The Impact of Immigration on Inhabitants' Educational Investments

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Abstract

We examine whether immigration into the labour market of the building and construction (BaC) industry affects enrolment in vocational programmes that teach the skills required in this industry. Results suggest that a higher supply of immigrant labour is associated with lower enrolment into programmes teaching BaC skills. The strength of this relationship increases according to the grades that the students achieved in lower secondary school. This finding indicates that the negative effect of immigration on educational recruitment is mainly caused by students who turn away from these programmes, rather than a reduction in apprenticeship positions offered by employers.

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I. Introduction

Over recent decades, Norway has experienced a large increase in immigration. In our study period, 2001 to 2008, the proportion of immigrants in the population grew from around 5 percent to around 12 percent. In the first four years of this period, immigrants came mainly from Asia and Africa, and a majority were seeking family reunification or protection in Norway. After the extension of the common EU/EEA labour market in 2004, the inflow of labour from the new EU member countries in Eastern and Central Europe increased sharply. Since 2006, immigrants have predominately been people who state work to be their main motivation for coming to Norway.[1] A relatively large number of these new workers have entered the building and construction (BaC) industry, which has thus experienced a positive supply shift.

The simple equilibrium model of the labour market suggests that if one type of skill becomes more abundant, the return on investments in this particular skill will decrease. On the supply-side, there is a decrease in the incentives for young people to attend educational programmes that teach the skills in question. On the demand-side, the incentives for employers to provide the relevant training for their apprentices are reduced as fully trained skilled workers become more available in the open labour market.

The questions we ask in this paper concern the effects of short-term changes in the labour supply on the educational choices of students and the training investments of employers. Specifically, we answer the following questions: First, to what extent has the positive immigration-induced supply shift in the labour market of the BaC industry reduced investments in vocational programmes that teach the skills specifically required by this industry? Second, who contributes most to the potential reduction—the students who choose

[1] http://www.ssb.no/en/befolkning/statistikker/innvgrunn

not to enrol in the vocational programmes teaching BaC skills or the employers who reduce the number of apprenticeships offered to the students within such programmes?

Using panel data for all students who entered upper secondary school from 2001 to 2008, we analyse the likelihood of new students enrolling in the BaC programme. If they did, we follow them and analyse whether they entered an apprenticeship later on and, if so, the type of skill specialisation they chose. The key explanatory variables in these analyses are the measures of immigration into the labour market of the BaC industry. To gain variations in the exposure to immigration, we use differences over time in the BaC industry's share of immigrant employment among both geographical regions and business areas within the industry. To correct for endogenous immigration to geographical regions, we apply a 2SLS procedure.

The empirical economic analysis of immigration-effects in receiving countries is dominated by studies of the impact on labour-market outcomes (Card, 2001; Borjas, 2003; Ottaviano and Peri, 2012; Manacorda *et al.*, 2012; Ottaviano *et al.*, 2014). Concerning the wage and employment effects of immigration, no consensus has yet been reached. However, there is a general agreement that the more the skills of native workers coincide with the skills of newcomers, the more they stand to lose from higher rates of immigration. Bratsberg *et al.* (2014) show generally negative effects of immigration on wages in the Norwegian labour force as a whole. They find that immigrant inflows from other relatively rich countries have significantly larger adverse effects on wages than inflows from developing countries outside the OECD. Bratsberg and Raaum (2012) are especially relevant in this context. Using Norwegian data, they show that immigration into the BaC industry has a strong negative effect on relative wages. These results are an important backdrop to our analysis. That is, since we examine changes in human capital investment behaviour, which theoretically follow from the impact of immigration on the wage structure, without a thorough investigation of this

effect in itself. As the mechanism working through the wage effect is vital for our study, we strengthen the analytical approach by performing a wage effect regression using our identification procedure.

We also build on two other strands of the literature analysing the effects of immigration in receiving countries. First, studies focusing on the endogenous mobility of natives. The general question posed in this part of the literature concerns whether native workers leave labour markets that become relatively more exposed to competition from immigrants (Card and DiNardo, 2000; Card, 2001; Hunt, 2012). Second, we build on the literature that addresses the influence of immigration on the educational achievements of natives, particularly the section that investigates whether immigration affects incentives to invest in education through its impact on the wage structure (Hunt, 2012). We contribute to the above literature in at least two ways. First, we investigate the effects of strong labour market competition on educational choices along the students' ability distribution. Thus, we investigate not only whether natives—through the educational channel—leave labour markets that are exposed to stronger competition from immigrants, but also how the leavers are selected with regard to their abilities. Second, we further contribute by examining a part of the educational system in which employers, via their supply of apprenticeship positions, have a relatively strong influence on the size of the teaching programmes.

Our results show that a higher supply of immigrants into the BaC industry reduces the recruitment to programmes teaching BaC skills. The analyses suggest that this relationship is primarily due to students turning away from the programmes, rather than employers reducing the number of apprenticeships offered (i.e., it is the supply-side mechanism that dominates the outcome).

The paper is organised as follows: Section II provides information about the Norwegian context. Section III presents a simple theoretical model intended to motivate the

empirical analyses. Section IV presents the data and the empirical approach. Section V discusses the empirical results. Section VI concludes the paper.

II. The Norwegian Context

When they enter 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 on-the-job training.

There are three major steps on the road to acquiring a vocational certification as a skilled BaC worker, all of which involve a significant element of choice by the student as well as the participation of BaC firms in the local business community. We conduct an empirical analysis to determine whether immigration into the labour market of the BaC industry affects the outcome of each of these steps.

First, when they enter upper secondary school, students must choose the BaC programme from twelve general programmes, nine of which are vocational. The public authorities in the counties are responsible for determining the sizes of the various programmes. However, with regard to vocational programmes, the number of places is determined through close cooperation with employers in the local business community, who offer the training positions, and the authorities.

Second, the students must decide to stay in the school-based BaC programme for two years and pass the required exams. Then, towards the end of the second year, they must apply for apprenticeship positions in BaC firms, receive at least one offer and accept it. If no private firm offers a position, the local school authorities are obliged to provide a school-based

alternative. However, this is considered to be an inferior alternative and many students seem to quit the programme at this stage if they are not able to obtain an apprenticeship.

Third, the students must choose from among 17 fields of BaC specialisation. The main part of the specialisation is carried out during the apprenticeship period. Thus, the student's specific skill as a BaC worker is determined partly by his or her own choice and partly by his or her ability to be hired by a firm that provides that type of training. After completing two years of work-related training and passing the final test, the students acquire a vocational certificate that qualifies them to work in their area of specialisation.

In the Web Appendix Table WA1, we list the 17 fields of BaC specialisation and the distribution of students among them. To indicate the significance of the BaC industry as a future labour market for this group of students, the shares of all employees who have graduated from the BaC programme and work within their field of specialisation are shown. Overall, 55 percent of employees with a diploma from the BaC programme worked within the BaC industry in 2004.[2] The rest were not concentrated in any particular industry. Among the vocational diplomas, the BaC programme clearly contributed the largest share of skilled workers to the BaC industry. The second largest contributor was the electronics programme. In 2004, 12 percent of all workers with a diploma in electronics worked in the BaC industry.

Our data shows that the employment shares of immigrants in the BaC industry vary considerably both among regions (counties) and over time. In the average county, the relative immigrant share in BaC increased by 15 percent from 2000 to 2004 and by 107 percent in the remaining part of our study period. The corresponding numbers for all other industries were 13 and 35, respectively. In 2004, the difference in this share among the counties with the

[2] No other vocational programme has such a large share of graduates working within one single industry (industry is identified by a two-digit NACE level). The next field of study, in this regard, is the vocational programme educating skilled hotel and restaurant workers. Our calculations show that approximately 30 percent of those who have a diploma from this programme work in the "hotels and restaurants" industry (NACE-code 55).

highest and the lowest portion of immigrants employed by the BaC industry was approximately nine percentage points. Based on the five-digit NACE code, the BaC industry is divided into 18 business areas. In Figure 1, the immigrant employment shares in 2001 and the average annual growth in these shares over the sample period are plotted for these 18 business areas. Their share of total industry employment in 2004 is provided in Table A1 in the Appendix. As this plot illustrates, there were large differences in the propensity to hire immigrants among the business areas and a strong positive correlation between the initial immigrant shares (in 2001) and their subsequent growth. This pattern clearly indicates that immigrants have relatively easy access to some parts of this labour market, while other parts seem more closed to workers from abroad.

[Figure 1 about here]

Like Bratsberg and Raaum (2012), we will argue that the BaC firms' openness to hiring workers from abroad is closely related to their need for skilled workers who meet different kinds of national licensing and certification requirements. For example, with regard to the main activities within the business areas of "plumbing" (6) and "electric wiring" (4), insurance companies and public building inspectors may demand that such activities are performed by workers with proper credentials. Within business areas such as "renting of equipment with operator" (1) and "construction of roads" (3), national approved licenses are necessary to operate the heavy machinery that is widely used. Particular certificates are also needed within business areas that involve dangerous materials, such as "demolition and wrecking" (2) or installations that are vital for the safe operation of large transport systems, such as "other installations" (8). In the latter area, the main products are the installation of lighting and light-signalling systems for roads, railways, airfields and harbour facilities.

The marked squares in Figure 1 represent the business areas in which licensing or certification – in some form – is required from the main types of skilled workers. These nation-specific formal rules probably work as effective barriers against the employment of relatively recently arrived immigrants. That is, for foreign workers to become fully employable, they must have their certificates approved by the Norwegian authorities, which requires passing certain tests or acquiring additional education. Thus, these formal requirements probably insert exogenous variation in the share of immigrants employed between the different business areas within the BaC industry.

III. Theoretical Background

In our analysis, we investigate the outcomes of two main mechanisms, one on the supply-side and one on the demand-side of the labour market. To develop an idea of how each mechanism works and to substantiate the empirical strategy used to determine which is the most influential, we present a simple theoretical model.

The supply-side mechanisms

We assume that young people wish to maximise their future incomes. When evaluating alternatives, they narrowly focus on the prevailing relative wages in the labour market. Students, consequently, invest in an educational programme, teaching a specific skill *s*, to the point at which the real wage of the fully trained workers is equal to their alternative cost:

$$a(GS^s) = W,\ a(GS) \leq W,\ da/dGS > 0 \qquad (1)$$

W signifies the wage of trained s-workers and *GS* is the grade scores achieved by the students in the level of education previously completed. The alternative cost, *a(GS)*, is equal to the expected future wage if the most promising alternative education is chosen.

When school places are rationed, applicants are admitted according to their *GS* rankings. Thus, the number of alternative education streams that are open to the applicants – and, accordingly, the alternative cost – increases with their *GS*.

In (1), GS^s signifies the grade score of *the marginal applicant* willing to invest in skill *s*. By differentiating equation (1) w.r.t. W, we obtain: $dGS^s/dW = (da/dGS^s)^{-1} > 0$ (i.e., as the wage increases, students with better GS values will choose the educational programme that teaches skill s). In Figure 2, we illustrate this supply-side mechanism, in the right panel, by the solid black line sloping upward from left to right. Along the horizontal axis, the population of potential applicants to the programme teaching skill *s* is ranked according to the value of their grade scores, while wage is represented vertically. For a given wage level, the GS value of the marginal applicant, GS^s, is identified where the alternative cost function crosses the wage line. The number of students who want to enter the educational programme is $F(GS^S)$, where F() signifies the cumulative distributional function for the GS values.

The demand-side mechanisms

The production function of the representative firm is:

$$X = x(L), \qquad dX/dL > 0, \qquad dX/d^2L < 0 \qquad (2)$$

$$L = L_1 + \alpha L_2,\ L_1 = N + M,\ \alpha > 0 \qquad (3)$$

X is the quantum produced using the input of labour, L. L is a composite of workers fully trained in skill *s* and hired from the open labour market, L_1, and workers who are trained in skill *s* within the firm, L_2. In general, L_1 may be supplied by natives, N, and immigrants, M, who are considered perfect substitutes. The apprentices, L_2, enter as part of a firm's workforce. In the initial period of their training, they are less productive than the fully skilled workers. Over a firm's time horizon, the workers hired from the open labour market are

expected to each contribute one efficiency unit, whereas the apprentices are each expected to provide α efficiency unit. Except for this difference, the L_1 and L_2 workers are perfect substitutes.

The employer decides the level of production, X, and the composition of the workforce. We assume that the employer makes these decisions in order to maximise the firm's profit:

$$\Pi = X - WL_1 - (\beta W + C)L_2, \qquad C = d + c(GS), \qquad dc/dGS < 0 \qquad (4)$$

w.r.t. L_1 and L_2. During the training period, the apprentices earn a share of the wage paid to the skilled workers, which is determined exogenously.[3] If he or she joins the firm's workforce of fully trained workers after graduation, the apprentice will receive the same wage as those hired in the open labour market. The firm must take on the training cost, C, consisting of a fixed part, d, and a variable part, which decreases with the GS of the apprentice hired.[4] As long as the training costs are positive, we must state that $\alpha > \beta$ for any training positions to be announced.

To the employers, W, C and α are all given parameters. The following first-order conditions apply:

$$dX/dL = W \qquad (5)$$

$$\alpha\, dX/dL = \beta W + d + c(GS^D) \qquad (6)$$

GS^D signifies the GS value of the marginal apprentice hired by the firm. From (5) and (6), we deduce:

$$W = [d + c(GS^D)]\ 1/(\alpha - \beta) \qquad (7)$$

[3] In Norway, the wage share is determined through negotiations between the authorities, the trade union and the employer's association.

[4] For simplicity, we assume that the value of GS does not affect students' productivity as fully trained, skilled workers.

Differentiating (7) w.r.t W, we obtain: $dGS^D/dW = (\alpha - \beta)(dc/dGS)^{-1} < 0$. That is, as the price of skilled workers increases, the employers lower their demands in terms of GS achievements for the students they are willing to employ in training positions.

[Figure 2 about here]

In Figure 2, this demand-side mechanism is illustrated by the downward sloping grey line in the right panel. The GS value of the marginal applicant employed is identified at the point where the downward-sloping training cost function crosses the wage line. For a given value of W, the firm wants to hire applicants for apprentice positions who all have GS > GS^D. Thus, the number of students/apprentices who are accepted into training positions is 1-F(GS^D).

The equilibrium outcome

For the sake of simplicity, we assume that the supply of skilled workers in the open labour market is completely inelastic. The supply of apprentices who have a GS level that is acceptable to the employer is:

$$L_2^S = F(GS^S) - F(GS^D) \qquad (8)$$

In equilibrium, L^S_2 is equal to the number of apprentices employed. The system of equations (1), (3), (5), (6) and (8) determines the equilibrium values of the variables L, W, L^S_2, GS^D and GS^S.

This equilibrium problem is illustrated by the interaction between the two panels shown in Figure 2. The left panel exhibits the usual supply and demand framework (homogenous labour). The function L^{Sh} describes the labour supply function prior to immigration (M = 0). When $W<W^0$, L^{Sh} is equal to the inelastic labour supply of fully trained native workers. For $W>W^0$, the number of apprentices who are both willing and accepted increases with W. The equilibrium value of $W = W^h$ is determined where the

labour demand curve crosses the L^{Sh} function. In the right panel, the equilibrium value of L^{S}_{2} is determined by the number of applicants who have GS values higher than GS = D^{h} and lower than GS = S^{h}. A positive exogenous shift in M takes place. In the left panel of Figure 2, the labour supply function moves outwards to L^{Sl} and a new equilibrium wage level, W^{l}, is established. Our main interest is in the effect of this event on the equilibrium value of L^{S}_{2} and on the average value of GS among the apprentices employed.[5] The implicit derivation of the equation system with respect to M implies that:

$$\frac{dL_2^S}{dM} = \frac{[f(GS^S)(da/dGS)^{-1} - f(GS^D)(dc/dGS)^{-1}[a-b]]dX/d^2L}{1-[f(GS^S)(da/dGS)^{-1} - f(GS^D)(dc/dGS)^{-1}[a-b]adX/d^2L]} < 0.$$

Thus, the number of apprentices employed by the representative firm will decrease.

In the right panel of Figure 2, the new equilibrium value of L^{S}_{2} is now determined by the number of applicants who have GS values higher than GS = D^{l} and lower than GS = S^{l}. The two horizontal dashed lines below the right panel in Figure 2 mark the acceptable GS intervals of applicants who attend the programme before (upper line) and after (lower line) the labour supply shift (dM>0) takes place. Thus, the number of employed apprentices is reduced both by the mechanisms on the supply-side and by the mechanisms on the demand-side of the labour market. The question then becomes which is stronger. That is, because of the supply shift, do employers reject a relatively higher number of willing students or do students reject a relatively higher number of offered training positions? Our suggestion is that this question should be decided by the direction of change in the average grade scores of the students who are actually attending the programme. In the following section, we explain in depth the empirical strategy applied to disentangle the influences of these supply- and demand-side mechanisms.

[5] That is, based on the value of $\overline{GS} = \frac{1}{L_2^S}\int_{GS^D}^{GS^S} t\, f(t)\, dt$ where f() is the density function of F().

IV. The Empirical Approach

The main topic of conflict in the literature analysing the impacts of immigration in receiving countries is how to identify exogenous variation in immigration. One major disagreement has been between advocates of the cross-area (Altonji and Card, 1991; Card, 2001) and the national (Borjas, 2003) approach to this problem. The question is whether the effect of an immigration-induced supply shift can be identified at the local level or whether it must instead be picked up at the country level, which, because of national boarders, would largely mirror a closed labour market. Our empirical approach is eclectic in this regard. We use variation on the local as well as the national level, implement both a 2SLS procedure and explore certification and licensing requirements, to achieve exogenous variation in the immigration-induced supply shifts.

The empirical models

We apply linear probability models (LPM) to analyse the first two steps towards achieving a vocational certificate as a BaC worker (enrolment and apprentice position). The decision problems of the main actors are represented by the following relation:

$$E_{ijt} = \alpha_1 X_{it} + \alpha_2 CM_{j,t-l} + \alpha_3 GS_i + \alpha_4 GS_i \cdot CM_{j,t-l} + \varepsilon_{ij,t-l} \qquad (9)$$

where E_{ijt}, in the first analysis, is a dummy taking the value 1 if pupil *i* enrols in the BaC programme in year t. In the second analysis, E_{ijt} takes the value 1 if student *i* has achieved an apprentice position in year *t*, which now signifies the third year after enrolling in the BaC programme.[6]

CM_{it-l} is a measure of the core explanatory variable, which is the relative immigration into the labour market of the BaC industry in year *t-1*. According to our theoretical model, immigration affects the choices of students and employers through its impact on the wage

[6] In the following, t always refers to the year in which the dependent variables are observed.

structure. Thus, CM_{it-l} should be specified as a measure of immigration to the labour market of the BaC industry *relative* to the immigration into labour markets, which becomes relevant in the case of the alternative educational choices.

GS_i is a measure of the grade scores student *i* achieved in lower secondary school, while X_{it} signifies the control variables varying across individuals and over time. Our interest concerns the marginal effect on the probabilities of a change in CM_{it-l} and how it interacts with the students' grade scores (GS). According to the theoretical derivations in section III, the mechanisms on both sides of the labour market work in the same direction. Hence we clearly expect the marginal effect, $dP_{it}/dCM_{j,t-1} = [\alpha_2 + \alpha_4 GS_i]$, to be negative where P_{it} signifies the probability that E_{it} = 1. With regard to the sign of α_4, the theory leads to conflicting predictions because the supply and demand mechanisms work in opposite directions. Thus, the sign of α_4 will be our test to determine which of these contributes more to an eventual reduction in the recruitment of students into the BaC educational programme following higher immigration into the labour market of the BaC industry. The theoretical prediction is that when the supply-side mechanism dominates, the average GS of participating students decreases with increasing immigration. In that case, α_4 is negative. If the demand-side mechanism dominates, the reverse is true.

Finally, to analyse the third step, i.e., the distribution of students among the 17 fields of specialisation during the third and fourth years of the BaC programme, we estimate a conditional logit model (McFadden, 1974). We create 17 observations for each student and introduce a binary variable, y_{ih}, with the following characteristics: if specialisation *h* is chosen, then y_{ih} = 1 for the observation of pupil *i* related to this particular specialisation, while for the 16 other specialisations y_{ih} = 0. The probability that pupil *i* will enter specialisation h = *s* may then be expressed as:

$$Pr(y_{is} = 1) = \frac{exp(Z_{st})}{\sum_{h=1}^{17} exp(Z_{ht})} \quad , \qquad Z_{ht} = S_h + \delta NM_{ht-1}, \qquad h = 1 - 17 \qquad (10)$$

where Z_h signifies the observable characteristics related to alternative h. $NM_{ht\text{-}l}$ is a measure of immigration to the labour market of workers who are educated in specialisation h in year t-l. S_h (h = 2,…,17) is a set of alternative specific fixed effects. In the conditional logit model, individuals only care about differences across alternatives when they make their choice. Individual traits only play a role when they interact with alternative specific characteristics. The same is true with regard to other variables that do not vary among alternatives, such as the year of observation. To measure the impact of such interactions, we estimate (10) separately for various groups and periods. The marginal effect of $NM_{st\text{-}l}$ on the probability that a pupil i will choose specialisation h = s is: $dP_{is}/dNM_{st-1} = P_{is}(1 - P_{is})\,\delta$, $P_{is} = \Pr(y_{is} = 1)$.[7]

Data, sample and variables

The data set is collected from different individual-level administrative registers that include the total population of Norway. The sample analysed is confined to males who were 16-18 years of age when they enrolled in upper secondary education from 2001 to 2008. The data set has a panel dimension that enabled us to follow students over time, through different stages in upper secondary school. As the BaC industry is heavily dominated by men, we limit the analyses to males.

When we analyse the first step towards acquiring a BaC diploma (i.e., enrolment in the BaC programme) the sample consists of the students who entered upper secondary school from 2001 to 2008. When we analyse the second step, the attainment of apprenticeship

[7] A well-known potential weakness of the conditional logit approach is the assumption of the independence of irrelevant alternatives, or IIA. The Hausman specification test is used to investigate the validity of the IIA assumption (Hausman and McFadden, 1984). We conduct the test by eliminating one alternative and then re-estimating the model. If the coefficient of interest in the restricted model is not systematically different from the coefficient estimated using the full model, then the IIA hypothesis is substantiated. In short, all the estimations in which we leave out alternatives present χ^2 statistics that are smaller than the critical values for those χ^2 statistics, which indicates that we cannot reject the hypothesis that IIA holds.

positions, the sample consists of those who entered the BaC general programme from 2001 to 2007. In the analysis of the third step, the distribution of students among the 17 specialisations within the BaC programme, the sample consists of all students who actually obtained an apprenticeship position in the third year of education. [8]

The dependent variables correspond to the three steps required to achieve the vocational certificate. For enrolment, we defined a dummy variable that takes the value 1 if student *i* enters the general BaC programme in the first year of upper secondary education. For attainment of an apprenticeship position, a dummy variable is defined that takes the value 1 if student *i* acquires an apprenticeship in a BaC firm in the third year after enrolment in the general BaC programme. Finally, regarding the choice of specialisation as a BaC apprentice, we construct a categorical variable defining the 17 possibilities, which are listed in Table WA1.

The key explanatory variables measure the labour supply of immigrants into the BaC industry. The definition of immigrant is a person who was born outside Norway and who has two foreign-born parents.

We construct two measures of immigrant supply.

i) The relative employment share of immigrants in the BaC industry of county j:

$$CM_{jt-l} = \frac{M_{BaCjt-l}}{M_{BaCjt-l} + N_{BaCjt-l}} \Big/ \frac{M_{Ojt-l}}{M_{Ojt-l} + N_{Ojt-l}}$$

where $M_{BaCjt-l}$ and $N_{BaCjt-l}$ signify the numbers of immigrants and natives, respectively, who are employed in the BaC industry of county j in year t-l. M_{Ojt-l} and N_{Ojt-l} denote the corresponding numbers of immigrants and natives employed in all other industries. This

[8] For the two latter analyses, we cannot include the 2008 cohort because the last year of observation is 2009. By construction, the population we look at in the second and third stages is selected with respect to treatment (i.e., the second and third stages consist of a selected group of those who have chosen to carry on with BaC studies). If the effect in the first stage is negative and large, one might suspect that the effect in stages 2 and 3 is small because the sample then consists of those who—in spite of competition—have chosen to proceed. We return to this in the empirical section.

measure explores the variation in immigration between counties and is used in the estimation of (9). The main reason that the county was chosen as the local unit for the analyses is that, in Norway, the dimensioning of secondary education takes place at the county level. Almost all enrolment in secondary school happens within the boundaries of the county.[9] When analysing enrolment, CM_{jt-l} is measured in the year in which the students entered upper secondary school, l = 0. When analysing whether an apprentice position is acquired in the third year of education, CM_{jt-l} is measured in the second year after enrolment, l = 1.

The definition of CM_{jt-l} implies that we use the immigrant share in all other industries within the students' county of residence as an indicator of the average immigration into labour markets, which is relevant if the best alternative to the BaC programme is chosen. Accordingly, we assume that a proportional change in the immigration share of the BaC industry and in all other industries has no effect on the educational choices of our concern.

ii) The immigration share in the nationwide BaC labour market of workers who have acquired a BaC specialisation: $NM_{st-l} = \sum_a \alpha_{as}[M_{at-l}/(M_{at-l} + N_{at-l})]$, where α_{as} is the share of all Norwegian employees with a vocational certificate in specialty s who were employed in business area *a* within the BaC industry in 2004. The 17 specialties (s) are listed in the Web Appendix, Table WA1, and the 18 business areas (*a*) are listed in the Appendix, Table A1. M_{at-l} and N_{at-l} signify the number of immigrants and natives, respectively, employed at the nationwide level within business area *a* in year t-l. In this analysis, l = 1. This measure of supply change is used in the estimation of (10) and explores the variation in immigrant employment shares among the business areas within the nationwide BaC industry.

The students' grade scores (GS) in lower secondary school are of central interest to the analysis in this paper. To measure this variable, we use the sum of grade scores from ten courses in the final year of lower secondary school. The grades in each course vary from 1

[9] There are 19 counties in Norway. The average county population number is approximately 260,000. It varies considerably, with approximately 600,000 in the capital region of Oslo and just over 70,000 in Finmark, the northernmost county in Norway. The average area size is 16,000 km^2 (numbers from Statistics Norway).

(lowest) to 6 (highest). To facilitate the interpretation, we standardise the GS measure with mean zero and standard deviation equal to 1 in all the empirical analyses.

As control variables (X_{it}), we include age at enrolment, the educational level of the mother and father (compulsory school, secondary education low level, secondary education high level, college/university low level, college/university high level, and unknown education), ethnic background (Norway, western country, non-western country),[10] county of residence (19 counties) and year of enrolment (2001-2008). Furthermore, we include the overall unemployment rate in the county of residence as a measure of the local business cycle. Table A2 presents the mean values for the included variables.[11]

Measurement error

Our indicators of the immigrant labour supply may contain measurement errors for at least three reasons.

First, a non-negligible portion of immigrant labour in recent years (especially after 2004) was employed through temporary work agencies (TWAs) (Dølvik *et al.*, 2006). Many of these immigrants were actually working in the BaC industry, although they were registered in the TWA industry.[12] In a survey conducted among Polish BaC workers in Norway, in 2006 and 2010, 25 percent and 20 percent were employed through Norwegian TWA in the two years, respectively (Eldring and Friberg, 2011).

Second, after the expansion of the EU in 2004, a sizeable portion of the immigrant workers in the BaC industry were hired by foreign contractors. That is, they worked in Norway in the BaC industry, but they were employed by foreign firms/contractors (Dølvik and

[10] Non-western immigrants include individuals with two foreign-born parents and backgrounds in Asia (including Turkey), Africa, South America and Central and Eastern European countries. The individuals themselves may have been born in Norway (i.e., we include second-generation immigrants in the definition).
[11] A more detailed description of the data set and its sources is provided in the Appendix.
[12] Even if we do not know the industry in which the workers in the TWA data really worked, we have undertaken an analysis that includes the relative share of immigrants in the TWA industry as an extra explanatory variable. This did not change the coefficient of the CM variable.

Eldring, 2008). Consequently, they did not appear in our data collected from the Norwegian population registers.

Third, immigrants employed in the BaC industry, may work "off the books" to a different extent than native employees do. In the survey of Polish BaC workers, 35 percent in 2006 and 26 percent in 2010 responded that they did not pay taxes (Eldring and Friberg, 2011).

Even though it is difficult to determine the extent of this problem, all three possible sources of measurement error will probably lead to an understatement of the share of immigrants in the BaC industry. If registered and unregistered immigrants in the BaC are positively correlated, and if they both have the same effect on programme enrolment, this will lead us to overstate the true effect of immigration on enrolment.[13] However, we will argue that because these measurement errors are related to immigration, the total effect will consist of the effect of registered immigrants and the effect of non-registered immigrants.[14]

Endogeneity

When we analyse enrolment, as well as the attainment of apprentice positions, the measure of immigration (CM_{it-l}; from now on we suppress the subscript) is based on geographical variations in immigrant employment. As new immigrants tend to move in the direction of job opportunities, we suspect that this measure is positively correlated with the local business cycle (Borjas, 2001; Røed and Schøne, 2012). If young people concurrently invest in the skills that are required by the industries thriving in their area of residence, our OLS estimates of the

[13] We cannot rule out a negative correlation between registered and unregistered migrant labour. A negative correlation exists if the latter is used as a substitute for the former. They could be substitutes if TWA workers are cheaper, which is an important reason for hiring them. In Andersen *et al.* (2012), a sample of Norwegian establishments were asked about the motivation for using TWA workers. The three most important reasons were to cover for persons on sick leave, to meet increased demand, and that it represented an alternative to hiring them on permanent contracts. Reduced wage costs were not among the three most important reasons given.

[14] Hanson (2006) discusses the distinction between legal and illegal immigration in a US setting. He argues that because the omitted variable in this case is immigrant-related, one could, instead of classifying it as a form of measurement error, argue that the estimated effect is the total effect of immigration (both legal and illegal).

immigration effect on educational choice are upward-biased. When this is the case, the estimates may be interpreted as conservative (upper bound). However, we cannot rule out the possibility that a bias could work in the opposite direction. This is the case if the BaC programme, for some unobserved reason, has become less popular and the growth in immigrant employment is driven by the lack of native BaC workers in the local labour market. To investigate the potential endogeneity bias, we apply a 2SLS procedure in which the following variable is used as an instrument to predict the CM variable:

$$IV_{jt-l} = \left(M_{BaCj90}/M_{BaC90}\right)M_{BaCt-l}$$

where M_{BaCj90} signifies the number of immigrants employed in the BaC industry of county j in 1990, and M_{BaC90} is the corresponding number for the entire country.[15] M_{BaCt-l} gives the total number of immigrants employed in the Norwegian BaC industry in year t-l (l=1). The instrument is applied in both the analysis of enrolment and in the analysis of whether those who are enrolled actually attain an apprenticeship.

This instrument distributes the aggregated yearly change in the number of immigrant workers in the Norwegian BaC industry between counties according to the "historic" (1990) propensity of local industries to employ immigrants. Thus, it is a variant of the "shift share" instrument widely employed in the literature, which analyses the effects of immigration in the labour markets of the receiving countries.[16] Our approach is to some extent in line with the standard "Bartik instrument" (Bartik, 1991), which predicts changes in local labour demand by assuming that the national employment changes in each industry are allocated

[15] The calculation of this ratio is based on the 1990 population census by Statistics Norway.

[16] An often-used procedure to construct a shift share in this respect is justified by the "chain migration" mechanism. This approach utilises country of origin specific settlement (or employment) patterns in a period prior to the analysis (see e.g. Card, 2001). We tested this method by using the 1990 origin specific geographical distribution of BaC workers to allocate the national change in immigrant employment of the BaC industry from 1995 onwards. However, the instruments constructed by this method did not have sufficient predictive power. One main difficulty related to the construction of a valid instrument using origin-specific employment patterns in the 19 Norwegian counties relates to the character of the data. As the 1990 population census is based on a sample covering approximately 30 percent of the population, the number of immigrants from different origins in a considerable number of counties, and particularly employed in their BaC industry, turned out to be very small.

proportionately across cities according to each city's initial industry composition. It also relates to the instrument approach applied in Ottaviano *et al.* (2014), where the share of immigrants employed in different industries in a particular "historic" year is used to establish the "shift shares" that distributed new immigrants across different industries. Note that since we employ county fixed effects, the relevant identifying variation comes from changes within the county over time.

A precondition for our instrument to predict the relative employment of immigrants in the BaC industry of the counties (CM) is that some path dependence exists in the firms' propensity to use the relatively heterogeneous group of immigrant labour. The following line of argument may substantiate the existence of such a relationship: Even though new immigrants arrive from different countries and continents during the period of study, they are all foreigners in Norway. This means that they speak a different language and have social and cultural codes, norms and unwritten rules that differ from those of native Norwegians. Such differences probably reduce the effectiveness of communication in the workplace, and the employment of immigrants may therefore be costly. However, this cost may diminish as the natives become more used to working with colleagues from other countries. In other words, communication problems decrease as firms adapt their organisation to a more multicultural labour supply and learn how to deal with people from different countries. This process of adaption has probably reached a higher level in establishments that started to employ immigrants earlier.

Using 1990 as the base year, there are more than 10 years between the geographical "initial" distribution of BaC immigrants workers (which establishes our "shift-share" ratio) and the observations of enrolment in upper secondary school (starting in 2001). Between these periods, Norway experienced distinct changes in the business cycle pattern. Therefore,

we consider it unlikely that our measures of immigrant shares were affected by the same business cycle as the instrument variable was.

Next, we need to instrument the interaction term GS·CM in equation (9). In this regard, we follow the approach chosen by Balli and Sørensen (2013). Thus, the interaction term is instrumented by the product: IV_{jt-1}·GS, where GS is the observed value of grade score from lower secondary school (which is assumed to be exogenous) and IV_{jt-1} is the already introduced instrument.

When we analyse the apprentices' distribution among fields of specialisation within the BaC programme, the measure of the labour market supply shock (NM_{st-1}) is based on variations in immigrant employment among business areas within the industry. In contrast to the two preceding steps, where we explored differences between regions within the country, we now explore variations in immigrant employment at the national level.

As elaborated in Section II, a considerable part of the variation in immigrant employment among these BaC business areas is probably due to differences in the degree to which their activities are subject to national licensing and certification requirements. Because the business areas belong to the same industry, it seems reasonable to assume that they are similarly affected by economic ups and downs. Thus, in the spirit of the natural experiment approach, we assume the licensing/certification requirements gives us a source of exogenous variation in immigrant inflow across the BaC industry.

However, as a sensitivity check, we explore the variation in the licensing and certification requirements between areas in a manner that ties the identification more directly to this information. For this purpose, we construct the variable: $IM_{st-1} = (1 - \gamma_s)\, M_{BaCt-1}/(M_{BaCt-1} + N_{BaCt-1})$ as an alternative measure of the supply shock towards the labour markets of the different specialities. Here, γ_{sl} is the share of all skilled native workers holding a vocational certificate in specialisation s, who in 2004 worked

in one of the business areas that are identified as being subject to some kind of licensing/certification- requirements, as shown in Figure 1 (category 1-8). The second term is the share of immigrants employed in the BaC industry in the year preceding the year when the apprentice positions are distributed.[17] If national licensing and certification is a barrier to immigrant employment, $(1-\gamma_s)$ is an indicator of the degree to which a vocational speciality is exposed to competition from a given immigrant supply shock to the labour market of the BaC industry. Thus, we expect the estimated coefficient of IM_{st-1} to be negative if our assertion is valid.

V. Results

Initial enrolment

Table 1 presents the main results of the enrolment analysis (i.e., whether the student enters the BaC programme at the beginning of upper secondary education or not). In all four models shown in Table 1, equation (9) is estimated using LPM, including the full set of controls presented in section IV. All regressions are clustered within county cells.[18]

[Table 1 about here]

As described in the theoretical section, the mechanisms on both the supply-side and the demand-side of the labour market work in the direction of a negative relationship between (relative) immigration into the BaC industry and enrolment in the BaC programme. In Model 1, equation (9) is estimated by OLS without an interaction term between the measure for immigration (CM) and grade scores (GS) from lower secondary school. The sign of the

[17] We also tested a variant of this variable in which the employment share of immigrants in the BaC industry in the country was replaced with the corresponding share for the county. This did not change the results significantly, so we limit the presentation to the country specification.
[18] In Web Appendix Table WA2, we present results comparing the clustering within county cells with the clustering within countyXyear. The results do not seem to be sensitive to the choice of clustering level.

estimated CM coefficient clearly confirms these theoretical predictions, while the sign of the GS coefficient shows that the BaC students are negatively selected, in this respect.

To investigate the severity of the endogeneity problem, we estimate the same specification by the 2SLS procedure described in Section IV. The last row in Model 3 presents an F-test for the excluded instrument, which suggests that the instrument is not weak. The comparison of the CM coefficients of Model 1 and Model 3 confirm our suspicion that the OLS coefficient of the CM variable is upward biased (i.e., that it is a conservative, upper-bound estimate of the actual effect). This is in line with the results of Hunt (2012), who uses an instrument based on the "chain migration" mechanism (see note 18). She finds that higher immigration of low-educated immigrants increases the likelihood that native students would complete 12 years of schooling, and the preferred 2SLS model yields the largest coefficient of all her model specifications.

The value of the CM coefficient in Model 3 suggests that an increase of one percentage point in relative immigration into the BaC industry decreased by 0.00087 the probability that a student would enter the BaC programme. For the study period, the standard deviation of CM·100 is approximately 19 percentage points. An increase in CM of one standard deviation, consequently, reduced the probability of enrolment by approximately 0.017, which constituted 14 percent of the average probability (0.12) during the period. From 2001 to 2008, the mean value of CM·100 increased by 38 percentage points, which according to this result should decrease the probability of enrolment into the BaC programme by 28 percent of its mean value.

So far, our analyses clearly indicate a negative (average) effect of immigration to the BaC industry on enrolment into the BaC programme at the upper secondary level. The next question is whether the demand- or supply-side mechanisms dominate in explaining this outcome. The assertion of the theoretical model is that if the supply-side mechanism

dominates, the average grade scores (GS) of the students entering the BaC programme will fall as immigration to the BaC industry increases. Conversely, if the demand-side mechanism dominates, the average GS of the students will rise as immigration increases.

To solve this problem empirically, we include an interaction term between CM and the standardised GS variable in the regression model of enrolment. The results from applying the OLS and the IV procedures to this specification are presented in Model 2 and Model 4, respectively. In this context, the interpretation of the CM coefficient is the marginal effect of a change in relative immigration to the BaC industry, applicable to students with an average score in lower secondary school. The interpretation of the coefficient on the interaction term is then the marginal effect of CM for individuals whose grade scores is a standard deviation above average. These coefficients are all negative and significantly different from zero. According to the IV estimates in Model 4, an increase by one percentage point in the relative supply of immigrants to the BaC industry induces a reduction of -0.0009 in the enrolment probability of students holding an average grade score. The corresponding numbers for students with a grade score one standard deviation down from the mean and up from the mean are, respectively, -0.0002 and -0.016. Thus, the negative effect of CM on the enrolment probability clearly increases with the students' grade scores in lower secondary school. It follows that the average grade of those who enter the BaC programme falls as the relative immigration to the BaC industry rises. Based on the theory, this result suggests that the supply-side mechanism is the dominant force, which explains the decreasing enrolment in the BaC programme following higher immigration to the BaC industry.

In order to increase the transparency of the results, we conducted several checks for robustness, as shown in Table 2. However, because the theoretical predictions work via the wage effect of immigration, we start out by supplementing the results of Bratsberg and Raaum (2012) using our identification strategy. As the dependent variable, we calculate, by county

and year, the average wage of natives working in the BaC industry relative to the corresponding average wage of natives employed in all other industries. As explanatory variables, we included the CM variable in addition to year and county dummies. We then estimate this wage equation using the 2SLS procedure, applying the same instrument that was used in the analysis of enrolment. The CM coefficient from the second stage, presented in the first column of Table 2, is negative and significant at the level of 10 percent.[19] Its value suggests that a 10 percentage points increase in CM reduces the relative wage in the BaC industry by 0.4 percent. At its mean value, this implies that a 10 percent increase in CM decreases relative wages by approximately 0.3 percent. This is somewhat lower than implied by the preferred estimate in Bratsberg and Raaum (2012). Nonetheless, the negative wage effect we obtain using our identification strategy is reassuring and increases the credibility of the empirical approach used to determine the effect of immigration on participation in the BaC programme.

In the remaining columns of Table 2, we present the results of estimating various specifications of Model 1 (in Table 1).[20] First, it can be questioned whether the county is the relevant labour market area in which to measure the effect of immigration on enrolment. In column 2, we present the results of estimating the model after substituting the 19 counties by 90 economic regions.[21] As presented in column 2, we still obtain a negative and significant, albeit somewhat smaller, CM coefficient when the local supply shock is measured at the level of the economic region. As previously mentioned, the county is the administrative level at which the upper secondary schools are organised, and not every economic region includes upper secondary schools, particularly those offering a BaC programme. Therefore, even

[19] The F-test for the excluded instrument shows that the instrument is not weak (F= 73.1).
[20] The 2SLS procedure did not satisfactorily work out the robustness checks in Table 2; therefore, OLS specifications are used.
[21] Norway has 428 municipalities, which is the lowest level of public (elected) authority. The economic regions are clusters of municipalities prepared by Statistics Norway based on geographical trade and residence patterns, as well as commuting distances. The classification is documented at https://www.ssb.no/a/publikasjoner/pdf/nos_c616/nos_c616.pdf

though it is reassuring that the value of the CM coefficient is not completely sensitive to the level at which the supply shock from immigration is measured, we argue that the county is the best unit of analysis in our context.

Next, it may be questioned whether county specific demand trends affect the results of the enrolment analysis. In column 3 of Table 2, we show the CM coefficient found when we estimate Model 1 (in Table 1) with county specific linear time trends. As can be seen, by comparing with the corresponding coefficient in Model 1 of Table 1, our main results are robust to the inclusion of such trends.

Finally, to investigate whether the effect of immigration on enrolment changed over time, a separate analysis is performed for each of the two periods 2001-2003 and 2004-2008. The results, which are presented in the two last columns of Table 2, reveal that significant effects are only found in the latter period, even though the difference in the value of the coefficients is small.

Attaining an apprenticeship position

During the study period, only 40 percent of the students who initially enrolled in the BaC programme were employed in an apprenticeship position three years later. We now analyse the effects of immigration to the BaC industry on this outcome variable. The sample at this point consists of all students who entered the BaC programme at the beginning of their upper secondary education between 2001 and 2007.

We propose that the supply and demand mechanisms may still be working at this stage of completing vocational education. However, the employers now have a more direct influence on the outcome because they provide the apprentice positions and decide whom to hire.

Table 3 presents the results of estimating the probability that a student who entered the BaC programme will be employed in an apprentice position during his third year of upper secondary education. Again, we estimate the linear probability model, including the full set of controls presented in section IV, and we generally follow the outline to the analysis of enrolment described in the preceding section.

[Table 3 about here]

In Model 1, equation (9) is estimated by OLS without an interaction term between the CM and the GS variables. The corresponding 2SLS results are presented in Model 3. The sign of both the OLS and 2SLS CM coefficient clearly confirms the prediction of a negative relationship between immigration and the likelihood of gained an apprenticeship position. The sign of the GS coefficients shows a positive selection for apprenticeship positions from the population of students who enter the BaC programme. The comparison of the CM results of Model 1 and Model 3 again confirm the hypothesis of a positive bias in the OLS estimate.

To indicate the size of the effect, the value of the estimated CM coefficient of Model 3 predicts that an increase of one standard deviation in CM (0.19) will decrease the probability of entering an apprentice position by 0.04, which constitute approximately 10 percent of the mean value for the study period (0.40).[22]

In Model 2 and Model 4, we again approach the question of how immigration affects selectivity to the BaC programme. In other words, is it students' decision to withdraw or the employers' exclusionary behaviour that dominates the immigration effect on recruitment to the apprentice positions? The OLS coefficient of the interaction term, in Model 2, is negative and significant, suggesting that the first alternative is valid. Using the 2SLS procedure, we also obtained a negative sign on the corresponding coefficient, but its value is reduced

[22] In footnote 8, we noted that the samples in stage 2 and stage 3 are selected on the basis of treatment. Still, even if the analyses are now limited to those who have chosen to proceed, the impacts of immigration are significant and sizeable.

considerably and no longer significant (Model 4). At this stage of the educational process we are, accordingly, not able to conclude clearly with regard to which side of the labour market dominates the negative immigration effect on recruitment.

The choice among fields of specialisation

Finally, we ask to what extent immigration to the BaC industry affects the distribution of students among the 17 fields of specialisation from which they choose during the last two years of their vocational education. To answer this question, we analyse the conditional logit model described by equation (10). The sample now consists of all students who enrolled in the BaC programme between 2001 and 2007 and who entered an apprenticeship position in their third year of education. In the preceding two steps of the analysis, our immigration measure (CM) compared the situation in the local labour markets of the whole BaC industry to the situation of other industries in the same local market. In this third step, the immigration measure (NM) compares the situation in the various fields of specialisation in the nation-wide labour market. Thus, the variation we observed in the immigration variable changes from the county level to the country level.

As explained in Section IV, to receive exogenous variation in the immigration measure, we assume that differences in the degree to which the specialisations are subject to licensing/certificate requirements gives us the necessary exogenous variation. However, as explained in Section IV, we also employ an alternative immigration measure (IM) that ties the identification more directly to the licensing information. Table WA1 in the Web Appendix presents descriptive evidence of the relationship between the yearly change in the recruitment of apprentices to the different BaC specialisations (column 4) and the change in our measure of immigration to their labour markets (column 3). The overall correlation coefficient between the changes in these variables is -0.58 and statistically significant.

The results of the conditional logit regressions are presented in Table 4. In Model 1, the analysis is performed for all students in the sample who gained an apprenticeship position in the third year of upper secondary education. The conditional logit coefficient of the NM variable is clearly negative. According to the NM coefficient in Model 1 and the expression of the corresponding marginal effect in Section IV, a one percentage point increase in the NM measure decreases the probability of choosing that speciality by approximately 10 percent.[23] One percentage point constitutes 26 percent of the average value of NM (equal to 3.8) during the period we study.

[Table 4 about here]

In Models 2 and 3, the analysis is performed separately for natives and immigrants. The coefficients are clearly negative and significant for both groups. In Models 4 and 5, the observation period is divided in two, and the analysis is performed separately for both periods. The NM coefficient is only significant for the final period (2004-2007); however, the point estimates of the coefficients are similar in both periods. In Model 6, the conditional logit model is estimated, excluding the counties in the capital area (Oslo and Akershus), which have the highest immigration shares in the country. The results show that the impact of immigration is still negative and significant.

Finally, in Model 7, we estimate the conditional logit model using the entire sample of apprentices, employing the alternative immigration measure described in Section IV (IM) and tying the identification more directly to the licensing information. The comparison of the coefficients derived from Model 1 and Model 7 shows that the two measures give similar results, which was reassuring.

[23] That is, if calculated using an average probability equal to 1/17.

VI. Conclusion

The questions asked in this paper concern whether the educational choices of students and employers' investments in training are affected by short-term changes in labour supply, which are measured by immigration. From the standard neoclassical theory of the labour market, we can deduce that a positive shift in labour supply will lead to downward wage pressure. This reduces the incentive of young people to attend educational programmes that teach the skills required in the affected types of work. The rational reaction of employers is to invest less in the training of employees in skills that have become more abundant in the open market. Thus, a combination of supply- and demand-side mechanisms work in the same direction. Our theoretical considerations predict that if the supply-side mechanism is the dominating force, the average grade score (GS) of students who participate in an educational programme would fall with increased immigration to the skill-specific labour market they intended to join after graduation. The opposite relationship will prevail if the demand-side mechanism is dominant.

We investigated these questions by studying how immigration to the Norwegian building and construction (BaC) industry has affected the recruitment of students to vocational programmes teaching skills that are particularly required by this industry. We utilise high-quality register data to follow students from enrolment in upper secondary school to entry into an apprenticeship position three years later.

Bratsberg and Raaum (2012) show that immigration to the Norwegian BaC industry has a negative effect on wage growth. The negative wage effect is confirmed using the identification approach in this paper. Our study reveals a negative relationship between labour immigration to this industry and the likelihood that resident students will enrol in the BaC programme when they enter upper secondary school. The same pattern was found with regard to the likelihood of entering an apprentice position at the beginning of the third year of

education by those who entered the BaC programme at the beginning of upper secondary school.

The strength of the negative relationship in the enrolment estimation increases with the students' grade scores (GS) from lower secondary school. Thus, in attempting to resolve the supply- and demand-side issue, we conclude that the supply-side mechanism is the most dominant factor. Finally, among students who were in an apprenticeship position in the third year of education, we find a negative relationship between the measure of immigration to the labour market for specialised skills and the likelihood that the student will choose that particular specialisation.

Our analysis clearly suggests that students react to increased immigration by choosing education in skills other than those that become more exposed to competition in the labour market. We argue that the result is strengthened by the fact that the main conclusion holds across different empirical approaches. That is, the negative relationship between immigration and educational recruitment emerges when we employ OLS as well as instrument variable methods and when we explore both local- and national-level variations in immigration.

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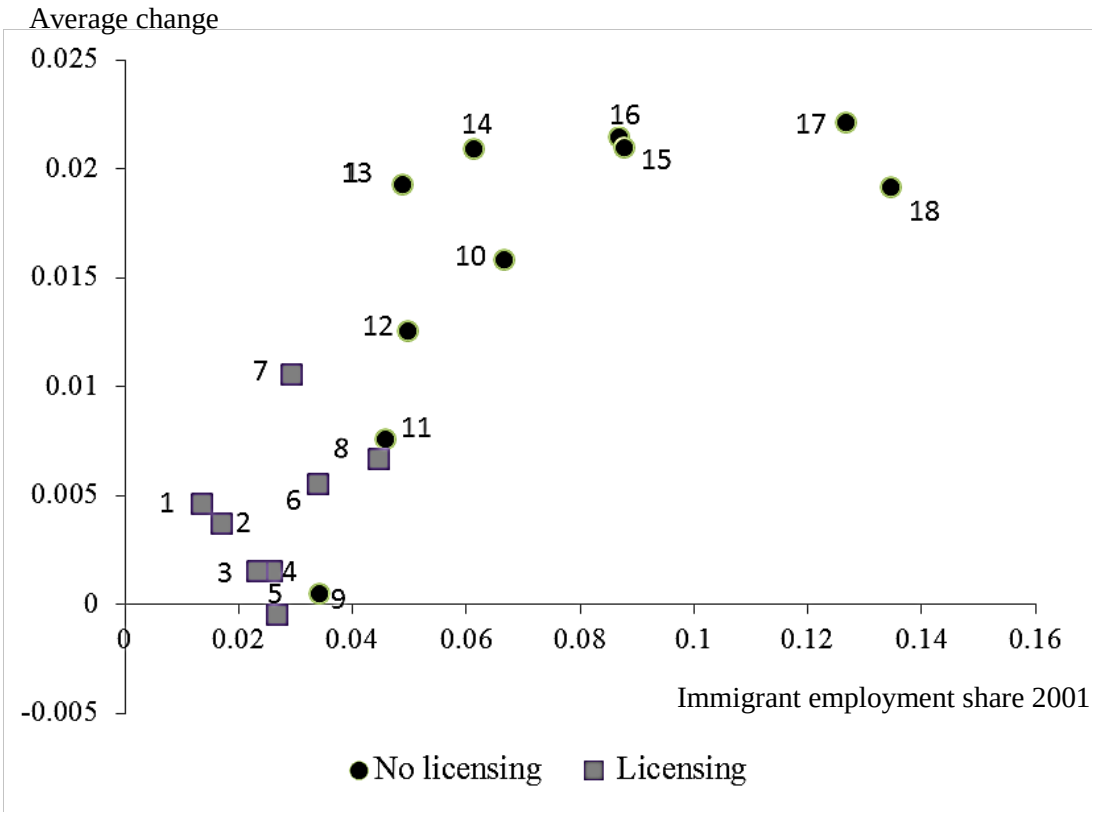
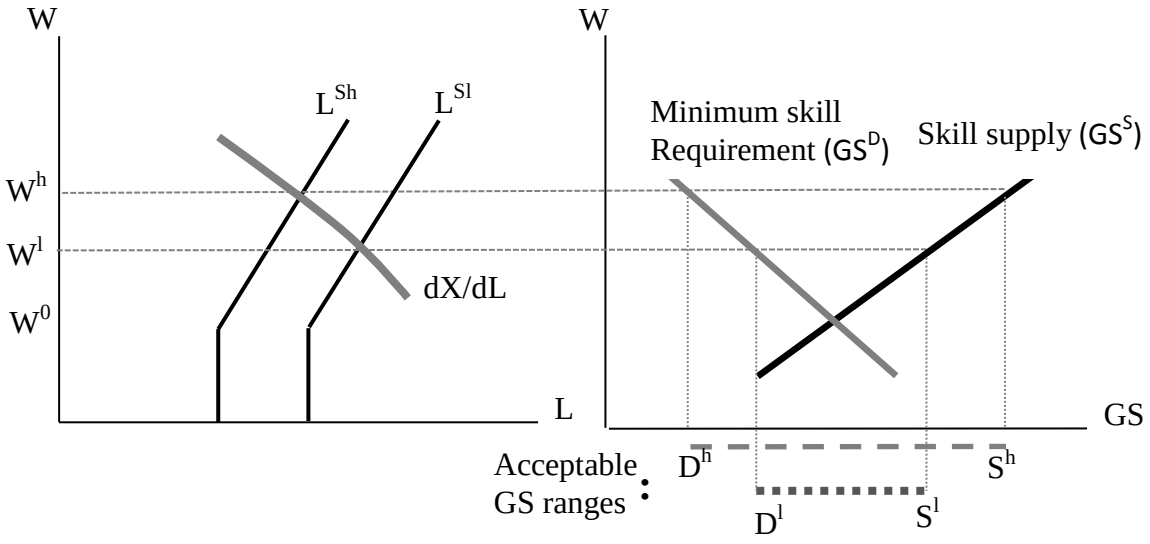
Figure 1. Immigrant employment shares in the studied business areas in 2001 and average annual change in employment share of immigrants 2001-2008



Note: See Table A1 in the Appendix for the 18 different business areas.

Figure 2. The labour market for apprentices and skilled workers - equilibrium solutions



Note: Where skill supply is determined by equation (1) and minimum skill requirement is determined by equation (7).

Table 1. The probability of enrolment into the BaC programme

	OLS	OLS	2SLS	2SLS
	Model 1	Model 2	Model 3	Model 4
CM	-0.036**	-0.039**	-0.087***	-0.090***
	(0.014)	(0.014)	(0.023)	(0.022)
GS	-0.066***	-0.023***	-0.065***	-0.013
	(0.002)	(0.008)	(0.025)	(0.028)
GS·CM		-0.054***		-0.067*
		(0.012)		(0.037)
R^2adj	0.064	0.065		
N	230324	230324	230324	230324
F-test CM			38.29	22.54
F-test GS·CM				8.75

Note: All male students aged 16-18 who entered upper secondary school between 2001 and 2008. OLS and 2SLS. CM is the relative employment share of immigrants in the BaC industry of county j. GS is grade score from lower secondary school. In all models, we control for year (dummies), county of residence (dummies), unemployment rate in county, age at enrolment, immigrant status, father's education and mother's education. Robust standard errors in parentheses are clustered within county cells. Level of significance: *** 1 percent, ** 5 percent, * 10 percent.

Table 2. Sensitivity analyses

	Wage effects	Enrolment	Enrolment	Enrolment	
		Labour market regions	Regional trends	Different periods	
	2SLS	OLS	OLS	OLS	OLS
				2001-2003	2004->
CM	-0.042*	-0.028**	-0.033***	-0.0358	-0.0385**
	(0.022)	(0.013)	(0.014)	(0.066)	(0.016)
GS		-0.024***	-0.023***	-0.044***	-0.026***
		(0.007)	(0.008)	(0.011)	(0.010)
GS·CM		-0.054***	-0.055***	-0.020	-0.053***
		(0.009)	(0.012)	(0.017)	(0.014)
R^2adj		0.061	0.035	0.059	0.067
N	152	230324	230324	78369	151955

Note: Wage effect of immigration and the probability of enrolment into the BaC programme. All male students aged 16-18 who entered upper secondary school between 2001 and 2008. OLS and 2SLS (wage effects). CM is the relative employment share of immigrants in the BaC industry of county j. In all models, we control for year (dummies), county of residence (dummies), unemployment rate in county, age at enrolment, immigrant status, father's education and mother's education. Robust standard errors in parentheses are clustered within county cells. Level of significance: *** 1 percent, ** 5 percent, * 10 percent.

Table 3. The probability of entering an apprenticeship

	OLS	OLS	2SLS	2SLS
	Model 1	Model 2	Model 3	Model 4
CM (2nd school year)	-0.118***	-0.118***	-0.218***	-0.221***
	(0.043)	(0.043)	(0.082)	(0.085)
GS	0.146***	0.185***	0.146***	0.171***
	(0.003)	(0.013)	(0.004)	(0.033)
GS·CM		-0.049***		-0.033
		(0.015)		(0.038)
R^2adj	0.133	0.133		
N	26056	26056	26056	26056
F-test CM			47.57	23.8
F-test GS·CM				15.8

Note: All male students aged 16-18 who entered the BaC programme between 2001 and 2007. OLS and 2SLS CM is the relative employment share of immigrants in the BaC industry of county j. GS is grade score from lower secondary school. In all models, we control for year (dummies), county of residence (dummies), unemployment rate in county, age at enrolment, immigrant status, father's education and mother's education. Robust standard errors in parentheses are clustered within county cells. Level of significance: *** 1 percent, ** 5 percent, * 10 percent.

Table 4. The probability of entering one of the 17 fields of specialisation within the BaC programme

Model	1	2	3	4	5	6	7
	All	Natives	Immigrants	2001-2003	2004-2007	Without Oslo/ Akershus.	All Alt imm measure
NM	-0.113***	-0.114***	-0.099**	-0.111	-0.142***	-0.121***	-0.098***
	(0.011)	(0.015)	(0.051)	(0.161)	(0.019)	(0.015)	(0.014)
Pseudo R^2	0.519	0.523	0.467	0.522	0.519	0.513	0.518
N	264438	246420	180018	84492	179946	233154	264438

Note: All male students who were in an apprentice position three years after entering the BaC programme. Conditional logit coefficient NM is the immigration share in the nationwide BaC labour market of workers who have acquired a BaC specialisation. In all models, dummies are included to control for the fixed effects of the specialisations. Robust standard errors are in parentheses. Level of significance: *** 1 percent, ** 5 percent, * 10 percent.

Appendix

Data sources

The data was gathered from different individual-level administrative registers. As a starting point, all data is collected and organised by Statistics Norway, then offered to the Norwegian research community. All information on education comes from *The National Database for Education* (*Nasjonal utdanningsdatabase*). Information on immigrant status was gathered from the Central Register of Individuals (*Det sentrale folkeregisteret*), which is governed by the tax authorities (*Skatteetaten*). Information on employment shares of immigrants in the BaC industry comes from the Employer/Employee Register (*Arbeidsgiver/Arbeidstaker-registeret*), which is governed by the Norwegian Labour and Welfare Administration (NAV).

Table A1. Business areas in the BaC industry. Share of employment in BaC

Business areas	SIC [1]	Employment share of BaC in 2004
1. Renting of equipment with operator	45450	1
2. Demolition and wrecking	45110	6
3. Construction of roads	45230	12
4. Electrical wiring	45310	19
5. Water projects	45240	0.2
6. Plumbing	45330	10
7. Glazing	45442	0.5
8. Other installation	45340	0.1
9. General construction	45212	4
10. Construction involving special trades	45270	7
11. Tinsmith work	45221	2
12. Construction of buildings	45211	29
13. Roof covering	45229	1
14. Joinery installation	45420	2
15. Other building completion	45450	0.5
16. Floor and wall covering	45430	1
17. Painting	45441	3
18. Insulation	45320	0.4

Note: [1] Standard industrial classification.

Table A2. Mean values. Men, 2001-2007. All students enrolled in upper secondary school and those who chose the building and construction programme

All upper secondary	Mean values	All BaC	Mean values
Share enrolling in		*Share reaching*	
Building and Construction (BaC)	0.129	apprenticeship position	0.522
Electronics	0.274		
Academic	0.652		
Relative immigrant share (CM)	0.767	Relative immigrant share (CM)	0.821
Local unemployment	3.026	Local unemployment	3.001
Local unemployment BaC	8.550	Local unemployment BaC	8.487
Grade point average from lower-secondary school (GS)[1]	40.69	Grade point average from lower-secondary school (GS)[1]	35.66
Non-western immigrants	0.087	Non-western immigrants	0.057
Western immigrants	0.031	Western immigrants	0.020
Father's education:		Father's education:	
Compulsory school	0.221	Compulsory school	0.305
Secondary school low	0.141	Secondary school low	0.170
Secondary school high	0.287	Secondary school high	0.334
College/university low	0.222	College/university low	0.132
College/university high	0.088	College/university high	0.022
Unknown education	0.041	Unknown education	0.036
Mother's education:		Mother's education:	
Compulsory school	0.276	Compulsory school	0.377
Secondary school low	0.153	Secondary school low	0.180
Secondary school high	0.218	Secondary school high	0.244
College/university low	0.288	College/university low	0.169
College/university high	0.037	College/university high	0.008
Unknown education	0.028	Unknown education	0.022
	362758		41012

Web Appendix

Table WA1. Fields of specialisation (certificates) within the BaC programme

		1	2	3	4	5
Field of specialisation	Education code[1]	% of all BaC – apprentices	Share of employees in lic.BaC[2]	Relative yearly increase in Immigration (NM).[3]	Relative yearly increase in apprentices [4]	Share of employees in BaC [5]
Railway track work	457103	0.10	0.845	0.064	0.703	87
Plumbing	457121	12.00	0.618	0.098	0.024	71
Road and construction work	457131	1.30	0.507	0.099	-0.024	68
Construction vehicle/machinery	457901	3.56	0.437	0.111	0.199	71
Concrete site work	457104	0.25	0.421	0.091	0.786	60
Asphalt work	457102	0.20	0.278	0.087	1.192	35
Ventilation and tinsmith	457117	2.10	0.165	0.110	0.085	63
Formwork	457108	5.20	0.108	0.132	-0.230	77
Reinforcing	457101	0.35	0.098	0.124	-0.017	70
Insulation	457115	0.28	0.028	0.105	0.123	25
Bricklaying	457119	6.28	0.027	0.133	-0.049	72
Carpentry	457129	59.04	0.025	0.147	0.002	63
Roofing	457124	0.19	0.016	0.180	0.081	91
Scaffolding	457123	0.31	0.008	0.126	0.212	21
Painting	457118	2.37	0.007	0.111	0.000	69
Industrial concrete work	457105	6.31	0.004	0.132	0.061	7
Paperhanging	457106	0.16	0.000	0.118	0.121	62

[1]Norwegian Standard Classification of education: http://www4.ssb.no/stabas/ItemsFrames.asp?ID=4969001 Language=en

[2] Share of all employees holding the vocational certificate in 2004 who worked within one of the licenced business areas marked with squares in Figure 1.

[3] Average relative yearly increase, 2001-2009, in immigration towards the BaC labour market of the speciality, as measured by NMt-1.

[4] Average relative yearly increase, 2001-2009, in recruitment of apprentice to the field of speciality.

[5]Share of all employees holding the vocational certificate in 2004 who worked within the BaC industry in 2004.

Table WA2. The probability of enrolment and the probability of entering an apprenticeship in the third year after enrolment into the BaC programme

	Enrolment		Apprentice position	
	County	CountyxYear	County	CountyxYear
	Model 1	Model 2	Model 1	Model 2
CM	-0.090***	-0.090***	-0.221***	-0.221***
	(0.022)	(0.021)	(0.085)	(0.071)
GS	-0.013	-0.013	0.171***	0.171***
	(0.028)	(0.015)	(0.033)	(0.035)
GSxCM	-0.067*	-0.067***	-0.033	-0.033
	(0.037)	(0.020)	(0.038)	(0.044)
R^2adj				
N	230324	230324	26056	26056
F-test CM	22.54	39.60	23.8	59.8
F-test GSxCM	8.75	11.27	15.8	7.7

Note: All male students aged 16-18 who entered the BaC programme from 2001 to 2007. In all models, we control for year (dummies), county of residence (dummies), unemployment rate in county, age at enrolment, immigrant status, father's education and mother's education. Robust standard errors in parentheses are clustered within county cells (Model 1) and countyxyear cells (Model 2). Level of significance: *** 1 percent, ** 5 percent, * 10 percent.