

Heß, Pascal; Anger, Silke; Kunaschk, Max

**Conference Paper**

## The Impact of Minimum Wages on Teenagers' Educational Expectations

Beiträge zur Jahrestagung des Vereins für Socialpolitik 2019: 30 Jahre Mauerfall - Demokratie und Marktwirtschaft - Session: Education Economics IV, No. D17-V2

**Provided in Cooperation with:**

Verein für Socialpolitik / German Economic Association

*Suggested Citation:* Heß, Pascal; Anger, Silke; Kunaschk, Max (2019) : The Impact of Minimum Wages on Teenagers' Educational Expectations, Beiträge zur Jahrestagung des Vereins für Socialpolitik 2019: 30 Jahre Mauerfall - Demokratie und Marktwirtschaft - Session: Education Economics IV, No. D17-V2, ZBW - Leibniz-Informationszentrum Wirtschaft, Kiel, Hamburg

This Version is available at:

<https://hdl.handle.net/10419/203595>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

# The Impact of Minimum Wages on Teenagers' Educational Expectations

Silke Anger\*

*IAB Nuremberg; University of Bamberg; IZA*

Pascal Heß†

*IAB Nuremberg;*

Max Kunaschk‡

*IAB Nuremberg;*

February 28, 2019

Very preliminary and incomplete - please do not cite or circulate

## Abstract

*We study the effect of the introduction of the German statutory minimum wage law in 2015 on teenagers' educational expectations. We focus on low-skilled students, the group most likely to be affected by the minimum wage after entering the labor market. Theoretical predictions of the effect of minimum wages on educational investments are ambiguous. On the one hand, to qualify for minimum wage jobs, teenagers might try to raise their productivity through higher educational achievement. On the other hand, they face higher opportunity costs of schooling, when being exposed to the minimum wage, and therefore might decrease educational goals. To shed light on the theoretically ambiguous relationship between minimum wages and teenagers' educational expectations, we explore the effects in a Difference-in-Difference(-in-Difference) framework using rich individual level data on teenage students. We find that teenagers' educational expectations, on average, decrease with age. With respect to the minimum wage, the analyses point towards important heterogeneous effects. To control for regional variation in treatment intensity, we include the share of workers affected by the minimum wage at the state level. The results suggest that in hardly affected regions, the minimum wage did not alter expected wage or employment prospects of adolescents and hence did not affect educational plans of students. In contrast, in highly affected regions, educational expectations of teenagers increased following the minimum wage introduction. Therefore, low-skilled students seem to consider regional labor market conditions in their intended schooling decision and try to compensate for lower employment probabilities by increasing investments in human capital.*

*JEL: J24, J31, I21*

*Keywords: minimum wage, educational expectations, employment prospects*

---

\*Silke Anger; Institute for Employment Research, Regensburger Str. 100, 90478 Nuremberg, Germany; ✉: silke.anger@iab.de.

†Correspondence to: Pascal Heß; Institute for Employment Research, Regensburger Str. 100, 90478 Nuremberg, Germany; ✉: pascal.hess@iab.de.

‡Max Kunaschk; Institute for Employment Research, Regensburger Str. 100, 90478 Nuremberg, Germany; ✉: max.kunaschk@iab.de.

## I. Introduction

Numerous studies show that minimum wages usually have the expected positive wage and/or earnings effects. The evidence on employment effects is much less clear (see, for example, Neumark and Wascher (2008); Dube et al. (2010)). Therefore, many studies investigate different channels of firm adjustments, such as the effects of minimum wages on prices (Aaronson and French, 2007), profits (Draca et al., 2011), turnover (Dube et al., 2010), and operational efficiency (Hirsch et al., 2015). Another important adjustment channel may be changes in firm’s human capital investments. Theory suggests that employers decrease firm-funded training in reaction to minimum wage increases. These predictions find some support in recent studies (Schumann (2017); Bellmann et al. (2017)).

While firm-level adjustments have been analyzed quite extensively in the literature, the labor supply side has received much less attention, even though changing market conditions affect incentives to supply labor and to invest in human capital.<sup>1</sup> In the case of a newly introduced or increased minimum wage, low-skilled individuals face higher potential wages at a given skill level. However, they do only receive those higher wages if they find employment. Depending on which of the two factors dominates, incentives to invest in human capital may increase or decrease. The increase in low-skilled wages is quite salient in the case of minimum wage increases. However, employment opportunities in the future are uncertain and depend on an individual’s expectation of her actual job opportunities. Therefore, the question of what happens to individual investment decisions when a minimum wage is introduced, is ultimately an empirical one.

We help answer this question by studying the impact of minimum wages on educational plans of low-skilled teenagers. We do this by exploiting the introduction of the federal minimum wage law in Germany in 2015. While the estimates of the overall effect of the minimum wage introduction are ambiguous, we show the importance of accounting for different local labor market conditions when analyzing human capital investment decisions. The more difficult the labor market conditions in a region, the more teenagers invest in general education as reaction to the minimum wage law. This suggests that in regions with unfavorable labor market conditions increasing wage levels serve as an incentive to invest in human capital.

We employ two different designs to ensure identification of the effect of the minimum wage. We first employ a panel structure of teenagers to follow the development of the same persons before and after the introduction of the minimum wage. However, as this approach may merely capture an age effect, we further employ a repeated cross-section of 9th graders based on two different cohorts. This

---

<sup>1</sup>Some studies consider aggregate changes in school enrollment rates and two studies focus on individual adjustments in reaction to the minimum wage.

ensures that we can rule out that our results are mainly driven by either age effects or major differences between the cohorts.

We find that the introduction of the minimum wage had no overall effect. However, by exploiting regional variation, we find that the group of low ability students decrease their educational expectations, when they live in a low affected region, i.e. low share of affected workers within a state. This implies that for this group of individuals, the positive wage effect outweighs the negative employment effect of the minimum wage introduction. Furthermore, we find that students living in high affected states increase their educational expectations. That implies that the employment effect outweighs the wage effect.

We contribute to extensive literature on minimum wages, as we are the first to investigate individual reactions in educational behavior in response to such a sizable minimum wage hike. So far researchers had to deal with many drawbacks, such as aggregated data, use of proxies, e.g. dropouts, or small minimum wage hikes. Our study overcomes all of these issues by using individual data on educational expectations exploiting a huge minimum wage hike.

The remainder of the paper is structured as follows: Section II introduces the reader to institutional background of the minimum wage and the educational legislation regarding teenagers. Section III describes the theoretical framework. Section IV describes the data and methods we apply. Section V contains results of the basic regression and various heterogeneity analyses. Section VI shows if our results are sensitive to various specifications. Section VII concludes.

## **II. Institutional Background**

### *A. Introduction of the Minimum Wage*

Until the introduction of the German Minimum Wage law in 2015, Germany did not have a federally mandated minimum wage. After a lengthy discussion starting with the federal election in September 2013, a wage floor of 8.50 Euro came into force on January 1st 2015 (see Bossler (2017) for a detailed time line). The minimum covers all dependently employed workers in Germany. However, some employee groups are exempt from the minimum wage. The self-employed, some types of interns, apprentices, volunteers, the long-term unemployed, and minors without a vocational training degree (Caliendo et al. (2018)). Overall, around 4 million people earned below 8.50 Euro in 2014 and were eligible for the minimum wage.

Early evaluations of the reform show that affected employers decreased their employment growth expectations even before the law came into force (Bossler, 2017). After the minimum wage had come into force, employment in affected establishments declined by around 1.9% (Bellmann et al., 2016).

Caliendo et al. (2018) report an employment loss of around 140,000 jobs. Most of those job losses stem from declines in marginal employment. Average wages in affected establishments increased by around 4.8% according to Bossler and Gerner (2016). Caliendo et al. (2018) report a compression at the bottom of the wage distribution in reaction to the minimum wage introduction, but find that decreases in working hours rather than increases in earnings drive the observed hourly wage effects. Thus, the reform had small negative effects on overall employment while increasing hourly wages for low-wage earners. To this day, no study analyzed the effects of the German federal minimum wage on teenagers.

As mentioned before, minors without a degree are exempt from the minimum wage. Therefore, the question why teenagers should adjust their expectations in reaction to a reform that technically does not cover them, merits some discussion. We will address this issue formally in section III. Furthermore, school leaving laws prevent minors usually from dropping out of the education system before the age of 18. However, we discuss in the next section that it is legally possible to exit school before the age of 18 and that we find a relevant amount of teenagers working in regular employment.

### *B. School Leaving Laws and Teenagers in the Labor Market*

In Germany, school leaving ages are set by federal state law. This leads to a lot of variation in details in regulations, but generally teenagers are required to complete 9 years of full-time general school and 3 years of part-time vocational school. Students who do an apprenticeship program usually fulfill their required years of vocational schooling by attending vocational school one or two days a week while working at a training firm the rest of the week. Alternatively, teenagers can complete the three years vocational school within one year of full-time vocational school. Consequently, as children usually start school when they are 6 years old, teenagers can legally leave school for regular work at around 16 years of age.

While it is not very common to enter the (non-vocational, regular) labor market at this age, every year a considerable number of teenagers enter the labor market without vocational training in order to work in a regular employment relationship. For example, preliminary calculations based on German social security data suggest that in January 2014, one year before the minimum wage introduction, around 3200 teenagers below age 18 worked in regular employment relationships. Over the year, this number usually increases towards the end of the school year. In August 2014, around 4500 teenagers below age 18 worked in regular employment relationships.<sup>2</sup>

---

<sup>2</sup>The figures are based on preliminary calculation using the Integrated Employment Biographies of the German Federal Employment Agency (2019). Detailed figures are available upon request.

### III. Theoretical Framework

We now propose a simple theoretical framework of minimum wages and educational decisions. We first model the individual decision in a competitive labor market and include a minimum wage, exemptions from the minimum wage, and regional heterogeneity afterwards.

Our model comprises of three time periods with  $t = \{0, 1, 2\}$  and assumes homogeneous abilities, homogeneous rates of learning, and low productivity at the beginning among all students. We further assume no interest rates or discount factors. Period  $t = 0$  is the decision period when students in their last mandatory school year choose between one more year of schooling or entering the labor market in  $t = 1$ . Schooling in  $t = 1$  increases productivity, such that the individual is more productive afterwards. For simplicity reasons we assume costs  $C_0 = 0$  and earnings  $E_0 = 0$  in  $t = 0$ . If students decide to go to school in  $t = 1$ , they bear direct costs of  $C_{1,H}$  and earn  $E_{1,H} = 0$ . If students decide to work, they bear direct costs of  $C_{1,L} = 0$  and earn the low-productivity wage  $E_{1,L}$  with the employment probability  $P_{1,L}$ . In  $t = 2$  the high-productivity workers enter the labor market and bear costs of  $C_{2,H} = 0$  and earn the high-productivity wage  $E_{2,H}$  with the employment probability  $P_{2,H}$ . In  $t = 2$  the low-productivity workers bear costs of  $C_{2,L} = 0$  and earn the low-productivity wage  $E_{2,L}$  with the employment probability of  $P_{2,L}$ . The present value for an individual is given by

$$PV_s = \sum_{t=0}^2 \times P_{t,s} \times E_{t,s} - C_{t,s}, \quad (1)$$

where  $t$  is the period, and  $S$  represents the productivity level. Individuals invest in schooling when the present value of being highly productive exceeds the present value of being low productive.

We first employ this basic framework to a competitive labor market, where the market is cleared and there is no unemployment. This means for the present value from (1) that  $P_{t,S} = 1 \forall t, S$ . Using the condition for investment in education  $PV_H > PV_L$ , we get

$$E_{2,H} - C_{1,H} > E_{1,L} + E_{2,L}. \quad (2)$$

In order to invest in schooling in a competitive labor market, the earnings for high-productivity workers minus the direct costs of schooling must exceed the sum of earnings of low-productivity workers from periods 1 and 2.

### A. Educational Decisions in an Imperfect Labor Market

We now introduce imperfections of the labor market to the model. This case serves as benchmark for the upcoming model extensions. To model imperfections we assume  $P_{t,L} < 1$ , i.e. some unemployment for low-productivity workers, and  $P_{t,H} = 1$ , i.e. no unemployment for high-productivity workers. We now get

$$E_{2,H} - C_{1,H} > P_{1,L} \times E_{1,L} + P_{2,L} \times E_{2,L}. \quad (3)$$

Since  $P_{t,L} < 1$ , the present value of being low productive worker decreases in comparison to the present value in a competitive labor market. This implies decreasing opportunity costs of schooling and thus increasing investments in schooling.

### B. Educational Decisions in an Imperfect Labor Market with a Minimum Wage

In addition to an imperfect labor market with unemployment for the low-educated, we further introduce a minimum wage  $E_{t,H} \geq E^{Min} > E_{t,L}$ . This condition implies that the employment probability for the low-educated further decreases ( $P_{t,L} \ll 1$ ), while the employment probability for the highly-educated is not affected ( $P_{t,H} = 1$ ). We now get

$$E_{2,H} - C_{1,H} > P_{1,L} \times E^{Min} + P_{2,L} \times E^{Min}. \quad (4)$$

We can now observe an increase in wages for the low-educated. Incorporating the decrease in employment probability, the effect of minimum wages on the present value of low-educated, and in turn on educational investments, is ambiguous. If we assume that the decrease in employment probability outweighs the increase in compensation, the present value of low education further decreases and educational investments increase. If we assume that the increase in compensation outweighs the decrease in employment probability, the present value of low-educated increases and educational investments decrease.

We now additionally introduce exemptions from the minimum wage to the model discussed in section II.A. Especially prominent is the exemptions for young workers. The German Minimum Wage Law excludes workers below 18 without vocational degree from eligibility. We can easily model this by the following equation:

$$E_{2,H} - C_{1,H} > P_{1,L} \times E_{1,L} + P_{2,L} \times E^{Min}. \quad (5)$$

Low educated now get the market wage in  $t = 1$ , but the minimum wage in  $t = 2$ . They will be

employed with the respective employment probabilities  $P_{1,L} < 1$  and  $P_{2,L} \ll 1$ .

#### IV. Data and Methods

To identify the effects of minimum wages on teenagers' educational expectations, we use data from the German National Educational Panel Study (NEPS). We focus on students attending the lowest school track in Germany as treatment group, as they are the group which is most likely to work in a minimum wage job in the future and therefore the most likely to adjust educational plans in reaction to the reform. Students attending the middle track are the control group. Their educational expectations should be unaffected by the minimum wage, as this group hardly considers minimum wage jobs as a realistic career perspective.<sup>3</sup> As central outcome variable, we create an indicator which takes the value 1 if a student expects to obtain at least an intermediate degree and 0 if the individual plans to obtain no more than a lower secondary degree.

Our main specification uses a panel of one cohort of students, following them from grade 5 till grade 9. To ensure that we do not merely pick up differing age-expectations profiles in different regions, we repeat our main analysis for two cohorts of 9th graders. The following sections provide a detailed overview over the two different samples and the resulting empirical specifications.

##### A. Panel Design

The first design we employ is a panel design using Starting Cohort 3 of the NEPS. The cohort started when students were usually around 11 years old and in grade 5. The NEPS conducted regular interviews from 2010/2011 and repeatedly surveyed the students on a yearly basis throughout secondary school. The interviews usually lasted from December of a given year until February of the following year. Due to heavy panel attrition and non-participation in the second wave, the NEPS refreshed the sample for the 2012/2013 wave. The latest wave we use is from 2014/2015, when the students are 15 to 16 years old and in grade 9. At this age, they decide whether they remain in school or enter the labor market. The main sample for the panel design consists of 12,574 students from lower and intermediate secondary schools over a period of 5 years.

Table 1 shows the development of educational expectations and aspirations from grade 5 to 9 in our sample. We report the pooled sample means and standard deviations for each grade. The number of observations for educational aspirations is 12,332 only due to item non-response. We observe that educational expectations start at a high level. 88% of the sample want to obtain an intermediate secondary degree in grade 5. The expectation decreases until grade 8, to around 80%. Expectations

---

<sup>3</sup>We discuss the definition of the treatment and control group in more detail later in this section.



TABLE 1  
EDUCATIONAL EXPECTATIONS AND ASPIRATIONS: PANEL

	Class 5	Class 6	Class 7	Class 8	Class 9
Educational Expectations	0.880 (0.325)	0.869 (0.337)	0.857 (0.350)	0.800 (0.400)	0.800 (0.400)
Educational Aspirations	0.915 (0.278)	0.944 (0.231)	0.950 (0.219)	0.918 (0.275)	0.905 (0.293)

This table reports mean expectations and aspirations for the sample of Starting Cohort 3. Standard deviations are reported in parentheses. Source: NEPS - Starting Cohort 3.

in grade 8 and 9 are very similar. Overall, we observe a decrease of 8%-points, which amounts to around 1000 students who decrease their expectations. A major drop occurs from grade 7 to 8, when expectations drop by 5.7%-points. However, this development could also be attributed to the fact that students come closer to the point of realization and better reflect their own abilities. Educational aspirations range between 90.5% and 95%. Comparing grade 5 and 9, we observe a drop by 1%-point only, which indicates that the intrinsic valuation of obtaining a higher degree stays at a constant level.

Figure 1 shows the development of educational expectations over time and for different groups. We distinguish between lower track students (LT) and intermediate track students (IT). Furthermore, we distinguish between low and high affected regions with regard to the minimum wage. To do so, we use the share of workers that earned below 8.50 Euro in 2014. The measure is available at the state level only<sup>4</sup>. A region is highly affected if the share of affected workers in a specific state exceeds the sample mean of 4.451%. We see that expectations for the different groups develop similarly from class 5 to

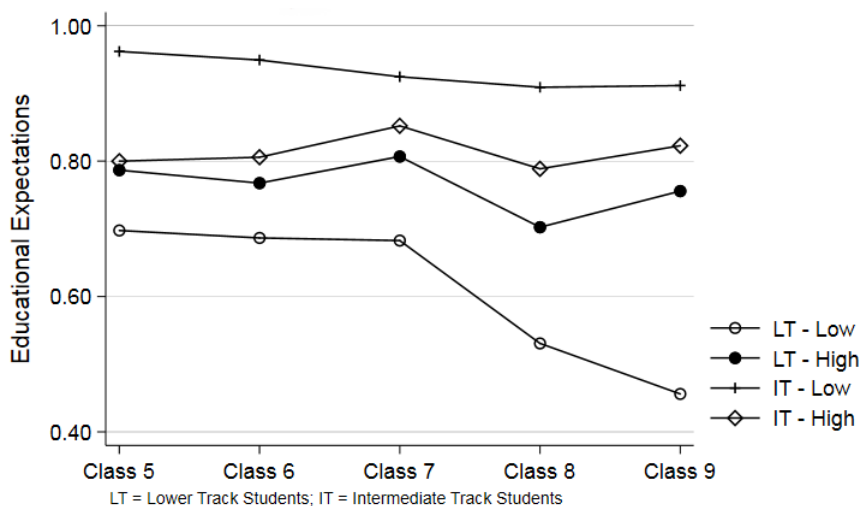


FIGURE 1  
DEVELOPMENT OF MEAN EXPECTATIONS BY STATE'S AFFECTEDNESS

7. Intermediate and lower track students' expectations develop similarly throughout the whole panel when living in high affected states. From class 7 to 8 we see a drop that is most pronounced for lower

<sup>4</sup>So far, we borrow the values from Bellmann et al.(2015) for the bite measure. Later versions of this paper will use indicators on the level of labor market regions.

track students in low affected states. Nonetheless, expectations decrease in all groups. However, the most prominent result of this graph is the change of expectations from class 8 to 9. While lower track students in low affected regions further decrease expectations, expectations in the remaining groups stay constant or even increase. Both, the results from table 1 and figure 1, already indicate how the introduction of the minimum wage affected students' educational expectations.

Table 2 reports central sample characteristics. To get a better idea of the composition of the sample, we show all characteristics for students living in low affected states, students living in high affected states, and the overall sample.<sup>5</sup> The share of females in the sample is 0.48 in low affected states

TABLE 2  
SAMPLE CHARACTERISTICS: PANEL

	Low Affected	High Affected	Total
Share of Females	0.480 (0.500)	0.470 (0.499)	0.478 (0.500)
Share of Lower Track Students	0.257 (0.437)	0.503 (0.500)	0.295 (0.456)
Share of Migrants	0.375 (0.484)	0.139 (0.346)	0.339 (0.473)
Highest Parental Education	2.352 (0.995)	2.303 (0.782)	2.345 (0.966)
Share of Affected Workers in %	3.103 (0.638)	11.790 (2.268)	4.451 (3.322)
N	10625	1949	12574

This table reports the mean for some characteristics of the sample. The first column reports the statistics for individuals going to school in low affected regions, the second column for individuals going to school in high affected regions. Individuals go to school in low (high) affected regions if the state's bite is equal to or below (above) the sample mean (4.451%). The third column reports the statistics for the whole sample. Highest parental Education ranges from 1 (no degree) to 4 (university degree). Standard Deviation is reported in parentheses. Source: NEPS - Starting Cohort 3.

and 0.47 in high affected states. The statistics for the share of lower track students obviously needs further explanation since the share in high affected regions is very large. While in low affected regions the share of lower track students is 25.7%, the share in high affected regions amounts to 50.3%. The source of this curiosity is the federal system of education in Germany, i.e. Germany has 16 different school systems. In states with relatively few students, e.g. Mecklenburg-Western Pomerania, schools may comprise several school tracks. Additionally, some states do not track students according to the three-tier school system, but let students at the end of class 9 decide whether to take the 10th class to achieve an intermediate secondary degree. Not tracking the students according to their (school-)abilities complicates the definition of a treatment and control group. We explain how we define treatment and control groups later in the section. The share of students having migration background

<sup>5</sup>Please note that, due to non-response, the number of observations for the share of migrants and highest parental education is below the reported number in the table.

is 37.5% in low affected states and 13.9% in high affected states. The average educational attainment of parents is the intermediate secondary degree. The share of affected workers is 4.451% for the whole sample.

### *B. Repeated Cross-Section Design*

The second design we employ is a repeated cross-sectional design. In addition to data from Starting Cohort 3, we utilize data from Starting Cohort 4. Starting Cohort 4 started when students were usually around 15 or 16 years old and in class 9. In contrast to the panel design, we compare expectations between different cohorts here. We do so by using the two Starting Cohorts and take information when they are in class 9. This sample contains 10,475 observations over two points of time, namely 2011 and 2015. Please be aware of the fact that the sample of class 9 students in the panel design and the repeated cross-section design slightly differ because of different selection processes of treatment and control group. Therefore, the sample of class 9 in the panel and the younger cohort in the repeated cross-section do not match exactly.

In table 3 we report the mean educational expectations and aspirations for the two cohorts. Again, the number of observations is slightly lower for aspirations, namely 10,238, due to item non-response. We observe an overall increase in educational expectations of 2.9%-points, which amounts to around

TABLE 3  
EDUCATIONAL EXPECTATIONS AND ASPIRATIONS: REPEATED CROSS-SECTION

	Older Cohort(2011)	Younger Cohort(2015)
Educational Expectations	0.747 (0.435)	0.776 (0.417)
Educational Aspirations	0.916 (0.277)	0.889 (0.315)

This table reports mean expectations and aspirations for the sample and the respective cohort. Standard Deviation is reported in parentheses. Source: NEPS - Starting Cohorts 3 & 4.

304 students more who want to attain an intermediate secondary degree in 2015 compared to 2011. Educational expectations decrease by 2.7%-points. Since we only have those two points in time, we can not answer the question of how expectations and aspirations have developed over time. However, time-series data on realized educational outcomes from the Federal Statistical Office suggest that the share of students with basic secondary degrees or without any degree decreased from 20.41% in 2011 to 15.74% in 2015.

Table 4 describes central sample characteristics for the repeated cross-section design. The number of observations for the share of migrants and highest parental education differ from the reported number of observations due to item non-response. The share of females in this sample is 47.1% in low

TABLE 4  
SAMPLE CHARACTERISTICS: REPEATED CROSS-SECTION

	Low Affected	High Affected	Total
Share of Females	0.471 (0.499)	0.477 (0.500)	0.472 (0.499)
Share of Lower Track Students	0.440 (0.496)	0.349 (0.477)	0.428 (0.495)
Share of Migrants	0.405 (0.491)	0.222 (0.416)	0.383 (0.486)
Highest Parental Education	2.619 (0.960)	2.654 (0.819)	2.624 (0.946)
Share of Affected Workers in %	3.072 (0.645)	11.000 (3.271)	4.059 (2.924)
N	9171	1304	10475

This table reports the mean for some characteristics of the sample. The first column reports the statistics for individuals going to school in low affected regions, the second column for individuals going to school in high affected regions. Individuals go to school in low (high) affected regions if the state's bite is equal to or below (above) the sample mean (4.059%). The third column reports the statistics for the whole sample. Highest parental Education ranges from 1 (no degree) to 4 (university degree). Standard deviations are reported in parentheses. Source: NEPS - Starting Cohorts 3 & 4.

affected states and 47.7% in high affected states. The overall share of lower track students of 42.8% seems too high, especially in comparison to the descriptive evidence from the panel design. The NEPS oversampled lower track students in Starting Cohort 4 in order to get a sufficient amount of lower track students. The share of migrants again is comparable to what we would expect from official data. Highest parental education is, on average, an intermediate secondary degree. The share of affected workers differs by almost 8%-points between low and high affected states and is 4.059% overall.

### C. Methods

To identify the effect of the minimum wage on educational expectations, we exploit the introduction of the minimum wage reform in Germany in 2015 and employ a panel and a repeated cross-section design.

In general, we estimate the effect of the minimum wage on educational expectations using a difference-in-difference approach. We estimate both equations with Ordinary Least Squares and State Fixed Effects. To do so, we estimate the following equation for the panel design:

$$Y_{i,t} = \beta_0 + \beta_1 Post_t + \beta_2 SchoolTrack_i + \beta_3 Post_t \times SchoolTrack_i + \epsilon_{i,t}, \quad (6)$$

where  $Y_{i,t}$  is the 0/1-indicator for the educational expectation of a student  $i$  at time  $t = [2011, \dots, 2015]$ . The indicator  $Post_t$  equals 1 if  $t = 2015$ , and 0 otherwise. The indicator  $SchoolTrack_i$  equals 1 if

student  $i$  is in the lower school track in class 8, and 0 if student  $i$  is in the intermediate school track in class 8. We are interested in the interaction term between  $Post_t$  and  $SchoolTrack_i$ . The estimates coefficient  $\beta_3$  is, therefore, the effect of the minimum wage introduction on educational expectations.

For the repeated cross-section design, we estimate a similar equation:

$$Y_{i,t} = \beta_0 + \beta_1 Post_t + \beta_2 SchoolTrack_i + \beta_3 Post_t \times SchoolTrack_i + \epsilon_{i,t}, \quad (7)$$

where  $Y_{i,t}$  is the 0/1-indicator for the educational expectation of a student  $i$  at time  $t = [2011, 2015]$ . Again, the indicator  $Post_t$  equals 1 if  $t = 2015$ , and 0 otherwise. The indicator  $SchoolTrack_i$  equals 1 if student  $i$  is in the lower school track in class 9, and 0 if student  $i$  is in the intermediate school track in class 9. We are again interested in the interaction term between  $Post_t$  and  $SchoolTrack_i$ . The estimates coefficient  $\beta_3$  is, therefore, the effect of the minimum wage introduction on educational expectations.

The common trends assumption is vital for credibly claiming effects. Since we can not show any trends for the repeated cross-section, we can extract the trends from the panel design only. Figure 2 shows trends for lower and intermediate track students. Because of the regional variation of school systems, we interact the share of affected workers that we can almost exclusively associate with states, with the single school track. We use class 8 as base outcome because it is right before the reform and therefore signals best whether the reform had an impact or not. For the common trend assumption to hold, we argue that the coefficients of our estimation must not be different from zero. Starting

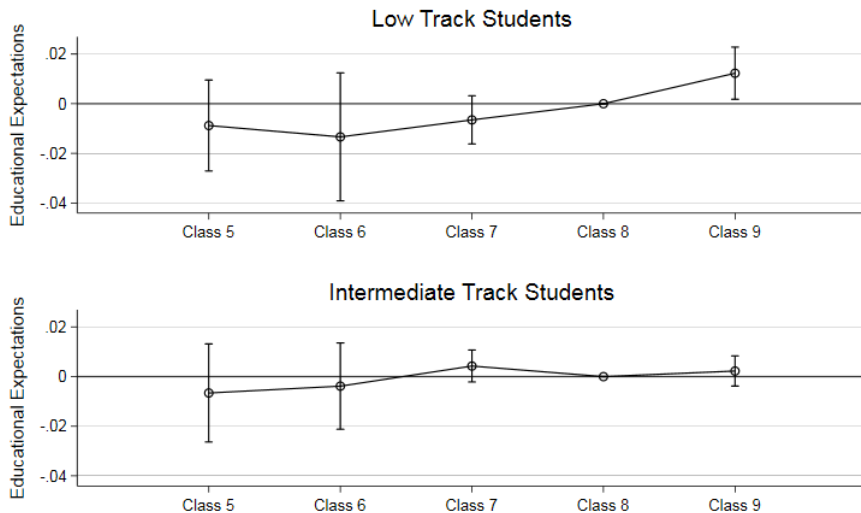


FIGURE 2  
COMMON TRENDS ASSUMPTION

with intermediate track students, we observe almost no variation in the development of educational expectations. No coefficient is different from 0. That means that expectations develop constantly

over time. Looking at lower track students, we can observe that all coefficients but the last are not different from 0. This means that the reform had an impact on educational expectations. However, it is a slight concern that from class 6 on we observe an upwards trend. This indicates, that we observe something unrelated to the minimum wage. We can counter this argument with our repeated cross-section design.

**Panel Design.** The panel design starts in 2010/2011 and ends in 2014/2015. We use the wave of 2014/2015 as our post-treatment period, while we use the waves before as pre-treatment periods. Since the last interviews started in November 2014, but the introduction of the minimum wage was in January 2015, we have to assume that students have already updated their expectations in light of the upcoming minimum wage. We do so by comparing students who were interviewed in November and December 2014 with students in January 2015. We do not find significant differences in educational expectations for November 2014 (0.805), December 2014 (0.794), and January 2015 (0.813).

In the panel design, we define our treatment and control groups based on the information on school track in 8th grade (2014), one year before the minimum wage was introduced. We assign students that are in a lower school track in class 8 to the treatment group and students in an intermediate school track to the control group. However, it is not always obvious who belongs to a lower or intermediate school track in Germany. We mentioned before, that some states refrain from sorting students into tracks. Therefore, we define our treatment group based on the mean outcome of a specific school track per state. For this, we use data from the Federal Statistical Office on how many students of a specific school track achieved a certain degree and assign those students to the treatment and control group accordingly.

**Repeated Cross-Section Design.** In addition to the panel design, we compare educational expectations for different cohorts aged 15 or 16 in a repeated cross-section design. Here, we use the last interviews of Starting Cohort 3 from 2014/2015 as post-treatment period. The first interview from Starting Cohort 4 is the pre-treatment period. We then compare 9th graders from 2011 with 9th graders from 2015. Starting Cohort 4 is thus far away from any public discussion of the minimum wage, so that anticipatory effects, e.g. pre-reform adjustments of learning behavior, do not play a role.

Lower track students are our treatment group, while intermediate track students are the control group. We solve the problem with the different types of school accordingly to the panel design. One difference, however, is that we now select students based on their school track in class 9.

## V. Results

In this section we provide results for several specifications and heterogeneity analyses. We start with a simple difference-in-difference analysis for our main specifications from equations (6) and (7). Afterwards we conduct a heterogeneity analyses by exploiting regional variation. Furthermore, we look at gender differences and differences in parental background.

Panel A of table 5 shows the estimation results for both repeated cross-section and panel design in a difference-in-difference approach. The first model of the respective design represents the whole sample while the second model uses a subsample only. The second models include controls for gender, migration background and parental education. We find that educational expectations decrease over

TABLE 5  
DIFFERENCE-IN-DIFFERENCE ESTIMATION

Panel A: Ordinary Least Squares				
	Repeated Cross-Section		Panel	
	Model 1	Model 2	Model 1	Model 2
Post	-0.03 (0.02)	-0.04 (0.02)	-0.06*** (0.01)	-0.05*** (0.02)
Post × School Track	0.06 (0.07)	0.11* (0.06)	-0.11*** (0.04)	-0.13*** (0.04)
Panel B: State Fixed Effects				
	Repeated Cross-Section		Panel	
	Model 1	Model 2	Model 1	Model 2
Post	-0.03 (0.02)	-0.03 (0.02)	-0.05*** (0.01)	-0.05*** (0.02)
Post × School Track	0.05 (0.07)	0.10 (0.06)	-0.10*** (0.04)	-0.12*** (0.04)
N	10475	5281	12574	8117
Controls	No	Yes	No	Yes

This table provides results for a difference-in-difference estimation using a linear probability model(OLS). Standard Errors are clustered the state level. All models include time fixed effects (if applicable). Source: NEPS - Starting Cohorts 3 & 4.

time. Being in the post-treatment period decreases expectations by 5%-points for Model 1 and 2, respectively, in the panel design. However, the coefficient for the post-treatment period is not different from zero in the repeated cross-section. This indicates that the effects in the panel design are age effects. One remarkable result is that the interaction of period and school track differ in signs between the two designs. In the repeated cross-section, the coefficients are positive, although not significant at the 5%-level, while the the coefficients in the panel design are negative and highly significant. Here, being in the post-treatment period, students in lower secondary schools decrease expectations, in

comparison to students from intermediate secondary schools, by 10%-points or 12%-points in Model 1 and 2, respectively. These results are perfectly in line with the expectation and realization literature that states that individuals become more and more realistic about an outcome the closer the realization of an outcome approaches. In other words, students in the panel design get closer to the point of realization and thus become more realistic and, in turn, decrease educational expectations. This is not true for the repeated cross-section as both cohorts attend the same class.

One further problem are different education systems in different states. Since some of the states clearly track students while others do not, it remains unclear whether the effect stems from these differences. To control for this, we add state-fixed effects to our model. We find that state fixed effects do not alter the results from the OLS regression. This indicates that the differences in the education system of the states do not drive the results.

#### A. Regional Variation

In the data section we have already mentioned regional differences in the share of workers that earned below 8.50 Euro before the introduction of the minimum wage. We exploit this variation in treatment intensity to control for regional differences. To do so, we borrow the bite measure from Bellmann, Bossler, Gerner, & Hübler(2015). To identify the effects of minimum wages on teenagers' educational expectations incorporating regional differences, we apply a difference-in-difference-in-differences estimator (Aaronson & French, 2007; Dube, Lester, & Reich, 2016). To do so, we estimate the following equation:

$$Y_{i,t} = \beta_0 + \beta_1 Post_t + \beta_2 SchoolTrack_i + \beta_3 Bite_s + \beta_4 Post_t \times SchoolTrack_i + \beta_5 Post_t \times Bite_s + \beta_6 SchoolTrack_i \times Bite_s + \beta_7 Post_t \times SchoolTrack_i \times Bite_s + \epsilon_{i,t,s}, \quad (8)$$

where we add  $Bite_s$ , the share of affected workers in 2014 in state  $s$ , and its interactions with  $Post_t$  and  $SchoolTrack_i$  to the basic equation (6). We are now interested in  $\beta_7$ , i.e. the interaction of  $Post_t$ ,  $SchoolType_i$ , and  $Bite_s$ . We also estimate this equation accordingly to the definitions from equation (7) for the repeated cross-section design.

Table 6 reports the results for the difference-in-difference-in-difference estimation. The first models of the respective design do not incorporate controls and estimate the effects for the whole sample. The second models incorporate controls and estimate the effects for a subsample only. We can observe no difference between the simple diff-in-diff and the triple diff-in-diff in the repeated cross-section design for the post-treatment period and the interaction between the post-treatment period and the school track. However, now we find that a significant and positive effect for the interaction of post-treatment period, school track, and bite. Increasing the bite by 1%-point increases educational expectations for



TABLE 6  
DIFFERENCE-IN-DIFFERENCE-IN-DIFFERENCE ESTIMATION

Panel A: Ordinary Least Squares				
	Repeated Cross-Section		Panel	
	Model 1	Model 2	Model 1	Model 2
Post	-0.03 (0.02)	-0.04 (0.02)	-0.05*** (0.01)	-0.04** (0.02)
Post × School Track	0.00 (0.04)	0.06 (0.04)	-0.13*** (0.02)	-0.15*** (0.03)
Post × School Track × Bite	0.03*** (0.01)	0.02* (0.01)	0.02*** (0.00)	0.02*** (0.00)
Panel B: State Fixed Effects				
	Repeated Cross-Section		Panel	
	Model 1	Model 2	Model 1	Model 2
Post	-0.03 (0.02)	-0.04 (0.02)	-0.04*** (0.01)	-0.04** (0.01)
Post × School Track	0.01 (0.04)	0.05 (0.04)	-0.13*** (0.02)	-0.15*** (0.03)
Post × School Track × Bite	0.03*** (0.01)	0.02* (0.01)	0.02*** (0.00)	0.02*** (0.00)
N	10475	5281	12574	8117
Controls	No	Yes	No	Yes

This table provides results for a difference-in-difference-in-difference estimation using a linear probability model(OLS). Standard Errors are clustered the state level. All models include time fixed effects (if applicable). The bite is mean-centered. Source: NEPS - Starting Cohorts 3 & 4.

lower track students after the introduction of the reform by 3%-points. An increase of the bite by one standard deviation (2.924, see table 4) increases educational expectations by around 8.8%-points for a lower track student after the introduction of the minimum wage. Adding controls decreases accuracy and size. Estimating the effects using state fixed effects does not alter the results remarkably.

The results for the panel design look clear. The post-treatment dummy and the post-treatment and school track interaction conform to the simple diff-in-diff estimation. The interaction of post-treatment period, school track, and bite is sizable and highly significant. An increase of the bite by one standard deviation(3.322, see table 2) increase educational expectations by 6.6%-points for a lower track student after the minimum wage introduction. Adding state fixed effects also does not alter the results remarkably in the panel design.

To further underline our findings, we will graphically show the heterogeneous effects the minimum wage introduction had on educational expectations. We will present two graphs for the panel design followed by one graph for the repeated cross section design. Figure 3 shows expectations of intermediate track students along the bite. To better understand the underlying mechanism, we plot expectations

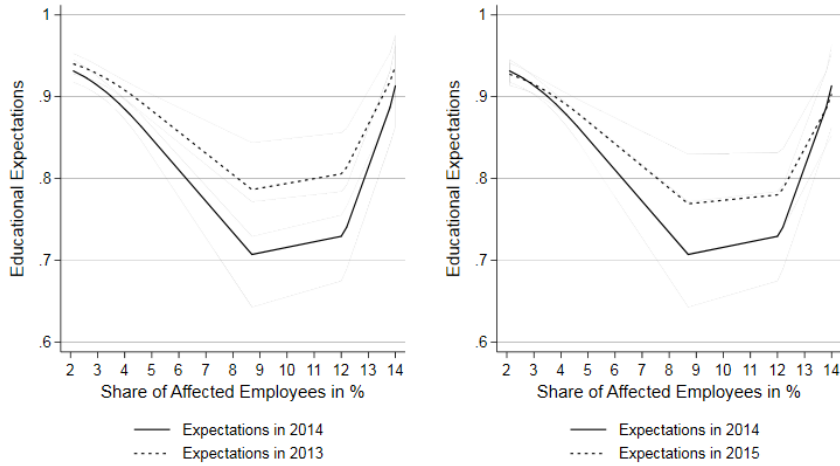


FIGURE 3  
REGIONAL VARIATION IN THE EFFECT OF THE MINIMUM WAGE ON EXPECTATIONS FOR INTERMEDIATE TRACK STUDENTS

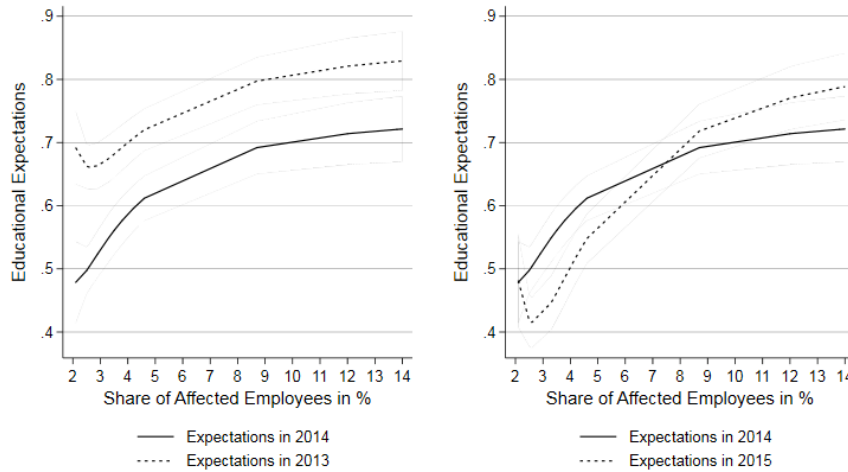


FIGURE 4  
REGIONAL VARIATION IN THE EFFECT OF THE MINIMUM WAGE ON EXPECTATIONS FOR LOWER TRACK STUDENTS

for 2013(class 7) and 2014(class 8) on the left side, and for 2014 and 2015(class 9) on the right side. In order to facilitate the interpretation of the graph, the solid black line show expectations for 2014 in both graphs. We observe a u-shaped pattern along the bite. Since the shape does not change from 2013 to 2014 and 2015, we can state that the introduction of the minimum wage does not play a role in the expectation for intermediate track students. The only difference between the lines in both graphs are the levels of expectations. However, these level differences can not be attributed to the reform because expectations in 2013 and 2015 do not differ at all.

Figure 4 shows expectations of lower track students along the bite. Again, we plot expectations for 2014 as a solid black line in both graphs to facilitate interpretation. We observe a parallel development of the expectations along the bite measure for 2013 and 2014. In contrast to intermediate track students we do not observe a u-shaped development, but a concave one. Coming closer to realization, students

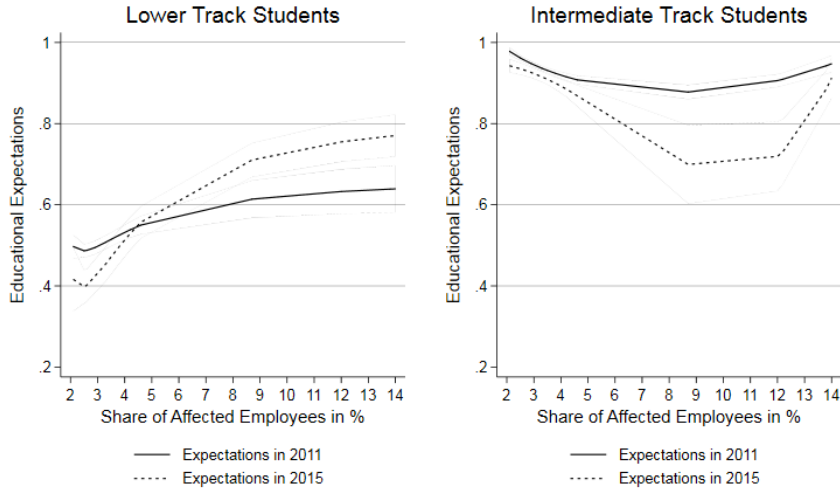


FIGURE 5  
REGIONAL VARIATION IN THE EFFECT OF THE MINIMUM WAGE ON EXPECTATIONS FOR LOWER  
AND INTERMEDIATE TRACK STUDENTS

decrease educational expectations. Turning to the right graph of figure 4 we see a strong shift in the form of the plot along the bite measure. The plot gets steeper from 2014 to 2015. Furthermore, they do not develop parallel as they do in the left graph and cross at around 8% of affected workers. This threshold separates eastern states, that are above the threshold and western states that are below the threshold.<sup>6</sup> This development is what we attribute to the introduction of the minimum wage. In comparison to 2014, students expect to obtain a lower degree in 2015 in low affected regions. In high affected regions, students want to obtain a higher degree. According to theory, students below the threshold of 8% further decrease expectations because their opportunity costs of schooling increases. The wage effect of the minimum wage outweighs the employment effect, because the risk of getting unemployed remains at a low level. Students above the threshold increase their expectations again, because the employment effect outweighs the wage effect.

Figure 5 shows expectations of lower and intermediate track students along the bite for the repeated cross-section sample. We plot expectations from 2011 as a solid black line in both graphs. We observe similar pattern as we could observe in figures 3 and 4. For intermediate track students we observe a u-shaped pattern again, although it is less pronounced than in the panel design. Looking at lower track students, we see a concave shape similar to the panel design before the minimum wage introduction. However, the difference between low and high affected states in educational expectations is not as pronounced as in the panel design. Also, the threshold decreases from 8% in the panel design to 4.5% in the repeated cross-section design. Again, the threshold splits the regions where the minimum wage has, at least perceived, greater wage effects than employment effects and regions where the minimum

<sup>6</sup>Attendants of several conferences suggested that the effect may be driven by a difference in the history of school systems between eastern and western states. Later versions of this paper will include analyses on labor market regions.

wage has greater employment effects than wage effects. This implicates that already medium affected states, i.e. northern states, differ from low affected states, e.g. Bavaria.

Both the regression results and the graphical illustrations suggest that intermediate track students changed expectations along the bite only in levels. Since the shape of the curve does not change or at least is very similar, the results suggest that the minimum wage had no effect on our control group. Lower track students change expectations in level and shape. If the minimum wage had no effect, or the effect would be due to different schooling systems in eastern and western Germany, we would observe different developments. If the minimum wage had no effect, the shape would not change along the bite measure. It would rather develop as in figure 3. Would it be due to schooling systems, the pattern would be clear cut, as in the u-shaped development of intermediate track students. However, it is a smooth development indicating an important impact of the minimum wage.

### B. *Heterogeneous Effects*

So far, we introduced regional differences as the only heterogeneous effects among students' educational expectations. However, there are two more possible heterogeneous effects that we must examine. We will first examine heterogeneity stemming from gender differences, and second we will examine heterogeneity stemming from differences in socio-economic background, i.e. parental education.

Table 7 reports the results for a difference-in-difference-in-difference estimation for the repeated cross-section and panel design by gender. Since we could not observe different results when adding control variables or state fixed effects, we focus on our main specification here. Before we discuss the

TABLE 7  
DIFFERENCE-IN-DIFFERENCE-IN-DIFFERENCE ESTIMATION: OLS-RESULTS.

	Repeated Cross-Section		Panel	
	Males	Females	Males	Females
Post	-0.05** (0.02)	-0.01 (0.02)	-0.06*** (0.01)	-0.05*** (0.01)
Post × School Track	-0.02 (0.05)	0.04 (0.03)	-0.17*** (0.03)	-0.09*** (0.03)
Post × School Track × Bite	0.02** (0.01)	0.03*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
N	5534	4940	6562	6012

This table provides results for a difference-in-difference-in-difference estimation using a linear probability model (OLS). Standard Errors are clustered the state level. The bite is mean-centered. All models include time fixed effects (if applicable). Source: NEPS - Starting Cohorts 3 & 4.

results for the repeated cross-section, let's recoup the baseline results from table 6, Panel A, Model 1. We found that overall the being in the post-treatment period, does decrease expectations, however,

the coefficient is insignificant. Also the school tracks do not behave differently after the introduction of the minimum wage. the only effect we found was that an increase in the bite measure increased educational expectations for students. Analyzing the effects separately for each gender reveals further insights in the effect of the minimum wage. The main difference is that boys react negatively after the introduction of the minimum wage. In contrast to girls, boys decrease expectations by 5%-points after the introduction of the minimum wage. The source of this difference lays in risk-aversion. Boys do not incorporate the negative employment effects, i.e. the risk of getting unemployed, of an exogenous wage shock when forming expectations about their future. Girls do care about possible unemployment in the future and thus do not decrease their educational expectations. The risk-aversion literature supports this argument, as they find that boys are more risk-seeking than girls (Booth and Nolen, 2012).

We do not find any strong differences between girls and boys in the panel design in contrast to the repeated cross-section design. The only noteworthy difference is that boys decrease expectations more strongly when they are in the lower school track after the reform. This again supports the argument for a more risk-seeking behavior.

The second heterogeneity analysis we conduct is for parental education. We distinguish between low educated parents and high educated parents. We classify parents as highly educated when they have a higher secondary degree or university degree, and low educated otherwise. Since parental education can have opposed effects on a child's expectation it remains unclear what effects we should expect a priori. On the one hand, higher parental education could increase a child's expectation because they are aware of the economic situation and therefore try to improve their child's labor market opportunities. On the other hand, higher educated parents usually have a better network available they can draw on. Therefore, it does not matter whether a child has lower school degree or intermediate school degree. Table 8 reports the results for the heterogeneity analysis for the repeated cross-section and panel design. Since parental interviews were not mandatory, we can analyze this question for a subsample only. Very different from our main specification, we find that being in a lower track school after the reform increases educational expectations only for children of low educated parents in the repeated cross-section design. It further increases when increasing the bite. While children from low educated parents react significantly positive, children from high educated parents do not seem to react in a significant magnitude. At least they do not react in terms of relevant variables.

In the panel design, children from low educated parents pretty much react as we found in the standard specification from table 6. Again, children from higher educated parents differ from children from low educated parents. The only way they react is through the channel of school track. When

TABLE 8  
DIFFERENCE-IN-DIFFERENCE-IN-DIFFERENCE ESTIMATION: OLS-RESULTS.

	Repeated Cross-Section		Panel	
	Low Educated	High Educated	Low Educated	High Educated
Post	-0.04 (0.03)	-0.03 (0.02)	-0.08*** (0.02)	0.00 (0.01)
Post $\times$ School Track	0.08** (0.03)	-0.00 (0.11)	-0.13*** (0.03)	-0.20*** (0.06)
Post $\times$ School Track $\times$ Bite	0.02*** (0.01)	0.02 (0.02)	0.02*** (0.00)	0.01 (0.01)
N	3691	1614	5225	3011

This table provides results for a difference-in-difference-in-difference estimation using a linear probability model(OLS). Standard Errors are clustered the state level. All models include time fixed effects (if applicable). Source: NEPS - Starting Cohorts 3 & 4.

they are in the post-treatment period, they decrease their educational expectations by 20%-points in contrast to their counterparts in intermediate school tracks. However, they do not react to an increase in the bite measure, which further indicates that we observe age effects here, too.

## VI. Sensitivity Tests

We conducted several sensitivity test to check whether our results hold when we change our arbitrarily chosen definitions, e.g. of the pre-treatment periods or the treatment and control groups.<sup>7</sup>

**Balanced Panel.** In a first step we checked for the panel design whether a balanced panel would change our results. We apply two different strategies. First, we used a semi-balanced panel that includes students taking part in each survey from class 7 to class 9. As already mentioned, the NEPS refreshed the sample in class 7 because of panel attrition and non-participation. Second, we used a full balanced panel that includes students only when they participated in each survey of the NEPS until class 9. Table 9 reports the estimation results. We do not observe any significant differences between our main specification and the balanced panel regressions. Only the post-treatment indicator gets insignificant using a fully balanced panel. This indicates that even though the NEPS suffered from panel attrition, the results are robust to different sample selections.

**Treatment & Control Group.** In a second step, we checked whether our results are sensitive to the assignments to treatment and control group. When we exclude students from schools where it is unclear whether they attend a lower or intermediate track, we lose variation mainly in eastern Germany. Since we have the largest difference in the bite between east and west, our coefficients tend

<sup>7</sup>The regression tables that are not shown here can be sent upon request.

TABLE 9  
DIFFERENCE-IN-DIFFERENCE-IN-DIFFERENCE ESTIMATION: OLS-RESULTS.

	Semi-Balanced	Fully Balanced
Post	-0.05** (0.02)	-0.03 (0.02)
Post $\times$ School Track	-0.13*** (0.03)	-0.17*** (0.02)
Post $\times$ School Track $\times$ Bite	0.02*** (0.00)	0.01** (0.00)
N	8942	5715

This table provides results for a difference-in-difference-in-difference estimation using a linear probability model(OLS). Standard Errors are clustered the state level. The bite is mean-centered. All models include time fixed effects (if applicable). Source: NEPS - Starting Cohorts 3 & 4.

towards zero.

Another sensitivity test regarding treatment and control group for the panel design is, that we assign students to be in treatment or control group when they are in class 7 instead of class 8. The results do not change dramatically here. The only result that changes is the estimation of the common trends, where for lower track students the coefficient in class 6 gets significant.

**Time  $\times$  State - Interaction.** The minimum wage literature often includes a very strong sensitivity test, that is including the interaction of time and the state. Including time-state interactions does not alter any relevant results. However, the interaction reduces accuracy of the remaining estimates resulting in higher coefficients and standard errors. Furthermore, the constant lies outside the 0/1-Range for some of the panel design regressions. This would imply that being in class 5 in the state of Baden-Wurttemberg in an intermediate school track, the likelihood of expecting intermediate school degree or more is greater than 1.

**Educational Aspirations as Dependent Variable.** In this sensitivity test we exchanged educational expectations and aspirations. We find that aspirations do not change because of the minimum wage. They rather change before the introduction of the minimum wage or not at all. Aspirations also do not behave as the minimum wage would influence it along the wage bite. Graphical illustrations suggest that there is a peak in aspirations that is very likely data driven in class 7.

**Placebo Tests** Placebo tests do not make sense for the repeated cross-section as we only have one pre-treatment period. To apply placebo tests on the panel design we changed the post-treatment period from being in class 9 only up to the point when class 5 is the only pre-treatment period. Another strategy is to cut the sample at class 8 and make class 8 the post-treatment period. The

placebo tests firmly support our findings that the minimum wage hit expectations in class 9 only.

## VII. Conclusion

In this study, we investigate the effect of the minimum wage introduction on educational expectations of teenagers. For this, we use data from the German National Educational Panel Study and conduct Difference-in-Difference(-in-Difference) estimations with two alternative designs, a panel design with one cohort of students and a cross-sectional design with two different cohorts of students of the same age. In contrast to other studies, we are able to detect whether individual labor supply reacted as response to the minimum wage with our data. In particular, we focus on changes in educational goals of lower track students.

Overall, we find mixed results for educational expectations depending on the design. The panel design suggests decreasing educational expectations with age, while the repeated cross-section design suggests increasing expectations between cohorts. We argue that the panel design identifies age effects rather than minimum wage effects in this model. Therefore, we conclude that the minimum wage had no effect on overall educational expectations in Germany. When we add regional variation to our model, we find that educational expectations increase in regions where the impact of the minimum wage was high. This result is highly significant and robust to various specifications. Furthermore, we find gender differences in our data. Male students decrease their expectations regardless of school track and state of living. In addition, parental education alters expectations. Students with highly educated parents do not alter expectations in response to the minimum wage. In contrast, students with low educated parents aim at obtaining a higher degree.

In conclusion, although individuals below age 18 are formally exempt from the newly introduced minimum wage in Germany, teenagers' educational decisions are indirectly affected by changes in the (future) minimum wage and by their employment prospects. Students consider regional labor market conditions and try to compensate for lower employment probabilities by increasing their intended human capital investments.

## References

- Aaronson, D. and French, E. (2007). Product Market Evidence on the Employment Effects of the Minimum Wage. *Journal of Labor Economics*, 25(1):167–200.
- Bellmann, L., Bossler, M., Dütsch, M., Gerner, H.-D., and Ohlert, C. (2016). Folgen des Mindestlohns in Deutschland: Betriebe reagieren nur selten mit Entlassungen. Technical report, Institute for Employment Research, Nuremberg.



- Bellmann, L., Bossler, M., Gerner, H.-D., and Hübler, O. (2017). Training and minimum wages: first evidence from the introduction of the minimum wage in germany. *IZA journal of Labor Economics*, 6(1):8.
- Booth, A. L. and Nolen, P. (2012). Gender differences in risk behaviour: does nurture matter? *The Economic Journal*, 122(558):56–78.
- Bossler, M. (2017). Employment expectations and uncertainties ahead of the new German minimum wage. *Scottish Journal of Political Economy*, 64(4):327–348.
- Bossler, M. and Gerner, H.-D. (2016). Employment effects of the new German minimum wage \* evidence from establishment-level micro data. *IAB Discussion Paper*, 10.
- Caliendo, M., Fedorets, A., Preuss, M., Schröder, C., and Wittbrodt, L. (2018). The short-run employment effects of the German minimum wage reform. *Labour Economics*, 53:46–62.
- Draca, M., Machin, S., and Van Reenen, J. (2011). Minimum wages and firm profitability. *American Economic Journal: Applied Economics*, 3(1):129–51.
- Dube, A., Lester, T. W., and Reich, M. (2010). Minimum wage effects across state borders: Estimates using contiguous counties. *The review of economics and statistics*, 92(4):945–964.
- Hirsch, B. T., Kaufman, B. E., and Zelenska, T. (2015). Minimum wage channels of adjustment. *Industrial Relations: A Journal of Economy and Society*, 54(2):199–239.
- Lergetporer, P., Werner, K., and Woessmann, L. (2018). Does Ignorance of Economic Returns and Costs Explain the Educational Aspiration Gap? Evidence from Representative Survey Experiments. *CESifo Working Paper*, 7000(11453).
- Neumark, D. and Wascher, W. (2008). *Minimum Wages*. MIT Press, Cambridge, MA, 2008 edition.
- Schumann, M. (2017). The effects of minimum wages on firm-financed apprenticeship training. *Labour Economics*, 47:163–181.