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New Evidence on the Effects of the Shortened School Duration in the German States - An Evaluation of Post-School Education Decisions

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NEW EVIDENCE ON THE EFFECTS OF THE SHORTENED
SCHOOL DURATION IN THE GERMAN STATES
AN EVALUATION OF POST-SCHOOL EDUCATION DECISIONS

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Abstract

Most German states have reformed university preparatory schooling by reducing duration from 13 to 12 years with unchanged graduation requirements. The reform was implemented in the states during the last decade in several consecutive years. In this paper, we use nationwide data on high school graduates to evaluate the reform effects on post-school education decisions. The results show that the reform has reduced (or at least delayed) university enrollment of females, but increased the probability of starting vocational education. A similar trend is found for male students, but only in the first year after school graduation. In addition, students are slightly more likely to do voluntary service or spend a year abroad after high school graduation.

Keywords: school duration, learning intensity, education decision, Germany

JEL Classification: I21, J18, C21

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1 Introduction

In a recent and fundamental reform, the duration of university preparatory schooling in Germany has been reduced from 13 to 12 years. However, graduation requirements and the total number of lessons have not been changed, so the curriculum has been compressed into the shorter school duration. This reform has several implications for the education system as well as for the labor market. It was the aim of the reform to achieve the same level of education in a shorter duration of schooling. Graduates should be enabled to start their university education and, subsequently, their occupational career one year earlier. However, several effects of the reform are conceivable. The notable increase of learning intensity resulting from the reform (i.e. students have to learn more curriculum per unit of instructional time) and the shorter duration of schooling could be either beneficial or detrimental for the quality of education. A number of studies has shown that instructional time has a causal effect on school achievements. Longer school days improve achievements (e.g. Bellei, 2009), whereas a reduction of instructional time decreases performance (e.g. Marcotte, 2007; Krashinsky, 2014). Consequently, the reform could decrease quality of university preparatory schooling. This effect has been shown by Büttner and Thomsen (2015) in an analysis based on data from the state of Saxony-Anhalt. However, there is little empirical evidence with respect to the role of school duration and instructional time for education decisions after high school graduation. Levine and Zimmerman (1995) have found that taking more math classes at high school can increase the probability of students to attend college and to choose a technical college major. Hence, contents and quality of high school can affect post-school education decisions. In addition, time spent in school does not only provide skills, but also helps students in discovering their talents and preferences (Schultz, 1968). Since high school graduates affected by the reform enter post-school education at a younger age and with less experience of life, they could be less oriented with respect to their decision on further education (cf. Malamud, 2011). In a previous study, we have analyzed the effects of the reform in the state of Saxony-Anhalt on post-school education decisions (Meyer and Thomsen, 2013). By using data from the 2007 double cohort of high school graduates, we have found that females have delayed university enrollment and increased participation in vocational education.

In the present paper we analyze the effects of the reform in other states. Since the reform was not introduced nationwide but separately in most states, we can use the timing difference in the reform implementation¹ to investigate the effects of the reform in other German states. We use nationally representative data, namely the 2006, 2008 and 2010 waves of the panel survey of high school graduates from all federal states, carried out by the German Centre for Research on Higher Education and Science Studies (DZHW, formerly HIS). We use a difference-in-differences (DiD) estimation in order to investigate whether education decisions made after graduation from high school are affected by the reform (i.e. by having experienced a shorter school duration and a higher learning intensity at school).

¹The reform was introduced, according to the state, between 2001 and 2008. The first affected cohort of students graduated after the shortened school duration between 2007 and 2016.

Our findings show that students affected by the reform are significantly less likely to be enrolled in university education in the first year after school graduation. When we consider also planned enrollment beyond the first year, the effect remains significant for female students, but disappears in the case of male students. The effect in the first year can be explained by the higher probability of spending a year abroad or doing a year of voluntary service, as well as by a slightly higher probability to start a vocational education. The higher participation in vocational education is also responsible for the lower (planned) university enrollment of females beyond the first year. Altogether, the results are consistent with the literature and confirm the findings from the analysis in Saxony-Anhalt (Meyer and Thomsen, 2013). The reform of school duration has changed the decision behavior of high school graduates with respect to university and vocational education.

The rest of the paper is organized as follows. The education system of Germany and the reform is described in section 2. The empirical approach is contained in section 3. Section 4 presents the results and robustness checks. Section 5 concludes.

2 The Reform

2.1 The Education System in Germany

Although education policy in Germany is a responsibility of the federal states, it is nevertheless broadly similar across states. After primary schooling of four years, students are tracked into one of the three secondary school types. The basic and intermediate tracks include schooling up to grade 9 and 10, usually followed by a vocational education in the German apprenticeship system. The higher secondary school track (high school, *Gymnasium*) leads to the university admittance qualification (*Abitur*), which is obtained – depending on the state law – after 12 or 13 years of schooling in total.²

After graduation from high school students can choose between two tracks of post-secondary education. The most frequently chosen track (by about 85% of high school graduates) is *university education*, which includes studying at a university, a university of applied sciences or at a professional college. University education leads after three years to the Bachelor degree, often followed by two years for obtaining the Master degree. Both degrees correspond to an ISCED qualification level of 5 (UNESCO, 1997). The other track, chosen by almost 25% of high school graduates is *vocational education* (about 10% of graduates do both university and vocational education in succession).³ Vocational education consists in the majority of cases of an apprenticeship. The German apprenticeship system is internationally quite unique and combines practical on-the-job training in a firm or in public service where the trainee is employed with part-time attendance of a vocational school. Usually, it takes about three years until

²In addition to high school, it is also possible to obtain the university admittance qualification (or at least the qualification for admittance to universities of applied sciences) at vocational high schools or comprehensive schools. However, these schools represent only a small part of the German school system.

³Numbers provided by the German Centre for Research on Higher Education and Science Studies (DZHW), in addition to Spangenberg, Beuße, and Heine (2011). Numbers refer to several years after high school graduation and contain all started post-school education decisions.

completion. The German apprenticeship system is acknowledged as providing high-quality education (OECD, 2010) and is classified as post-secondary non tertiary education. A completed vocational education corresponds to an ISCED qualification level of 4 if the student has also obtained the university admission qualification, otherwise to a level of 3.

The process of gathering information about post-school education possibilities and thinking about own preferences and aims starts in the last years of high school. About half of students begin about two or three years before graduation, whereas the other half does not start before the last year of high school (Lörz et al., 2011, p. 14). In order to start vocational education, students have to apply for their desired job several months before the intended starting date, which mostly is August or September. In order to start university education, students have to apply for their desired subject to their desired university. Some subjects in Germany have a restricted admission; here, applications have to be submitted to the desired university by July for enrollment in October. In addition, very few subjects, especially medical sciences, require an application to the Central Office for the Allocation of Study Places (ZVS). Nevertheless, other subjects, especially the so-called STEM subjects⁴, can be studied without restriction.

Quite a few students take a year between high school graduation and starting university or vocational education for other activities, for example doing an internship or voluntary service or spending a year abroad. Until 2011, males were principally obliged to carry out military or civilian service for nine months, which often started shortly after school graduation.

2.2 The Reform of School Duration

The debate about the duration of university preparatory schooling has a long history in Germany. However, West Germany had a decades-long tradition of 13 years, which became increasingly questioned in the middle and late 1990s. This trend was supported by the fact that East German states were used to a 12-year policy until the German reunification in 1990 (after reunification they mostly adopted the West German system). As a consequence, between 2001 and 2008 most federal states introduced the elimination of the last year of high school (see Table 1). The only exceptions were Saxony and Thuringia, which had maintained the duration of 12 years after the reunification, and Rhineland-Palatinate, which left its system of 12.5 years unchanged.

The implementation of the reform, by and large, was similar across states. However, some differences exist. For example, in many states the first affected cohort were students entering grade 5 (which is the first grade of the *Gymnasium*), but in some states the change was introduced in higher grades. Nevertheless, graduation requirements were maintained in all states, which means that the curriculum was compressed into the shorter school duration. The reform implementation was completed in each state with the so-called double cohort of graduates, which includes the first cohort graduating after the shorter school duration of 12 years and the last cohort graduating after 13 years. The first double cohort graduated in Saxony-Anhalt in

⁴STEM subjects include natural sciences, technology, engineering and mathematics.

2007, followed by one or more other states in each of the subsequent years (see Table 1).

Insert Table 1 about here

As a consequence of the reform, students had to learn the same curriculum within shorter time. Therefore, the learning intensity experienced at school (i.e. the amount of learning contents per unit of time) notably increased. Theoretically, this could have positive as well as negative effects. On the one hand, the efficiency of learning and the ability to cope with academic requirements could be improved. In this case, post-school education decisions should not be affected, or even more students could choose university education or challenging university subjects. On the other hand, it could be detrimental for learning outcomes, for example by over-taxing students or by leaving fewer possibilities for teaching and revising the learning contents in the necessary depth. Consequently, students could be or feel less prepared for university and could choose a less demanding track or subject in post-school education. In addition to these possible effects, post-school education decisions could be influenced by the reform through another channel. Due to the shorter school duration and the younger age at graduation, students have one year less to get to know their own abilities and to develop occupational preferences. Therefore, the insecurity about what to do after school graduation could be increased. This could prolong the time until entry into post-school education, or could lead more students to start first as a precaution a less demanding course of post-school education.

3 Empirical Approach

3.1 The Data

For the empirical analysis of the reform effects on post-school education decisions, we use data of high school graduates from all German states that are provided by the German Centre for Research on Higher Education and Science Studies (DZHW). Every two or three years since 1976, the DZHW surveys students from randomly selected schools in all federal states (about 12% of all high schools). Each survey is carried out as a short panel with a first wave half a year before high school graduation. Students are asked by means of a written questionnaire about their experiences at high school, their plans after school graduation, the process of information collection and related problems. In a second wave, the same students are asked half a year after graduation about their realized or firmly planned post-school education. The final third wave for each cohort is conducted three and a half years after graduation, by which the observations on post-school education are updated.⁵ The data used in this paper include the 2006, 2008 and 2010 cohorts of graduates. Unfortunately, data from the third wave three and a half years after school graduation are up to now only available for the 2006 cohort. Thus, post-school education decisions can only be investigated with respect to the time period of half a year after graduation. However, education plans are sufficiently concrete at that point in time, which allows the identification of effects for at least two or three years after school graduation.

⁵A description of data collection can be found, for example, in Heine et al. (2008).

The original sample contains 12,137 observations in 2006, 28,756 observations in 2008 and 29,418 observations in 2010. For the analysis, some modifications of the data are necessary. First, all students graduating not from high school (but e.g. from comprehensive schools or vocational high schools) or obtaining not the general university admittance qualification (but e.g. only the qualification for admittance to universities of applied sciences) are excluded, since the reform does mostly not apply to these schools. We also exclude students, who do not belong to the respective birth cohorts.⁶ Thus, students who repeated or skipped a grade, are not considered. Moreover, we further dropped observations of students from the states without reform (Rhineland-Palatinate, Saxony, Thuringia). The estimation sample therefore includes 4,597 observations in 2006, 8,631 in 2008 and 8,174 in 2010, which participated in the first survey half a year before graduation. Unfortunately, the data are affected by panel attrition and not all students have participated in the second wave of the survey. Thus, information about post-school education decisions is only available for 2,440 observations in 2006, 2,487 observations in 2008 and 3,103 observations in 2010.

For the post-school education decisions, we employ several dummy variables from the second survey. Enrollment in university and vocational education is observed half a year after school graduation and is analyzed with respect to two outcome dimensions. A first dummy variable includes actual enrollment, whereas the second dummy indicates whether a student is actually enrolled or has firmly planned to enroll in university or vocational education as first post-school education (e.g. after having completed military, civilian or voluntary service or some other activities in the year after school graduation). In order to minimize a potential bias from insecurity of plans and decisions, only students who have already decided on their post-school education are included in the second dummy variable. However, more than 97% of students have made this decision at the time of the survey. And in almost all cases they intend to enroll one year after school graduation.⁷ Moreover, we distinguish the choice of university subjects. It is measured with respect to actual and firmly planned university enrollment. University subjects are categorized into six groups: (1) humanities, (2) education and social sciences, (3) law and economics, (4) engineering, (5) natural sciences and mathematics, and (6) medical sciences. Due to the particular importance of engineering, natural sciences and mathematics (the so-called STEM subjects), these subjects are additionally considered as a group. Medical sciences are content-related to STEM subjects, but it is not cleared finally whether they belong to this group. Therefore, STEM subjects are considered in the analysis first with a narrow definition (without medical sciences) and second with a broader definition (including medical sciences). Finally, three other activities in the year after high school graduation are captured

⁶The cut-off birth date for a school year in Germany is 30 June. Hence, students in a given cohort are mostly born between 1 July of the respective year and 30 June of the following year. Only these students are included.

⁷The question in the survey from which the variable *firmly planned enrollment* is obtained, contains three response categories: (1) "I have decided to enroll in university/vocational education (or to do something else)", (2) "I have not finally decided, but I will probably enroll in university/vocational education (or do something else)", and (3) "I have by now absolutely no idea about my further education". Only category (1) is considered in the variable on planned enrollment, but it contains almost all students. Less than 3% of students belong to categories (2) and (3).

covering (1) military or civilian service, (2) internship or temporary work, and (3) voluntary service or spending a year abroad.

3.2 Identification Strategy

To evaluate the reform effects on post-school education decisions we use a difference-in-differences approach. The different timing of the introduction of the reform in the federal states provides regional variation to enable a comparison of students who have graduated under the old system with 13 years and under the new system with 12 years. Four states have completed the reform between 2007 and 2010, which means that the first students have graduated from high school after 12 years of schooling. These states (Saxony-Anhalt, Mecklenburg-Western Pomerania, Saarland, Hamburg) represent the treatment group.⁸ In contrast, all other states have completed the reform not before 2011, and can be used as the comparison group (see Table 1 and Figure 1).

Insert Figure 1 about here

The causal effect of the reform is then estimated by the following difference-in-differences probit model:

$$Prob(E_{p,s,i} = 1) = \Phi(\beta_0 + \beta_1 TREATGR_i + \beta_2 POST_i + \beta_3 DiD_i + \beta_4 \mathbf{X}_i + \gamma_s). \quad (1)$$

The binary outcome variable is denoted by $E_{p,i}$. $Prob(E_{p,i} = 1)$ is then the probability of individual i from state s to be enrolled in a specific type of post-school education p (i.e. university education, vocational education, several university subjects, several other activities in the year after school graduation). Each outcome is estimated separately. On the right hand side of equation (1), β_0 is the constant. $TREATGR_i$ is a dummy variable which takes the value 1 if an individual belongs to the treatment group and 0 if an individual belongs to the control group. Thus, the coefficient β_1 captures the non-reform difference between students from the treatment and control groups. $POST_i$ indicates the time period and equals 0 for pre-reform observations (2006) and 1 for the post-reform period (2010), with the coefficient β_2 . The interaction term between $TREATGR_i$ and $POST_i$ is denoted by DiD_i , which is equal to 1 if an individual belongs to the treatment group in the post-reform year. The marginal effect, derived from the corresponding coefficient β_3 , indicates the impact of the reform, namely the average treatment effect (ATE).⁹

In order to consider differences between years and groups and to increase the efficiency of the estimates, further variables influencing post-school education decisions are included in the regression in \mathbf{X}_i . These are dummy variables indicating whether at least one parent has an academic degree, whether the current or last occupation of parents belongs to the middle

⁸Table A.1 in the appendix presents the composition of the treatment group by federal states. Graduates from Hamburg in 2010 represent a double cohort. Therefore, the 2010 sample from Hamburg contains only students with 12 years of schooling.

⁹Puhani (2012) has shown that in nonlinear difference-in-differences models the incremental effect of the coefficient of the interaction term represents the treatment effect.

or upper category of occupational status, whether the student has a migration background, and whether the student belongs to the older group of students in the respective cohort (i.e. born between 1 July and 31 December).¹⁰ Finally, state dummies γ_s capture the influence of characteristics of the federal state in which students have graduated from high school.¹¹ The analysis is carried out separately for males and females, since post-school education decisions differ by gender (see e.g. Buchmann et al., 2008; for Germany see e.g. Lörz et al., 2011) and thus the reform could have different effects for males and females.

We compare the outcomes of high school graduates in 2006 (pre-reform) and 2010 (post-reform) in the treatment group (first difference). Then we compare this difference with the respective difference in the outcomes of the control group, which is not affected by the reform. From this comparison (second difference) the causal effect of the reform is obtained. With this procedure, any common time trend between 2006 and 2010 as well as differences in students' characteristics between treatment and control groups are eliminated from the analysis.

However, identification requires that no selection bias between groups is present. This requirement should be fulfilled, since from the students' perspective, the reform was randomly introduced. In the respective states, the reform implementation took place within a short period of time. Students had in principle no possibilities to evade the reform. Evading would only be possible by moving or commuting to another state, by switching to another type of school (in three of the four treatment states it is still possible to graduate after 13 years at comprehensive schools), or by skipping or repeating a grade. However, moving or commuting to another state would include very high monetary and non-monetary costs. Furthermore, the German education system normally does not provide the possibility of fast-tracking school by skipping a grade. Finally, official statistics do not indicate a large increase in grade retention or movement to other schools in the treatment states. The shares of students not successfully passing final high school examinations are not that different between the cohorts graduating 2006, 2008 and 2010 in the treatment states (see Table A.2 in the appendix).

There are further assumptions which have to be fulfilled for identification (see, for example, Meyer, 1995). There must be no interaction between time and groups except for the treatment, i.e. any time trends have to be equally existent in both groups (common trend assumption). This should be the case here since the analyzed period contains only four years, in which no other large reforms have been introduced in the German education system.¹² Thus, conditions for post-school education decisions were the same in both years. Furthermore, between 2006 and 2010 macroeconomic conditions have not changed differently across states. As another requirement,

¹⁰Several studies have shown that older students within a cohort show better education outcomes than younger students. This relative age effect can persist even beyond secondary schooling (Fredriksson and Öckert, 2005; Bedard and Dhuey, 2006; Crawford et al., 2010).

¹¹Dummies are included for each state except for one state from the treatment group and one state from the control group (reference states).

¹²The only other possibly relevant reform was the introduction of university tuition fees in some states. However, in most of these states the introduction had already taken place (or at least was resolved) in 2006 and was still valid in 2010. Moreover, empirical evidence suggests that the introduction of university tuition fees in Germany had no influence on university enrollment (see, for example, Helbig et al., 2012).

treatment and control groups should not be too different in their characteristics, and any changes in these characteristics should be similar between groups. In addition, outcome variables should have similar values between groups in the pre-treatment period. Both requirements will be checked in the next section.

The presented identification strategy has the advantage that the analyzed students do not represent the first affected cohorts (except the small number of students from Hamburg 2010). This means that implementation effects or temporary effects, possibly caused by the special situation of the double cohorts, are unlikely to be still present in the other states in 2010.

3.3 Descriptive Statistics

Table 2 contains a description of several characteristics of students from treatment and control groups. Unfortunately, the DZHW data provide only a few background characteristics. The treatment group consists of two states from West Germany and one state from East Germany. The control group largely consists of students from West Germany, but two East German states (Berlin, Brandenburg) are included. With respect to migration background, only small differences can be observed. The educational background of students reveals a time trend, since in 2010 relatively more students have a non-academic family compared to 2006 or 2008. This is due to an increasing social openness of the high school in Germany for many years (see, for example, Trautwein and Neumann, 2008). This process is observed for treatment and control groups, although in the female sample the decrease of students with academic parents is larger in the treatment group than in the control group. Hence, consideration of family background characteristics in the analysis is reasonable. Compared to the educational background, the occupational position of parents as measured by the International Socio-Economic Index of Occupational Status (ISEI, see Ganzeboom et al., 1992) is similar across time and groups, at least in the female sample.

Insert Tables 2 and 3 about here

A description of outcome variables is shown in Table 3. Half a year after high school graduation, about 70 to 80% of females and 40 to 50% of males are enrolled in post-school education. These numbers increase to about 95 to 98%, when firmly planned enrollment (which in almost all cases takes place one year after graduation, e.g. after having completed military, civilian or voluntary service) is included. Around 80% of students start (or firmly plan to start) university education, about 20% vocational education. Male students are slightly more likely to enroll in university than females, whereas females have a higher probability of choosing vocational education.

First indications of reform effects can be observed in the female sample. Whereas enrollment in university education has increased in the control group, it has decreased in the treatment group. The opposite is true with respect to vocational education. A similar trend can be observed for male students. With respect to the subject of the started or firmly planned university education, nearly no difference can be observed in the female sample. However, the

share of male students choosing natural sciences and mathematics has decreased notably in the treatment group, whereas it has increased slightly in the control group.

Finally, other activities are carried out by about 25% of females and about 55% of males. The share of students doing voluntary service or spending a year abroad has significantly increased in the treatment group, but remained constant in the control group. However, with respect to males, this observation has to be interpreted with caution, because the total number of students doing military or civilian service has decreased notably. This is because in the years before the abolishment of obligatory military and civilian service in 2011, less and less students have been drafted for service (German Bundestag, 2010).

4 Estimation Results

4.1 Enrollment in University and Vocational Education

Estimation results on university and vocational enrollment are presented in Tables 4 and 5, with respect to actual enrollment (i.e. already started six months after graduation) as well as actual and firmly planned enrollment (i.e. already started or firmly planned within the next year). The reform has significantly reduced the enrollment of female students in university education by about 0.17 in the first year after high school graduation. This effect decreases to 0.09 when enrollment plans are included. On the contrary, there is a slight increase in the probability to be enrolled in vocational education of around 0.06 (in both outcome dimensions). With respect to male students, the effects on actual enrollment point in the same direction as the female ones, but the coefficient of university education is insignificant. Moreover, the effects disappear when firmly planned enrollment is considered as well. However, the effects in the male sample have to be interpreted with caution, since the fraction of male students being drafted for military or civilian service has changed between 2006 and 2010 (as mentioned above).

Insert Tables 4 and 5 about here

4.2 Choice of University Subjects

Table 6 contains the reform effects on university subjects with respect to actual and firmly planned enrollment (only the treatment effects are reported, but all other explaining variables are considered in the estimations as well). Only small and insignificant effects can be observed in the female sample. In contrast, the reform has reduced the probability of male students to study a STEM subject (engineering, natural sciences, mathematics, medical sciences) by about 0.20, which is mostly caused by a reduction in natural sciences and mathematics of about 0.16. The effect on STEM subjects as a group is valid regardless of whether medical sciences are included or not.

Insert Table 6 about here

4.3 Activities in the Year after High School Graduation

Besides starting university or vocational education, students often use the year after high school graduation for several other activities. Doing military or civilian service (obligatory for many males), spending a year for voluntary service in social, ecological or cultural institutions, spending a year abroad (e.g. work and travel, au pair), doing an internship or working temporarily are the most common activities. Military and civilian service is not affected by the reform, because it is under the control of the official authorities. Regarding internship and temporary work, no reform effect is observed. Compared with this, the reform has increased the probability to spend a year abroad or for voluntary service by about 0.07 for females and 0.09 for males (Table 7). However, as mentioned above, the effect on males could be confounded by changes in the conscription system.

Insert Table 7 about here

4.4 Robustness Analysis

a) Alternative Treatment and Control Group Definitions

Although the reform implementation was in principle similar across the federal states, some differences exist. In order to rule out that the reform effects are driven by a specific state, regressions are carried out, in which one of the larger states in the treatment group (Saxony-Anhalt, Mecklenburg-Western Pomerania) is excluded. In the case of exclusion of Saxony-Anhalt, the year 2008 can be used additionally as pre-reform period, which increases the number of observations. Table A.3 in the appendix shows that the effects on university and vocational education are similar to the ones presented above. However, the effect on STEM subjects in the male sample disappears, especially in the case when Saxony-Anhalt is left aside. Thus, it can be concluded that the lower probability of males to study a STEM subject is relevant for Saxony-Anhalt, but not that much for the other states analyzed. The increase in the probability of voluntary service or spending a year abroad becomes stronger when Saxony-Anhalt is excluded, but weaker without consideration of Mecklenburg-Western Pomerania.

In addition, we compare the original treatment group to a different control group, namely the non-reform states Rhineland-Palatinate, Saxony, and Thuringia. As expected, the reform effects remain similar in size and significance (Table A.4). Only the effect on females' actual enrollment in university education becomes a bit weaker (but is still significant), whereas the effect on vocational enrollment increases in size and significance. However, no effect is found with respect to voluntary service and staying abroad.

b) Similar Development of Academic Background over Time

Another robustness check is addressed to the problem mentioned in section 3.3 that the decrease in the fraction of female students with academic parents is larger in the treatment group than in the control group. Therefore, we exclude states from the control group, in which no decrease can

be observed. These are Baden-Wuerttemberg, Bavaria, Berlin and Schleswig-Holstein. After exclusion, the share of female students with academic parents in the control group decreases from 0.61 in the pre-reform year to 0.51 in the post-reform year, which is larger than the decrease in the original sample. Hence, the change in the educational background is now rather similar between treatment and control groups. Nevertheless, the estimations yield nearly the same reform effects (Table A.5 in the appendix). Although the coefficients of vocational education and university education including planned enrollment become statistically insignificant in the female sample, they remain almost constant in magnitude and are at the edge of the 10%-significance level ($p = 0.10$ and 0.11).

c) Placebo Difference-in-Differences Estimation

A usual sensitivity check in difference-in-differences analyses is to perform placebo tests. We use observations not affected by the reform as the treatment group. Firstly, the states from North Germany in the control group are used as treatment group and are compared to the states from South Germany in the control group. Secondly, we compare the control states from East Germany to the control states from West Germany. Thirdly, the three states without reform (Rhineland-Palatinate, Saxony, and Thuringia) are used as treatment group, compared to the original control group. If the abovementioned findings represent causal effects of the reform, they should disappear in the three placebo tests. This is the case for females and mostly for males. Almost all effects are small and insignificant (Table A.6 in the appendix).¹³ Furthermore, we estimate the reform effect with the original treatment and control groups on outcome variables which are most likely to be not affected by the reform. Unfortunately, we only have two variables in the data which fulfil this requirement – students are asked to assess the general job prospects of graduates from university and vocational education. No effect of the reform on these variables can be observed (Table A.7 in the appendix). Altogether, the placebo tests support the identified reform effects.

d) Possible Confounding Effects of Contemporary Reforms

Finally, as mentioned in section 3.2, some federal states introduced university tuition fees in the analyzed period. This could possibly influence the decision to enroll at university in some states, which could confound the effects of the shortened school duration. However, no evidence is found for an influence of tuition fees on enrollment behavior by Helbig et al. (2012) or by Thomsen and von Haaren (2014). Furthermore, several states did not introduce tuition fees, and in most introducing states the introduction had already taken place in 2006 and was still valid in 2010. Only in three states (Bremen, Hesse, Saarland), the introduction could possibly confound the results.¹⁴ In these states, students had to expect the introduction of tuition fees in 2006,

¹³Only when East German control states are used as the treatment group, a significant effect on STEM subjects occurs. However, this effect is due to an untypically low number of observations in this subject group in 2006 in one of the East German states.

¹⁴In Bremen, tuition fees were introduced in 2006 and the law was in force in 2010, but fees were charged only once in 2006. In Hesse, tuition fees were resolved in 2006, introduced in 2007, but abolished in 2008. In Saarland,

but in 2010 fees were already abolished. However, students had sufficient possibilities to study in a state without tuition fees. Nevertheless, as a robustness check, we exclude the three critical states from the analysis. Results from these estimations (Table A.8 in the appendix) show that the effects on females' university enrollment remain significant. The effects on vocational education of females become slightly insignificant, but are still very close to the 10%-significance level ($p = 0.12$). The higher probability of doing voluntary service or staying abroad becomes stronger for male students, but disappears in the female sample.

5 Conclusion

The importance of the duration of schooling results from the fact that time spent in school contributes to the development of skills as well as to the discovery of tastes and talents. A major education reform in Germany has reduced the duration of university preparatory schooling by one year. However, requirements for final graduation were not changed, which means that the curriculum has to be taught and learned in shorter time. In this paper we have evaluated the impact of this reform on post-school education decisions in three German states. The evaluation is based on nationally representative data of high school graduates. The effects are identified using the different timing of the reform introduction in the German states (difference-in-differences estimation).

The results confirm largely the findings from our study based on detailed data of Saxony-Anhalt (Meyer and Thomsen, 2013). Female students affected by the reform are less likely to enroll in university education by 0.17 in the first year after high school graduation. This effect remains significant beyond the first year (i.e. when firmly planned enrollment is included), although the magnitude decreases to 0.08. On the other hand, they have a slightly higher probability of 0.07 to start vocational education (with respect to both outcome dimensions). They are also slightly more likely by 0.07 to spend a year abroad or to do voluntary service in the year after high school graduation. Very similar effects are observed for male students, but the effects are partly insignificant and disappear after one year. Taken together, the lower enrollment of female students in university education even beyond the first year can be explained by their higher participation in vocational education. The larger effect on university enrollment in the first year is additionally caused by the higher probability of doing voluntary service or spending a year abroad. The effects remain stable in most of the robustness checks. However, the additional finding, a lower probability of males to choose natural sciences and mathematics, is driven by Saxony-Anhalt. Furthermore, the higher probability of females to do voluntary service or to spend a year abroad reveals some further effect heterogeneity, since the effect is only significant in some specifications.

A reasonable explanation for the findings is that students graduating after a shorter and more compressed school duration in Germany feel less prepared and/or less oriented with respect to university education. This leads to a lower university enrollment of female students in the

fees were resolved in 2006, implemented in 2007, but abolished in 2009.

first years after high school graduation. Additional information in the data on difficulties with the post-school education decision shows that females (but not males) affected by the reform have significantly more problems with assessing the skills required in post-school education and with uncertainty about their own interests. This underlines that feeling less oriented is a relevant problem as well as a reasonable explanation for the reform effects. As a consequence, female graduates could have been more likely to choose as a precaution vocational education instead of university education. This is plausible, since in Germany females are in principle more likely than males to choose vocational education, among others because they evaluate their success probability at university lower than males (Lörz et al., 2011, p. 40). Furthermore, finding significant effects beyond the first year only for female students can have an additional reason. Until 2011, about 40% of male students were obliged to do military or civilian service after high school graduation, which gave them an additional year to think about their post-school education. This emphasizes the importance of the orientation function of schooling in the current system. After elimination of compulsory service it is possible that effects also occur for male students.

The question arises whether the objective of the reform, to allow an earlier start of university education and occupational career, will be fully achieved. Although most of the students enter university one year earlier, about 17% of female students delay university enrollment. 8% delay by one year¹⁵ and will enter labour market at the same age as before the reform. However, 9% delay by more than one year. Under the assumption that they will enter university after completion of vocational education, which normally takes three years, they will be two years older at the time of university graduation. Besides an earlier start of university education and occupational career, the reform was intended to achieve the same level of educational quality within a shorter time. However, the lower enrollment in university education in the first years after school graduation could indicate that students are (or feel) not as good prepared for higher education as before.

Altogether, the results presented in this paper show that the reduction of university preparatory schooling has affected the decision of high school graduates to enroll in university and vocational education. Since the effects are found for different states and different cohorts, it is unlikely that they represent temporary, implementation or state-specific effects. Therefore, the duration of secondary schooling is relevant for education decisions made after school graduation. This is in line with previous findings in the literature, which have shown negative effects of reducing instructional time on school achievements (e.g. Marcotte, 2007; Krashinsky, 2014). Thus, when reducing school duration it is important to consider at least two aspects. The curriculum and its teaching should be organized in a way that students are prepared and motivated for university education as good as with the longer duration of schooling. Moreover, it should be ensured that academic and occupational guidance is sufficiently provided.

¹⁵Table 4 shows that the probability of university enrollment is reduced by 0.17 in the first year and by 0.09 beyond the first year. Therefore, 8% of students start university education in the second year. Most of the remaining 9% are those enrolled in vocational education (see Table 5).

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Tables and Figures

Figure 1: The German States: Treatment Group (dark grey) and Control Group (light grey)



Table 1: Introduction of the Shortened School Duration by State

	Reform Introduction	Double Cohort of Graduates ^a	
Saxony-Anhalt (ST)	2003	2007	Treatment Group
Mecklenburg-Western Pomerania (MW)	2001	2008	
Saarland (SL)	2001	2009	
Hamburg (HH)	2003	2010	
Bavaria (BA)	2004	2011	Control Group
Lower Saxony (LS)	2004	2011	
Baden-Wuerttemberg (BW)	2004	2012	
Bremen (BR)	2004	2012	
Berlin (BE)	2006	2012	
Brandenburg (BB)	2007	2012	
North Rhine-Westphalia (NW)	2005	2013	
Hesse (HE)	2005-06	2013-14	
Schleswig-Holstein (SH)	2008	2016	

^a The double cohort includes the first cohort graduating after 12 years and the last cohort graduating after 13 years of schooling.

· Rhineland-Palatinate, Saxony, and Thuringia are not included since no reform was introduced in these states.
 · Differences in the difference between the year of reform introduction and the year of the double cohort across states are due to the fact that the reform was introduced for the first affected cohort in each state in a different grade.

Table 2: Means of Background Characteristics of Students

	Female Sample				Male Sample			
	Treatment Gr.		Control Gr.		Treatment Gr.		Control Gr.	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST
Migration Background ^a	0.04	0.08	0.13	0.14	0.08	0.03	0.13	0.14
High School Graduation of Parents ^b	0.65	0.50	0.65	0.62	0.65	0.52	0.72	0.66
Academic Degree of Parents ^c	0.72	0.53	0.61	0.55	0.70	0.60	0.68	0.61
Occupational Status of Parents: low ^d	0.19	0.23	0.12	0.13	0.19	0.22	0.12	0.12
Occupational Status of Parents: middle ^d	0.43	0.41	0.42	0.40	0.45	0.39	0.36	0.36
Occupational Status of Parents: high ^d	0.37	0.36	0.46	0.46	0.36	0.39	0.52	0.52
State of High School Grad.: West Germany	0.26	0.28	0.90	0.89	0.29	0.28	0.91	0.89
<i>N</i>	202	168	1490	1914	63	93	685	928

^a Migration background is defined as follows: Student is born abroad, or has foreign citizenship, or at least one parent is born abroad, or language at parental home is not only German.

^b At least one parent has graduated from high school, i.e. has a university entrance qualification.

^c At least one parent has an academic degree.

^d Occupational Status is measured by the International Socio-Economic Index of Occupational Status (ISEI). Low status is from 0 to 49, middle from 50 to 67, and high from 68 to 85.

· PRE indicates the pre-reform year 2006, POST the post-reform year 2010.

Table 3: Means of Post-School Education Decisions of Students

	Female Sample				Male Sample			
	Treatment Gr.		Control Gr.		Treatment Gr.		Control Gr.	
	PRE	POST	PRE	POST	PRE	POST	PRE	POST
<i>First Post-School Education^a</i>								
University Education started	0.55	0.45	0.54	0.59	0.42	0.39	0.34	0.42
University Education started/planned	0.70	0.67	0.75	0.80	0.83	0.76	0.85	0.85
Vocational Education started	0.23	0.27	0.17	0.14	0.01	0.11	0.05	0.07
Vocational Education started/planned	0.28	0.31	0.21	0.18	0.12	0.19	0.08	0.11
<i>Subject of started/planned University Education^b</i>								
Humanities	0.13	0.08	0.13	0.13	0.02	0.06	0.08	0.07
Education and Social Sciences	0.35	0.35	0.35	0.32	0.10	0.14	0.12	0.11
Law and Economics	0.21	0.24	0.22	0.24	0.12	0.17	0.19	0.21
Engineering	0.11	0.10	0.08	0.11	0.39	0.35	0.30	0.34
Natural Sciences and Mathematics	0.09	0.10	0.11	0.10	0.33	0.23	0.19	0.23
Medical Sciences	0.15	0.14	0.12	0.12	0.07	0.08	0.10	0.06
<i>Activities in the Year after High-School Graduation^c</i>								
Military or Civilian Service	0.00	0.00	0.00	0.00	0.45	0.26	0.47	0.37
Internship or Temporary Work	0.10	0.10	0.11	0.11	0.04	0.07	0.04	0.04
Voluntary Service/ Spending a Year Abroad	0.10	0.17	0.14	0.14	0.04	0.15	0.06	0.08
<i>N</i>	202	168	1490	1914	63	93	685	928

^a Share of high school graduates being enrolled (or having decided to enroll in near future) in university or vocational education half a year after school graduation.

^b Share of students being enrolled or planning to enroll in a specific university subject.

^c Share of high school graduates participating in different activities half a year after school graduation.

· PRE indicates the pre-reform year 2006, POST the post-reform year 2010.

Table 4: Probability of University Education (Probit Estimates, Marginal Effects)

Independent Variables	Female Sample		Male Sample	
	started/ Marg.eff.	started/ planned/ Marg.eff.	started/ Marg.eff.	started/ planned/ Marg.eff.
DiD	-0.170*** (0.053)	-0.088** (0.042)	-0.118 (0.077)	-0.031 (0.054)
Post-Reform	0.046*** (0.017)	0.060*** (0.015)	0.070*** (0.025)	-0.003 (0.019)
Treatment Group	0.106* (0.058)	0.038 (0.046)	0.180** (0.081)	0.125** (0.060)
Academic Degree of Parents ^a	0.096*** (0.018)	0.121*** (0.015)	-0.034 (0.027)	-0.006 (0.020)
Occupational Status of Parents: middle ^b	0.047* (0.025)	0.059*** (0.020)	0.041 (0.039)	0.020 (0.026)
Occupational Status of Parents: high ^b	0.019 (0.027)	0.085*** (0.022)	0.073* (0.040)	0.107*** (0.028)
Migration Background ^c	-0.001 (0.024)	0.003 (0.021)	0.058* (0.035)	0.045 (0.028)
Half Year of Birth ^d	0.022 (0.016)	0.007 (0.014)	0.046* (0.023)	0.007 (0.017)
State Dummies	yes	yes	yes	yes
N	3,703	3,703	1,739	1,739

^a Academic degree of at least one parent (reference: no academic degree).

^b Occupational Status is measured by the International Socio-Economic Index of Occupational Status (ISEI): low status (from 0 to 49, reference category), middle status (from 50 to 67), high status (from 68 to 85).

^c Migration background: student is born abroad or has foreign citizenship, or at least one parent is born abroad, or language at parental home is not only Germany (reference: no migration background).

^d Half year of birth: student belongs to the older group of students (reference: younger group of students).

· Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in university education.

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Probability of Vocational Education (Probit Estimates, Marginal Effects)

Independent Variables	Female Sample		Male Sample	
	started/ Marg.eff.	started/ planned/ Marg.eff.	started/ Marg.eff.	started/ planned/ Marg.eff.
DiD	0.063*	0.071*	0.090*	0.002
	(0.035)	(0.039)	(0.052)	(0.043)
Post-Reform	-0.039***	-0.043***	0.021*	0.030*
	(0.013)	(0.014)	(0.013)	(0.017)
Treatment-Group	-0.036	-0.029	-0.167***	-0.027
	(0.038)	(0.043)	(0.062)	(0.047)
Academic Degree of Parents ^a	-0.098***	-0.109***	-0.012	-0.015
	(0.013)	(0.014)	(0.013)	(0.016)
Occupational Status of Parents: middle ^b	-0.048***	-0.064***	-0.005	-0.003
	(0.017)	(0.019)	(0.017)	(0.022)
Occupational Status of Parents: high ^b	-0.045**	-0.076***	-0.053***	-0.073***
	(0.019)	(0.020)	(0.019)	(0.024)
Migration Background ^c	-0.004	-0.006	-0.083***	-0.071***
	(0.018)	(0.020)	(0.028)	(0.027)
Half Year of Birth ^d	-0.008	-0.010	-0.007	0.004
	(0.012)	(0.013)	(0.012)	(0.015)
State Dummies	yes	yes	yes	yes
N	3,703	3,702	1,739	1,739

^a Academic degree of at least one parent (reference: no academic degree).

^b Occupational Status is measured by the International Socio-Economic Index of Occupational Status (ISEI): low status (from 0 to 49, reference category), middle status (from 50 to 67), high status (from 68 to 85).

^c Migration background: student is born abroad or has foreign citizenship, or at least one parent is born abroad, or language at parental home is not only Germany (reference: no migration background).

^d Half year of birth: student belongs to the older group of students (reference: younger group of students).

· Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in vocational education.

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 6: Probability of University Subjects (Probit Estimates, Marginal Effects)

	Female Sample started/ planned Marg.eff.	Male Sample started/ planned Marg.eff.
DiD: Humanities	-0.065 (0.046)	0.023 (0.066)
DiD: Education and Social Sciences	0.019 (0.061)	0.070 (0.060)
DiD: Law and Economics	0.005 (0.054)	0.107 (0.083)
DiD: Engineering	-0.021 (0.037)	-0.018 (0.084)
DiD: Natural Sciences and Mathematics	0.016 (0.041)	-0.160** (0.073)
DiD: Medical Sciences	-0.004 (0.041)	0.012 (0.048)
DiD: STEM (narrow definition) ^a	-0.005 (0.052)	-0.199** (0.092)
DiD: STEM (broad definition) ^b	-0.010 (0.060)	-0.190** (0.094)
N	2,903	1,487

^a STEM subjects (narrow definition) include engineering, natural sciences and mathematics.

^b STEM subjects (broad definition) include engineering, natural sciences and mathematics, and medical sciences.

· Dependent variable: Dummy indicating enrollment or firmly planned enrollment in a specific university subject.

· Regressions are separately run for each subject.

· Regressions include further explaining variables: post-reform- and treatment-group-dummy, academic degree of parents, occupational status of parents, migration background, half year of birth, and state dummies.

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 7: Probability of Voluntary Service or Spending a Year Abroad
(Probit Estimates, Marginal Effects)

Independent Variables	Female Sample	Male Sample
	Marg.eff.	Marg.eff.
DiD	0.065*	0.089*
	(0.039)	(0.046)
Post-Reform	0.008	0.012
	(0.012)	(0.014)
Treatment Group	-0.086*	-0.068
	(0.044)	(0.058)
Academic Degree of Parents ^a	0.017	0.031**
	(0.013)	(0.015)
Occupational Status of Parents: middle ^b	0.028	0.033
	(0.019)	(0.024)
Occupational Status of Parents: high ^b	0.045**	0.029
	(0.020)	(0.025)
Migration Background ^c	-0.004	-0.018
	(0.017)	(0.020)
Half Year of Birth ^d	-0.012	0.004
	(0.011)	(0.013)
State Dummies	yes	yes
N	3,703	1,739

^a Academic degree of at least one parent (reference: no academic degree).

^b Occupational Status is measured by the International Socio-Economic Index of Occupational Status (ISEI): low status (from 0 to 49, reference category), middle status (from 50 to 67), high status (from 68 to 85).

^c Migration background: student is born abroad or has foreign citizenship, or at least one parent is born abroad, or language at parental home is not only German (reference: no migration background).

^d Half year of birth: student belongs to the older group of students (reference: younger group of students).

· Dependent variable: Dummy indicating participation in a voluntary year of social or ecological service or spending a year abroad (half a year after high school graduation).

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

A Appendix

Table A.1: Composition of Treatment Group (Number of Observations)

	Female Sample		Male Sample	
	2006	2010	2006	2010
Saxony-Anhalt	96	57	28	26
Mecklenburg-Western Pomerania	54	71	15	37
Saarland	8	23	5	20
Hamburg	44	17	15	10
Treatment Group	202	168	63	93

Table A.2: Share of High School Students Not Successfully Passing Final Examinations

	Graduation Cohort		
	2006	2008	2010
Saxony-Anhalt	0.10	0.11	0.12
Mecklenburg-Western Pomerania	0.05	0.06	0.10
Saarland	0.04	0.02	0.09
Hamburg	0.06	0.05	0.07

- Number of students not successfully passing final examinations in relation to the number of students entering last year of high school.
- Source: Federal Statistical Office (n.y.).

Table A.3: Robustness Check I: Estimations without Saxony-Anhalt / Mecklenburg-Western Pomerania (Probit Estimates, Marginal Effects)

	Female Sample		Male Sample	
	w/o ST Marg. eff.	w/o MW Marg. eff.	w/o ST Marg. eff.	w/o MW Marg. eff.
DiD: University Education (started) ^a	-0.188*** (0.055)	-0.214*** (0.064)	-0.179** (0.080)	-0.139 (0.089)
DiD: University Education (started/planned) ^a	-0.076* (0.043)	-0.108** (0.050)	-0.048 (0.051)	-0.085 (0.065)
DiD: Vocational Education (started) ^b	0.061* (0.036)	0.097** (0.042)	0.073** (0.036)	0.440 (16.269)
DiD: Vocational Education (started/planned) ^b	0.069* (0.041)	0.110** (0.047)	0.025 (0.042)	0.007 (0.050)
DiD: STEM (narrow definition) ^c	0.084 (0.054)	-0.016 (0.063)	-0.012 (0.090)	-0.157 (0.104)
DiD: STEM (broad definition) ^c	0.089 (0.061)	-0.043 (0.071)	-0.056 (0.089)	-0.160 (0.104)
DiD: Voluntary Service/ Stay Abroad ^d	0.074** (0.037)	0.058 (0.046)	0.124*** (0.042)	0.104* (0.055)
N	5,128	3,581	2,391	1,687

^a Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in university education.

^b Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in vocational education.

^c Dependent variable: Dummy indicating enrollment or firmly planned enrollment in a STEM university subject (STEM subjects narrowly defined include engineering, natural sciences and mathematics, STEM subjects broadly defined additionally include medical sciences).

^d Dependent variable: Dummy indicating participation in a voluntary year of social or ecological service or spending a year abroad.

· Regressions are separately run for each outcome.

· Regressions include further explaining variables: post-reform- and treatment-group-dummy, academic degree of parents, occupational status of parents, migration background, half year of birth, and state dummies.

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.4: Robustness Check II: Estimations With a Different Control Group (Rhineland-Palatinate, Saxony, Thuringia) (Probit Estimates, Marginal Effects)

	Female Sample Marg.eff.	Male Sample Marg.eff.
DiD: University Education (started) ^a	-0.127* (0.066)	-0.134 (0.105)
DiD: University Education (started/planned) ^a	-0.102* (0.057)	-0.072 (0.079)
DiD: Vocational Education (started) ^b	0.097* (0.052)	0.124* (0.067)
DiD: Vocational Education (started/planned) ^b	0.111** (0.055)	0.102 (0.074)
DiD: STEM (narrow definition) ^c	-0.015 (0.064)	-0.246** (0.118)
DiD: STEM (broad definition) ^c	-0.055 (0.075)	-0.219* (0.117)
DiD: Voluntary Service/ Stay Abroad ^d	0.018 (0.049)	0.065 (0.066)
N	998	373

^a Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in university education.

^b Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in vocational education.

^c Dependent variable: Dummy indicating enrollment or firmly planned enrollment in a STEM university subject (STEM subjects narrowly defined include engineering, natural sciences and mathematics, STEM subjects broadly defined additionally include medical sciences).

^d Dependent variable: Dummy indicating participation in a voluntary year of social or ecological service or spending a year abroad.

· Regressions are separately run for each outcome.

· Regressions include further explaining variables: post-reform- and treatment-group-dummy, academic degree of parents, occupational status of parents, migration background, half year of birth, and state dummies.

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.5: Robustness Check III: Estimations Without Four Control States (Probit Estimates, Marginal Effects)

	Female Sample w/o BW, BA, BE, SH Marg.eff.	Male Sample w/o BW, BA, BE, SH Marg.eff.
DiD: University Education (started) ^a	-0.159*** (0.056)	-0.096 (0.082)
DiD: University Education (started/planned) ^a	-0.074 (0.046)	-0.006 (0.061)
DiD: Vocational Education (started) ^b	0.052 (0.041)	0.106* (0.062)
DiD: Vocational Education (started/planned) ^b	0.073 (0.044)	-0.012 (0.052)
DiD: STEM (narrow definition) ^c	-0.015 (0.053)	-0.189* (0.097)
DiD: STEM (broad definition) ^c	-0.030 (0.062)	-0.164* (0.099)
DiD: Voluntary Service/ Stay Abroad ^d	0.050 (0.040)	0.090* (0.048)
N	2,267	1,010

- ^a Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in university education.
- ^b Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in vocational education.
- ^c Dependent variable: Dummy indicating enrollment or firmly planned enrollment in a STEM university subject (STEM subjects narrowly defined include engineering, natural sciences and mathematics, STEM subjects broadly defined additionally include medical sciences).
- ^d Dependent variable: Dummy indicating participation in a voluntary year of social or ecological service or spending a year abroad.
- Regressions are separately run for each outcome.
 - Regressions include further explaining variables: post-reform- and treatment-group-dummy, academic degree of parents, occupational status of parents, migration background, half year of birth, and state dummies.
 - Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.6: Robustness Check IV: Placebo Tests (Probit Estimates, Marginal Effects)

	Female Sample			Male Sample		
	(1) Marg.eff.	(2) Marg.eff.	(3) Marg.eff.	(1) Marg.eff.	(2) Marg.eff.	(3) Marg.eff.
DiD: University Education (started) ^a	0.008 (0.038)	-0.017 (0.056)	-0.036 (0.044)	0.029 (0.057)	0.112 (0.084)	0.030 (0.067)
DiD: University Education (started/planned) ^a	-0.045 (0.031)	-0.012 (0.045)	0.011 (0.036)	-0.016 (0.040)	0.100* (0.055)	0.034 (0.049)
DiD: Vocational Education (started) ^b	0.039 (0.026)	0.028 (0.038)	-0.022 (0.030)	0.049* (0.027)	0.007 (0.037)	-0.034 (0.032)
DiD: Vocational Education (started/planned) ^b	0.040 (0.029)	0.024 (0.042)	-0.032 (0.034)	0.024 (0.033)	-0.058 (0.044)	-0.068* (0.039)
DiD: STEM (narrow definition) ^c	0.020 (0.037)	-0.022 (0.053)	0.011 (0.043)	-0.001 (0.064)	0.244** (0.100)	0.063 (0.074)
DiD: STEM (broad definition) ^c	0.037 (0.043)	0.035 (0.063)	0.039 (0.049)	0.001 (0.062)	0.222** (0.094)	0.035 (0.072)
DiD: Voluntary Service/ Stay Abroad ^d	0.024 (0.027)	0.015 (0.039)	0.049 (0.031)	0.029 (0.030)	0.011 (0.044)	0.024 (0.036)
N	3,341	3,341	3,977	1,586	1,586	1,806

(1) Placebo Test: Using control states from Northern Germany as treatment group and control states from Southern Germany as control group.

(2) Placebo Test: Using control states from East Germany as treatment group and control states from West Germany as control group.

(3) Placebo Test: Using states without reform (Rhineland-Palatinate, Saxony, Thuringia) as treatment group, compared to the original control group.

^a Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in university education.

^b Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in vocational education.

^c Dependent variable: Dummy indicating enrollment or firmly planned enrollment in a STEM university subject (STEM subjects narrowly defined include engineering, natural sciences and mathematics, STEM subjects broadly defined additionally include medical sciences).

^d Dependent variable: Dummy indicating participation in a voluntary year of social or ecological service or spending a year abroad.

· Regressions are separately run for each outcome.

· Regressions include further explaining variables: post-reform- and treatment-group-dummy, academic degree of parents, occupational status of parents, migration background, half year of birth, and state dummies.

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Robustness Check IV: Reform Effect on Outcomes Not Affected by the Reform (Regression Estimates, Marginal Effects)

	Female Sample Marg.eff.	Male Sample Marg.eff.
DiD: General Job Prospects with University Education	-0.031 (0.076)	-0.011 (0.102)
DiD: General Job Prospects with Vocational Education	0.088 (0.080)	-0.089 (0.114)
N	3,556	1,665

- Dependent variable: students' assessment of general job prospects of graduates from university and vocational education; assessment half a year after high school graduation; assessment on a five-point Likert scale, ranging from 1 (very good) to 5 (very bad).
- Regressions are separately run for each outcome.
- Regressions include further explaining variables: post-reform- and treatment-group dummy, academic degree of parents, occupational status of parents, migration background, half year of birth, and state dummies.
- Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A.8: Robustness Check V: Test of the Possibly Confounding Influence of University Tuition Fees (Probit Estimates, Marginal Effects)

	Female Sample w/o BR, HE, SL Marg.eff.	Male Sample w/o BR, HE, SL Marg.eff.
DiD: University Education (started) ^a	-0.142*** (0.054)	-0.141* (0.081)
DiD: University Education (started/planned) ^a	-0.076* (0.043)	-0.040 (0.057)
DiD: Vocational Education (started) ^b	0.056 (0.036)	0.086 (0.056)
DiD: Vocational Education (started/planned) ^b	0.063 (0.041)	0.023 (0.047)
DiD: STEM (narrow definition) ^c	0.005 (0.054)	-0.228** (0.097)
DiD: STEM (broad definition) ^c	0.009 (0.062)	-0.193* (0.099)
DiD: Voluntary Service/ Stay Abroad ^d	0.051 (0.039)	0.123** (0.053)
N	3,303	1,573

^a Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in university education.

^b Dependent variable: Dummy indicating enrollment (or firmly planned enrollment) in vocational education.

^c Dependent variable: Dummy indicating enrollment or firmly planned enrollment in a STEM university subject (STEM subjects narrowly defined include engineering, natural sciences and mathematics, STEM subjects broadly defined additionally include medical sciences).

^d Dependent variable: Dummy indicating participation in a voluntary year of social or ecological service or spending a year abroad.

· Regressions are separately run for each outcome.

· Regressions include further explaining variables: post-reform- and treatment-group-dummy, academic degree of parents, occupational status of parents, migration background, half year of birth, and state dummies.

· Marginal effects are average marginal effects. Standard errors are shown in parenthesis below marginal effects. Stars denote significance of the estimates as follows: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.