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Balancing Study and Work: Heterogeneous Impact of the Bologna Reform on the Labour Market

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Abstract

The Bologna reform, the largest European education reform, was implemented in Russia in 2011. The reform shortened the duration of some undergraduate programmes by 1 year and compressed their curricula. Using a difference-in-differences design, I find that the reform had no short- or medium-term adverse effects on employment. However, I find that null average effects on wages mask considerable heterogeneity. I find that female students with high relative returns worked less during their studies, invested in their human capital, and secured stable wages. In contrast, male students with low relative returns underinvested in human capital and experienced a decline in wages.

I. Introduction

The Bologna reform, the most significant educational reform of the 21st century in Europe, aimed to create a European Higher Education Area by implementing a system of comparable degrees and a credit transfer system to enhance student mobility. The reform resulted in a reduction of both the length of university programmes and the content of curricula throughout Europe (Schomburg, 2011).[1] This study investigates the influence of the reform on graduates' labour market outcomes. The findings of this study are crucial for policymakers and university management to understand the benefits of the reform, as there has been ongoing debate about its effectiveness for graduates (Teichler, 2011). Kroher *et al.* (2021) review prior work on the impact of the Bologna reform, concluding that studies in the literature 'often do not allow for causal conclusions and only provide a

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[1]The Bologna reform's impact is comparable to changes observed in higher education systems in Colombia (Arteaga, 2018) and the USA (Denning *et al.*, 2022).

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fragmented picture, which makes evidence–based adjustments in reform implementation difficult'.

This paper investigates the impact of the Bologna reform on employment and wages of university graduates in Russia. The case of Russia is particularly suitable for identifying causal effects of the reform due to three key factors: the unexpected timing of the reform, the absence of a gap year culture, and high compliance with the nominal duration of study. The reform was announced in 2003, but its full implementation did not occur until 2011, due to the complexities of executing such an extensive reform across the nation. Furthermore, Russian students rarely take gap years, leaving little room for adjusting application strategies. This unanticipated timing, combined with the lack of a gap year culture, enables the elimination of anticipation effects among high school graduates. Additionally, in contrast to other countries implementing the Bologna reform, Russian university students typically graduate within the nominal duration of study, seldom exceeding their official study duration due to administrative barriers and financial costs. This factor mitigates concerns about students endogenously adjusting their graduation time, which could otherwise bias results. The paper presents evidence supporting these identifying assumptions based on administrative data.

In a nutshell, the Bologna reform transformed university degrees from 5-year to 4-year programmes and changed the content of curricula, though some programmes were not affected by the reform. The reform's unanticipated timing, the lack of a gap year culture, and high compliance with the nominal duration of study create a unique opportunity to utilize programmes that underwent changes as a treatment group and those that remained unchanged as a control group. These features provide a credible identification strategy to estimate the impact of the reform using a difference–in–differences design. I compare students who graduated in the same year to estimate the differences in employment probabilities and wages for bachelor's and specialist's degree holders before and after the reform by including programme, region, and year of graduation fixed effects. The key identifying assumption is that, in the absence of the reform, the quantity and quality of university applicants and graduates would have evolved similarly in programmes that experienced a policy change relative to programmes that did not experience such a change.

This study employs data from two sources to investigate the impact of the Bologna reform on employment and wages of university graduates in Russia. The first dataset, the National Survey of Graduate Employment, contains wage and employment information for 11,768 individuals who graduated between 2010 and 2015. The second dataset, drawn from the Russian Labor Force Survey, includes employment data for 300,580 individuals who graduated between 2010 and 2020. Both datasets offer comprehensive information on demographics, educational background, and labour market outcomes.

The results indicate that the Bologna reform did not adversely affect the employment of graduates in the short or medium term. However, the reform's impact on wages displayed notable differences based on sex. Specifically, female graduates' wages were not negatively affected, whereas male graduates experienced a significant decline in wages. The influence of the Bologna reform on postgraduate aspirations reveals no significant shift in the desire for further education among males and females or in student migration patterns, suggesting these factors do not account for the observed wage disparities. Further analysis into the quality of employment, through indicators such as

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full-time employment and permanent contracts, reveals that investment in human capital by female students translates into better job quality post-graduation. The results suggest that the Bologna reform positively influenced the likelihood of female graduates securing full-time positions, in contrast to a negative impact on male graduates. Although there is suggestive evidence pointing towards an increased likelihood of females obtaining permanent contracts as opposed to males, these findings require cautious interpretation due to less precise estimates.

This study explores a novel mechanism explaining heterogeneous impact of the Bologna reform on the wages of males and females. This phenomenon can be explained by considering the trade−off students make between investing in education or in working. If relative returns to education compared to returns to work experience are high, it is beneficial to work less during the study programme. Empirical evidence supports this argument. When the reform forced students to have fewer years of education, female students, with higher relative returns, chose to work less while studying, in order to invest in their human capital and secure stable wages after graduation. On the other hand, males, with lower relative returns, prioritized working while studying, resulting in underinvestment in their human capital, which led to a decline in wages and the need for additional on-the-job training after graduation.

This paper makes two important contributions to the literature. First, it is one of the first papers to provide causal evidence on the impact of the Bologna reform on the labour market. Several papers have studied the effects of the reform on employment and wages of graduates, including Bosio and Leonardi (2011) in Italy, Farčnik and Domadenik (2012) in Slovenia, Garra (2013) in Portugal, Neugebauera and Weiss (2018) in Germany, and Domínguez and Gutiérrez (2023) in Spain. However, only one study provides credible causal evidence of the effect of the reform (Bosio and Leonardi, 2011). The authors use the variation in the introduction of the reform by universities as an instrument to identify changes in the supply of college graduates in 1998−2007 in Italy. They estimate the effects of the reform on the probability of employment and wage premium of college graduates relative to non-graduates and find that the reform increases the relative employment and decreases the wage premium of graduates. In contrast to Bosio and Leonardi (2011), the present study employs a more up-to-date dataset covering the years 2010−20 and finds precisely estimated null effects of the reform on employment. By incorporating more recent data, this research contributes new causal evidence to the existing literature, elucidating the Bologna reform's implications within the context of the postfinancial crisis period. The discovery of null effects on employment challenges the widely held, yet misguided, belief among policymakers and university management that the Bologna reform negatively influenced graduates' employability.

Second, this paper offers a novel mechanism and provides empirical evidence to explain how students deal with the negative consequences of education reforms. To the best of my knowledge, this is the first Bologna reform study that explains why labour outcomes have been affected for some students while remaining unchanged for others. I find that that female students choose to combine study with work less often, invest in their human capital, and secure stable wages. In contrast, male students work more while studying, underinvest in their human capital and experience a decline in wages. These findings suggest that excessive working while studying can adversely impact academic

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performance and future labour market success (Stinebrickner and Stinebrickner, 2003; Häkkinen, 2006; Avdic and Gartell, 2015).

The results of this study offer a nuanced perspective for those considering similar educational reforms. While this research does not directly evaluate specific policy interventions, it highlights the importance of understanding student behaviours in response to educational changes (Finkelstein and Hendren, 2020; Hendren and Sprung-Keyser, 2020). It suggests that supporting students in managing work and study commitments could potentially alleviate some challenges posed by reforms (Fryer, 2014; Bettinger *et al.*, 2019; Anderson *et al.*, 2020; Rothstein and Rouse, 2021; Xu and Ran, 2021; Canaan *et al.*, 2022).

The paper is structured as follows. Section II reviews the institutional background of the Russian higher education system and the Bologna reform. Section III describes the data and the identification strategy. Section IV presents the results. Section V concludes.

II. Institutional background and the reform

The Russian higher education system

In Russia, there are approximately 700 public and private universities. Private universities constitute a small proportion of the sector, with enrolment comprising less than 6% of total students. Apart from differences in funding, private universities are subject to the same regulations imposed by the Ministry of Science and Higher Education on public universities.[2]

Traditionally, the majority of university applicants are high school graduates applying in the same year of graduation. In 2010 and 2011, 80.1% and 79.7% of admitted students, respectively, were recent high school graduates. In Russia, the concept of taking a gap year does not prevail, with fewer than 3% of high school graduates choosing this path (Netology, 2023). This trend is particularly prevalent among male students, as there is a mandatory conscription system in place for Russian male citizens and avoiding conscription is considered a criminal offense. The statistics reveal a sex difference: in 2010, 82.0% of the admitted male students and 78.5% of the admitted female students were recent high school graduates; in 2011, these figures were 81.3% for males and 77.1% for females, respectively.

Admission to universities in Russia is based on scores obtained on the Unified State Exam (similar to the Scholastic Aptitude Test in the USA), taken during the final year of high school. The average age of applicants is 18 years (see Figure 1 and Table A1). The Ministry of Science and Higher Education determines the number of state-funded places and the curricula at universities. State-funded places are financed by the state budget and allow students to attend university tuition-free (hereinafter, I refer to these places as 'tuition-free places'). Figure A1 illustrates the inflow of full-time students admitted to tuition-free places from 2005 to 2020. The proportion of tuition-free places remains stable

[2]In this paper, I describe the system of higher education that is relevant for full-time students in public and private universities, who are the subject of the study. Hereinafter, by 'universities' I mean all types of higher education institutions, including universities, institutes and academies.

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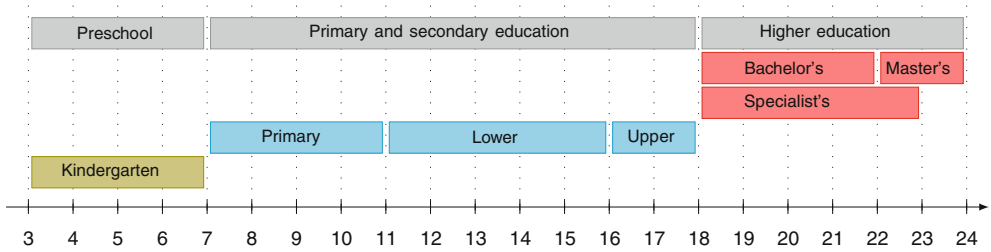

Figure 1. The Russian education system. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: Age indicates student's age based on the nominal duration of study

over time, while the total number of admitted students has decreased due to demographic changes.

In Russia, students can apply for either tuition-free places (more competitive) or fee-based places (less competitive). The application process allows students to submit a list of up to five universities, with a maximum of three programmes at each university. The competition for tuition-free places is fierce, with admission determined by merit, as measured by scores on the admission exam. Typically, students with the highest exam scores enrol in public universities for tuition-free places, while those with lower scores attend private universities for fee-based places.

Approximately 60% of students enrol in tuition-free places at public universities. Some universities, under the supervision of various sectoral ministries such as the Ministry of Agriculture, Ministry of Culture and Ministry of Health, have autonomy to set their own regulations. However, they have limited ability to influence the curricula and programme quality. The Ministry of Science and Higher Education oversees all universities, including those under sectoral ministry supervision. This is due to the centralized nature of the higher education sector, as the Ministry holds the power to grant licenses, accredit universities, and assign admission quotas (Law, 2018). It also controls a significant portion of the budget allocated to the higher education sector. For further information on the Russian higher education system, see Platonova and Semyonov (2018), Froumin and Leshukov (2019), and Kuzminov and Yudkevich (2022).

The Bologna reform in Russia

Historically, the Russian higher education landscape was a unitary system (Froumin and Leshukov, 2019). Under this system, students would typically enrol in a comprehensive 5-year programme leading directly to a specialist's degree. This system was straightforward but limiting in terms of academic transition and mobility.

In 2003, Russia committed to the Bologna Declaration, aiming to harmonize its higher education system with those of other European countries (Law, 2005). However, the full realization of this commitment was not achieved until 2011, hindered by administrative complications associated with introducing such a big reform throughout the nation. When the Bologna reform was eventually implemented in 2011, it marked a significant transformation in the Russian higher education system. The country transitioned from its

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traditional unitary system, which was characterized by five-year specialist's degrees, to a two-cycle system comprising 4-year bachelor's and 2-year master's programmes.

The universities that were under the supervision of the Ministry of Science and Higher Education, among other institutions, adapted by converting some of their specialist's programmes into bachelor's degrees. However, universities overseen by sectoral ministries were not uniformly obligated to adhere to these changes (Law, 2009). The way universities adapted to the Bologna reform varied. Some institutions streamlined their course structures and curricula, often reducing optional components. In contrast, others simply tried to transfer the courses from the old specialist's curriculum to the new, condensed bachelor's format without significant changes.

Central to the Bologna reform was the alignment with the European Qualifications Framework, which set out specific learning outcomes for each degree level (European Commission, 2018). The goal was to achieve a more streamlined, efficient approach to higher education, reducing redundancies and focusing on core competencies. As a consequence, certain study programmes underwent modifications to fit the new degree structures (such as services, education and social sciences). These changes often meant shortening programmes that previously exceeded the standardized length. For example, only 27% of arts and humanities programmes were bachelor's programmes in 2010, while this share grew to more than 85% in 2011 (see Table A2). On the other hand, programmes that already aligned with the new structure, or those rooted in academic cultures with traditionally longer duration like engineering and medicine, remained unchanged.

The Bologna reform, initiated in 2011, primarily targeted new enrollees, meaning those who started their studies postimplementation would experience the new structure. However, students who had enroled prior to 2011 would have continued with their studies under the previous system. As a result, from 2011 to 2015, many universities managed two parallel systems. The older system for students who had started their education before the reform, ensuring they completed their studies as initially planned. At the same time, the new system was in place for the incoming students. This dual system ensured a smooth transition period, minimizing disruptions and ensuring that all students, regardless of when they enroled, received the education they had anticipated.

The Bologna reform is one of the most significant institutional reforms of the Russian higher education system in the past decade and is a widely debated topic (Platonova and Semyonov, 2018). The mass introduction of two-cycle higher education degrees occurred in the academic year 2010–11 (see Figure 2). This creates a natural experiment for the 2011 intake, as there was a significant shift in the proportion of students admitted to specialist's programmes (79%) vs. bachelor's programmes (21%) in 2010, to the opposite pattern in 2011 (16% specialist's students and 84% bachelor's students). More details about the control group and identifying assumptions are provided in section III.

Numerous studies have investigated the returns to education in Russia (Lukiyanova, 2010; Roshchin and Rudakov, 2015; Kyui, 2016; Belskaya *et al.*, 2020; Melianova *et al.*, 2020; Rozhkova *et al.*, 2021, 2023). However, these studies primarily offer correlational estimates, leaving a gap in the literature concerning causal estimates of the Bologna reform's impact on labour market outcomes for graduates, particularly in relation to employment and wages.

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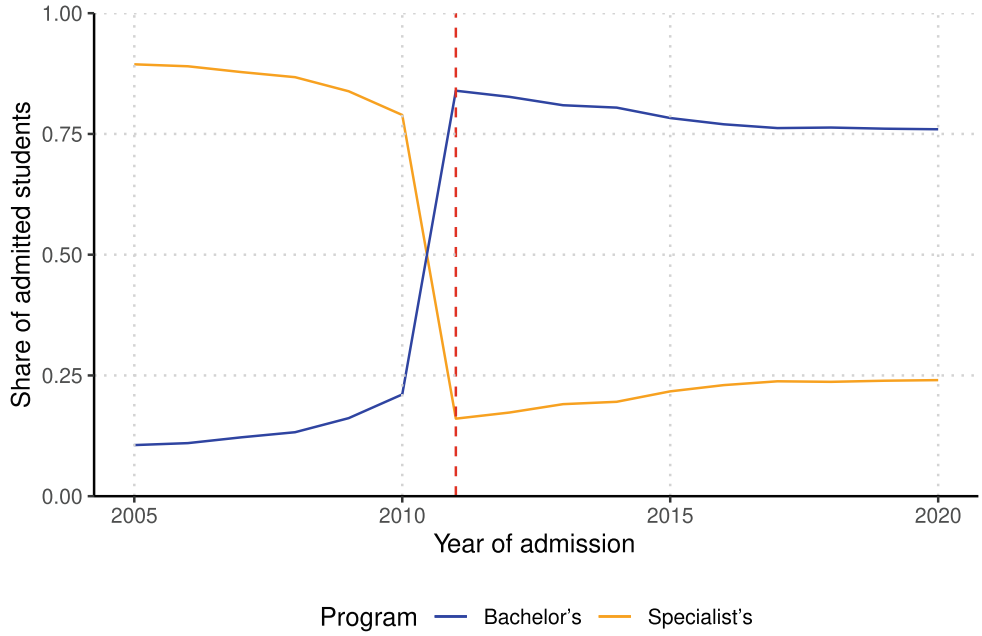

Figure 2. The share of bachelor's and specialist's full-time students admitted in 2005–20. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The red dashed line shows the year of the implementation of the reform – 2011. *Source*: The Ministry of Science and Higher Education

III. Research design

Data

This study utilizes data from two sources. The first dataset is the National Survey of Graduate Employment conducted by the Russian Federal State Statistics Service. The sample was selected based on primary information from the census data and includes a repeated cross-sectional sample of students who graduated between 2010 and 2015. The sample is representative of the population and provides detailed information on demographics (sex, age, region, type of settlement and citizenship status), educational background (type of degree, year of graduation, type of university, funding and combining study and work) and labour market outcomes (wages, number of working hours and days, employment, full-time job, permanent contract and on-the-job training) in the years following graduation. The survey includes weights, which were calculated by comparing the stratified sample by sex, age group, and type of settlement with the general population. In total, there are 11,768 observations.

The second dataset is obtained from the Russian Labor Force Survey conducted by the Russian Federal State Statistics Service. This dataset provides information on demographics (sex, age, region, type of settlement, and citizenship status), educational background (type of degree and year of graduation), and the labour market outcome (employment) in the years following graduation. This dataset has drawbacks as it does not provide information on whether a student graduated from a full-time or part-time

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programme, and there is no information on wages. Although this may introduce bias, I expect the bias to be consistent for the treatment and control groups.[3] In total, there are 300,580 observations.

The study focuses on graduates with bachelor's and specialist's degrees, and only includes graduates from full-time programmes. The education variable refers to the highest level of education attained.[4] I use both net monthly and hourly wages, calculated from the number of working days and hours per day.[5] The unemployed category includes both registered unemployed and economically inactive individuals.

The descriptive statistics in Table A3 show that about 40% of graduates are males, most of them (75%) live in urban areas, and nearly all have Russian citizenship. The majority (95%) of graduates studied at public universities, and 59% had tuition-free places. This is consistent with the administrative statistics by the Ministry of Science and Higher Education discussed in section II. In the year of the survey, 86% of graduates were employed, with a mean monthly wage of approximately 24,000 RUB (370 USD, with a 1 USD = 65 RUB exchange rate).

Identification strategy

This paper estimates the causal effect of the Bologna reform on employment and wages of university graduates in Russia by using the reform as a source of exogenous variation in the length of higher education and the content of the curricula. I compare two cohorts of students who graduated in the same year to estimate the differences in employment probabilities and wages for bachelor's and specialist's degree holders under similar labour market conditions. However, these simple estimates are confounded by other changes that may have affected students enroled before and after the reform. To correct for this, I use a control group of graduates from programmes that did not change due to the reform. The changes in the differences between the treated and control groups, under certain assumptions, can then be attributed to the effect of the Bologna reform. This DiD design allows me to estimate the average treatment effect on the treated.[6]

In summary, the announcement of the implementation of the Bologna reform occurred in 2003 but the actual reform took place in 2011. Due to these delays, high school graduates and their families were unable to predict when the reform would be implemented. Besides, students almost never take a gap year so there is no room to adjust their application

[3]In the main dataset, the percentage of full-time students among bachelor's students is 87.4% and among specialist's students is 88.4%. To check whether there could be possible biases due to the inclusion of part-time students, I compare the means of two groups. *P*-value of the *t*-test is 0.24. In section IV, I use the main sample and include both full- and part-time students to estimate the short-term effect of the reform on wages and employment. The results remain unchanged.

[4]Note that although the survey only allows respondents to choose between 'bachelor's' and 'specialist's/master's' degrees, the share of master's graduates in the 2010–15 cohort is negligible (between 4% and 8%).

[5]It should be noted that some employed graduates did not report their wages, but there are no statistically significant differences in observable characteristics between those who did and did not report their wages (see Table A4).

[6]Although a DiD design is used to estimate the causal effect of a policy intervention when some individuals are subject to treatment and others not, and outcomes are measured in each group before and after the policy reform, individuals in the treated and control groups should not be necessarily the same individuals (Bertrand *et al.*, 2004; Athey and Imbens, 2006; Abadie *et al.*, 2023).

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strategies. This means that applicants could not affect their decision to participate in the reform or not by adjusting the year of application. Such unexpected timing, coupled with the absence of a gap year culture, allow me to rule out the anticipation effect concerns. Additionally, the duration of programmes is strictly limited to the nominal duration of study (Law, 2018). This means that students must graduate within the specified time limit due to administrative barriers and financial costs. Therefore, any changes in the differences between the treated and control groups can be attributed to the effect of the Bologna reform.

These institutional features make the case of Russia particularly suitable for studying the effects of the Bologna reform on the labour market. The reform provides a source of exogenous variation in the length of the university study period and the content of the curricula. This means that the variation in the length of higher education and the content of studies is assumed to be uncorrelated with other factors that might affect labour market outcomes, such as ability or self-selection.

To obtain naïve OLS estimates of returns to education, I use the following model:

$$Y_{iprt} = \beta \mathrm{Edu}_i + X_i\gamma + \alpha_p + \eta_r + \lambda_t + \varepsilon_{iprt}, \tag{1}$$

where Y_{iprt} is the labour market outcome (either log monthly wages or an indicator equal to 1 if the graduate is employed) of graduate i from programme p in region r in year t, Edu_i is the imputed number of years of education of graduate i, X_i represents individual characteristics of graduate i (sex, type of settlement, citizenship status, type of university and funding), α_p are programme fixed effects, η_r are region fixed effects, and λ_t are year of graduation fixed effects. The inclusion of the type of university and funding in the model allows me to control for students prior ability, as students with higher admission scores typically enrol in public universities for tuition-free places, while students with lower scores enrol in private universities for fee-based places. To estimate the probability of being employed, I use a linear probability model.

I estimate the short-term effect of the Bologna reform on labour market outcomes using the following difference-in-differences model:

$$Y_{iprt} = \delta \mathrm{Treated} \times \mathrm{Post} + X_i\gamma + \alpha_p + \eta_r + \lambda_t + \varepsilon_{iprt}, \tag{2}$$

where Treated × Post is an indicator equal to 1 if a student graduated from a bachelor's programme p after 2015. The control group consists of students who graduated from specialist's programmes. The parameter of interest δ gives the estimate of the reduced-form effect of the Bologna reform. Only δ is reported in the tables, unless stated otherwise. The terms Treated and Post are not included as they are collinear with programme and year fixed effects.

I estimate the medium-term effect the Bologna reform using the following event study model:

$$Y_{iprt} = \sum_{\tau \in [-4,5], \tau \neq -1} \delta_\tau D_{p\tau} + X_i\gamma + \alpha_p + \eta_r + \lambda_t + \varepsilon_{iprt}, \tag{3}$$

where $D_{p\tau}$ is an indicator equal to 1 if a student i graduated from a bachelor's programme p in year τ relative to 4 years after the reform. All results reported in this paper are

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obtained using sample weights. I use two-way clustering of standard errors (SEs) on the programme and graduation year level to account for the treatment being assigned at this level (Abadie *et al.*, 2023).

Evidence on the identifying assumptions

Gap year, nominal duration of study and drop out rates

Panel A of Table 1 illustrates that the majority of high school students apply to university in their graduation year, with approximately 80% of high school graduates being university applicants in the same year. These shares also indicate that there are no anticipation effects due to the reform, as the shares of high school students applying in their graduation year remain stable throughout the analysed period.

Panel B of Table 1 highlights that a high percentage of bachelor's (99%–100%) and specialist's (95%–97%) graduates complete their studies within the nominal duration of study, which is crucial for the identification strategy. Furthermore, Panel C shows that the dropout rate is low, at less than 11% for bachelor's graduates and less than 8% for specialist's graduates. This suggests that the estimates of the effect of the Bologna reform on the analysed sample of graduates are not biased.

Enrolment and graduation patterns

By making the programmes shorter, the Bologna reform might have made it more attractive to enrol in university. Consequently, some might have opted for fields with a shorter study duration. Moreover, the intensified curricula might have presented challenges for students to graduate. These factors are crucial to consider in my identification strategy, given that the sample consists of university graduates. Since the primary dataset only includes graduates, I use additional data from the Russian Longitudinal Monitoring Survey. This survey provides information on university enrolment, type of degree, field of study, and graduation. I focus on four cohorts born between 1991 and 1994, with those born in 1993

TABLE 1

The share of high school students who applied to university in their graduation year and the share of university students who did not graduate within the nominal duration of study and the drop out rate

	2006	*2007*	*2008*	*2009*	*2010*	*2011*
Panel A: High school students who applied to university in their graduation year						
Bachelor's programmes	0.79	0.79	0.78	0.79	0.79	0.79
Specialist's programmes	0.80	0.80	0.79	0.79	0.80	0.80
	2010	*2011*	*2012*	*2013*	*2014*	*2015*
Panel B: Students who did not graduate within the nominal duration of study						
Bachelor's programmes	0.00	0.00	0.00	0.00	0.00	0.01
Specialist's programmes	0.03	0.03	0.03	0.03	0.04	0.05
	2010	*2011*	*2012*	*2013*	*2014*	*2015*
Panel C: Students who dropped out						
Bachelor's programmes	0.09	0.09	0.09	0.11	0.10	0.09
Specialist's programmes	0.07	0.07	0.07	0.08	0.07	0.07

Source: The Ministry of Science and Higher Education.

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being the first cohort exposed to the reform. I estimate the impact of the reform using the following model:

$$Y_{ic} = \delta \text{Treated} + X_i\gamma + \varepsilon_{ic}, \quad (4)$$

where Y_{ic} indicates an education outcome of a person i from cohort c, Treated indicates whether a person born in the cohort was affected by the reform (born in 1993 or 1994), and X_i includes controls from Model 2, programme and year fixed effects, as well as the running variable, year of birth. SEs are clustered at the cohort level.

As illustrated in Table 2, the reform did not impact the likelihood of university enrolment, type of funding, chosen field of study, or graduation rates, suggesting that potential biases from only analysing graduates or from sorting of students into different study fields are likely negligible.

Compositional changes

One potential concern with the DiD analysis is that the distribution of characteristics among the cohorts may have changed over time, which could lead to bias in the estimation of the average treatment effect on the treated (Sant'Anna and Xu, 2023). To address this concern, I examine whether the distribution of covariates remains constant over time. Tables A5 and A6 show the descriptive statistics for students by the year of their graduation, and the results indicate that the shares of males, people who live in urban areas, have citizenship status, graduate from public universities or have tuition-free places are similar throughout all years.

To formally assess whether there exists a compositional change in covariates due to the reform, I run a covariate regression using Model 2 with observable characteristics such as sex, the type of settlement, citizenship status, the type of university and funding as

TABLE 2

The effect of the Bologna reform on educational outcomes

Panel A: *Extensive margin*	*Enroled in a university* *(1)*	*Enroled in a bachelor's programme* *(2)*	*Enroled in tuition-free programme* *(3)*	*Graduated from university* *(4)*
Treated	−0.019	0.241***	0.002	−0.001
	(0.012)	(0.024)	(0.008)	(0.017)
Prereform mean	0.95	0.25	0.40	0.89
Observations	2,408	2,253	2,253	2,253
Panel B: *Intensive margin*	*Enroled in STEM* *(1)*	*Enroled in Medicine* *(2)*	*Enroled in Social sciences* *(3)*	*Enroled in Humanities* *(4)*
Treated	0.006	0.003	−0.003	−0.001
	(0.004)	(0.002)	(0.002)	(0.003)
Prereform mean	0.22	0.02	0.31	0.15
Observations	2,253	2,253	2,253	2,253

Notes: Robust SEs clustered at the cohort level in parentheses. All columns include running variable, individual controls (sex, type of settlement, citizenship status), programme and year fixed effects. Treated indicates whether a person is born in 1993 or 1994.

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.

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the dependent variable. None of the coefficients are statistically significant (see Tables A5 and A6). Taken together, these results provide evidence that the observed characteristics of the cohorts are stable over time and not affected by the reform. This suggests that there is no bias in the estimation of the average treatment effect on the treated and supports the validity of the DiD analysis.

Pretrends

The key identifying assumption of this study is that, in the absence of the Bologna reform, the quantity and quality of university applicants and graduates would have evolved similarly in programmes that experienced a change in the length of education and curricula relative to programmes that did not experience such changes. This assumption is based on the idea that graduates with a particular set of individual characteristics who received the treatment would have, on average, experienced the same changes in their outcomes had they not received the treatment as individuals with the same characteristics who did not receive the treatment.

I provide a test of the parallel pretrends in Figures 3,4, and A2–A11. These figures provide the estimates of the pretreatment leads with 95% confidence intervals, that is, the estimates of the interaction of the treatment indicator and pre-reform period dummies. The test of parallel pretrends supports the parallel trend assumption, suggesting that before 2015, labour and education outcomes of the treated and control groups followed similar patterns.

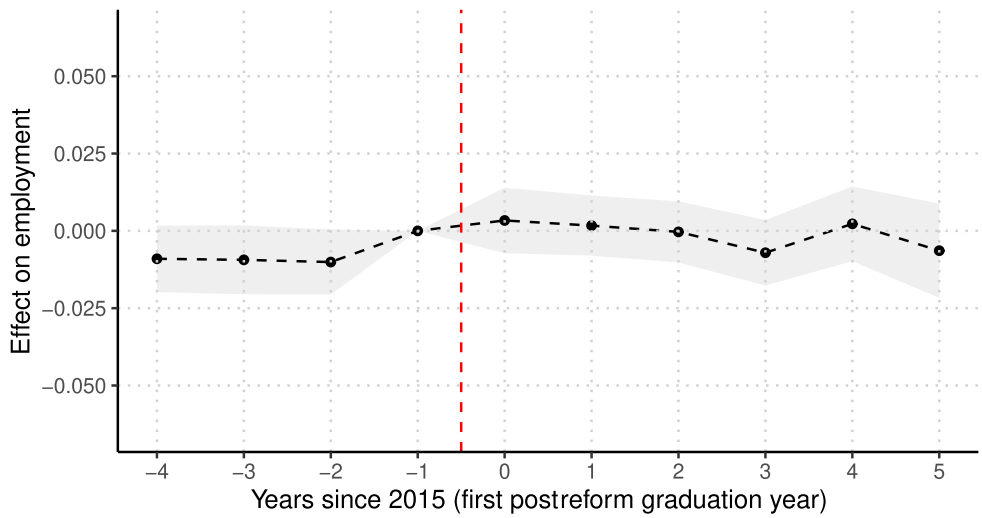

Figure 3. Event study estimates of the effect of the Bologna reform on employment. [Colour figure can be viewed at *wileyonlinelibrary.com*]

Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1—year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for sex, type of settlement, citizenship status, type of university and funding

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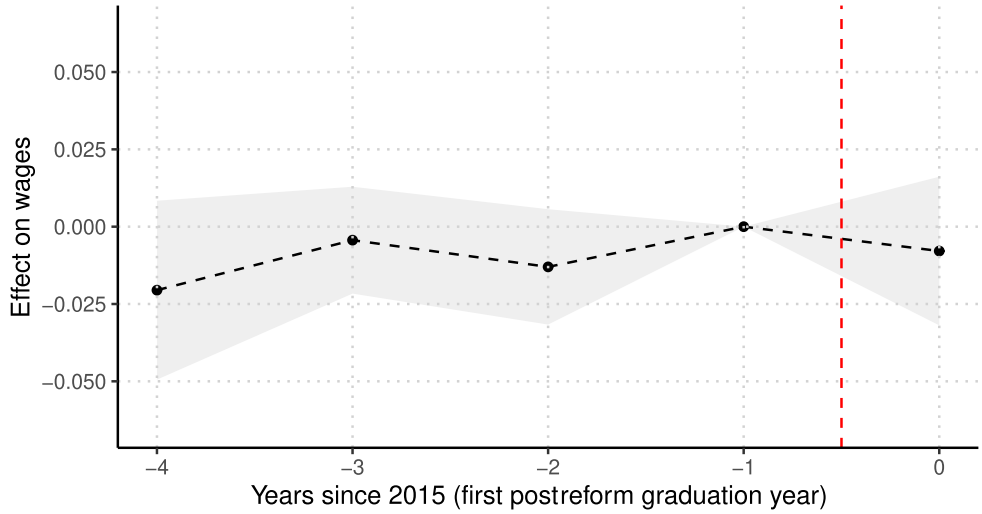

Figure 4. Event study estimates of the effect of the Bologna reform on wages. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for sex, type of settlement, citizenship status, type of university and funding

IV. Results

Main results

In this section, I discuss the naïve OLS estimates of returns to higher education and present the results of the DiD estimates of the effect of the Bologna reform on employment and wages.

OLS estimates of returns to higher education

Table 3 presents the estimates of the returns to 1 year of higher education in Russia. Panel A depicts the association between one year of higher education and log monthly wages for all graduates, as well as separately for males and females. Panel B presents the results of the linear probability model for employment. The estimated associations can be interpreted in a similar manner to returns to one year of higher education.

The results for log monthly wages reveal that returns to one year of higher education are 5.1% with SEs = 0.010. Notably, returns are higher for females than for males, which is consistent with previous literature (Montenegro and Patrinos, 2014). The overall results are largely driven by returns to higher education for females, with returns to one year of education estimated at 6.0% (SE = 0.016) for females and 3.1% (SE = 0.014) for males. All estimates are statistically significant.

The results for employment indicate that one year of education is associated with a 2.1 percentage point increase (SE = 0.007) in the probability of being employed. These results are primarily driven by female graduates, with one year of education associated

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TABLE 3
OLS estimates of the association between years of higher education with wages and employment

	All (1)	Male (2)	Female (3)
Panel A: Log monthly wages			
Years of education	0.051***	0.031*	0.060***
	(0.010)	(0.014)	(0.016)
Prereform mean	10.02	10.13	9.92
Observations	6,448	2,869	3,579
Panel B: Employed			
Years of education	0.021**	0.014	0.024*
	(0.007)	(0.009)	(0.010)
Prereform mean	0.88	0.95	0.83
Observations	11,768	4,958	6,810

Notes: Robust SEs clustered at the programme and graduation year level in parentheses. Years of education indicate imputed years of education. All columns include programme, region, and year fixed effects. Column (1) includes individual controls for sex, type of settlement, citizenship status, type of university and funding. Columns (2) and (3) include the same individual controls as Column (1), excluding sex. *P*-values of the difference in coefficients in Columns (2) and (3) of Panel A is 0.04 and in Columns (2) and (3) of Panel B is 0.12.
$^{*}P < 0.1$; $^{**}P < 0.05$; $^{***}P < 0.01$.

with a 2.4 percentage point increase (SE = 0.010) in the employment probability for females, while the coefficient for males is not statistically significant (0.014, SE = 0.009).

Given substantial returns to education in terms of employment and wages, the Bologna reform potentially can have negative impact on the labour market due to the reduction of the length of study programmes. This is a view shared by policymakers and university management, who blame the reform for causing negative labour market outcomes for bachelor's graduates (Teichler, 2011). However, it is important to keep in mind that the results from studies using OLS may be biased upwards due to endogeneity bias. Even with the included fixed effects, individuals may choose their educational path based on unobservable individual factors such as motivation, ability, or family background. These unobserved characteristics can influence both educational attainment and labour market outcomes, leading to biased estimates.

First-stage estimates of the effect of the Bologna reform

To assess the impact of the Bologna reform on the average length of higher education, I examine the average age of graduates in the sample. The main variable of interest is Treated × Post which equals equal to 1 if a student graduated from a bachelor's programme after 2015. This variable captures the reduced-form effect of the reform. Panel A of Table 4 shows that the average age of graduates after the reform decreased by 0.21 years, which is consistent with the expectation that the reform led to shortened programmes.

The effect of the Bologna reform on employment

I estimate the effects of the Bologna reform on employment in two time periods: the short term and the medium term. I start with a parsimonious specification in Column (1) of Panel B that includes only programme, region, and year fixed effects. In Column (2), I

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TABLE 4

DiD estimates of the effect of the Bologna reform on graduation age, employment, and wages

	All		*Male*	*Female*
Panel A: *Graduation age*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.214***	−0.205***	−0.219*	−0.225***
	(0.046)	(0.042)	(0.097)	(0.019)
Ind. controls		✓	✓	✓
Prereform mean	23.26	23.26	23.30	23.23
Observations	11,768	11,768	4,958	6,810
	Employed in 2015		*Employed in 2015–20*	
Panel B: *Employed*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.001	−0.004	−0.001	−0.001
	(0.005)	(0.006)	(0.005)	(0.005)
Ind. controls		✓		✓
Prereform mean	0.88	0.88	0.88	0.88
Observations	11,768	11,768	300,580	300,580
	Log monthly wages		*Log hourly wages*	
Panel C: *Log wages*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.003	0.000	−0.014	−0.007
	(0.013)	(0.012)	(0.017)	(0.022)
Ind. controls		✓		✓
Prereform mean	10.02	10.02	4.91	4.91
Observations	6,448	6,448	6,448	6,448
	Employed in 2015–20		*Log monthly wages*	
Panel D: *Heterogeneity by sex*	*Male* *(1)*	*Female* *(2)*	*Male* *(3)*	*Female* *(4)*
Treated × Post	−0.001	−0.002	−0.044**	0.023
	(0.005)	(0.006)	(0.016)	(0.014)
Prereform mean	0.95	0.83	10.13	9.92
Observations	122,511	178,069	2,869	3,579
	Employed in 2015		*Log monthly wages*	
Panel E: *Heterogeneity by ability*	*Tuition-free* *(1)*	*Fee-based* *(2)*	*Tuition-free* *(3)*	*Fee-based* *(4)*
Treated × Post	0.001	−0.007	−0.008	0.009
	(0.011)	(0.016)	(0.018)	(0.010)
Prereform mean	0.89	0.86	10.02	10.01
Observations	6,947	4,821	3,877	2,571

Notes: Robust SEs clustered at the programme and graduation year level in parentheses. Treated × Post indicates whether a student graduated from a bachelor's programme after 2015. All columns include programme, region, and year fixed effects. Columns (2) and (4) include individual controls for sex, type of settlement, citizenship status, type of university and funding. *P*-values of the difference in coefficients in Columns (1) and (2) of Panel D is 0.87, in Columns (3) and (4) of Panel D is 0.01, in Columns (1) and (2) of Panel E is 0.74, in Columns (3) and (4) of Panel E is 0.42.

$^{*}P < 0.1$; $^{**}P < 0.05$; $^{***}P < 0.01$.

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add all individual controls. The results show that the Bologna reform does not affect the employment of university graduates in the short term (−0.004, SE = 0.006).

To estimate the medium-term effect of the Bologna reform, I use different data from the same source for students who graduated in 2010–20. In total, there are six cohorts of students who graduated after the reform. The estimates of the medium-term effect of the reform on employment are presented in Columns (3) and (4) of Panel B of Table 4, and the event study estimates are presented in Figure 3. Ultimately, there is no evidence of the medium-term effect of the reform on employment. Null effects are precisely estimated. The estimated coefficients allow me to rule out effects larger than 1 percentage point: the point estimate is −0.001 with SE of 0.005. These findings are surprising given the significant attention and concern surrounding the employment prospects of bachelor's degree holders (Teichler, 2011).

The effect of the Bologna reform on wages

Panel C of Table 4 presents the effects of the Bologna reform on log monthly and hourly wages. Columns (1) and (2) yield the results for log monthly wages. Column (1) of Panel C of Table 4 includes only programme, region, and year fixed effects, and I add all individual controls in Column (2). The event study estimates are presented in Figure 4. The results show that the Bologna reform has no adverse effects on log monthly wages. I can rule out effects larger than 2%: the point estimate is 0.000 with SE of 0.012.

One might expect that individuals with more years of education receive higher monthly wages because they work more hours, or because their productivity increases so their hourly wages increase. Therefore, I estimate Model 2, using log hourly wages as the dependent variable. Columns (3) and (4) of Panel C of Table 4 yield identical results, suggesting that the Bologna reform does not cause changes in the working hours (−0.007, SE = 0.022).

Table A7 presents core findings, with SEs clustered at the programme × graduation year level, confirming the robustness of these results against such adjustments.

Heterogeneity results

To examine whether the effects of the Bologna reform on employment and wages are heterogeneous across different groups, I estimate Model 2 separately by sex and ability.

By sex

Panel D of Table 4 presents the results separately by sex. Columns (1) and (2) show the impact of the reform on employment for male and female graduates. Consistent with the results for the pooled sample, the reform does not reduce the probability of employment for male (−0.001, SE = 0.005) and female (−0.002, s.e. = 0.006) graduates. I can rule out effects greater that 1.1 percentage points for males and 1.3 percentage points for females. In a study by Bosio and Leonardi (2011), they find the effect of the Bologna reform on employment is 0.069 (0.015) for male graduates and 0.027 (0.016) for female graduates. Hence, my estimates allow me to rule out the effects found in the previous research. This is an important finding, as it contradicts the widely held belief that the Bologna reform hindered employment opportunities for bachelor's graduates.

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Columns (3) and (4) show the effects of the Bologna reform on wages for male and female graduates, respectively. The results show that there is a negative, statistically significant effect of the reform on male graduates' wages (−0.044, SE = 0.016), while the effect is not statistically significant for female graduates (0.023, SE = 0.014). This differential impact suggests that the Bologna reform contributed to narrowing the wage gap between male and female graduates by 5.2%.

By ability

As a proxy for ability, I use an indicator for whether a graduate studied at a tuition-free or fee-based place, as applicants with higher scores on the standardized admission exam are more likely to study at a tuition-free place.

Panel E of Table 4 presents the results of the analysis by ability. Columns (1) and (2) show the effects of the Bologna reform on employment for graduates who studied at tuition-free and fee-based places, respectively. Columns (3) and (4) show the effects of the reform on wages for graduates from the same two groups. The results indicate that the effect of the reform is not statistically significant from zero for both groups of graduates who studied at tuition-free (0.001, SE = 0.011 for employment and −0.008, SE = 0.018 for wages) or fee-based places (−0.007, SE = 0.016 for employment and 0.009, SE = 0.010 for wages). This suggests that people with different ability levels do not respond differently to the reform.

Mechanism

The Bologna reform led to shortened degrees, which resulted in a notable disparity in wages between female and male graduates. Specifically, while wages for female graduates have remained relatively stable, wages for male graduates have fallen due to the reform. To understand this phenomenon, it is crucial to consider the trade-off that students make between investing in education or in work experience.

As a response to the reform, universities compressed traditional 5-year curricula into 4-year programmes and made certain courses optional. Theoretically, this increased the intensity of studies, forcing students to allocate more time to studying and less time to working. I argue that, in response to the reform, female students choose to work less while studying, as their returns to education are higher than returns to working. Conversely, male students choose to work more while studying, as their returns to education are lower than returns to working. These differential responses lead to a divergence in wages between female and male graduates, with female graduates maintaining relatively stable wages and male graduates experiencing a decline.

Empirical evidence supports this argument. Columns (1) and (2) of Panel A of Table 5 show the associations between years of education with wages, and Columns (3) and (4) show the associations between combining study and work with wages. For females, returns to education are higher than returns to working (0.060, SE = 0.016 and 0.039, SE = 0.010). For males, returns to education are lower than returns to working (0.031, SE = 0.014 and 0.036, SE = 0.012).

As a result of different relative returns among females and males, the Bologna reform had significant influence on the rates of female and male students combining study and

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TABLE 5

OLS estimates of the association between years of education and the probability to combine study and work with wages and DiD estimates of the effect of the Bologna reform on job market outcomes

	Log monthly wages			
***Panel A**: OLS*	*Male* *(1)*	*Female* *(2)*	*Male* *(3)*	*Female* *(4)*
Years of education	0.031*	0.060***		
	(0.014)	(0.016)		
Combining study and work			0.036**	0.039***
			(0.012)	(0.010)
Observations	2,869	3,579	2,869	3,579
	Combining study and work		*On-the-job training*	
***Panel B**: DiD*	*Male* *(1)*	*Female* *(2)*	*Male* *(3)*	*Female* *(4)*
Treated × Post	0.093***	−0.054***	0.073**	−0.049**
	(0.012)	(0.012)	(0.026)	(0.015)
Prereform mean	0.29	0.21	0.14	0.13
Observations	4,958	6,810	1,422	1,800
	Full-time job		*Permanent contract*	
***Panel C**: DiD*	*Male* *(1)*	*Female* *(2)*	*Male* *(3)*	*Female* *(4)*
Treated × Post	−0.011***	0.012**	−0.027	0.011
	(0.001)	(0.003)	(0.029)	(0.014)
Prereform mean	0.89	0.80	0.85	0.78
Observations	4,320	5,392	4,339	5,415

Notes: Robust SEs clustered at the programme and graduation year level in parentheses. Treated × Post indicates whether a student graduated from a bachelor's programme after 2015. All columns include programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding. *P*-values of the difference in coefficients in Columns (1) and (2) of Panel A is 0.04 and in Columns (3) and (4) of Panel A is 0.79.

$^{*}P < 0.1$; $^{**}P < 0.05$; $^{***}P < 0.01$.

work (see Columns (1) and (2) of Panel B of Table 5). Before the reform, 21% of female and 29% of male students worked while studying. The reform decreased the share of females combining study and work (−0.054, SE = 0.012), while it increased the share of males doing so (0.093, SE = 0.012). This indicates that to compensate for human capital losses, female students chose to work less during their shortened university programme (a 26% decrease compared to the pre-reform mean), while male students decided to work more (a 32% increase).

To determine if the reform resulted in disparities in accumulated human capital among females and males, I examine whether it had a differential impact on the likelihood of female and male graduates receiving on-the-job training. If a graduate lacks the necessary accumulated human capital, on-the-job training may be required to make up for this deficiency. Prior to the reform, approximately 14% of both female and male graduates required on-the-job training. Columns (3) and (4) of Panel B of Table 5 indicate that the reform led to a decrease in the probability of on-the-job training for female graduates (−0.049, SE = 0.015) and an increase for male graduates (0.073, SE = 0.026).

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These coefficients, while substantial in their own right, are particularly noteworthy when compared to the pre-reform means. Specifically, the probability of receiving on-the-job training decreased by 37% for females and increased by 51% for males following the reform.

Investing in human capital can help improve the job quality of graduates. Since female students invest more in their human capital compared to males, they can get a higher-quality job after graduation. To test whether female and male graduates have different job quality, I examine two characteristics: whether a graduate has a full-time job and a permanent contract. These characteristics are considered desirable by many employees and are used as indicators of job quality. The results, presented in Panel C of Table 5, show that the Bologna reform has a positive effect on the probability of female graduates getting a full-time job (0.012, SE = 0.003) and a negative effect on the probability of male graduates getting a full-time job (−0.011, SE = 0.001). Additionally, I find suggestive evidence that females are more likely to get a permanent contract (0.011, SE = 0.014), while males are less likely (−0.027, SE = 0.029). However, the estimates are not precise enough to draw conclusions.

In conclusion, the Bologna reform led to differing wage outcomes for female and male graduates as a result of differing relative returns to education and to working. The choices made by females and males in response to the reform resulted in divergent outcomes in terms of human capital investment and post-graduation wages.[7] I find that male graduates required a substantial increase in on-the-job training, which is indicative of a significant decline in their level of human capital. This decline is attributed to an inefficient allocation of time during their studies.[8] This highlights the importance of effective time management for students in order to improve their human capital and enhance their chances of success in the job market (Fryer, 2014; Xu and Ran, 2021; Canaan *et al.*, 2022).

Robustness checks

In this section, I check the robustness of my results to the exclusion of programmes with high average wages, the inclusion of part-time students and different model specifications. I also present estimates of the effect of the reform using RDD.

[7]Another interesting question is whether the reform had a differential impact on enrolment in master's programmes for males and females, which could explain the observed heterogeneity. The survey includes a question inquiring if respondents wish to pursue further education. Although this does not directly help studying the effect of the reform on master's programme enrolment by sex, it offers insights into any differing educational aspirations between males and females for postgraduate studies. Prior to the reform, the aspiration for further education was balanced between males and females: 6.3% of males and 6.5% of females expressed a desire to continue. Postreform data does not show a significant shift, with an increase of 0.015 (SE = 0.009) for males and 0.028 (SE = 0.021) for females. Hence, the reform did not significantly alter the educational strategies of either males or females in relation to pursuing master's programmes (at least, for the analysed cohorts).

[8]The objective of the Bologna reform was to harmonize degree systems across European countries. One might thus wonder if the introduction of this reform catalysed the migration of students from Russia to other European countries. Specifically, could there be a disproportionate migration of high-ability men that could have potentially influenced the observed negative effects on wages? Administrative statistics by the Ministry of Science and Higher Education show that in 2014 only 0.21% of students studied abroad for at least one term, with a slight increase to 0.22% in 2015. Such figures suggest a limited propensity among students to pursue education in other countries. I also analyse the migration patterns of the general population. In 2014, about 0.73% of men aged 20–29 migrated, with a modest increase to 0.78% in 2015. The corresponding figures for women stand at 0.26% and 0.29%. Although men demonstrate a marginally higher probability to migrate, it is unlikely to explain the heterogeneous effects.

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Exclusion of programmes with high average wages

Prior to the Bologna reform, there was a difference in the average wages between bachelor's and specialist's degree graduates. The average monthly wage for students from control programmes before 2015 was 24,925 RUB, compared to 24,115 RUB for the graduates from treated programmes (P-value of the difference is 0.09). To make the control and treated groups more balanced, I trim the dataset by excluding programmes whose graduates earned over 65,000 RUB prior to 2015. This adjustment results in the control group's average pre-reform wage being revised to 24,350 RUB, and the treated group's to 24,092 RUB (P-value of the difference is 0.32). Using this sample, I examine the robustness of the core findings, which are presented in Table A8. The results remain consistent with the main analysis.

Inclusion of part-time students

In the main analysis, I use data on graduates from full-time programmes to estimate the short-term effects of the Bologna reform on employment and wages. However, to estimate the medium-term effects, I use a different data source that does not allow me to distinguish between full-time and part-time students. To ensure that the medium-term effects are not biased by the inclusion of part-time students, I compare the short-term effects of the reform on full-time students and then add in part-time students. The results, presented in Table A9, show that the effects of the reform on employment and wages are similar for both full-time and full-time together with part-time students. These findings suggest that the medium-term effects of the Bologna reform are not biased by the inclusion of part-time students.

Different model specifications

To ensure that the main results of the study are robust, I examine the effect of including different sets of fixed effects. I first present the baseline results in Column (1) of Panel A of Table A10 for employment and Panel B for wages. In Column (2), I add the interaction between programme and year fixed effects. In Column (3), I add the interaction between region and year fixed effects. In Column (4), I add the interaction between programme and region fixed effects. Overall, the estimates do not change when different sets of fixed effects are included, indicating that the results are robust to these changes.

Regression discontinuity design

To complement the DiD estimates, I estimate the impact of the Bologna reform using the RDD analysis. The first reform-exposed cohort comprises those born in 1993. Thus, the treated group consists of the 1993–94 cohorts, while the 1991–92 cohorts serve as the control. I estimate the impact of the reform separately by sex using the following model:

$$Y_{ic} = \delta \text{Treated} + X_i\gamma + \varepsilon_{ic}, \tag{5}$$

where Treated indicates whether a person born in the cohort affected by the reform (born in 1993 or 1994) and X_i includes controls from Model 2, programme and year fixed effects, as well as the running variable, year of birth. To ensure similarity, only two cohorts to the left and right of 1993 are compared. The results are in Table A11. The

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first-stage estimates reveal people from the 1993–94 cohort are more likely to graduate with a bachelor's degree than people from the 1991–92 cohort: 17.1 percentage points (0.041) for males and 20.1 percentage points (0.030) for females. I find that employment remained unaffected: effects being −0.003 (0.005) for males and −0.009 (0.007) for females. The reform reduced male graduates' wages (6.8%, SE = 0.006) while leaving female wages unaffected (0.8%, SE = 0.008). These results support the previous findings that the Bologna reform did not affect the employment of university graduates and had a heterogeneous impact on wages by sex.

V. Concluding remarks

This paper presents one of the first empirical investigations of the causal effects of the Bologna reform, a major higher education reform implemented in Europe, on employment and wages of university graduates. The reform aimed to create a more unified higher education system by reducing the length of university programmes and changing the content of curricula. As such, it has been the subject of much debate among policymakers and university management.

This study finds that the reform did not negatively affect the employment of graduates in the short- or medium-term. The impact of the reform on wages revealed a clear sex divide: it significantly lowered male graduates' wages, while female graduates' wages were not adversely affected. The divergence in outcomes can be attributed to the different ways male and female students responded to the reform's reduction in programme length and curricular adjustments. Female students, facing higher returns from education, seemed to prioritize their studies, which helped them maintain their wage levels and secure better job positions. On the other hand, male students, with lower educational returns, increased their work during their studies, which did not compensate for their reduced educational investment, resulting in lower wages. These findings highlight the importance of considering heterogeneous responses by students when evaluating the effects of educational reforms.

In addition, this study also highlights the potential benefits of the Bologna reform for graduates. The reduction in the university study period resulted in decreased forgone earnings and tuition fees, allowing graduates to gain an additional year of labour market experience compared to those who completed longer programmes. Previous research has shown that additional work experience can have a positive impact on lifetime earnings, making the Bologna reform potentially beneficial for the long-term wealth of graduates (Topel, 1991; Dustmann and Meghir, 2005).

Further research could use the reform as a natural experiment to study the long-term effects of higher education on labour market outcomes, as well as other outcomes such as lifetime wealth, health, and fertility.

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Appendix A:

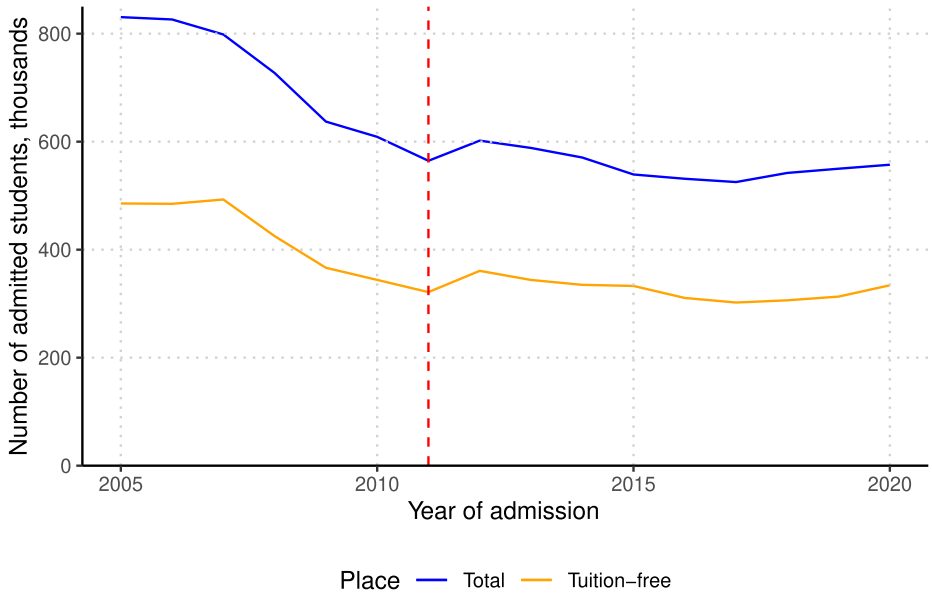

Figure A1. The number of bachelor's and specialist's full-time students admitted in 2005–20, thousands. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The red dashed line shows the year of the implementation of the reform – 2011. *Source*: The Ministry of Science and Higher Education.

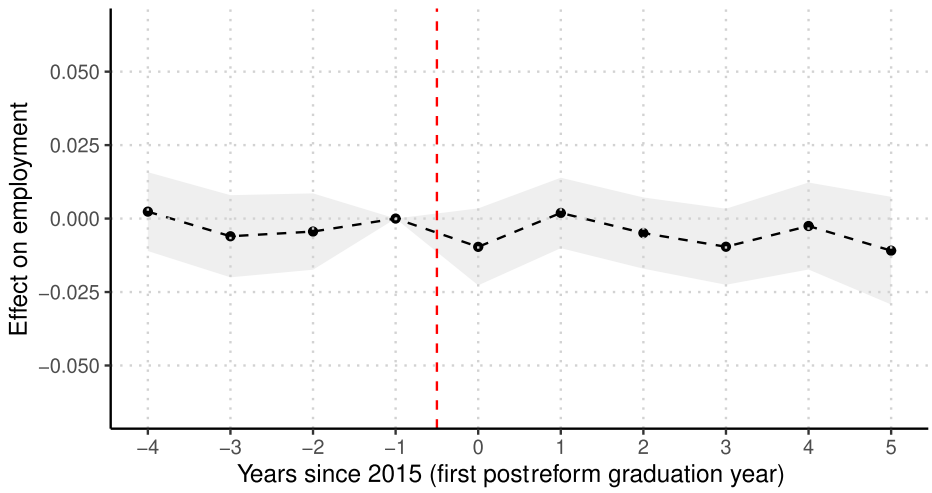

Figure A2. Event study estimates of the effect of the Bologna reform on employment of males. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

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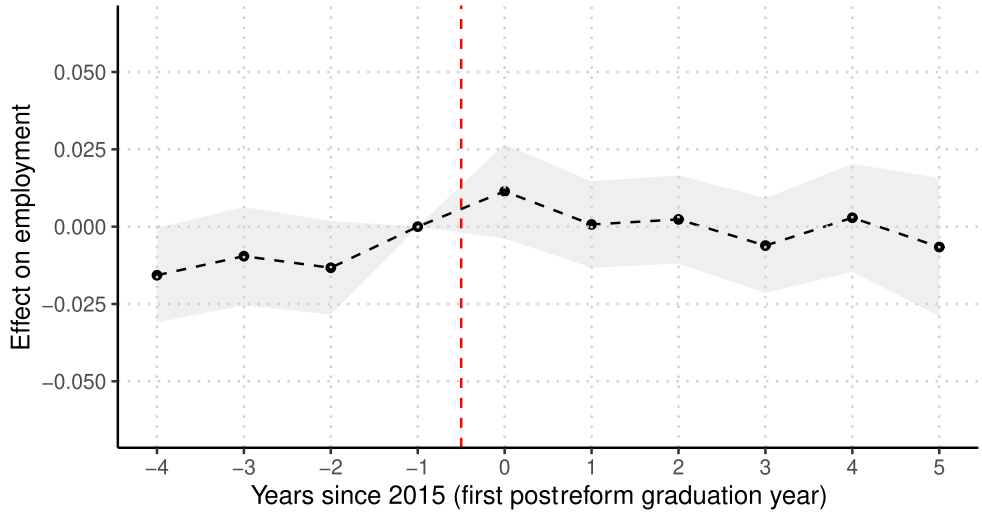

Figure A3. Event study estimates of the effect of the Bologna reform on employment of females. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first post-reform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

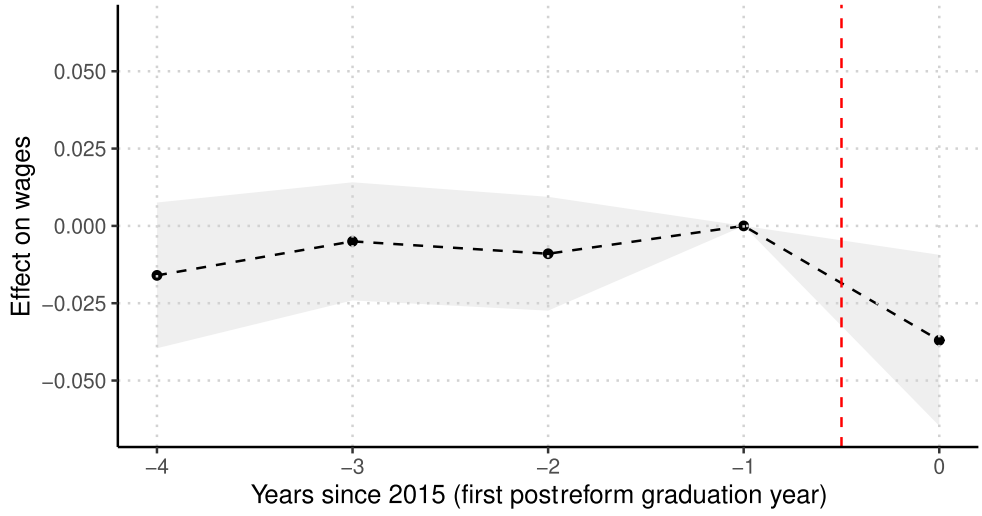

Figure A4. Event study estimates of the effect of the Bologna reform on wages of males. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

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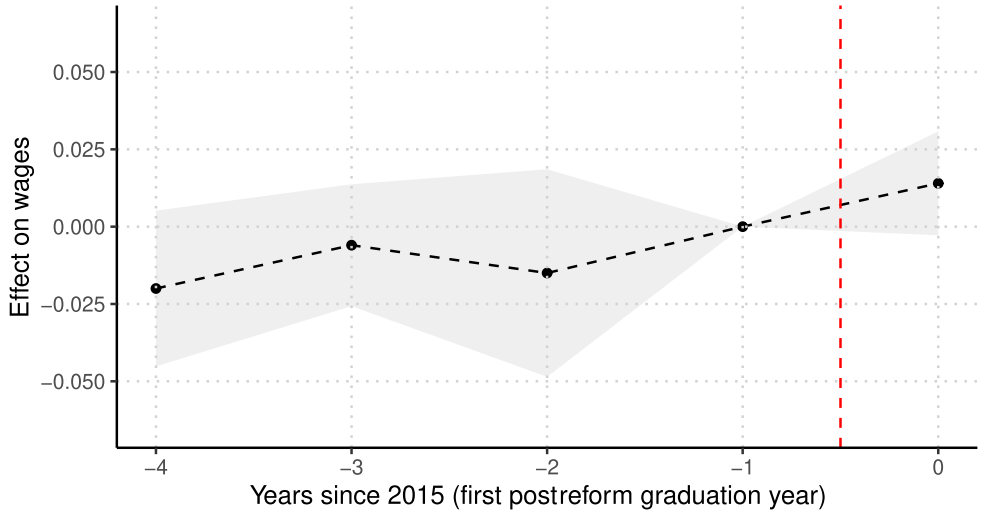

Figure A5. Event study estimates of the effect of the Bologna reform on wages of females. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first post-reform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

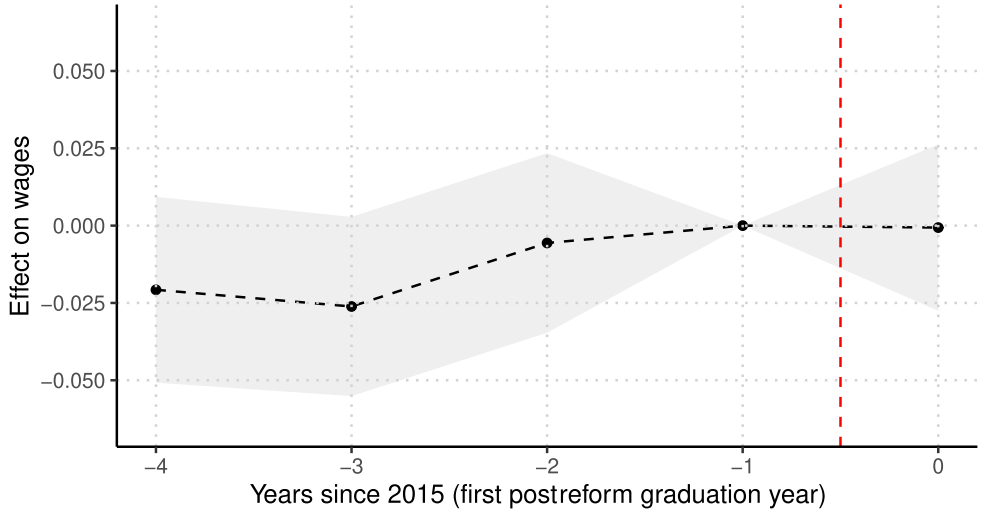

Figure A6. Event study estimates of the effect of the Bologna reform on wages of graduates who studied at tuition-free places. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for sex, type of settlement, citizenship status, and type of university

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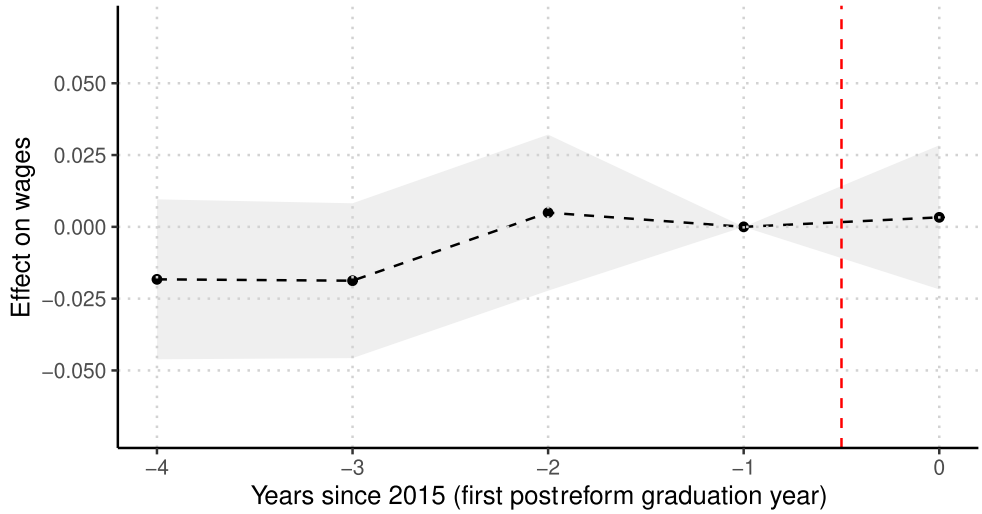

Figure A7. Event study estimates of the effect of the Bologna reform on wages of graduates who studied at fee-based places. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for sex, type of settlement, citizenship status and type of university

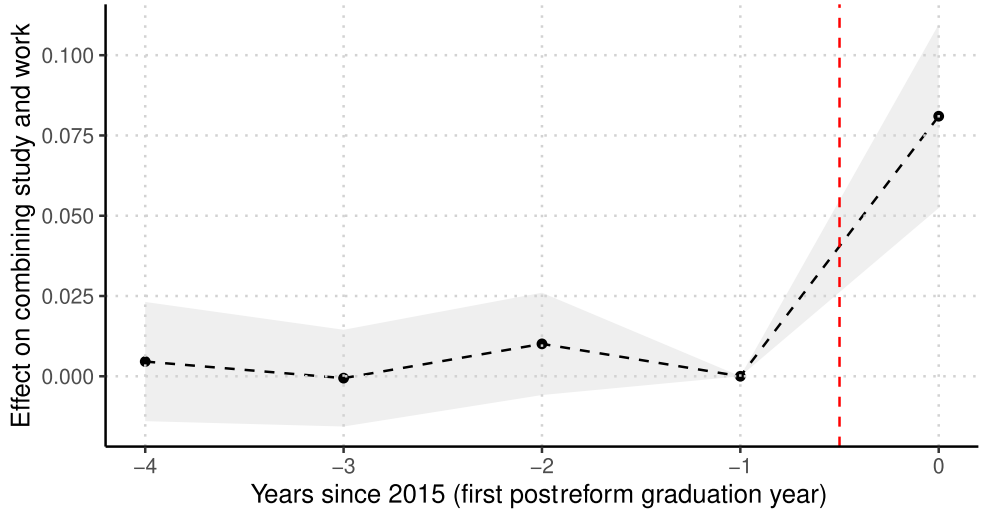

Figure A8. Event study estimates of the effect of the Bologna reform on the probability to combine study and work among males. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first post-reform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

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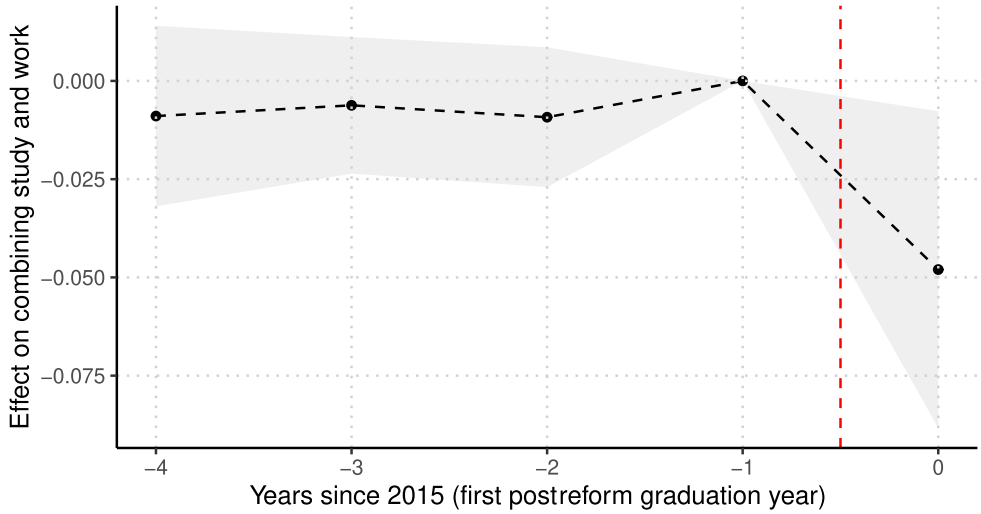

Figure A9. Event study estimates of the effect of the Bologna reform on the probability to combine study and work among females. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

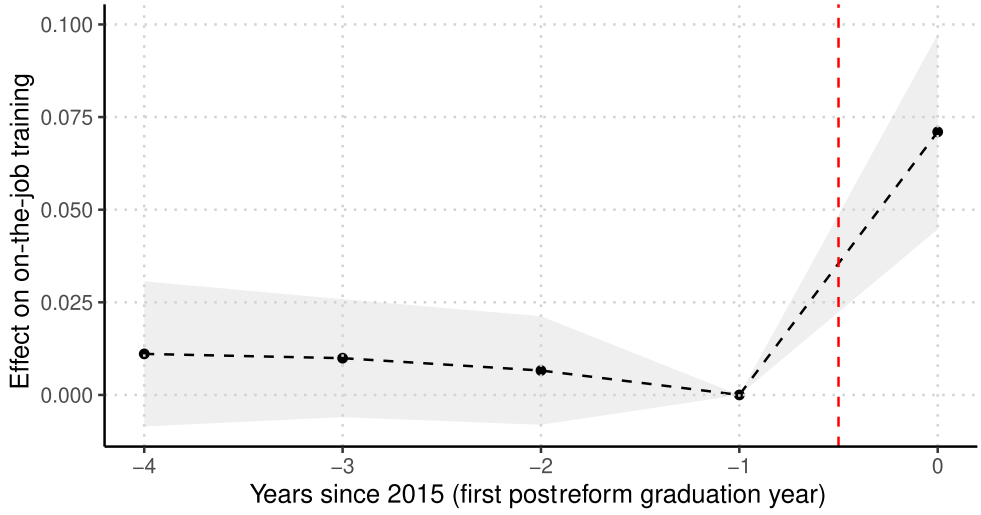

Figure A10. Event study estimates of the effect of the Bologna reform on the level of on-the-job training among males. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

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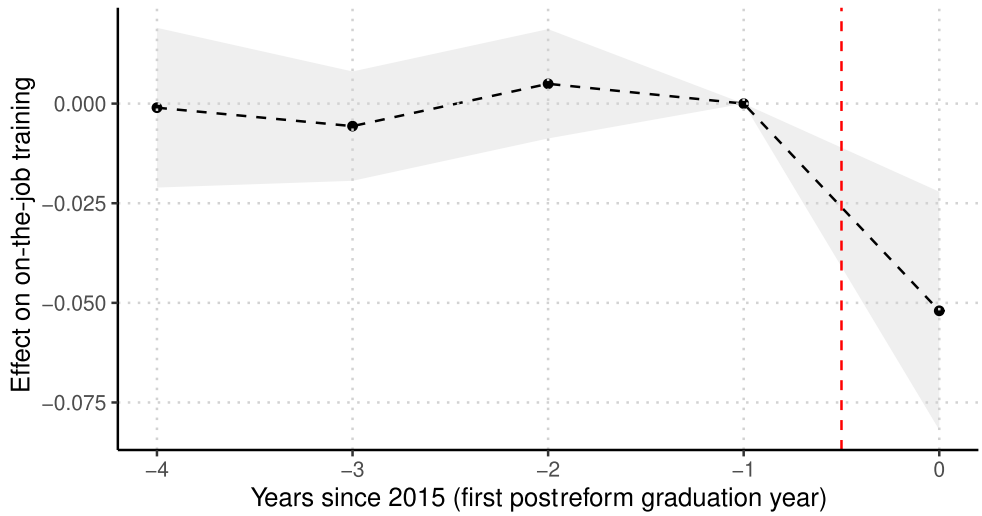

Figure A11. Event study estimates of the effect of the Bologna reform on the level of on-the-job training among females. [Colour figure can be viewed at *wileyonlinelibrary.com*]
Notes: The figure shows the regression coefficients of interaction between the treatment variable and time period dummies with 95% confidence intervals. The omitted period is −1 – year 2014. The red dashed line shows the first postreform graduation year. Robust SEs are clustered at the programme and graduation year level. The model includes programme, region, and year fixed effects, as well as individual controls for type of settlement, citizenship status, type of university and funding

TABLE A1

The number of bachelor's and specialist's full-time students admitted in 2010 and 2011 by age

Age	2010	2011
16 and less	53, 394	42, 931
17	254, 577	239, 806
18	207, 738	194, 320
19	43, 644	41, 910
20 and more	49, 599	45, 672
Total	608, 952	564, 639

Source: The Ministry of Science and Higher Education.

TABLE A2

The share of applicants to bachelor's programmes in 2010 and 2011 by the field of study

Field	2010	2011
Services	0.20	1.00
Education	0.31	0.99
Social sciences	0.26	0.99
Natural sciences, mathematics and statistics	0.51	0.95
Information and communication technologies	0.31	0.92
Arts and humanities	0.27	0.85
Agriculture, forestry, fisheries and veterinary	0.24	0.85
Engineering, manufacturing and construction	0.27	0.83
Health and welfare	0.00	0.03
Total	0.21	0.84

Source: The Ministry of Science and Higher Education.

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TABLE A3

Summary statistics of characteristics of graduates

	Observations	Mean	SD	Min	Max
Panel A: Graduated in 2010–15					
Bachelor's graduates					
Male	1,760	0.41	0.49	0	1
Urban	1,760	0.76	0.43	0	1
Citizen	1,760	0.99	0.02	0	1
Public university	1,760	0.95	0.23	0	1
Tuition-free	1,760	0.53	0.50	0	1
Employed	1,760	0.82	0.38	0	1
Monthly wage, RUB	906	23,190	11,031	5,000	130,000
Specialist's graduates					
Male	10,008	0.42	0.49	0	1
Urban	10,008	0.74	0.44	0	1
Citizen	10,008	0.99	0.04	0	1
Public university	10,008	0.96	0.21	0	1
Tuition-free	10,008	0.60	0.49	0	1
Employed	10,008	0.86	0.34	0	1
Monthly wage, RUB	5,542	24,544	11,937	5,000	120,000
***Panel B**: Graduated in 2010–20*					
Bachelor's graduates					
Male	74,884	0.39	0.49	0	1
Urban	74,884	0.69	0.46	0	1
Citizen	74,884	0.99	0.05	0	1
Employed	74,884	0.83	0.37	0	1
Specialist's graduates					
Male	225,696	0.41	0.49	0	1
Urban	225,696	0.75	0.43	0	1
Citizen	225,696	0.99	0.05	0	1
Employed	225,696	0.87	0.33	0	1

Source: Panel A is based on National Survey of Graduate Employment carried out by the Russian Federal State Statistics Service. Panel B is based on Russian Labor Force Survey carried out by the Russian Federal State Statistics Service.

TABLE A4

The characteristics of students by whether they reported their wages

	Reported	Not reported	*P*-value
Male	0.42	0.42	0.23
	(0.50)	(0.49)	
Urban	0.76	0.73	0.55
	(0.43)	(0.44)	
Citizen	0.99	0.99	0.32
	(0.04)	(0.05)	
Public university	0.96	0.95	0.90
	(0.20)	(0.22)	
Tuition-free	0.60	0.58	0.59
	(0.49)	(0.49)	

Notes: This table shows sample means and standard deviations from the National Survey of Graduate Employment carried out by the Russian Federal State Statistics Service. *P*-values are from the *t*-test.

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TABLE A5

The characteristics of students by the year of graduation in 2010–15

	2010	2011	2012	2013	2014	2015
Male	0.44	0.43	0.45	0.42	0.40	0.39
	(0.50)	(0.50)	(0.50)	(0.49)	(0.49)	(0.49)
Urban	0.79	0.77	0.75	0.72	0.73	0.72
	(0.41)	(0.42)	(0.43)	(0.45)	(0.44)	(0.45)
Citizen	0.99	0.99	0.99	0.99	0.99	0.99
	(0.03)	(0.03)	(0.02)	(0.03)	(0.06)	(0.05)
Public university	0.95	0.96	0.95	0.95	0.96	0.95
	(0.22)	(0.20)	(0.22)	(0.22)	(0.19)	(0.21)
Tuition-free	0.59	0.60	0.59	0.59	0.59	0.58
	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)

Notes: This table shows sample means and standard deviations from the National Survey of Graduate Employment carried out by the Russian Federal State Statistics Service. To check whether characteristics of students changed due to the reform, I run Model 2 using observable characteristics as the dependent variable, that is, sex, type of settlement, citizenship status, type of university and funding. *P*-values of the treatment coefficient γ_2 are as follows: 0.65, 0.97, 0.17, 0.11 and 0.38.

TABLE A6

The characteristics of students by the year of graduation in 2010–20

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Male	0.41	0.41	0.40	0.40	0.41	0.41	0.41	0.40	0.41	0.42	0.41
	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)
Urban	0.73	0.73	0.74	0.73	0.73	0.73	0.72	0.73	0.72	0.74	0.73
	(0.43)	(0.43)	(0.43)	(0.44)	(0.44)	(0.45)	(0.45)	(0.45)	(0.46)	(0.46)	(0.45)
Citizen	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99	0.99
	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)	(0.05)

Notes: This table shows sample means and SDs from the Russian Labor Force Survey carried out by the Russian Federal State Statistics Service. To check whether characteristics of students changed due to the reform, I run Model 2 using observable characteristics as the dependent variable, that is, sex, type of settlement and citizenship status. *P*-values of the treatment coefficient γ_2 are as follows: 0.70, 0.44 and 0.27.

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TABLE A7

DiD estimates of the effect of the Bologna reform on graduation age, employment and wages

	All		*Male*	*Female*
***Panel A**: Graduation age*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.214***	−0.205***	−0.219***	−0.225***
	(0.048)	(0.041)	(0.058)	(0.009)
Ind. controls		✓	✓	✓
Prereform mean	23.26	23.26	23.30	23.23
Observations	11,768	11,768	4,958	6,810
	Employed in 2015		*Employed in 2015–20*	
***Panel B**: Employed*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.001	−0.004	−0.001	−0.001
	(0.002)	(0.008)	(0.006)	(0.006)
Ind. controls		✓		✓
Prereform mean	0.88	0.88	0.88	0.88
Observations	11,768	11,768	300,580	300,580
	Log monthly wages		*Log hourly wages*	
***Panel C**: Log wages*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.003	0.000	−0.014	−0.007
	(0.011)	(0.013)	(0.009)	(0.023)
Ind. controls		✓		✓
Prereform mean	10.02	10.02	4.91	4.91
Observations	6,448	6,448	6,448	6,448
	Employed in 2015–20		*Log monthly wages*	
	Male	*Female*	*Male*	*Female*
***Panel D**: Heterogeneity by sex*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.001	−0.002	−0.044**	0.023
	(0.005)	(0.006)	(0.018)	(0.016)
Prereform mean	0.95	0.83	10.13	9.92
Observations	122,511	178,069	2,869	3,579
	Employed in 2015		*Log monthly wages*	
	Tuition-free	*Fee-based*	*Tuition-free*	*Fee-based*
***Panel E**: Heterogeneity by ability*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	0.001	−0.007	−0.008	0.009
	(0.016)	(0.020)	(0.021)	(0.011)
Prereform mean	0.89	0.86	10.02	10.01
Observations	6,947	4,821	3,877	2,571

Notes: Robust SEs clustered at the programme × graduation year level in parentheses. Treated × Post indicates whether a student graduated from a bachelor's programme after 2015. All columns include programme, region and year fixed effects. Columns (2) and (4) include individual controls for sex, type of settlement, citizenship status, type of university and funding.

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.

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TABLE A8

DiD estimates of the effect of the Bologna reform on graduation age, employment and wages using trimmed sample

	All		*Male*	*Female*
Panel A: *Graduation age*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.201***	−0.196***	−0.226*	−0.204***
	(0.049)	(0.047)	(0.099)	(0.022)
Ind. controls		✓	✓	✓
Prereform mean	23.21	23.21	23.19	23.23
Observations	11,234	11,234	4,529	6,705
	Employed in 2015		*Employed in 2015–20*	
Panel B: *Employed*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.003	−0.006	−0.001	−0.001
	(0.005)	(0.006)	(0.005)	(0.005)
Ind. controls		✓		✓
Prereform mean	0.88	0.88	0.88	0.88
Observations	11,234	11,234	297,900	297,900
	Log monthly wages		*Log hourly wages*	
Panel C: *Log wages*	*(1)*	*(2)*	*(3)*	*(4)*
Treated × Post	−0.004	0.000	−0.017	−0.009
	(0.015)	(0.010)	(0.015)	(0.018)
Ind. controls		✓		✓
Prereform mean	10.00	10.00	4.89	4.89
Observations	6,135	6,135	6,135	6,135
	Employed in 2015–20		*Log monthly wages*	
Panel D: *Heterogeneity by sex*	*Male* *(1)*	*Female* *(2)*	*Male* *(3)*	*Female* *(4)*
Treated × Post	−0.002	−0.002	−0.046***	0.024
	(0.005)	(0.006)	(0.011)	(0.014)
Prereform mean	0.95	0.83	10.11	9.91
Observations	120,403	177,497	2,604	3,531
	Employed in 2015		*Log monthly wages*	
Panel E: *Heterogeneity by ability*	*Tuition-free* *(1)*	*Fee-based* *(2)*	*Tuition-free* *(3)*	*Fee-based* *(4)*
Treated × Post	0.005	−0.010	0.008	−0.001
	(0.010)	(0.015)	(0.019)	(0.012)
Prereform mean	0.89	0.86	10.00	10.00
Observations	6,630	4,604	3,690	2,445

Notes: Robust SEs clustered at the programme and graduation year level in parentheses. Treated × Post indicates whether a student graduated from a bachelor's programme after 2015. All columns include programme, region, and year fixed effects. Columns (2) and (4) include individual controls for sex, type of settlement, citizenship status, type of university and funding. The sample includes all graduates, except those from programmes where graduates earned more than 65,000 RUB before 2015.

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.

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TABLE A9

DiD estimates of the effect of the Bologna reform on employment and wages using a sample of full- and part-time students

	Employed in 2015		Log monthly wages	
	Full-time (1)	Full- and part-time (2)	Full-time (3)	Full- and part-time (4)
Treated × Post	−0.004	−0.004	0.000	−0.003
	(0.006)	(0.005)	(0.012)	(0.016)
Prereform mean	0.88	0.88	10.02	10.01
Observations	11,768	13,439	6,448	7,342

Notes: Robust SEs clustered at the programme and graduation year level in parentheses. Treated × Post indicates whether a student graduated from a bachelor's programme after 2015. All columns include programme, region, and year fixed effects, as well as individual controls for sex, type of settlement, citizenship status, type of university and funding.
$^{*}P < 0.1$; $^{**}P < 0.05$; $^{***}P < 0.01$.

TABLE A10

DiD estimates of the effect of the Bologna reform on employment and wages using different model specifications

	(1)	(2)	(3)	(4)
***Panel A**: Employed*				
Treated × Post	−0.001	−0.002	0.001	0.000
	(0.005)	(0.005)	(0.004)	(0.005)
Programme, region, year FEs	✓			
Programme × year FEs		✓		
Region × year FEs			✓	
Programme × region FEs				✓
Observations	300,580	300,580	300,580	300,580
***Panel B**: Log wages*				
Treated × Post	0.000	−0.002	0.005	0.003
	(0.012)	(0.006)	(0.012)	(0.010)
Programme, region, year FEs	✓			
Programme × year FEs		✓		
Region × year FEs			✓	
Programme × region FEs				✓
Observations	6,448	6,448	6,448	6,448

Notes: Robust SEs clustered at the programme and graduation year level in parentheses. Treated × Post indicates whether a student graduated from a bachelor's programme after 2015. All columns include individual controls for sex, type of settlement, citizenship status, type of university and funding.
$^{*}P < 0.1$; $^{**}P < 0.05$; $^{***}P < 0.01$.

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TABLE A11

The effect of the Bologna reform on graduation from a bachelor's programme, employment and wages

	Graduated from a bachelor's programme		Employed		Log monthly wages	
	Male (1)	Female (2)	Male (3)	Female (4)	Male (5)	Female (6)
Treated	0.171***	0.201***	−0.003	−0.009	−0.068***	0.008
	(0.041)	(0.030)	(0.005)	(0.007)	(0.006)	(0.008)
Prereform mean	0.25	0.23	0.80	0.79	10.02	9.86
Observations	859	1,417	859	1,417	442	752

Notes: Robust SEs clustered at the cohort level in parentheses. All columns include running variable, individual controls (sex, type of settlement, citizenship status), programme and year fixed effects. Treated indicates whether a person is born in 1993 or 1994.

*$P < 0.1$; **$P < 0.05$; ***$P < 0.01$.

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