	(0.0373)
Post-reform (1994,1997)	-0.0374		(0.0339)				-0.0212		(0.0297)			
Post-reform (1994)				-0.0320		(0.0326)				-0.0113		(0.0279)
Post-reform (1997)				-0.0402		(0.0415)				-0.0436		(0.0440)
$\delta^{mean}_{1994,1997}$	-0.0332		(0.0421)				-0.0344		(0.0404)			
δ^{mean}_{1994}				-0.0589		(0.0486)				-0.0492		(0.0451)
δ^{mean}_{1997}				-0.0175		(0.0513)				-0.0168		(0.0496)
Trend	0.0267	***	(0.0083)	0.0266	***	(0.0087)	0.0244	***	(0.0083)	0.0257	***	(0.0090)
Age	-0.0027		(0.0027)	-0.0027		(0.0028)	-0.0015		(0.0029)	-0.0016		(0.0029)
Male	0.0418	**	(0.0175)	0.0417	**	(0.0174)	0.0414	**	(0.0177)	0.0414	**	(0.0176)
Final high school grade	0.2781	***	(0.0142)	0.2781	***	(0.0142)	0.2738	***	(0.0143)	0.2737	***	(0.0143)
Father: vocational degree	0.0478	**	(0.0209)	0.0478	**	(0.0209)	0.0486	***	(0.0178)	0.0485	***	(0.0179)
Father: tertiary degree	0.0839	***	(0.0223)	0.0840	***	(0.0223)	0.0831	***	(0.0200)	0.0830	***	(0.0201)
Mother: vocational degree	0.0043		(0.0145)	0.0043		(0.0145)	0.0062		(0.0143)	0.0058		(0.0144)
Mother: tertiary degree	0.0416	**	(0.0199)	0.0417	**	(0.0198)	0.0451	**	(0.0181)	0.0448	**	(0.0182)
Duration of study	0.0055		(0.0051)	0.0054		(0.0051)	0.0056		(0.0050)	0.0056		(0.0050)
Change of university or major	0.0275		(0.0175)	0.0276		(0.0176)	0.0274	*	(0.0163)	0.0275	*	(0.0163)
Law/Economics/Social Sciences	-0.1102		(0.0721)	-0.1100		(0.0721)	-0.1030		(0.0655)	-0.1027		(0.0653)
Natural Sciences	-0.0425		(0.0579)	-0.0426		(0.0579)	-0.0312		(0.0544)	-0.0312		(0.0543)
Medicine	0.0859		(0.0938)	0.0862		(0.0937)	0.0964		(0.0883)	0.0975		(0.0882)
Engineering	-0.1258	*	(0.0688)	-0.1258	*	(0.0687)	-0.1196	*	(0.0641)	-0.1196	*	(0.0640)
Arts/Others	0.2037	***	(0.0545)	0.2037	***	(0.0545)	0.2082	***	(0.0513)	0.2082	***	(0.0513)
Quality of teaching	0.2699	**	(0.1097)	0.2708	**	(0.1097)	0.2847	***	(0.1051)	0.2855	***	(0.1046)
Performance requirements	-0.5473	***	(0.0466)	-0.5471	***	(0.0466)	-0.5636	***	(0.0464)	-0.5633	***	(0.0463)
Structure of study	0.2772	***	(0.0805)	0.2767	***	(0.0804)	0.2734	***	(0.0804)	0.2725	***	(0.0803)
University of Essen	0.0513		(0.0418)	0.0514		(0.0418)	0.0548		(0.0377)	0.0545		(0.0378)
University of Karlsruhe	-0.0848	**	(0.0379)	-0.0850	**	(0.0378)	-0.0814	**	(0.0368)	-0.0813	**	(0.0369)
University of München	-0.0047		(0.0336)	-0.0046		(0.0336)	-0.0039		(0.0332)	-0.0038		(0.0333)
Technical college of München	-0.1401	***	(0.0410)	-0.1399	***	(0.0412)	-0.1450	***	(0.0398)	-0.1442	***	(0.0400)
Constant	3.4489	***	(0.3273)	3.4465	***	(0.3271)	3.4617	***	(0.3159)	3.4600	***	(0.3152)
$\bar{R}^2$	0.285			0.285			0.295			0.294		
N	9,496			9,496			10,307			10,307		
F	124.38			257.38			241.08			240.73		

Notes: Clustered standard errors in parentheses. - * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.
Source: Student survey 1983-2007, AG Hochschulforschung, own calculations.