Train or Hire? Labour Immigration and Firms' Investments in Workers' Skills

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Abstract

In this paper we analyse if the large influx of labour immigrants after the EU-expansion has affected firm's investments in human capital in the receiving country. We choose to look at the BaC industry since many of the immigrant after the EU-expansion, entered the BAC-industry. The empirical approach is twofold: in the first, we estimate firm-fixed OLS and IV-models, estimating the effects of the share of immigrants in narrowly defined business areas on the number and probability of apprentices. In the second approach we use an DD-approach, using the EU expansion in 2004 to analyse the development in apprentices for two groups of firms: those exposed and those less exposed to the increased inflow of labour immigrants.

The results suggest that inflow of immigrants reduce the firms' incentives to invest in apprentices, measured both by number of apprentices, and the probability of having apprentices (extensive margin). These results appear in both the empirical approaches we use, first in the firm-fixed effect IV-approach, and in the DD-approach. This result suggests that firms substitute away from training their own workforce to hiring more immigrant workers, when then the inflow of labour immigrants increase. The results are robust to including control for the supply side mechanisms.

JEL Classification: Labour immigration; Firm behaviour; Labour demand; Apprenticeship training.

Keywords: D22; J23; J61; M53.

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1. Introduction

The expansion of European labour markets in the European Union (EU) has substantially increased the international migration of workers. For high-income countries in the European Economic Area (EEA) such as Norway, the 2004 EU enlargement had especially large effects on the supply of manual workers. The EU enlargement led to a rapid increase in labour immigration, and a large share of the labour immigrants entered the Building and Construction (BaC) industry. A relatively large literature has looked at the consequences of increasing the EU-labour market, mostly focussing on wages and earnings of domestic workers. Many of these studies have found negative effects on wages and earnings on native, male, vocational skilled workers in Norway (Bratsberg, Raaum, 2012, Finseraas, Røed, Schøne, 2019) and in Finland (Kousmanen and Meriläinen, 2022).

In this paper we analyse another side of increased international migration; we analyse if the large influx of labour immigrants after the EU-expansion has affected firm's investments in human capital of their workforce. We choose to look at the BaC-industry since many of the immigrant after the EU-expansion, entered the BAC-industry. Firms in this industry has a long history of training new employees through investments in apprentices. This is an important of the skilling of new generations of craftsmen in this industry. A well-functioning apprenticeship system is also considered important for combating youth unemployment. Several countries face large problems related to youth unemployment, which could lead to a "scarred" generation facing long periods of unemployment and inactivity.

We analyse whether increased labour immigration into this sector affected the firm's decision to invest in apprenticeships. The firm faces a decision whether to invest in apprenticeship or hire labour immigrants. We analyse whether the incentives for employers to provide relevant training for their apprentices are reduced as fully trained workers become more available in the open labour market.

Training apprentices is costly for employers. The apprentices will initially have lower productivity compared to fully trained, and they require training and following up in the apprenticeship period. A large change in the supply of skilled workers may tip the balance between training and hiring. We hypothesize that easier access to labour immigrants decrease the costs of hiring skilled workers, and eventually also the wages of skilled workers, and that this will lead some firms to substitute away from training their own workforce to hiring more immigrant workers.

To identify the causal effect of increased labour supply from immigration in firm's training investments, we use two approaches, both exploit that some parts of the BAC industry are more or less exposed to increased immigration due to licensing requirements. Mainly due to safety reasons, some occupations, such as electrician and plumber, need a license to perform their work, while other occupations, such as painter and carpenter, need not. In the first approach we follow Bratsberg and Raaum (2012) and split the BaC industry into licensed and not licensed business area (explained later). In the second approach, we use information on occupational licensing requirements within detailed educational codes.

The empirical approach is twofold: in the first, we estimate firm-fixed OLS and IV-models, estimating the effects of the share of immigrants in narrowly defined business areas on the number of apprenticeships and probability of having apprentices. In the second approach we use an DD-approach, using the EU-expansion in 2004, that significantly increased the number of labour immigrants into Norway from Eastern Europe, to analyse the development in apprentices for two groups of firms: those exposed and those less exposed to the increased inflow of labour immigrants.

The results in this paper show that inflow of immigrants reduce the firms' incentives to invest in apprentices, measured both by number of apprentices, the share of apprentices, and the probability of having apprentices (extensive margin). These results appear in both the

empirical approaches we use, first in the firm-fixed effect IV-approach, and the DD-approach. This result suggests that firms substitute away from training their own workforce to hiring more immigrant workers, when then the inflow of labour immigrants increase substantially.

A large part of the literature that has analysed effect of immigration on domestic labour markets, have focussed on it effect on wages. The empirical literature has not reached consensus with respect to the size of the effects and includes studies reporting negative and sizable effects (see e.g., Borjas, 2003) and studies reporting small and not statistically significant and even positive impacts (see e.g., Ottaviano and Peri (2012)). Part of the reason for the empirical controversy is related to differences in methodological approaches that identify parameters that are not directly comparable (Dustmann et al., 2016).

We build more directly on the literature that addresses the influence of immigration on investments in human capital in receiving countries (Røed and Schøne, 2016, Hunt, 2012, Aepli and Kuhn 2021). Aepli and Kuhn (2021) is a recent related paper. They study whether Swiss employers substitute between training apprentices and hiring cross-border workers. They account for potential endogeneity issues by instrumenting a firm's share of cross-border workers using a firm's distance to the national border and therefore its possibility to fall back on cross-border workers to satisfy its labour demand. They find that both OLS and IV-estimates are negative across a wide range of alternative specifications, suggesting that firms substitute between training and hiring workers when the supply of skilled workers is higher.

The paper proceeds as follows: The next section gives a brief presentation of the educational system in Norway, Section 3 discusses the EU expansion, licensing and labour immigration, Section 3 presents the empirical approach, Section 4 the data and variables, while the results are presented in Section 5, and Section 6 concludes.

2. The educational system in Norway

Compulsory education in Norway consists of seven years of primary and three years of lower secondary education. Since 1997, when the starting age was lowered from seven to six and years of compulsory education was increased from nine to ten, compulsory school normally runs from age six to 16. After graduating from compulsory lower secondary school, students can leave the school system or enroll into upper secondary school. More than 95 percent of youths in each cohort choose the latter alternative. When entering upper secondary school, students must choose between an academically oriented track, which gives access to a university or college education, and a vocational track, which leads to an occupational qualification. The academic programme normally takes three years. The vocational programme usually consists of two years of school-based learning, followed by two years of apprenticeship at a firm.

By the end of the second year in upper secondary school students in the vocational track must – if the necessary exams are passed - apply for apprenticeship, by either contacting a firm directly or go through the local school administration. The number of apprentices in the vocational track is the result of decisions of students, firms that hire, and the local school administration (county). Firms that can hire apprentices must all be registered as a "Apprenticeship firm" ("Lærebedrift"). The local school administration has a coordinating role, by focussing on local dimensioning of apprenticeships. The apprenticeship firm is entitled a public grant, which is meant to cover costs that the firm has related to the apprenticeship position. The grant is meant to cover costs the firm has the first year of the apprenticeship period, where time used to instruct is largest. In the second year it is considered that the apprentice contributes to value creation in the firm and is thus not compensated. The grant is meant to cover on full year with instructions. The calculation of the apprenticeship grant is based on a principle that the subsidy should correspond to what a year in school would have

cost. In 2016, the grant for one year and one apprenticeship was equal to 139,066 Norwegian kroner (approximately 14,000 EURO).

At the beginning of the apprenticeship, most of the time is spent on training, but eventually the apprentice is supposed to participate in the usual work tasks in the workplace, with the same rights and obligations as other employees in the firm. The apprentice is entitled to continuous follow-up and assessment throughout the apprenticeship period. The apprentice is paid salary that equals a share of a worker that has passed apprenticeship. The share increases with the length the apprenticeship period, and normally reaches 80 per cent by the end of the period. At the end of the two year period, a formal is test is required, and if passed, the apprentice receives the certificate. When the training period is over and the exam is passed, the firm has no further obligations, and the student is free to seek employment elsewhere. Still, if the match between firm and student is good, the apprentice is often hired at the training firm at similar terms as already skilled workers.

3. The EU expansion, licensing and labour immigration

Immigrant inflow to Norway increased substantially over the last 20 years. In the mid-1990s, the total gross inflow of immigrants was about 15,000 a year, while in 2012, inflows reached about 65,000. All types of immigration increased over this period, but the most important increase is labour immigration after 2004. Prior to 2004, labour immigration to Norway was fairly limited and quite stable from year to year. From 2004, the European Economic Area was expanded with 10 new member countries, including Poland. The expansion led to a rapid increase in labour immigration from a couple of thousand in 2004 to about 25,000 in 2012.

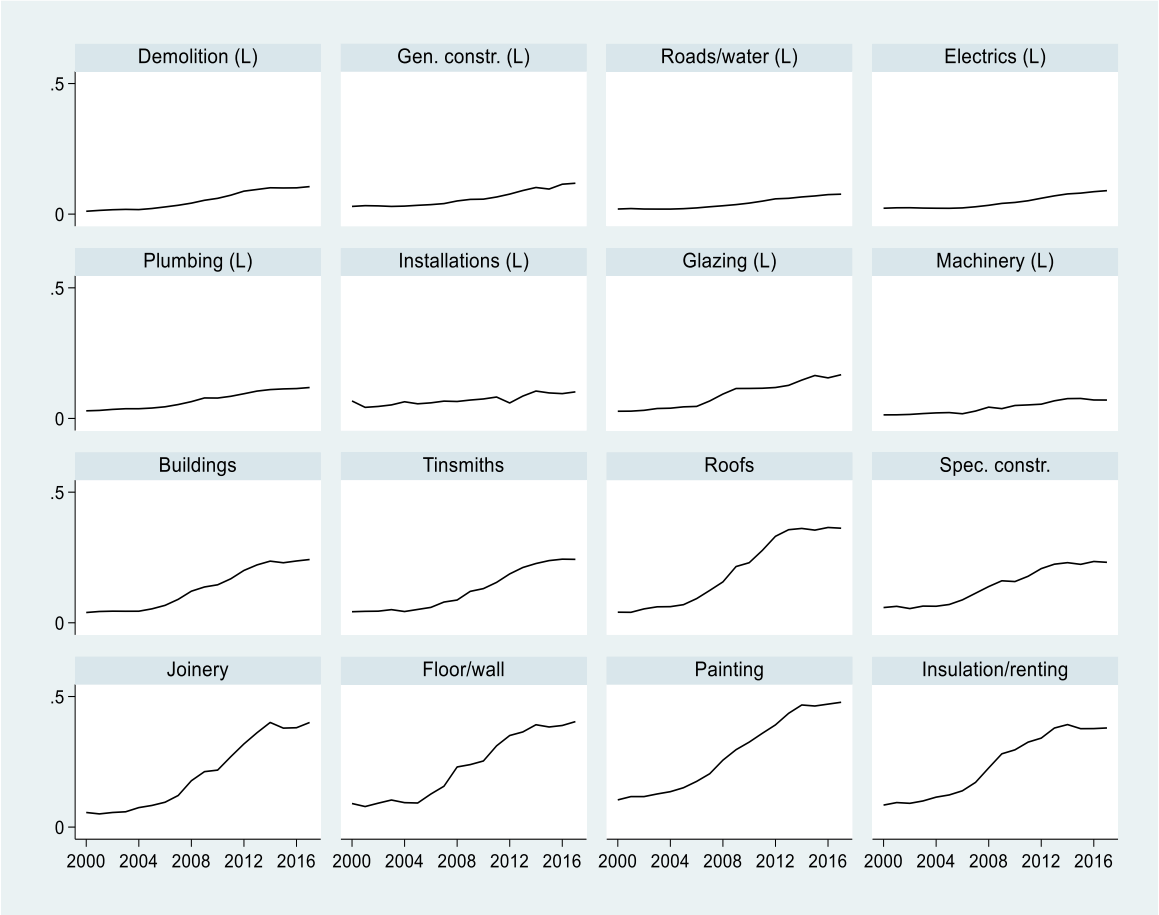
About one third of the labour immigrants that arrived after 2003 entered the BaC industry (own calculation), which thus experienced a positive labour supply shift. While a large share of labour immigrants from the old EU countries tend to return home after some

years, about 70% of immigrants from the new member states settle permanently in Norway (Bratsberg et al., 2017: 22).

We exploit licensing and certification demands to get exogenous variations in the immigration shock within the BaC industry. Occupational licensing occurs when the law (or insurance companies) requires that all workers in an occupation pursue specialised vocational education to execute the tasks that fall into their profession. For example, insurance companies and public building inspectors demand that plumbing and electric work is performed by workers with proper credentials, nationally approved licenses are in place to operate heavy machinery, and particular certificates have been earned to handle dangerous materials or to install lighting and light-signalling systems for roads, railways, airfields and harbour facilities. Such credentials typically follow from the completion of the relevant vocational education, and similar types of education or licenses from abroad are typically not accepted. The implication is that workers who have completed a vocational education programme that entails licensing and certification are effectively protected from labour immigration.

To illustrate the effect of licensing on labour immigration, we present some illustrative means for so-called 'business areas'. The BaC industry can be divided into 16 business areas or trades, defined by five-digit industry codes. Each trade tends to be dominated by workers with one particular type of vocational education. Figure 1 graphs the development of the share of immigrants in each of the 16 trades from 2000 to 2018. Trades that are dominated by protected workers are indicated by *L* in the figure.

Figure1. Immigrant share by trades in the BaC industry.



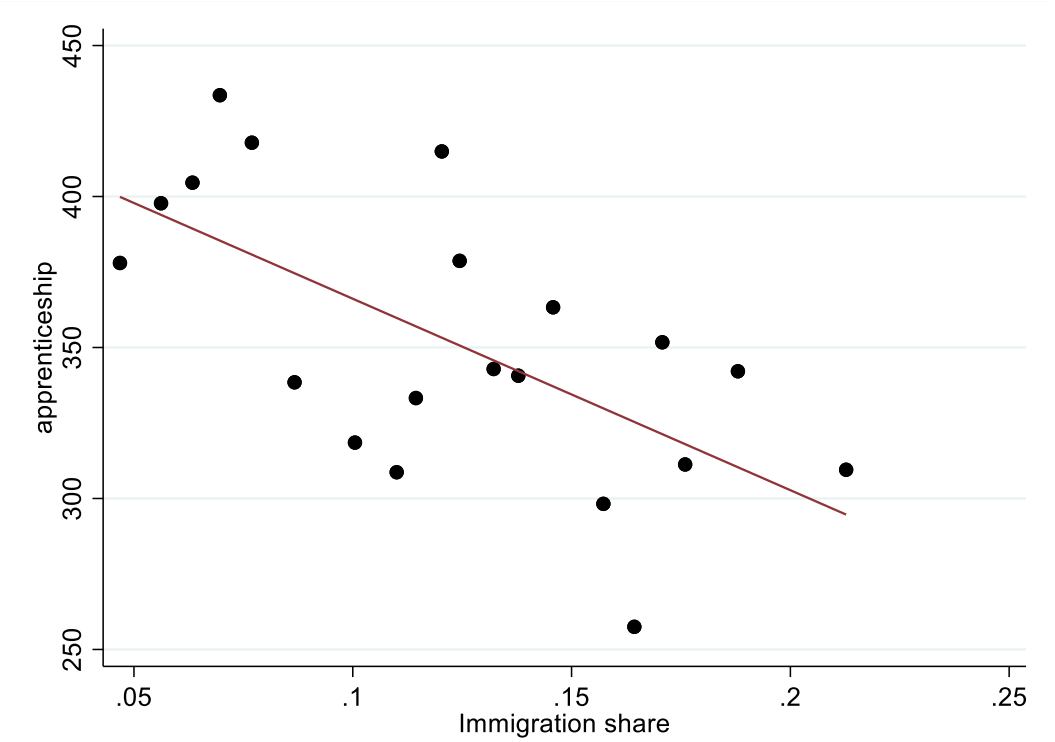
Note: Workers' industry of employment is classified using employer–employee identifiers.

We see that the increase in immigrant share from 2004 is large in most of the trades without protection, compared to the trades with protection. In several of the non-licensed trades, the share of immigrants approaches 50% at the end of the period.

Figure 2 visualises the relationship between immigration and number of apprenticeships within trades over time. Each dot consists of 5% of the observations and is displayed in the figure according to the average number of apprenticeships within that bin, controlling for trade area and year fixed effects. The regression line is the relationship between immigrant share and number of apprenticeships based on the underlying data. The

figure shows a negative correlation between immigrant share and number of apprenticeships at the trade area level.

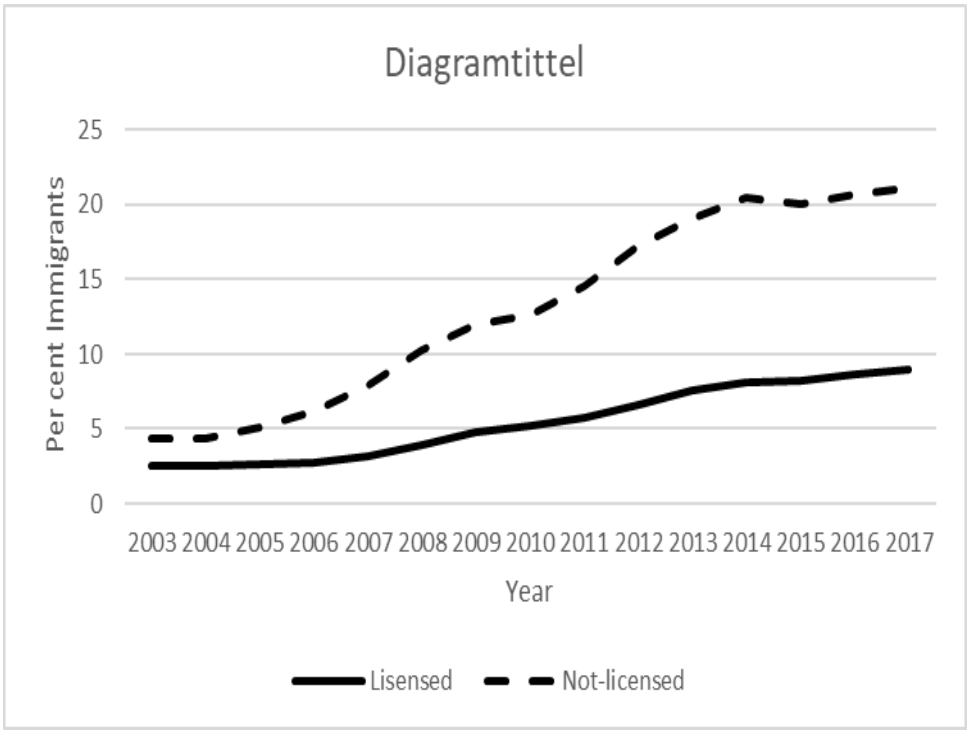
Figure 2. Immigrant share and number of apprenticeships.



Note: The figure displays the relationship between immigrant share and number of apprenticeships, controlling for year and trade area fixed effects. The bins represent the mean number of apprenticeships for 20 equal-sized bins of immigrant share (see Stepner, 2013). The line is the regression line based on the underlying data

Next, Figure 3 shows the share immigrants in licensed and not-licensed occupations (explained in more detailed in section 4). The figure shows that the increase in the immigrant share is especially large in occupations that do not require a license; in those occupations, the immigrant share increases to a we analyse above 20 percent in the period. In licensed occupations, the share increases only to around 9 percent. Therefore, licensing requirements seem to have effectively sheltered some workers from labour market competition although they are not completely sheltered.

Figure 3. Share immigrants in licenced and not-licensed occupations



The degree to which licensed occupations are also affected by the EU enlargement depends among other things on how easy it is for immigrants to get the right certifications and enter licenced occupations, the substitutability of licensed and non-licenced occupations in production, and general equilibrium effects such as increased demand for all types of products and services when the population grows. Figure 3 shows that immigrants do enter licensed occupations as well, but to a much smaller degree.

3. Empirical approach

We use two different empirical approaches. In the first approach, we estimate variants of equation (1), for firms in the BAC industry:

$$(1) \quad Y_{jt} = \alpha_j + \beta IMM_{bt} + \gamma_t + \delta X_{jt} + \varepsilon_{jt}$$

Where Y_{jt} is the outcome in firm j at time t. We use three firm level outcome measures: number of apprentices, the share of the firm's workforce that are apprenticeships, and a binary variable, measuring whether the firm has apprentices or not. IMM_{bt} is the share of immigrants in business area b in year t. X contains time-varying firm-level control for number of employees. The period of observation is 1999-2017. We also include firm- and year-fixed effects. The key parameter to be estimated is β, measuring the impact of the immigrant share in business area b at year t, on the number of apprentices at firm j in year t. We present both OLS and IV-versions of (1).

In the IV-version, we instrument the immigrant share using two approaches. In the first approach we use the following two step procedure. The instrument is given by the product of inflow of immigrants to the BaC industry (IMFLOW) and the ratio of the number of workers in licensed occupations in trade area *b* in 2003 (ELIb,t=2003), and the total number of workers in licensed occupations in 2003 (ELI_t=2003), i.e., the instrument is $IMFLOWx\frac{\text{ELIb,t=2003}}{\text{ELIt=2003}}$. IMFLOW is measured as a ratio; the annual inflow of immigrants to the BAC industry is divided by the total number of employees in the BAC industry.

With this IV-approach, we construct a predicted immigrant inflow by distributing all incoming immigrants to the BaC industry as if the initial licensing share of each trade completely determines the allocation of the incoming immigrants. To measure if the worker is in a licensed occupation, we use *the Norwegian Occupational Regulations Database (NORD)* which registers the prevalence of occupational licensure and certifications. In this database, "[a]n occupation is classified as licensed if the right to practise is regulated by the authorities by law or by regulations of the law." (Alecu and Drange, 2016; Bol and Drange, 2017). The regulations determine the educational requirements, which must be fulfilled to practice within an occupation. Mainly due to safety reasons, some occupations, such as electrician and plumber, need a license to perform their work, while other occupations, such as painter and carpenter, need not. Access to a licensed occupation is given to workers with certified vocational training

(e.g., education as an electrician). The right to work in a licensed occupation can also be given to immigrant workers, but usually after a lengthy bureaucratic process for formal approval of their educational skills. Thus, the requirements give native Norwegians with the right education a competitive advantage with regard to employment in licensed occupations

As a second instrument, we exploit information on the share of workers in licensed occupations within detailed educational codes, and the mean share of this value within each of the 16 business areas, measured in 2003. To construct the instrument, we start by constructing the mean share of licensed workers with two-digit educational codes. We limit the construction to skilled vocational educational tracks with craftsmanship, that is codes measuring a completed vocational education (concretely, we limit the construction to two-digit educational code 45, as defined by the Standard Classification of education (NUS)). Next, we construct mean values of this measure within the 16 business areas. The instrument is then: $IMFLOWxMLW_{bt=2003}$, where IMFLOW is explained above, and MLW is the mean share of workers in licenced occupations within two-digit educational codes explained above), in business area b, in 2003.

In the second empirical approach, we estimate *DD-variants* of equation (2):

$$(2) \quad Y_{jt} = \alpha_j + \sum_{t=1999}^{t=2017} \beta_t \, Treat_j T_t + \gamma_t + \varepsilon_{jt}$$

where Y_{jt} are the outcome variables measured in year t (1999–2017) for firm j. $Treat_j$ is the treatment dummy equal to 1 if the firm is exposed to competition from labour immigration, and 0 if the firm is more sheltered. T is a vector of year indicators from 1999 to 2017; 2003 is omitted as the reference year. βt are the coefficients of interest. They are the coefficients on the interaction term $Treat_j \times Tt$; the estimated difference between the treatment and comparison groups in all the years 1999–2017 (omitting 2003 as the reference year). The pre-treatment

estimates (1999–2002) serve as tests of similar pre-trends. The post-treatment estimates are the reduced form yearly effects of the EU enlargement on skill investments of exposed firms relative to more sheltered firms.

To increase the robustness of the results we employ two definitions of treat and control. In the *first* definition we use the firm's business area. From Figure 1, all business areas that are not licensed are defined as treatment groups, the rest, which is the licensed business areas, are defined as control group. The idea is that the treatment group of firms are more exposed to increased labour immigration. In the *second* definition we use the mean share licensed workers in the two-digit educational group (presented above), aggregated up at the firm level. At the firm level we define firms with mean share licenced workers below the average, as treatment groups, and those above, as controls.

The difference-in-differences identification strategy relies on a change in immigrant share in the treatment group relative to the comparison group but does not rely on zero changes in the immigrant share in the comparison group. What we use for identification is that some groups are more affected by the EU enlargement than other groups.

The key assumption in the DD-analyses is that treat, and control firms would have trended similarly in the absence of the EU expansion. This is a strong assumption. We will present pre-EU expansion DD-coefficients to see whether they trend differently prior to the shock. Furthermore, we will conduct a robustness check presenting analyses using entropy balancing weights, adjusting for pre-EU labour market expansion differences between treat and control firms (Hainmuller 2012). With weights, we are more confident that divergent trajectories in the two groups after the EU expansion are not due to different initial characteristics.

4. Data and variables

We use high-quality administrative register data with a panel dimension, collected and organised by Statistics Norway.

The sample consist of all firms in the BAC industry in the period 1999-2017, with complete panel data of both firms and the workforce, over the whole period, and not the least, complete information the firm's hiring's of apprentices. To be included in the sample we require the firm has 5 employees or more. Information on apprentices is based on detailed individual information from the Norwegian educational database, with timing of when this type education was undertaken, and link to the firm where the apprenticeship is undertaken. We link these individuals to firms, and then aggregate up to the firm level. We construct three measures of apprentice use: i) Number of apprentices, ii) the share apprenticeship of the workforce, and iii) a binary measure, measuring whether the firm has apprentices or not.

The key explanatory variables is the share of immigrants within each of the 16 business areas within the BAC industry in each year. This information is based on individual information from the Employer-Employee register, including detailed annual information on industry location, linked with information on birth country for each individual registered as working in the Bac industry. An immigrant is defined as an individual born outside Norway. We do not distinguish between different birth countries. In turn, individual information on industry location is aggregated up at the business area level, constructing the man immigrant share. As control variable, we include number of employees at the firm. Table A1 in Appendix presents descriptive statistic for the key variables.

The second sample is constructed to be used in the DD-approach, see equation (2). Treatment and control firms are defined in 2003, consisting of alle BAC-firms operative in that year. To be included in the sample we require the firm has 5 employees or more in 2003. The definition of treat and control groups is explained in Section 3. Then, we follow treat and

control firms from a pre-period (back to 1999) to a post period (to 2017). The dependent variables are also here number of apprentices, the share apprentices, and a binary variable measuring whether the firm has apprentices or not. Table A2 in Appendix presents descriptive statistic for the key variables for this sample.

5. Results

Fixed effects and IV-results

Table 1 present OLS and IV results from estimating (1), using the three measures of apprentices. The first three models present OLS estimates. The last six models present results from IV-estimations, using the two different IV-approaches.

Table 1. Immigration and apprentices

	(1) OLS_1	(2) OLS_2	(3) OLS_3	(4) IV_1	(5) IV_2	(6) IV_3	(7) IV_4	(8) IV_5	(9) IV_6
	N Apprentices hips	Share Apprentices hips	Binary measure	N Apprentices hips	Share Apprentices hips	Binary measure	N Apprentices hips	Share Apprentices hips	Binary measure
Share IMM	-1.850***	-0.0727***	-0.570***	-3.005***	-0.103***	-0.820***	-2.149***	-0.0919***	-0.748***
	(0.509)	(0.0235)	(0.135)	(0.696)	(0.0267)	(0.124)	(0.724)	(0.0341)	(0.167)
First stage				-64.950***			-0.0002***		
				(15.347)			(0.0000)		
Kleib-Paap F				15.56	15.56	15.56	30.43	30.43	30.43
N	129330	129330	129330	126163	126163	126163	126163	126163	126163
R^2	0.653	0.310	0.411	0.144	0.004	0.015	0.145	0.004	0.015

Note: Controls include number of employees, year fixed effects and firm-fixed effects. Standard errors in parentheses. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In all models, we find a negative a significant relationship between inflow of labour immigrants and the firm's use of apprentices. The estimate in Model 1 suggests that increasing the immigrant share by 10 percentage points, reduces the number of apprentices by .185. The average number of apprentices is 0.73. This implies that increasing the immigrant share by 10 percentage points reduces the number of apprenticeships by approximately 25 per cent. Results for the share measure suggest that increasing the immigrant share by 10 percentage points, reduces the share with apprenticeships with 0.07 percentage points. A relative reduction of approximately 18 per cent, measured from the mean share apprentices. The binary specification suggests that an increasing the immigrant share by 10 percentage points reduces the likelihood of having apprenticeships by approximately 6 percentage points. This implies a relative reduction of approximately 17 per cent, measured from the mean share of firms with apprentices.

The last four models present IV-results. In general, the negative effects are amplified somewhat after instrumenting the immigrant share. Using the business area IV-approach (Model 4), the estimate for number of apprenticeships increases from -1.850 to -3.005. The increase in the negative effects is somewhat smaller for the binary measure, and especially for the share measure.

The Kleibergen-Paap F-test tells that the instruments have sufficient power in the first stage. The overall picture is that controlling for the endogeneity of the immigrant share, gives a somewhat stronger negative effects of immigration on all three measures of firm-level investments in apprenticeships. Reassuringly, the IV-results appear robust across the two IV-specification.

Controlling for supply-side mechanisms

The number of apprentices used in Table 1 is a result of decisions taken by both employers and students, i.e., from both the demand and supply side. To include control for the supply side we include the number of first-year students in BAC fields of study in the local county where the firm is located. In Table 2 we re-estimate Table 1, including control for the number of BAC students, locally.

Table 2. Immigrants and apprentices. Including control for number of BAC students

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS_1	OLS_2	OLS_3	IV_1	IV_2	IV_3	IV_4	IV_5	IV_6
Share IMM	-1.850***	-0.0727***	-0.570***	-3.016***	-0.103***	-0.820***	-2.156***	-0.0919***	-0.749***
	(0.514)	(0.0235)	(0.135)	(0.702)	(0.0267)	(0.124)	(0.727)	(0.0341)	(0.167)
BAC-students	0.000619**	0.0000045	0.0000388	0.00062***	0.0000045	0.0000388	0.000619**	0.0000045	0.0000388
	(0.000228)	(0.000004)	(0.000032)	(0.000211)	(0.000004)	(0.00004)	(0.000207)	(0.000004)	(0.00003)
N	129330	129330	129330	126163	126163	126163	126163	126163	126163
R^2	0.653	0.310	0.411	0.145	0.004	0.015	0.146	0.004	0.015

Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

For the number of apprentices (Model 1,4,7) we find a positive relationship between number of students in the county and number of apprentices at the firm. For the share measure and the binary measure, the relationships are positive, but not significant. The coefficients for the share of immigrants are almost unaltered after the inclusion of the number of students. This result suggest that the demand side Is an important determinant for explaining the number of apprentices at the firm.

Differences-in-differences results

In this section we present the DD-results. First, Table 3 presents descriptive statics for the dependent variables and firm size (number of employees), separately for treat and control firms. The time of measurement is 2003.

Table 3. Descriptive statistics. DD-sample. Treat and control firms

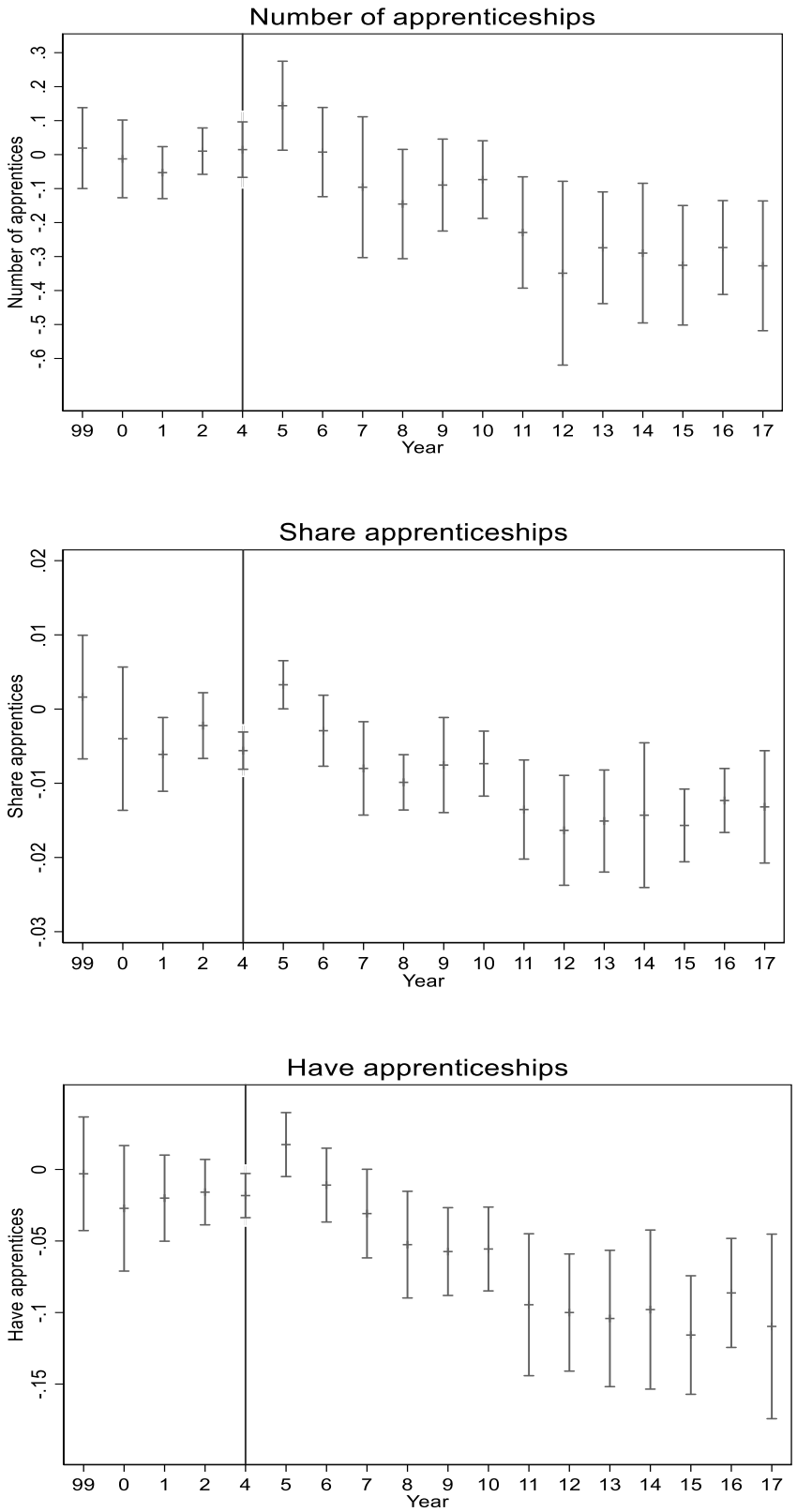
	Business area definition		Licensing requirements in groups of education	
	Treat	Controls	Treat	Controls
Number of employees	17.03	20.77	20.23	19.4
Number of apprentices	0.64	0.63	0.65	0.71
Share apprentices	0.04	0.03	0.04	0.04
Have apprentices	0.36	0.33	0.35	0.38
N	2929	3197	3164	2538

Note: Descriptives are measured in 2003.

In general, the differences in means between treat and control firms are modest. The two approaches for identifying treat and controls, differ somewhat in relative differences in means between treat and controls. Using the Business area approach, treat firms are somewhat smaller, and have somewhat small share of firms with apprentices. Using the Licensing requirements approach, the opposite is true. Still, the differences are fairly small.

Figure 4 presents DD-regression results for the three outcomes from estimating equation (2), using the first treatment definition, i.e., the business area definition. Full set of DD-coefficients are presented in Appendix, Table A4 and A5.

Figure 4. Immigration and apprentices. DD-analyses. Dependent variable: Number of apprentices, share, and binary measure of apprenticeships. Business area definition

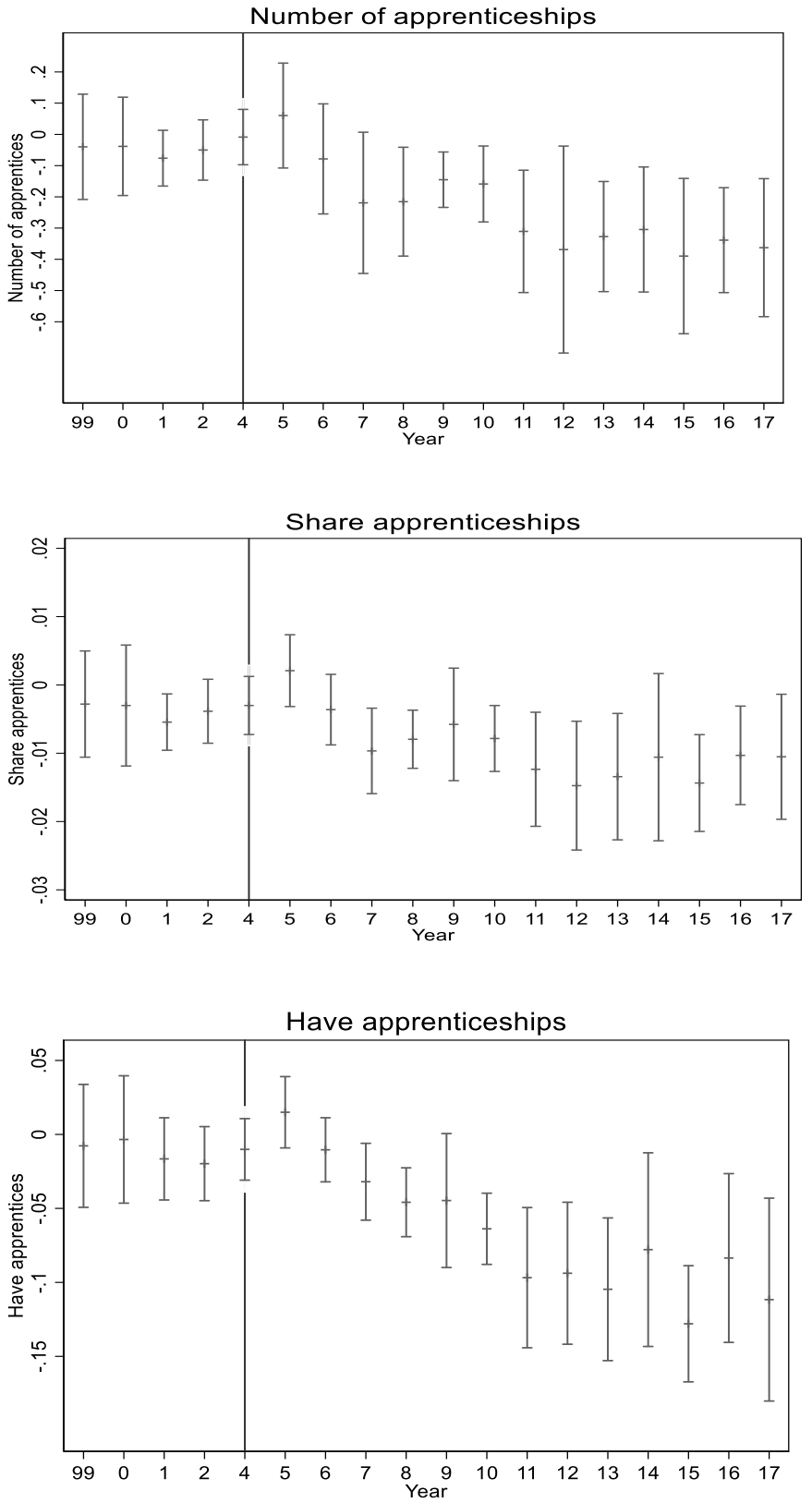


Note: Coefficients and 95% confidence intervals.

In general, we do not find that treat and control group firms are trending differently in the pre-period. In the post-period, the overall pattern is that treatment firms, that are more exposed to increased immigration after the EU-enlargement, respond by investing less in apprentice training. In general, the negative effects seem to be working rather slowly in the beginning of the post-period. This may be due to firms already having apprentices in their workforce when the EU-expansion started, and they wanted to complete these employment conditions. It could also be that the effects are more visible after some time, after the immigrant flow increased, and employers perhaps realised that the change from the EU expansion was lasting. In 2010, six years after the opening of the European labour market, the number of apprentices is down 0.055, the share is down approximately 1 percentage point, and the likelihood of having apprenticeships is down by approximately 3 percentage points. The patterns of the effects are quite similar across the three outcome specifications.

Figure 5 presents DD-regression results for the three outcomes, using the second treatment definition, i.e., the licensing requirements in groups of education. Full set of DD-coefficients are presented in Appendix, table Ax and Ay.

Figure 5. Immigration and apprentices. DD-analyses. Dependent variable: Number of apprentices, share, and binary measure of apprenticeships. Licensing requirements in groups of education



Note: Coefficients and 95% confidence intervals.

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The results using the second definition largely resembles the first definition. Treat and control firms do not trend differently in the pre-period, and firms more exposed to increased labour supply from immigration, experience a more negative development in apprenticeships, using all three measures. Again, we see that the outcome variables are rather slow to react.

Next, we present DD-results when we collapse pre- and post-periods to just one post-period and one post-period. The pre-period is 1999-2003, and the post-period is 2004-2017. We create mean aggregate values for the three measures of apprenticeship use for the two periods. To be included in this analysis we require the firms to be present in all years. Approximately 62 per cent of the firms is present in all years.

Table 4 presents the DD-coefficients from this exercise. The upper half presents results from the Business area approach, the latter half using the licensing requirements approach.

Table 4. Immigrants and apprentices. DD-regression. Aggregate pre- and post-periods

	Business area approach		
	N Apprenticeships	Share Apprenticeships	Binary measure
DD	-0.159***	-0.00696***	-0.0496***
	(0.0406)	(0.00142)	(0.0108)
Observations	61218	61218	61218
R^2	0.910	0.753	0.876
	Licensing requirements in groups of education		
	N Apprenticeships	Share Apprenticeships	Binary measure
DD	-0.188***	-0.00541**	-0.0575***
	(0.0340)	(0.00204)	(0.00617)
Observations	58007	58007	58007
R^2	0.909	0.744	0.871

Note: Controls include year fixed effects and firm-fixed effects. Standard errors in parentheses. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

In both specifications and for all three measures the DD-coefficients are negative and significant. This is in line with the disaggregated results in Figure 4 and 5. Using the business

area approach and the number of apprentices, the coefficient suggests that firms more exposed to increased labour supply from immigration reduces their number of apprenticeships from the pre- to the post-period by 0.159 number of apprentices, compared to firms less exposed. The mean number of apprenticeships in 2003 for the control group is 0.63 (see Table 2). This implies a relative reduction of approximately 25 per cent. The relative reductions for the share apprentices and the binary measure are 20 and 15 per cent respectively. Finally, the sizes of the DD-coefficients are stable across the two treat specifications.

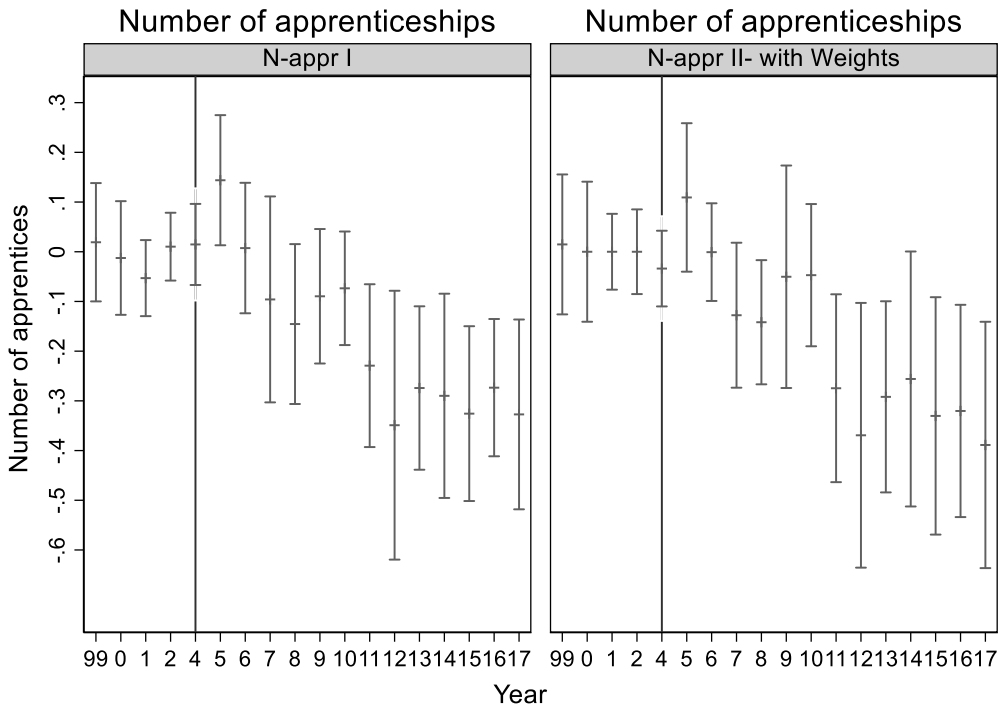
Robustness checks

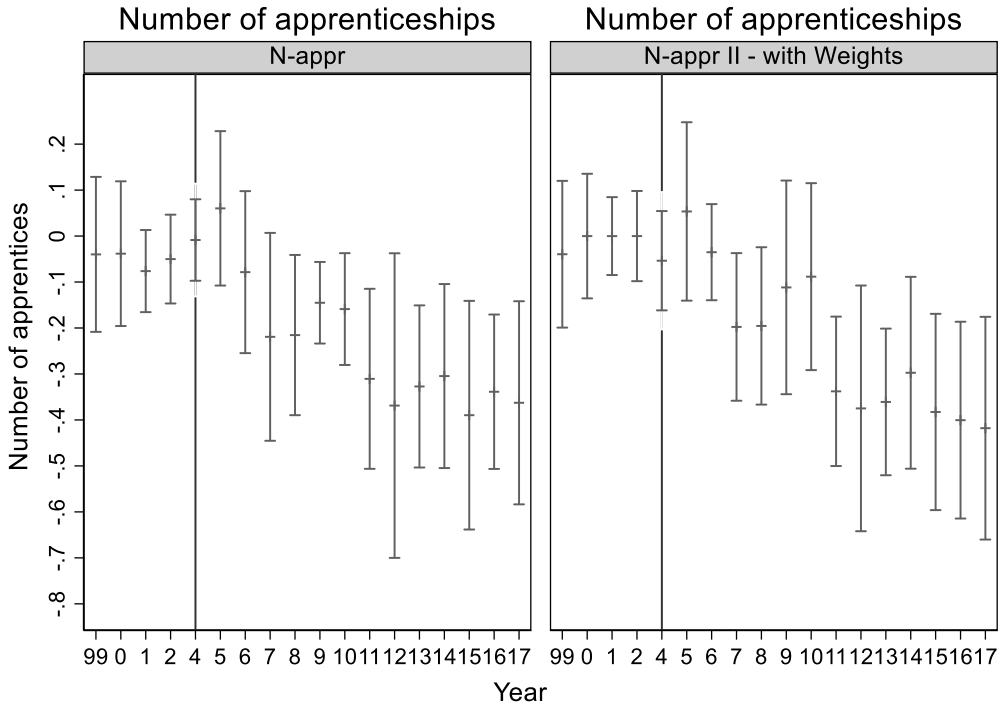
The key assumption for the DD-approach to reflect the effect of the immigration shock is that the two groups of firms would have had a similar year-by-year trajectory without the EU expansion. We have so far presented pre-trends that show similar patterns, which is reassuring. Still, one concern is that a different composition of the two groups with respect to background characteristics will violate this assumption, for instance, if there is a firm size difference between the two groups. We adjust for initial differences between the two groups by re-weighting the sample so that they are similar, on average, across a set of pre-variables. The pre-variables include number of employees, turnover, union density, number of apprenticeships, and mean firm-level wages. The pre-period years used for weighting are 2000-2003. For mean wages we only use observations from 2003. The weighting procedure we use is entropy balancing (Hainmueller, 2012). We balance on means values. Table A7 in appendix, presents the included weighting variables and their pre- and post-weighting values.

Figure 6 presents DD-coefficients for number of apprentices (share and the binary measure shows similar patterns but are not reported), with balancing weights (right panel) and without balancing weights (left panel). We include both the business area definition (upper

half) and licensing requirements in groups of education (lower half)

Figure 6. Immigration and apprentices. DD-analyses. Dependent variable: Number of apprentices. Business area definition (upper half) and Licensing requirements in groups of education (lower half)





Note: DD-Coefficients and 95% confidence intervals.

The weighting procedure do make the pre-immigration coefficients somewhat closer around zero. Still, the post coefficients are almost unaltered, suggesting the previous unweighted measures represent the true effect of increased immigration on skill investments. This is perhaps not surprising, when looking at the values of the weighting variables in Table A7. The treat and control firms have relatively similar values for the included variables.

6. Conclusions

The expansion of European labour markets in the European Union (EU) has substantially increased the international migration of workers. For high-income countries in the European Economic Area (EEA) such as Norway, the 2004 EU enlargement had especially large effects on the supply of manual workers. The EU enlargement led to a rapid increase in labour immigration, and a large share of the labour immigrants entered the Building and Construction

(BaC) industry. A relatively large literature has looked at the consequences of increasing the EU-labour market, mostly focussing on wages and earnings of domestic workers. Many of these studies have found negative effects on e\wages and earnings on native, male, vocational skilled workers in Norway (Bratsberg, Raaum, 2012, Finseraas, Røed, Schøne, 2019) and in Finland (Kousmanen and Meriläinen, 2022).

In this paper we analyse another side of increased international migration, we analyse if the large influx of labour immigrants after the EU-expansion has affected firm's investments in human capital in the receiving country. We choose to look at the BaC industry since many of the immigrant after the EU-expansion, entered the BAC-industry. Firms in this industry has a long history of training new employees through investments in apprentices. This is an important of the skilling of new generations of craftsmen in this industry.

The empirical approach is twofold: in the first, we estimate firm-fixed OLS and IV-models, estimating the effects of the share of immigrants in narrowly defined business areas on the number and probability of apprentices. In the second approach we use an DD-approach, using the EU expansion in 2004 to analyse the development in apprentices for two groups of firms: those exposed and those less exposed to the increased inflow of labour immigrants.

The results in this paper suggest that inflow of immigrants reduce the firms' incentives to invest in apprentices, measured both by number of apprentices, and the probability of having apprentices (extensive margin). These results appear in both the empirical approaches we use, first in the firm-fixed effect IV-approach, and the DD- approach. This result suggests that firms substitute away from training their own workforce to hiring more immigrant workers, when then the inflow of labour immigrants increase substantially.

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Appendix

Table A1. Descriptive statistics. Running sample

	All firms		10 employees or more	
	Mean	St.dev	Mean	St.dev
Number of apprentices	0.73	1.571	1.13	2.00
Share apprenticeships,	0.04	0.07	0.04	0.06
Have apprentices	0.36	0.48	0.50	0.50
N	135065		73029	

Table A2. Descriptive statistics. DD-sample

	All firms		10 employees or more	
	Mean	St.dev	Mean	St.dev
Number of apprentices	0.79	1.68	1.20	2.11
Share apprentices	0.04	0.07	0.04	0.06
Have apprentices	0.37	0.48	0.49	0.50
N	969181		51716	

Table A3. Immigration and apprentices. DD-analyses. Business area definition

	(1) Number of apprenticeships	(2) Share apprenticeships	(3) Having apprenticeships
99	0.0192	0.00162	-0.00301
	(0.0558)	(0.00391)	(0.0186)
0	-0.0125	-0.00399	-0.0272
	(0.0537)	(0.00453)	(0.0206)
1	-0.0530	-0.00611**	-0.0200
	(0.0359)	(0.00233)	(0.0141)
2	0.0103	-0.00222	-0.0158
	(0.0320)	(0.00208)	(0.0107)
4	0.0147	-0.00560***	-0.0183**
	(0.0383)	(0.00118)	(0.00724)
5	0.144**	0.00328**	0.0174
	(0.0614)	(0.00152)	(0.0105)
6	0.00744	-0.00292	-0.0109
	(0.0616)	(0.00224)	(0.0121)
7	-0.0959	-0.00800**	-0.0308*
	(0.0972)	(0.00295)	(0.0145)
8	-0.145*	-0.00987***	-0.0525***
	(0.0755)	(0.00175)	(0.0175)
9	-0.0896	-0.00754**	-0.0574***
	(0.0635)	(0.00301)	(0.0144)
10	-0.0735	-0.00735***	-0.0556***
	(0.0536)	(0.00205)	(0.0137)
11	-0.229***	-0.0135***	-0.0945***
	(0.0768)	(0.00313)	(0.0233)
12	-0.349**	-0.0163***	-0.1000***
	(0.127)	(0.00347)	(0.0192)
13	-0.274***	-0.0151***	-0.104***
	(0.0771)	(0.00323)	(0.0223)
14	-0.290***	-0.0143***	-0.0979***
	(0.0964)	(0.00457)	(0.0261)
15	-0.326***	-0.0157***	-0.116***
	(0.0825)	(0.00230)	(0.0194)
16	-0.273***	-0.0123***	-0.0863***
	(0.0648)	(0.00202)	(0.0179)
17	-0.327***	-0.0132***	-0.110***
	(0.0896)	(0.00355)	(0.0303)
Observations	96918	96918	96918
R^2	0.575	0.201	0.371

Note: Model 1 and 2 use the first treatment definition, i.e., the business area definition. Model 3 and 4 uses the second definition, i.e., using licensing requirements in groups of education. The difference between Model 1 and 2 (and 3 and 4) is inclusion of firm-fixed effects in Model 2 and 4. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A5. Immigration and apprentices. DD-analyses. Dependent variable: Having apprentices. Licensing requirements in groups of education

	(1) Number of apprenticeships	(2) Share apprenticeships	(3) Having apprenticeships
99	-0.0398	-0.00280	-0.00773
	(0.0791)	(0.00365)	(0.0195)
0	-0.0383	-0.00301	-0.00341
	(0.0739)	(0.00415)	(0.0202)
1	-0.0762*	-0.00544**	-0.0165
	(0.0419)	(0.00194)	(0.0130)
2	-0.0501	-0.00385*	-0.0198
	(0.0453)	(0.00220)	(0.0117)
4	-0.00860	-0.00301	-0.0101
	(0.0416)	(0.00199)	(0.00976)
5	0.0603	0.00209	0.0150
	(0.0788)	(0.00247)	(0.0113)
6	-0.0785	-0.00362	-0.0104
	(0.0827)	(0.00242)	(0.0102)
7	-0.219*	-0.00966***	-0.0320**
	(0.106)	(0.00294)	(0.0122)
8	-0.215**	-0.00795***	-0.0458***
	(0.0818)	(0.00200)	(0.0109)
9	-0.145***	-0.00578	-0.0447*
	(0.0416)	(0.00386)	(0.0212)
10	-0.159**	-0.00784***	-0.0638***
	(0.0570)	(0.00226)	(0.0113)
11	-0.311***	-0.0124***	-0.0968***
	(0.0919)	(0.00392)	(0.0222)
12	-0.369**	-0.0147***	-0.0938***
	(0.155)	(0.00442)	(0.0225)
13	-0.327***	-0.0134***	-0.105***
	(0.0827)	(0.00434)	(0.0226)
14	-0.305***	-0.0106*	-0.0779**
	(0.0939)	(0.00574)	(0.0307)
15	-0.390***	-0.0144***	-0.128***
	(0.117)	(0.00332)	(0.0184)
16	-0.339***	-0.0103***	-0.0835***
	(0.0788)	(0.00338)	(0.0268)
17	-0.363***	-0.0105**	-0.112***
	(0.104)	(0.00429)	(0.0322)
Observations	90646	90646	90646
R^2	0.572	0.193	0.360

Note: Model 1 and 2 use the first treatment definition, i.e., the business area definition. Model 3 and 4 uses the second definition, i.e., using licensing requirements in groups of education. The difference between Model 1 and 2 (and 3 and 4) is inclusion of firm-fixed effects in Model 2 and 4. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Appendix A3: Heterogeneity analyses: Firm size

In Table A6, we re-analyse Table 1 for firms with 20 employees or more.

Table A6. Immigration and firm's investments in apprentices. 20 employees or more. OLS and IV

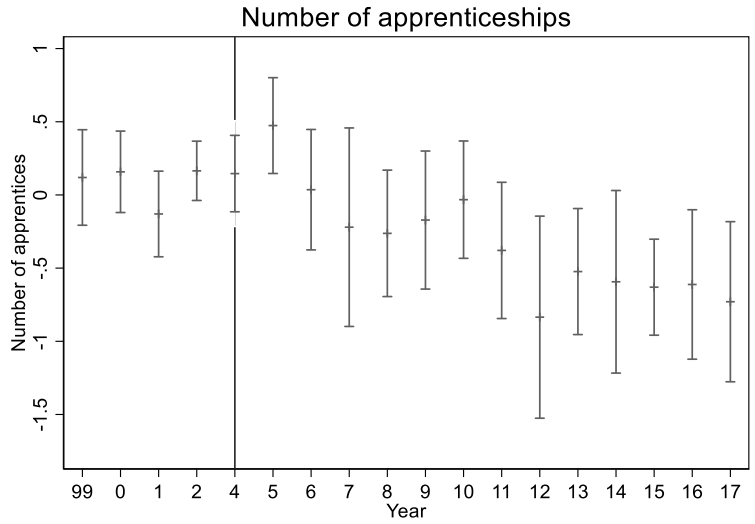
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	OLS_1	OLS_2	OLS_3	IV_1	IV_2	IV_3	IV_4	IV_5	IV_6
	N Apprenticeships	Share Apprenticeships	Binary measure	N Apprenticeships	Share Apprenticeships	Binary measure	N Apprenticeships	Share Apprenticeships	Binary measure
Share IMM	-4.891***	-0.0715**	-0.578***	-6.999***	-0.0959***	-0.535***	-5.125***	-0.0622*	-0.539**
	(1.172)	(0.0248)	(0.162)	(1.124)	(0.0247)	(0.191)	(1.521)	(0.0364)	(0.210)
First stage				-64.950***			-0.0002***		
				(15.347)			(0.0000)		
Kleib-Paap F				15.56	15.56	15.56	30.43	30.43	30.43
N	30524	30524	30524	29799	29799	29799	29799	29799	29799
R^2	0.658	0.438	0.464	0.170	0.012	0.019	0.171	0.012	0.019

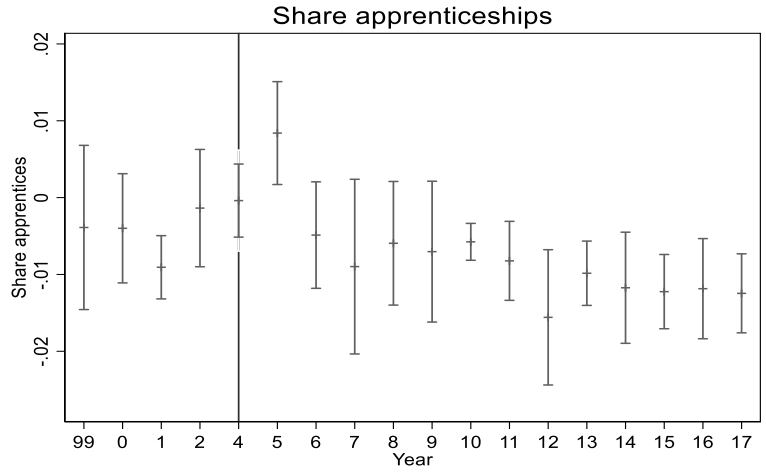
Note: Controls include number of employees, year fixed effects and firm-fixed effects. Standard errors in parentheses. Level of significance: * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

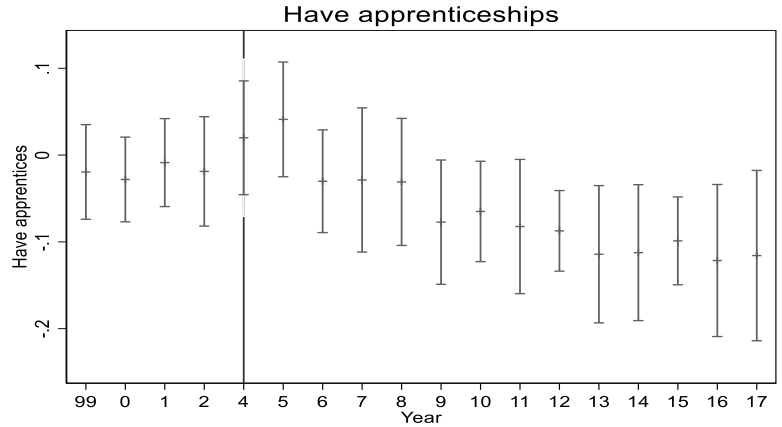
Compared to the estimates in Table 1, the estimates in Table A6 for number of apprentices are larger. The inflow of labour immigrants has a stronger impact on the number of apprentices. This is as expected since we now are analysing larger firmsapprentices in larger firms. The last IV coefficient for the number of apprentices suggests that increasing the immigrant share by 10 percentage points, reduces the number of apprentices by approximately 0.4. The average number of apprentices is 0.9. This implies that increasing the immigrant share by 10 percentage points reduces the number of apprenticeships by approximately 45 per cent.

Next, Figure A1 presents DD- analyses for number of apprenticeships in firms with 20 employees or more. These estimates can be compared to Figure 4.

Figure A1. Immigration and apprentices. DD- analyses. Firms with 20 employees or more. Business area approach





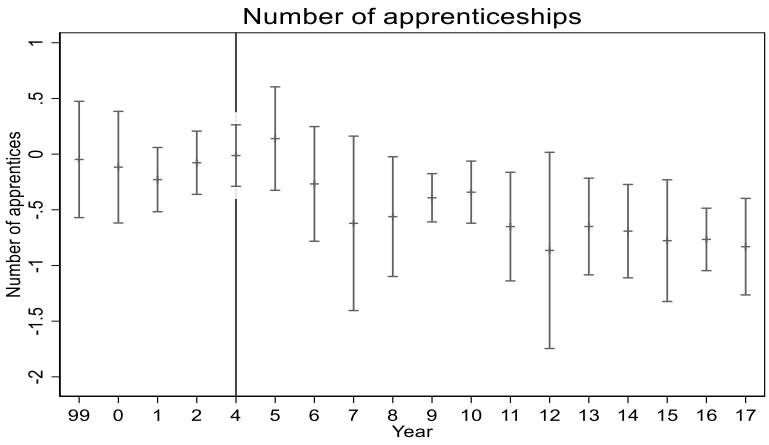


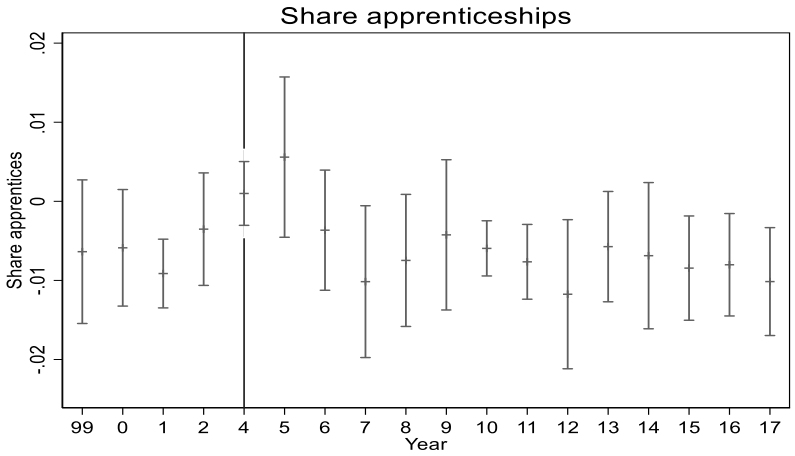
Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

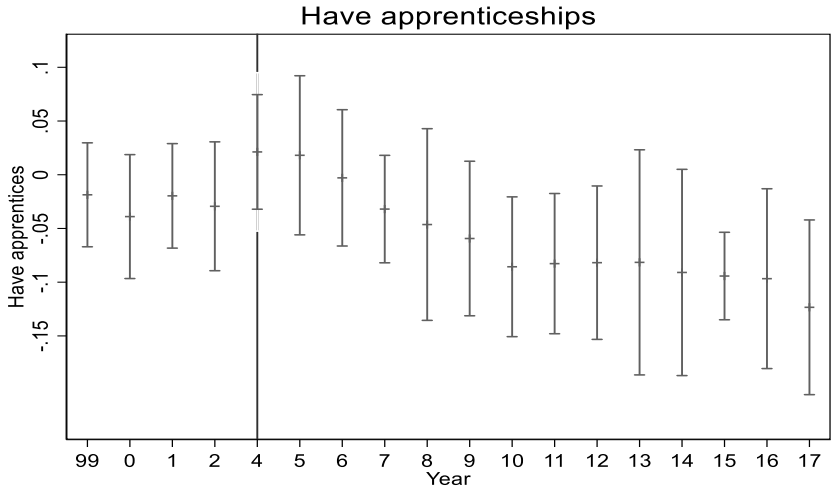
Also using the DD- approach we find that the effects are amplified when limiting the analyses to larger firms. As the post-period evolve the difference between treat and control firms increase, and the difference is larger compared to estimates in Figure 4.

Finally, in Figure A2 we estimate the DD- analyses using the second treatment definition (share licensed in education groups). We find the same pattern of results. The difference between treat and controls are reinforced when focussing on larger firms.

Figure A2. Immigration and apprentices. DD- analyses. Firms with 20 or more employees. Treatment definition based on licensed workers within education groups







Note: Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A.7: Entropy balancing. Included variables. Before and after weighting

Before: without weighting

	Treat			Control		
	mean	variance	skewness	mean	variance	skewness
ansatte~2003	16.12	504.8	9.715	16.79	865.5	10.52
ansatte~2002	16.07	506.7	7.959	16.95	980.2	10.46
ansatte~2001	15.41	443	5.953	16.67	1406	19.99
ansatte~2000	14.71	546	9.735	15.89	1337	21.09
oms_2003	17912	1.34e+09	14.06	22424	3.64e+09	11.52
oms_2002	17110	1.09e+09	15.38	22398	4.53e+09	13.78
oms_2001	15759	8.01e+08	13.77	20200	3.30e+09	14.7
oms_2000	14765	9.05e+08	15.42	17920	2.08e+09	11.94
union_2003	.209	.07033	1.202	.176	.06003	1.366
union_2002	.2283	.06941	1.109	.1977	.06112	1.246
union_2001	.222	.06939	1.134	.1896	.05981	1.277
union_2000	.2081	.07116	1.215	.1834	.06477	1.357
wlonn	294748	3.11e+09	.7526	272720	3.26e+09	.8812
slarlin~2003	.64	1.438	3.365	.6473	1.432	3.545
slarlin~2002	.6832	1.737	4.102	.6813	1.783	4.709
slarlin~2001	.5799	1.645	5.12	.5523	1.329	4.267
slarlin~2000	.6636	1.796	4.28	.6705	2.134	5.547

After: with weighting variable

	Treat			Control		
	mean	variance	skewness	mean	variance	skewness
ansatte~2003	16.12	504.8	9.715	16.12	376.9	5.486
ansatte~2002	16.07	506.7	7.959	16.07	465.4	7.381
ansatte~2001	15.41	443	5.953	15.41	385.5	6.252
ansatte~2000	14.71	546	9.735	14.72	419.2	7.818
oms_2003	17912	1.34e+09	14.06	17919	6.61e+08	5.751
oms_2002	17110	1.09e+09	15.38	17116	5.07e+08	4.881
oms_2001	15759	8.01e+08	13.77	15765	4.06e+08	4.259
oms_2000	14765	9.05e+08	15.42	14769	4.47e+08	5.994
union_2003	.209	.07033	1.202	.209	.0717	1.125
union_2002	.2283	.06941	1.109	.2283	.07179	1.054
union_2001	.222	.06939	1.134	.222	.06926	1.056
union_2000	.2081	.07116	1.215	.2081	.07238	1.155
wlonn	294748	3.11e+09	.7526	294754	4.92e+09	2
slarlin~2003	.64	1.438	3.365	.6401	1.414	2.994
slarlin~2002	.6832	1.737	4.102	.6834	1.647	4.283
slarlin~2001	.5799	1.645	5.12	.58	1.259	3.38
slarlin~2000	.6636	1.796	4.28	.6638	1.814	4.203