

Labor supply shocks in the apprenticeship market. Quasi-experimental evidence from Germany

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Abstract: This paper investigates the consequences of a large labor supply shock for the German apprenticeship market. In particular, due to an educational reform, there were no high school graduates in two federal states in the year 2001. Applying difference-in-difference analyses, it is investigated, first, how firms adjusted their hiring strategy to the shock. Second, it is analyzed to which extent wages and career progressions of apprentices were affected while making their apprenticeship and afterwards.

Keywords: Apprenticeship training, labor supply shock, wages

JEL classification: J21, J24, J31

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1.Introduction

The German education system was subject to a variety of reforms in recent years. One of these reforms was expanding the years required for receiving a high school degree from 12 to 13 years. As this reform was implemented in two federal states in the same year, there were no high school graduates in 2001 in these states. After receiving their school degree, high school graduates do either enter the university or start apprenticeship training. This paper evaluates the consequences of this labor supply shock for the apprenticeship market. As the share of graduates starting an apprenticeship is rather small in comparison to the overall number of apprentices (16%), it is investigated, first, whether and how the apprenticeship market was affected by the supply shock. Second, it is investigated whether apprentices' labor market outcomes were influenced.

The second section describes the German schooling and apprenticeship system as well as the school reform. Section 3 analyses which occupations were affected by the reform and Section 4 presents results on how labor market outcomes were shaped. The last section concludes the study.

2. Institutional background and the labor supply shock

2.1 The schooling and apprenticeship system in Germany

In Germany, education policy is set on the level of the federal states and differs, therefore, to a large extent by states. The schooling system is characterized by early tracking usually after fourth grade (at the age of ten), in some states also after sixth grade. The selection of school track is based on ability and school achievement where better performing pupils attend schools with longer duration. Three tracks can be distinguished: lower secondary school (*Hauptschule*) finishes after nine years of schooling, junior high school or intermediate level secondary school (*Realschule*) finishes after 10th grade and high school or higher level secondary school (*Gymnasium*) finishes after 12 or 13 years of schooling (differs by federal state). In Gymnasium, the high school degree (*Abitur*) can be acquired after exams are passed.

The dual apprenticeship system is the most important vocational training institution in Germany. Today around two thirds of the labor force have an apprenticeship degree. The dual apprenticeship system combines publicly-financed formal class-room schooling and on-the-

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job learning at work.¹ Most often, the distribution between school and work per week is 1-2 days and 3-4 days, respectively. The apprenticeship system is specified by law in the *Berufsbildungsgesetz*. The duration, curriculum, time schedules and exam requirements are constituted in the *Ausbildungsordnung* separately for every of the 340 officially-recognized occupations. The occupations are heterogeneous because they cover service sector jobs (ranging from hairdresser to banking clerk) and manufacturing jobs (such as masons, carpenters, electricians). Exams are organized and accomplished by organizations like industrial chambers or chambers of trade.²

Employers are legally obligated to pay wages during vocational training. In most industries, these wages are determined on the basis of collective wage agreements and vary remarkably by occupation. The average apprenticeship wage in 2000 was 571 Euro in West Germany and 490 Euro in East Germany (BMBF 2008). This average amount covers the basic costs of living like rents or food expenditures. The duration of the apprenticeship depends on the occupation. The majority of newly hired apprentices have chosen apprenticeships that last between 30 and 36 months (more than 70%). Approximately 1/5th have chosen an apprenticeship with duration of 42 months and fewer than 10% with duration of 24 months or less.

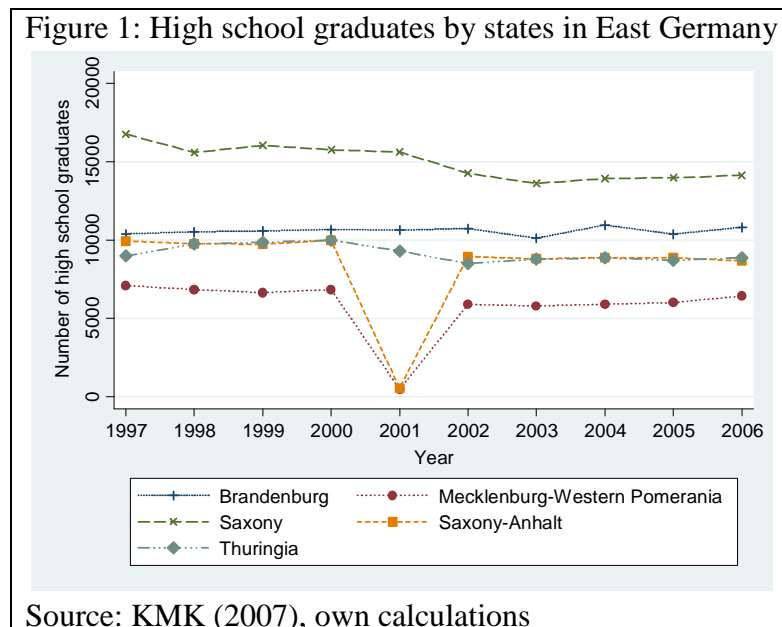
Applications for an apprenticeship in a specific occupation have to be directed to the firms who chose their apprentices among the pool of applicants. Applying for an apprenticeship is not restricted to graduates with a particular school degree. The majority of apprentices come from lower or intermediate secondary school. In 2000, the share of apprentices with a high school degree was around 15% in Germany. However, apprentices' educational background differs tremendously by occupation. For instance, the percentage of apprentices with a high school degree is larger in occupations in the service sector than in manufacturing. Section 3 provides a description of this heterogeneity. After the apprenticeship is finished, firms' decide whether they retain all, some or no one of their apprentices. Retained apprentices obtain a regular labor contract and wage. When firms' decide not to keep their apprentices, no firing costs are involved since the apprenticeship contract usually expires after the apprenticeship is finished.

¹ There is also the possibility to attain an apprenticeship degree in a vocational school which involves no on-the-job training. However, the share of participants in the school-based system is much lower than the share in the dual apprenticeship system (BMBF 2008).

² For a more detailed description of the German apprenticeship system see Steedman (1993).

2.2 The labor supply shock

In West Germany, attaining a high school degree took 13 years of schooling during the time period under investigation. In East Germany, there were different regulations across federal states. The school system in the former GDR required only 12 years for being qualified for university entrance. The East German states Saxony and Thuringia kept with the former system of 12 years, Brandenburg switched to West German standards shortly after reunification and Mecklenburg-Western Pomerania and Saxony-Anhalt, who are in the focus of this study, extended the years of schooling from 12 to 13 years not until 2000.³ Due to this extension, there were no graduates from high school in 2001 because in both states the last cohort graduating after 12 years left school in 2000 and the first cohort graduating after 13 years left school in 2002. The school reform was implemented in Mecklenburg-Western Pomerania in May 1996 (SchulG M-V, §21 Abs. 5) and in Saxony-Anhalt in January 1998 (Gesetz zur Änderung des Schulgesetzes, §1). Figure 1 documents the number of high school graduates by state. Even though Mecklenburg-Western Pomerania and Saxony-Anhalt rank among the states with smaller population size and, thus, have a smaller number of school leavers, there was an overall drop of approximately 16.000 school graduates in 2001.



Although cohort size of high school graduates dropped in 2001, the shock in the labor market occurred at different years for males and females. While the labor supply shock in the

³ A map of the German states is contained in the Appendix Figure A-1.

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apprenticeship market occurred in 2001 only for females, it was divided between 2001 and 2002 for males. This is because military service lasting approximately one year is obligatory for German males whose state of health is sufficient.⁴ Males returning from military service in 2000 could potentially start an apprenticeship in 2001 and males being exempted from military service in 2002 could enter the labor market in 2002.

3. The impact of the supply shock on the apprenticeship market

Even though the cohort size of high school graduates was almost zero in 2001, it is an open question whether this had an effect on the apprenticeship market. Mobility of school leavers across states, substitution of apprentices by school degree and substitution between occupations are potential mechanisms that could dampen the consequences of a skill shock. In addition, some males were available for the apprenticeship market in 2001. Therefore, it is more likely that there was only a skill shock in some occupations while others were not affected at all. In this section, we identify those occupations that have a high number of high school graduates and that are female-dominated.

3.1 Data and descriptive statistics

The analysis is based on administrative data from administrative Apprenticeship Training Data (*Berufsbildungsstatistik*) that is reported yearly for the reference date December, 31st by the industrial chambers or chambers of trade. The data was provided by the Federal Statistical Office (*Statistisches Bundesamt*). It covers socio-demographic information such as gender or educational background of newly hired apprentices in the dual apprenticeship system. There is additional information on occupation and the state. During 1993 to 2006, the data set is comparable on the federal level. Unfortunately, the data is not available as micro data. Instead it is provided in aggregate form, e.g. in the dimensions state, year, occupation and educational background or in the dimensions state, year, occupation and gender. Therefore, it is not possible to consider the number of apprentices by gender and by schooling background together. The variable educational background contains the three school degrees lower, intermediate and high school degree.⁵

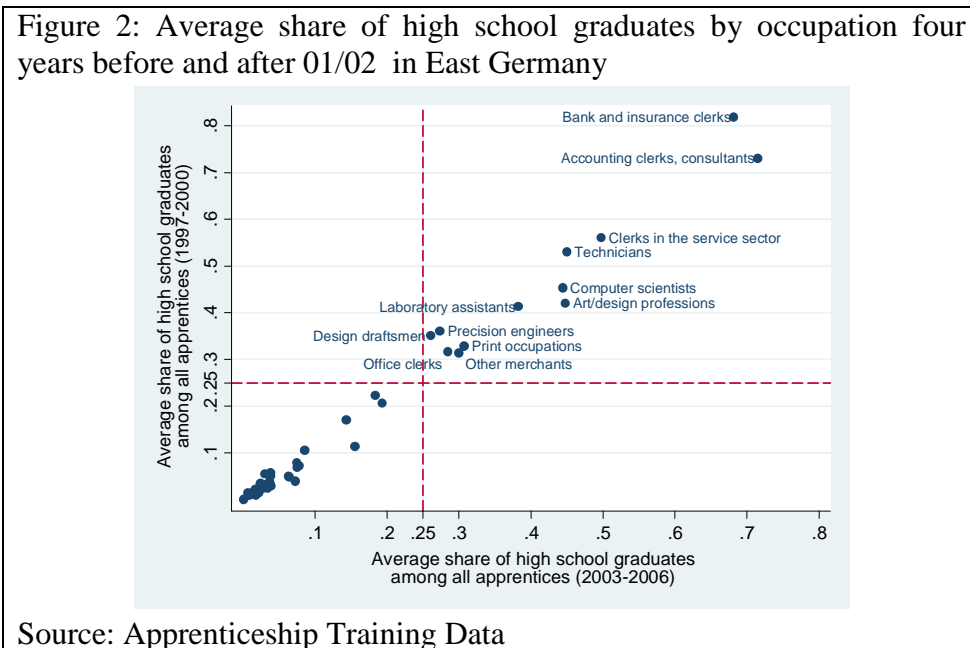
⁴ As an alternative for draft resisters, young men could also fulfill civilian service. Those who were exempted from military service could enter the labor market or university directly after high school graduation.

⁵ Qualifications achieved within vocational prep schools where adolescences who did not obtain an apprenticeship in the current year are prepared for the apprenticeship system are assigned to the three school degrees on the basis of the average school degree of participants in each of the prep schools. See Table A-1 in

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The average share of high school leavers by occupation are depicted for East Germany in figure 2. The averages are calculated using a four-year observation period before and after 2001/02. It can be seen that they are fairly stable across time. The occupations are categorized into 49 occupational groups.⁶ The majority of occupations do not have a high share of high school graduate. 37 occupations have a share of fewer than 20% of which 33 have even fewer than 10%.

The remaining 12 occupations hired more than 25% of apprentices with high school degree. There are two occupations that exhibit a very high rate of around 70% (i.e. bank and insurance clerks and accounting clerks). Clerks in the service sector, technicians, computer scientists and art/design professions exhibit a share of more than 40 percent. More than 25% and less than 40% of the apprentices have a high school diploma in the occupations laboratory assistants, precision engineers, design draftsmen, office clerks, other merchants and in prints occupations.⁷



the Appendix for further information. In addition, persons who did not achieve a lower secondary school degree are classified in the group "lower secondary school degree" for reason of simplicity.

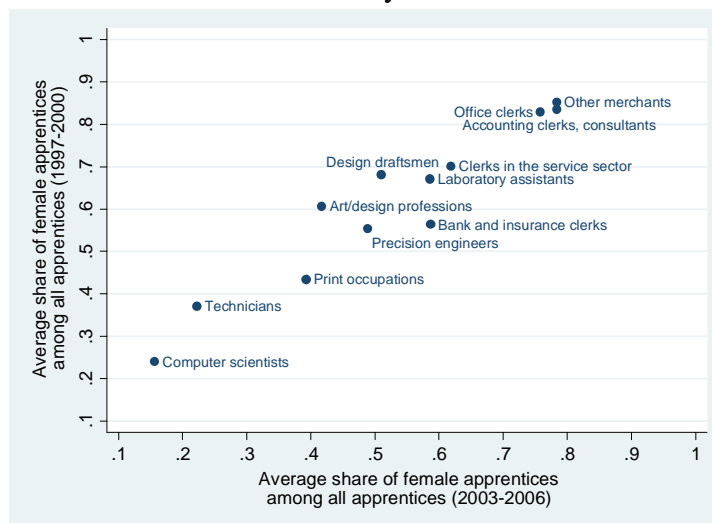
⁶ The overall number of occupational groups was 71 of whom 22 were dropped because their number of newly hired apprentices was small, i.e. fewer than 50 apprentices in 1999 in Mecklenburg-Western Pomerania and Saxony-Anhalt. The 49 occupational groups still cover 290 occupations. For ease of illustration, the occupational groups are referred to as occupations in the following.

⁷ A more detailed description of these occupations is provided in the Appendix Table A-2. They differ in terms of training contents and working tasks. Clerks face similar job tasks and working conditions, in particular, bank and insurance clerks, accounting clerks, clerks in the service sector and office clerks. These four occupations can be characterized as office jobs in the service sector. The remaining occupations cannot be categorized accordingly.

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Since males and females are interested in different fields of occupations, there are large gender differences across occupations. Figure 3 documents the gender distribution for every of the 12 occupations. The occupations with the highest share of females of approximately 80% are other merchants, office clerks and accounting clerks. A share well above average is found for clerks in the service sector and laboratory assistants (60%-70%). An average share of a little less than 60% is found for banking and insurance clerks. The gender distribution of design draftsmen and art/design professions is less stable across time. It dropped from a fraction that was above average between 1997/2002 to an average fraction in 2003/06. Precision engineers exhibit an even distribution of males and females. The remaining occupations are rather male dominated which is particularly present for technicians and computer scientists.

Figure 3: Average share of female apprentices by occupation four years before and after 01/02 in East Germany



Source: Apprenticeship Training Data

3.2 Empirical Analysis

A difference-in-difference strategy is applied to discover in which occupations a supply shock of high skilled apprentices occurred. The treatment states, Mecklenburg-West Pomerania and Saxony-Anhalt, will be compared to other East German states, i.e. Brandenburg, Saxony and Thuringia.⁸ The apprenticeship training behavior of West and East German firms differs as

⁸ East Berlin is not considered in the following because there are no statistics available distinguishing East and West Berlin any longer. In addition, Berlin is a city state characterized by high population and firm density. It might, therefore, not be comparable to the other large-area federal states.

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was shown in Beckmann (2002), e.g. because of differences in labor market conditions. Furthermore, the high school system is similar in East German states which can be seen most distinctively when comparing the number of years required for obtaining a high school degree that was as already mentioned 12 years in the East except for Brandenburg. To check whether the results are sensitive to the chosen definition of the comparison group, some sensitivity checks are applied, in particular, excluding Brandenburg from the comparison states and considering West German states.

The years 1997 to 1999 are chosen as pre-reform period because it is sufficiently far away from the transition period in the early nineties. We assume that there were no adjustment efforts in the years when the reform was announced because the number of hired apprentices highly depends on the business cycle whose development was not known in 95 or 97, respectively. Indeed sensitivity checks show that the results remain unchanged when using pre-announcement year 1995 as comparison year for Mecklenburg-West Pomerania and 1997 for Saxony-Anhalt. The year of main interest in this study is 2001 where the main skill shock occurred. Moreover, it will be analyzed whether there was an additional effect in 2002 or whether the shock had longer lasting effects in 2003 to 2006. It will also be investigated whether firms anticipated the reform and increased the number of high school graduates among their apprentices in the pre-reform year 2000. To gain insights on contemporaneous shocks and the robustness of the results, placebo-tests are carried out.

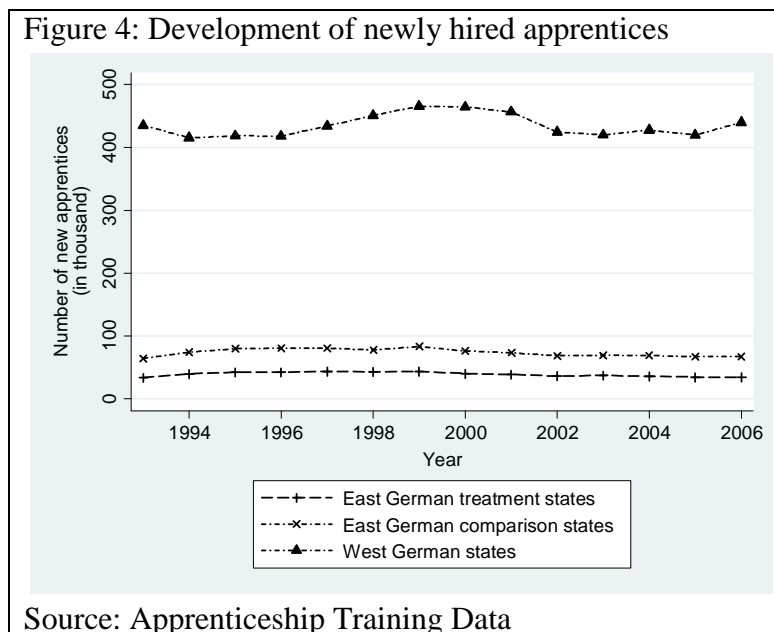
The dependent variable of main interest is the number of high school graduates. Furthermore, it can be analyzed whether firms hired school leavers with medium secondary degree instead or whether no such adjustments were made which simply led to a reduced cohort size of apprentices. To do so, we also used the overall number of apprentices and the number of apprentices with medium secondary school degree as dependent variable. The identification assumption is that the development of the dependent variables in East Germany would have been the same within the time period under investigation between treatment and comparison states in the absence of the skill shock in 2001/2002.

The reform effect is identified by running OLS regressions for each of the dependent variables on a dummy for treatment versus comparison states, year dummies and interaction terms between the states and years. The dependent variables enter the regression in logarithmic form. It is impossible to disentangle the effects on other adjustment processes

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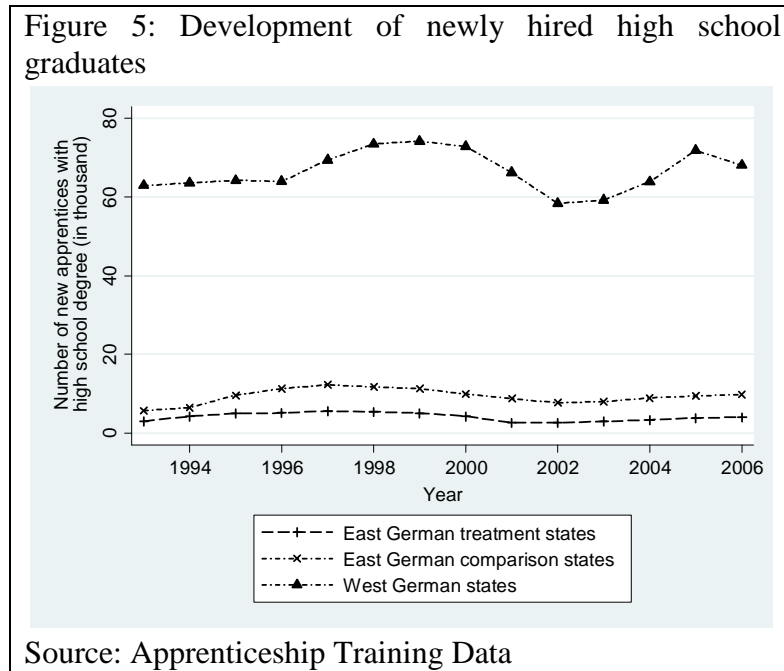
such as the mobility decisions of apprentices because this information is not contained in the data. Since mobility attenuates the skill shortage if high skilled school leavers from other states apply for training in the treatment states, the results presented in this paper should be interpreted as a lower bound of the causal effect.

Since there is no formal statistical test to check whether the identification assumption is valid, its validity will at least be discussed on the basis of descriptive statistics. In Figure 4, the time trend of the number of newly hired apprentices is depicted separately for East and West Germany.⁹ It becomes obvious that the trend is more comparable within East Germany. In particular, while there is a rather constant development in East Germany, the West German development is more volatile. This is even more pronounced when looking at the number of newly hired high school graduates which is documented in Figure 5. In this graph, it also becomes obvious that the lines in the East German states run parallel not until 1996/97 which justifies that we use the time period from 1997 to 1999 as pre-reform period and not earlier years. Last, figure 4 and figure 5 do not suggest that there is an effect of the skill shock when looking at all occupations together because there is no pronounced deviation of the lines in 2001/02 between treatment and comparison group in these graphs. Therefore, running regression separately by occupation seems to be justified.



⁹ The West German city states Hamburg and Bremen are excluded for the rest of the paper because they might exhibit different training patterns than large-area states.

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3.3 Results and sensitivity analysis

The results when focusing on the number of high school graduates as dependent variable are shown in Table 1. There are statistically significant negative results for clerk occupations, in particular, for accounting clerks, clerks in the service sector and office clerks. These occupations exhibit a very high share of female apprentices as was shown above. The only clerk occupation where no statistically significant effect is banking and insurance which could be attributed to a smaller average share of female apprentices. In the remaining occupations, there is no statistical significant effect in 2001 or in 2002.

Table 1: The effect on the number of high school graduates

	Bank and insurance clerks	Accounting clerks	Clerks in the service sector	Office clerks	Technicians	Computer scientists	Art/design professions	Print occupations	Precision engineers	Laboratory assistant	Design draftsmen	Other merchants
2000	-0.033 (0.315)	0.024 (0.269)	-0.082 (0.235)	-0.153 (0.292)	0.428 (0.487)	-0.020 (0.418)	-0.206 (0.477)	-0.137 (0.402)	-0.074 (0.387)	-0.015 (0.527)	0.112 (0.423)	0.082 (0.463)
2001	-0.352 (0.315)	-0.543* (0.269)	-0.481** (0.235)	-0.705** (0.292)	0.186 (0.487)	0.157 (0.418)	-0.195 (0.477)	-0.255 (0.402)	-0.488 (0.387)	-0.370 (0.527)	0.181 (0.423)	0.058 (0.463)
2002	-0.174 (0.315)	-0.014 (0.269)	-0.266 (0.235)	-0.387 (0.292)	-0.037 (0.487)	0.054 (0.418)	-0.313 (0.477)	-0.280 (0.402)	-0.404 (0.387)	-0.478 (0.527)	-0.229 (0.423)	0.432 (0.463)
2003	-0.036 (0.315)	-0.184 (0.269)	0.146 (0.235)	-0.330 (0.292)	0.157 (0.487)	0.034 (0.418)	-0.475 (0.477)	-0.316 (0.402)	-0.156 (0.387)	-0.162 (0.527)	-0.295 (0.423)	0.401 (0.463)
2004	-0.043 (0.315)	-0.003 (0.269)	-0.043 (0.235)	-0.192 (0.292)	-0.776 (0.487)	0.213 (0.418)	0.029 (0.477)	-0.608 (0.402)	-0.416 (0.387)	-0.403 (0.527)	-0.204 (0.423)	0.383 (0.463)
2005	-0.052 (0.315)	-0.152 (0.269)	0.222 (0.235)	-0.244 (0.292)	-0.346 (0.487)	-0.037 (0.418)	-0.048 (0.477)	0.144 (0.402)	-0.141 (0.387)	-0.067 (0.527)	-0.136 (0.423)	0.243 (0.463)
2006	-0.065 (0.315)	-0.220 (0.269)	0.027 (0.235)	-0.177 (0.292)	0.284 (0.487)	0.209 (0.418)	0.045 (0.477)	-0.441 (0.402)	-0.186 (0.387)	-0.229 (0.527)	-0.251 (0.423)	0.612 (0.463)
N	50	50	50	50	50	50	50	50	50	50	50	50
R-sq	0.562	0.644	0.712	0.728	0.642	0.539	0.557	0.715	0.543	0.248	0.750	0.732

Notes: OLS regression results based on Apprenticeship Training Data. Dependent variable: Log of number of high school graduates. Standard errors are shown in paranthesis. Reference period: 1997-1999. Treatment states: Mecklenburg-Western Pomerania and Saxony-Anhalt. Comparison states: Brandenburg, Saxony, Thuringia. Significance levels: *** 1%, ** 5%, * 10%.

Table 2: The effect on the number of apprentices

	Bank and insurance clerks	Accounting clerks	Clerks in the service sector	Office clerks	Technicians	Computer scientists	Art/design professions	Print occupations	Precision engineers	Laboratory assistant	Design draftsmen	Other merchants
2000	-0.037 (0.344)	-0.055 (0.314)	-0.140 (0.267)	-0.078 (0.285)	0.041 (0.291)	0.069 (0.430)	0.076 (0.450)	-0.273 (0.444)	-0.039 (0.389)	-0.130 (0.416)	-0.170 (0.613)	-0.159 (0.311)
2001	-0.203 (0.344)	-0.176 (0.314)	-0.157 (0.267)	-0.123 (0.285)	0.042 (0.291)	0.408 (0.430)	0.045 (0.450)	-0.154 (0.444)	-0.114 (0.389)	-0.196 (0.416)	-0.040 (0.613)	-0.100 (0.311)
2002	-0.035 (0.344)	-0.101 (0.314)	-0.124 (0.267)	-0.104 (0.285)	0.070 (0.291)	0.395 (0.430)	0.065 (0.450)	-0.009 (0.444)	-0.125 (0.389)	-0.068 (0.416)	-0.291 (0.613)	-0.077 (0.311)
2003	-0.005 (0.344)	-0.195 (0.314)	0.203 (0.267)	-0.087 (0.285)	0.098 (0.291)	0.181 (0.430)	-0.236 (0.450)	-0.311 (0.444)	-0.205 (0.389)	0.070 (0.416)	-0.294 (0.613)	-0.030 (0.311)
2004	0.011 (0.344)	-0.148 (0.314)	0.071 (0.267)	-0.067 (0.285)	-0.170 (0.291)	0.117 (0.430)	0.169 (0.450)	-0.249 (0.444)	-0.108 (0.389)	0.008 (0.416)	-0.386 (0.613)	-0.080 (0.311)
2005	-0.012 (0.344)	-0.155 (0.314)	0.138 (0.267)	-0.118 (0.285)	0.056 (0.291)	0.149 (0.430)	-0.004 (0.450)	-0.065 (0.444)	-0.043 (0.389)	0.032 (0.416)	-0.224 (0.613)	0.020 (0.311)
2006	-0.001 (0.344)	-0.173 (0.314)	0.135 (0.267)	-0.065 (0.285)	0.256 (0.291)	0.243 (0.430)	0.038 (0.450)	-0.177 (0.444)	-0.098 (0.389)	0.028 (0.416)	-0.365 (0.613)	0.458 (0.311)
N	50	50	50	50	50	50	50	50	50	50	50	50
R-sq	0.354	0.517	0.415	0.304	0.672	0.573	0.395	0.513	0.438	0.196	0.479	0.795

Notes: OLS regression results based on Apprenticeship Training Data. Dependent variable: Log of number of apprentices. Standard errors are shown in paranthesis. Reference period: 1997-1999. Treatment states: Mecklenburg-Western Pomerania and Saxony-Anhalt. Comparison states: Brandenburg, Saxony, Thuringia. Significance levels: *** 1%, ** 5%, * 10%.

The results when using the overall number of apprentices in logs are contained in Table 2. For none of the occupations, there is a statistically significant result. When looking at the number of apprentices with intermediate school degree (see Table 3), there is again no statistically significant result. For the clerk occupations where the number of high school graduates was reduced as a reaction to the school reform, the sign of the coefficients from Table 2 and Table 3 will be interpreted additionally. This provides suggestive evidence on how the omission of high school leavers was addressed by firms. The negative coefficient of the number of apprentices is descriptive evidence that the gap of high school leavers could not be fully compensated, even though some of the high school graduates were substituted with graduates from intermediate school as a positive coefficient of the number of intermediate school graduates for most of the clerk occupations suggests.

Table 3: The effect on the number of intermediate school graduates

	Bank and insurance clerks	Account- ing clerks	Clerks in the service sector	Office clerks	Techni- cians	Computer scien- tists	Art/design profes- sions	Print occu- pations	Precision engin- eers	Labor- atory assistant	Design drafts- men	Other mer- chants
2000	0.194 (0.544)	-0.240 (0.561)	-0.141 (0.367)	-0.042 (0.356)	-0.259 (0.313)	0.022 (0.495)	0.191 (0.516)	-0.257 (0.585)	-0.039 (0.462)	-0.206 (0.457)	-0.252 (0.799)	-0.457 (0.372)
2001	0.376 (0.544)	0.275 (0.561)	0.114 (0.367)	-0.017 (0.356)	-0.132 (0.313)	0.483 (0.495)	0.193 (0.516)	-0.095 (0.585)	-0.022 (0.462)	-0.145 (0.457)	-0.078 (0.799)	-0.301 (0.372)
2002	0.406 (0.544)	-0.324 (0.561)	0.002 (0.367)	-0.101 (0.356)	-0.103 (0.313)	0.412 (0.495)	0.293 (0.516)	0.141 (0.585)	-0.018 (0.462)	0.143 (0.457)	-0.127 (0.799)	-0.393 (0.372)
2003	0.250 (0.544)	-0.202 (0.561)	0.210 (0.367)	-0.040 (0.356)	-0.089 (0.313)	0.162 (0.495)	-0.055 (0.516)	-0.242 (0.585)	-0.249 (0.462)	0.212 (0.457)	-0.304 (0.799)	-0.279 (0.372)
2004	0.402 (0.544)	-0.455 (0.561)	0.114 (0.367)	0.002 (0.356)	0.011 (0.313)	-0.046 (0.495)	0.465 (0.516)	-0.027 (0.585)	0.024 (0.462)	0.178 (0.457)	-0.413 (0.799)	-0.337 (0.372)
2005	0.185 (0.544)	-0.180 (0.561)	0.070 (0.367)	-0.070 (0.356)	0.199 (0.313)	0.153 (0.495)	0.081 (0.516)	-0.037 (0.585)	0.135 (0.462)	0.275 (0.457)	-0.224 (0.799)	-0.123 (0.372)
2006	0.326 (0.544)	-0.158 (0.561)	0.141 (0.367)	-0.021 (0.356)	0.183 (0.313)	0.108 (0.495)	-0.080 (0.516)	-0.018 (0.585)	-0.025 (0.462)	0.258 (0.457)	-0.379 (0.799)	0.222 (0.372)
N	50	50	50	50	50	50	50	50	50	50	50	50
R-sq	0.286	0.298	0.125	0.144	0.640	0.564	0.167	0.231	0.335	0.193	0.294	0.673

Notes: OLS regression results based on Apprenticeship Training Data. Dependent variable: Log of number of apprentices with medium school degree. Standard errors are shown in paranthesis. Reference period: 1997-1999. Treatment states: Mecklenburg-Western Pomerania and Saxony-Anhalt. Comparison states: Brandenburg, Saxony, Thuringia. Significance levels: *** 1%, ** 5%, * 10%.

To check the robustness of the results, a variety of sensitivity tests were undertaken where the number of high school graduates was used as dependent variable. Since there were only statistically significant results for clerk occupations, the sensitivity checks are restricted to these occupations. For ease of exposition, all clerk occupations were considered in a single regression where occupation fixed effects are applied. The sensitivity results are presented in Table A-3 in the Appendix. The results remain robust when dropping Brandenburg from the comparison group. It was also examined how the results change when considering Mecklenburg-Western Pomerania or Saxony-Anhalt in separated regressions. This leaves the results unchanged, which also holds true when using additionally 1995 as reference period for Mecklenburg-Western Pomerania and 1997 for Saxony-Anhalt. When using West German states as comparison group, the results remain constant once again. Interestingly, the coefficients increased compared to the other specifications which could e.g. be attributed to a lower mobility effect. However, using the more heterogeneous West states as comparison comes at the cost of rising standard errors that result in less precise estimates.

In Table A-4 in the Appendix, results of a placebo-test are provided, i.e. applying the difference-in-difference approach to the pre-reform years 1997 to 1999. In accordance with the sensitivity checks, the analysis focuses on clerk occupations and the number of high school graduates is used as dependent variable. The results indicate that there are no statistically significant results in any of the years. Additionally, it was tested whether there was a time trend between treatment and comparison group in the pre-reform period. This

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could not be confirmed on a statistically significant level (results not shown) which is why we conclude that using 1997 to 1999 as comparison years is justified.

In sum, while clerk occupations reacted most sensitive to the shock as the number of highly skilled school graduates was reduced sharply, we cannot find a significant effect in other occupations. Two reasons can be suggested for this finding. First, the average fraction of female apprentices and of apprentices with high school degree is high in clerk occupations. Second, the possibilities to substitute high school graduates from other occupations were limited. This is because substitution is more likely in occupations that have similar training contents. For instance, someone who is interesting in becoming a clerk in the service sector might also change his or her career aspirations to become an office clerk. However, he or she will be less likely to switch e.g. to an art or design profession or apply for an apprenticeship as laboratory assistant. The second part of this paper investigates how the shock affected apprentices' wage and career development in these occupations.

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4. How did the labor supply shock affect wages and career progression of apprentices?

XX to come XX

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5. Conclusion

XX to come XX

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Appendix

Figure A-1: Map of Germany



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Table A-1: Assignment of vocational preparation schools to regular school degree

Type of vocational prep school	Description	Assigned to
Vocational preparation school	Usually one year of full-time classes preparing for vocational training; mandatory for adolescents who did not reach compulsory schooling age and have not obtained an apprenticeship contract; the lower school degree can be achieved	lower school degree
Year of basic vocational training	One year of full-time vocational schooling within one field of occupation (e.g. metallic or electric engineering, business studies/ economics)	lower school degree
Vocational school	At least one year of full-time schooling where skills are learned that are also part of regular apprenticeships; a vocational degree can be obtained in some occupations; some skills can be transferred to a regular apprenticeship	medium school degree
Other school degree	E.g. school degree obtained abroad or school degree unknown	medium school degree

Table A-2: Description of occupations with high fraction of high school leavers

Occupation group	Description
Bank and insurance clerks	Bank and insurance clerks
Accounting clerks	Accounting clerks, consultants
Clerks in the service sector	Clerks in the service sector (e.g. logistics, tourism, events, advertisement, real estate)
Office clerks	Office clerks, industrial clerk, lawyer assistant, municipal clerk, judicial clerk
Technicians	Technician for equipment and technology (e.g. for transport, road and water systems)
Computer scientists	Computer programmer/operator, IT administrator, assistant in informatics
Art/design professions	Art/design professions: Product designer, make-up and scene artist, photographer
Print occupations	Print and print finishing occupations
Precision engineers	Precision engineers, jeweler, optician, dental technician, making watches and toys
Laboratory assistant	Laboratory assistant (e.g. for physics, chemical, biology, lacquer), material tester
Design draftsmen	Design draftsmen, architectural draftsmen
Other merchants	Pharmacy assistant, Digital and print media assistant, filling station attendant, bookseller

Table A-3: Sensitivity analysis

Sensitivity checks	Coeff.	Std. Error
Exclude Brandenburg from comparison states	-0.460 ***	0.157
Separate regression for Mecklenburg-Western Pomerania	-0.519 ***	0.186
Separate regression for Saxony-Anhalt	-0.521 ***	0.177
Pre-announcement reference period for Mecklenburg-Western Pomerania (1995)	-0.544 **	0.239
Pre-announcement reference period for Saxony-Anhalt (1997)	-0.494 **	0.220
Using West German states as comparison	-0.694 *	0.358

Notes: OLS regression results with occupation fixed effects based on Apprenticeship Training Data. Only clerk occupations considered. Dependent variable: Number of high school graduates. Significance levels: *** 1%, ** 5%, * 10%.

Table A-4: Placebo test

Placebo test (1997 versus 98/99)	Coeff.	Std. Error
1997		Base group
1998	0.050241	0.188327
1999	0.052468	0.188327
N		60
R-sq, within		0.128
R-sq, between		0.597

Notes: OLS regression results with occupation fixed effects based on Apprenticeship Training Data. Only clerk occupations considered. Dependent variable: Number of high school graduates. Significance levels: *** 1%, ** 5%, * 10%.