

Immigration and native investments in human capital*

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Summary

This article reviews the economic research literature that focuses on how increased labour supply through immigration affects the investment in skills in the receiving country; either through investment in formal education in the educational system or through skill specialisation in the labour market. We discuss the results from the research literature in the context of a welfare state of the Scandinavian type.

The high wage floor in the labour market makes immigration to the Scandinavian labour market particularly attractive for low- and semi-skilled workers. If immigration leads to investments in more education among inhabitants, it will lead to a more educated and more productive inhabitant workforce. This could be considered as positive. One uncertainty is related to the stream of immigrants in the future.

Keywords: immigration, human capital investments.

JEL classification numbers: J24, J31, J61.

* The authors thank participants at the Nordic Economic Policy Review workshop in Copenhagen in November 2012 for fruitful comments and discussions, as well as an anonymous referee and the editors for most valuable comments. The work is financed by the Norwegian Research Council, project: "The educational system in Norway: Putting it to the test of the labour market." The financial support is gratefully acknowledged.

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The topic of this article is how immigration may influence different aspects of the human capital accumulation of natives. More specifically, we review recent contributions to the research literature on how investments in formal education, as well as in upgrading of country-specific skill and occupational specialisation, are affected by changes in the influx of labour from abroad. One purpose is to discuss results from the recent literature on this topic, in the context of a welfare state of the Scandinavian type. Hence, we put a particular focus on the scant evidence based on data from this region.

During the last few decades, the Scandinavian countries have, along with many other industrialised countries, experienced a large increase in immigration. In Norway, the proportion of immigrants within the total population increased by 116 per cent from 1995 to 2010. Among the EU countries, only Ireland had a higher growth. The corresponding numbers for Sweden and Denmark are a 60 and 40 per cent increase, respectively. Sweden, however, started out on a higher level in 1995; with a share of immigrants in the total population of 10.5 per cent compared to 5.5 in Norway and 4.5 in Denmark (OECD, 2012). In all three countries, during this period as a whole, the majority of newcomers arrived from developing countries in Asia, Africa and Latin America and stated family reunification or need of protection as their main migration motive. Since the extension of the common EU/EEA labour market to include the new EU member countries in Eastern and Central Europe in 2004, the inflow of labour immigrants from the new EU member states to the Scandinavian countries has increased sharply. This trend has been particularly strong in Norway.

Empirical economic analyses of immigration effects in receiving countries have been dominated by studies of the impact on residents' wages and employment (Card, 2001, 2009; Borjas, 2003; Aydemir and Borjas, 2007; Ottaviano and Peri, 2008, 2012; Manacorda et al., 2012). No general consensus on the magnitude of the total effects of this kind has been reached in this literature. However, a general agreement is that the more similar the skills of resident workers are to the skills of newcomers, the more they stand to lose from larger immigration. That is, the more immigrant workers directly compete with natives in the labour market, the more the relative income of natives may suffer from a larger influx of labour from abroad. Hence, unless the skill composition of new-

comers is the same as in the resident labour force, the reward structure in the labour market will change as a result of higher immigration. In turn, the incentives to invest in human capital will change as well, i.e., since the return on such investments depends on the expected relative wages during total working life.

In this article, we focus on research literature that has investigated this wage structure mechanism through which immigration may affect the resident population's formal educational attainment (Jackson, 2011; Hunt, 2012; Røed and Schøne, 2012), as well as its occupational specialisation (Peri and Sparber, 2009; D'Amuri and Peri, 2012).

A related body of research literature studies the effect of immigration on the geographical mobility of natives within the receiving country (Card, 2001; Borjas, 2006). The main hypothesis tested in this field of work is that stronger competition in local labour markets triggers native outflow. If this is the case, a positive shift in local labour supply caused by immigration will be diminished by the reaction of native workers; either by moving out or not moving in as earlier planned. This point has been one of the major criticisms against the so-called "area approach" to the analysis of the wage effect of immigration. Basically, this method deduces the wage effect from the correlation between natives' wages and the fraction of immigrants in the (skill-specific) local labour market. If natives adjust their mobility – by moving in the opposite direction of immigrants – the wage effect will be underestimated in the local setting.

Whether native mobility in this way constitutes a severe problem to the "area-approach" is still a controversial question within this literature. Borjas (2003) proposes that the wage effect should be identified by the correlation over time between the fraction of immigrants and wage growth in skill groups across the national labour market. He suggests that the skill groups are established by crossing levels of education with the length of labour market experience. His main argument to promote this "national approach" over the "area approach" is that the national borders, as well as the "borders" between these skill groups, are more difficult to cross than the borders of geographically defined labour markets within a country. Thus, the skill groups in the national labour market to a greater extent mimic the closed labour markets which, according to economic theory, is necessary to capture the negative wage effect of a positive labour supply shift. In his study, based on the national approach, Borjas

(2003) presented estimates for the wage effects of immigration to the US that are considerably more negative than earlier estimates deduced in studies based on the “area approach”.

The literature we review adds to the discussion about the labour market effects of immigration in two ways: First, by exploring to what degree natives invest in formal education to avoid stronger competition caused by higher immigration. And, thus, if the immigrant inflow into labour market clusters defined by education triggers a native outflow through the work of the wage structure mechanism. Second, by investigating adjustment mechanisms that work within the labour market clusters, defined by formal education. That is, to what extent does higher immigration to their labour markets induce natives to invest in country-specific skills (e.g., related to communication and cultural knowledge) which lead to occupational specialisations that protect them from the stronger competition.

A welfare state of the Scandinavian type is characterised by a compressed wage structure, created by an interaction between centralised and collective wage bargaining, and generous welfare provisions with universal benefit rights (Barth et al., 2003). From an economic point of view, the high de facto minimum wages and the strong redistribution of welfare make immigration to the Scandinavian labour market particularly attractive for low- and semi-skilled workers.

The high productivity demands that mirror the high wage level, combined with strong employment protection (at least in Sweden and Norway), make the Scandinavian labour market difficult to enter from below. Thus, relatively newly arrived immigrants may compete poorly with native insiders about the jobs they already occupy and may segregate into more narrow segments of the labour market. A prediction of the model developed by Angrist and Kugler (2003) is that employment protection and entry barriers reinforce the negative employment effects of immigration by hampering job creation and productive reallocation of labour. However, it may be that the strongly subsidised educational sector of the Scandinavian countries makes investments in formal education relatively sensitive to changing labour market conditions and thus, facilitates a productive reallocation through this channel.

The article proceeds as follows: The next section gives a brief presentation of the theoretical framework underlying the literature that we discuss. Section 2 presents some empirical work on the relationship between

immigration and inhabitants' investments in formal education and Section 3 focuses on the relationship between immigration and inhabitants' task specialisation and skill upgrading in the labour market. Section 4 ends with a concluding discussion.

1. Theoretical framework

1.1 Who moves where?

Mainstream economics views migration as a human capital investment project, i.e., individual workers take on moving costs to relocate to a labour market where the expected return to their own human capital is higher. Identifying migrants as individuals making a rational investment decision, this framework goes back to Sjaastad (1962). It draws on Becker's human capital model (1962) in which people decide how much to spend on education and training by maximizing the net present value of their future income. Thus, according to this understanding, income differences between countries are the main determinant of labour migration. To analyse the skill composition of migration flows, Borjas (1987) combines the human capital framework with the Roy model (1951), developed to analyse the occupational distribution of people with different abilities.

In what way will the compressed income distribution of the rich Scandinavian countries affect the skill composition of immigrants that move into this region? To highlight some main points, we discuss this question within a simplified version of this Borjas (1987) model: Suppose that the world consists of three countries and that their income distributions may be described as in Figure 1. Income is measured at the horizontal axis and the density (frequency) of people on the vertical axis. Country A is on average poor and income is unevenly distributed in the population. Country B – maybe the US – is on average rich, but the income is just as unevenly distributed as in Country A. In Country C, which mirrors the Scandinavian case, the population is on average equally rich as in Country B, but the income distribution is considerably more compressed.

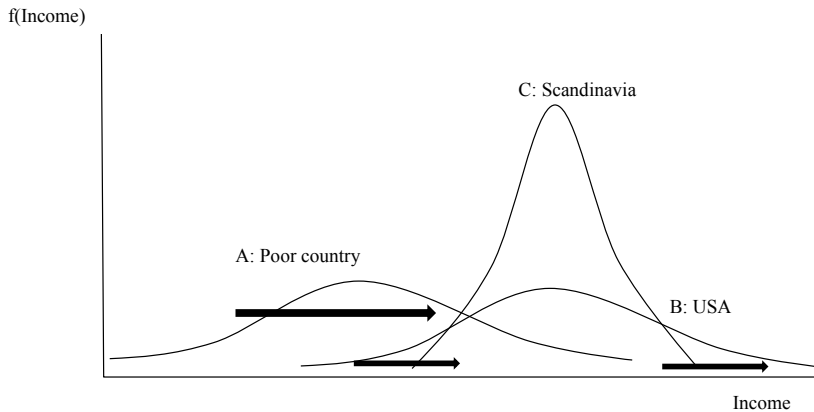
The relative productivity of the human capital an individual holds entirely determines her or his placement in the income distribution. Since

there is a strong positive correlation between level of education and productivity, these terms are close to interchangeable in this context.

Suppose further that individuals in all three countries have the same rank in the income distribution, irrespective of in which country he or she is located. That is, if moving from Country A to Country B or C, the person of concern will occupy the same location in the income distribution as was the case in the country he or she left. This assumption disregards the fact that some types of human capital are country specific and, thus, lose their value if transferred across national borders.

When individuals only pursue economic goals, i.e., they maximise their lifetime expected income, who moves between which countries? First, if we assume that C is not an option, who moves from A to B? Assuming the cost of moving to be independent of the individual worker's productivity, a representative sample of the population in A will move to B, i.e., the skill composition of immigrants will be equal to the skill composition in the native population.

Figure 1. The income distribution and the composition of migration flows



Source: Calculations from own register data.

Second, now disregarding Country A, who moves between Countries B and C? The answer is that the low-productivity workers move from the bottom of the income distribution in B to the bottom of the income distribution in C, while the high-productivity workers move between the tops of the income distributions, in the opposite direction. The point is that

individuals move to the country in which they get the highest return to their relative position in the productivity distribution.

Third, the migration flow from the poor Country A is divided between the two rich Countries B and C, so that the more productive part moves towards B and the less productive part moves towards C.

The migration costs are high, particularly when the cultural differences between sending and receiving areas are large. Thus, a really strong migration pressure only emerges when the average income differences between countries are huge. Due to the compressed income structure, the economic driving forces will tend to direct the relatively less productive, i.e., low- and semi-skilled immigrant workers, in the direction of the Scandinavian welfare states. In summary, these deductions indicate that larger immigration to Scandinavia first of all will execute a downward pressure in the lower part of the wage distribution. The study by Bratsberg et al. (2013) confirms that poorly educated workers have clearly been overrepresented in the immigration flows to Norway during the last few decades and indicates that this has decreased the relative wage of low-educated Norwegian workers.

1.2 Who gains and who loses from immigration?

Some simplified considerations, based on standard economic theory, can illustrate how immigration may affect the incentives for human capital investments among natives. Once more, the general starting point is the standard theory of investment in human capital (Becker, 1962). To make rational decisions about how much to spend on education or training, individuals must form expectations regarding the future income streams following from different alternatives. Such expectations are clearly affected by many different factors, among which the relative wage differences prevailing between skill groups are probably of great importance.

One main point, underlying the following discussion, is that residents in the receiving country – compared to newly arrived immigrants – have easier access to the educational system and a comparative advantage in exploring country-specific skills in their occupational specialization.

In a manufacturing process, there are roughly two kinds of relationships between factors of production: If the factors in the production process can replace each other relatively easily, we call them substitutes. If a

certain amount of both factors is necessary for each factor to work well, we call them complements. An increase in the supply of one type of skill has a negative effect on the marginal productivity and thus, the competitive wage, of workers holding skills that are substitutes. At the same time, the same supply shift will raise the productivity and, accordingly, the competitive wage, of workers with skills that are complements in production to the type that becomes more abundant.

We assume that the competitive wage is determined in a market where neither employees nor employers have any power to coordinate or manage the aggregated outcome.

This assumption is, of course, far from true in the Scandinavian countries, but this simple “perfect competition” model may still illustrate some basic mechanisms that will also generate an underlying pressure in a labour market of the Scandinavian type.

Two complementary factors are involved in the production process: workers holding skill a and workers holding skill b . Type a may refer to manual skills or low education, while b may be communicative skills or high education. To acquire skill b , investments in human capital (for example through formal schooling and/or on-the-job-training) are necessary. Assume further that all immigrants belong to skill group a , while natives are divided between the two groups.

Given this simple world, we discuss the effects of immigration on the wage structure and on human capital investments in two rounds, illustrated in Figure 2. First-round effects are demonstrated in the upper panel, and second-round effects in the lower panel. The left- and right-hand sides of the figures signify the labour markets for skill a and skill b , respectively.

The relationship between labour demand and wages is represented by the D-curves. Since the marginal productivity of each type of labour decreases with the number employed in the production process, measured along the horizontal axis, the demand curve is downward sloping. In other words, the demand curve represents the wage that an employer is willing to pay to the last employee hired, i.e., given the number of already employed and for a fixed amount of the other type of labour involved in the production process.

The relationship between labour supply and wages is represented by the S-curves. The upward sloping shape of this supply curve in the a -

market signifies that more workers holding skill a are willing (and able) to work if they are paid more. The vertical shape of this curve in the b -market signifies that, since it takes time before more workers are able to acquire skill b , the immediate supply of labour is not sensitive to wage change. The competitive wage is determined where the demand curve and the supply curve intersect. That is, where the last worker the employer is ready to hire is willing to work for a wage that equals the marginal product he or she contributes. As can be seen in the figure, the next worker demands a higher wage than his marginal contribution and this is obviously not good for business.

Due to immigration, the supply curve of workers holding skill a moves outwards; from S_1 to S_2 in the left diagram of the upper panel. The new supply curve intersects with the demand curve for a higher value of employment and a lower value of wage. Thus, more workers with skill a are employed in the production process and due to factor complementarity, the productivity of skill b workers increases. The demand curve in the labour market of these workers accordingly moves rightward; from D_1 to D_2 in the right-hand diagram of the upper panel. Since the supply of skill b is fixed in the short run, the demand shift increases the wages of skill b workers, but their level of employment is unchanged.

Thus, one first-round consequence of immigration is higher relative wages for the workers holding skill b (W_1^b to W_2^b) and, due to their lower wage level, a second consequence is that fewer natives holding skill a are ready to work. A share of these native employees who withdraw their labour supply from E_{1n} to E_{2n} will, due to the higher returns on this kind of investment, allocate their new spare time to acquire skill b .

As a result, the supply curve in the labour market of skill b workers moves outwards, from S_1 to S_2 , in the right-hand part of the lower panel. Due to the factor complementarity, this also moves the demand curve in the labour market of the skill a workers outwards, from D_1 to D_2 in the left part of the lower panel. At the same time, the supply curve in the labour market of skill a moves inwards, from S_2 to S_3 . That is, since the workers who invest in skill b withdraw their labour supply from that market. As can be seen in the figure, this second round of adjustments taking place on both sides of the labour market once more compresses the wage difference which increased in the first round of immigration effects.

Figure 2. Wage and investment effects in a market economy with two types of labour

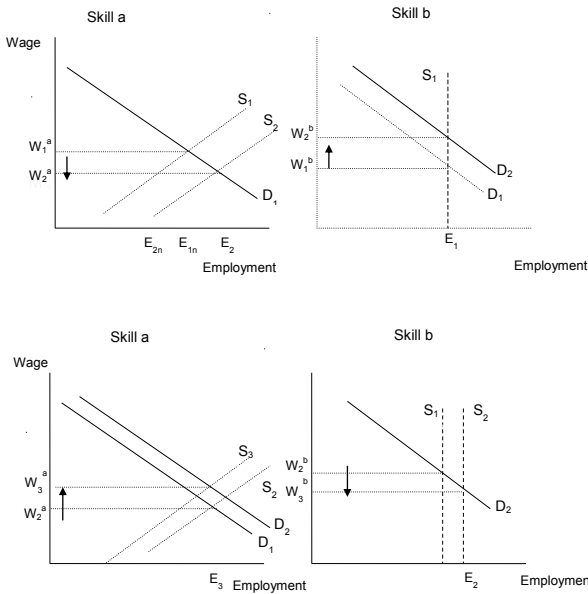


Figure 2 outlines the direction of changes which are triggered by immigration within this simplified model. However, a new long-term equilibrium is not established by the two first rounds of adjustments. One mechanism which may affect the further process is that the new immigrants will gradually acquire the same investment possibilities as natives, i.e., they will gain access to the school system and accumulate country-specific skills. Thus, their relative supply of labour to the two markets will become more equal to that of natives.

To summarise the main points: By investing in formal education, and/or specialising in occupations more intensively utilizing country-specific skills, natives may reap the return on immigration through the acquirement of human capital that is complementary to that held by newcomers. Such changes in the composition of human capital accumulation among natives may mitigate the distributional conflicts which, due to greater income inequality, could arise in the first round of immigration effects.

2. Immigration and investments in formal education in the receiving country

In this section, we review some recent contributions to the research literature analysing the effect of immigration on investment in education in the receiving country. As already emphasised, we focus on the effect that occurs through the labour market incentives, i.e., the immigration-induced changes in the wage structure.

The empirical literature on the relationship between immigration and investment in education is dominated by US evidence. Jackson (2011) explores decadal US census micro data from 1970-2000 to analyse the relationship between immigration and enrolment of natives in college. He identifies the wage structure effect on human capital investment via the correlation between the ratio of low-educated to high-educated in the states' immigrant workforces and the rate of native college enrolment. There may be a "simultaneity problem" related to the use of geographical variation in immigration to identify its effect on human capital investment. That is, unobserved demand shifts may affect both the inflow of foreign labour to an area and the educational choice of natives in the same area. To isolate a geographical variation in immigration that is independent of the local economic development, Jackson (2011) uses the historical settlement pattern of immigrants. This approach explores the "chain migration" mechanism, following from the fact that people want to live close to others who are similar to themselves. Using historic settlement patterns for this purpose is a well-established strategy within the economic literature analysing different effects of immigration in the receiving countries.

A key finding of Jackson (2011) is that an increase in the share of unskilled immigrants in the labour force of the states clearly raises the rate of native college enrolment through the wage structure mechanism. A one per cent state-level increase in relatively unskilled immigrant labour increases the rate of enrolment in college by 0.33 per cent. This effect is larger for young people who have access to public school attendance. According to the author, this may be the result of the student admission policy, which is more sensitive to the number of applicants in public compared to private colleges (Bound and Turner, 2007).

Using a state panel based on census data from 1940-2008, Hunt (2012) analyses the impact of immigration on the high school completion of native children in the US. According to Hunt, immigrants to the US are strongly overrepresented among the unskilled and also to some extent among the highly educated. Thus, the effect of higher immigration on the wage structure should be to increase the difference in the lower part of the earnings distribution, i.e., between those who drop out of high school and those who complete it. Hunt identifies the wage structure effect on human capital investment via the correlation between the shares of immigrants with less than 12 years of schooling in the state populations (18-64 years of age) and the natives' high school completion rate in the same area. To distinguish between the wage structure effect and the school displacement effect, she includes the share of immigrants in the population aged 11-17 in the relationship analysed. The share of immigrants in the population is measured when natives are aged 11-17, and their educational attainment at the age of 21-27. Similar to Jackson (2011), Hunt (2012) utilises historic settlement patterns to acquire a variation in the level of immigration that is independent of local business cycles.

The results show that the effect of immigration of adults (aged 18-64) with less than 12 years of schooling on natives' completing 12 years of schooling is positive and significant. This supports the hypothesis that the presence of unskilled immigrants in the labour market changes the wage structure to give natives an incentive to complete 12 years of schooling.

Scandinavian evidence on this matter is scant; one exception is Røed and Schøne (2012). They analyse the relationship between immigration to the Norwegian Building and Construction (BaC) industry and the recruitment of pupils to vocational programmes in upper secondary school that are educating workers that are particularly in demand in that industry.

When Norwegian pupils enter upper secondary school, they must choose between an academically oriented track, which provides access to a university or college education, and a vocational track leading to an occupational qualification. If entering the vocational track, the pupil must choose between nine different general vocational programmes. The standard way of acquiring the occupational certificate involves two years of school-based education followed by two years of specialisation in an apprentice position.

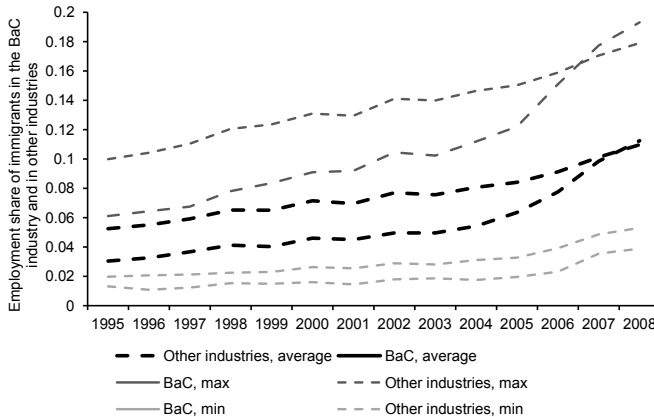
The data used in the study is extracted from administrative population registers. Panels of all pupils who started an upper secondary education from 1995 to 2009 are established. Including a wide range of socio-economic background variables, this data set gives yearly information about the pupils' level and field of study, and if they leave the educational system. Røed and Schøne (2012) identify the wage structure effect on educational choice by analysing the relationship between the relative employment rate of immigrants in the BaC industry in their country of residence and two types of dependent variables: i) the probability that new pupils enrol in the program teaching BaC skills and ii) if they do, their probability of entering an apprentice position two years later.

Figure 3 describes the development of the immigrant share in employment from 1995 to 2008 and how it varies between the 19 Norwegian counties and between the BaC industry and all other industries. The figure shows that the relative share of immigrants in the BaC industry increased considerably after the enlargement of the common EU/EEA labour market in 2004.

Bratsberg and Raaum (2012) indicate that immigration has lowered the wage of workers in the Norwegian BaC industry during the period studied by Røed and Schøne (2012). The key result of Røed and Schøne's (2012) study suggests that higher immigration into the BaC industry is clearly negatively related to the probability that pupils enter the BaC programme at the beginning of their upper secondary education. On average, a one per cent increase in the relative employment of immigrants in the BaC industry decreases the enrolment in the BaC programme by approximately 0.29 per cent. The relative immigration to the BaC industry of Norwegian counties increased by 75 per cent from 1995 to 2008. Thus, an interpretation of this result is that the mean probability of all new upper secondary pupils enrolling in the BaC programme decreased by 22 per cent, from 1995 to 2008, due to immigration. To reach causal statements regarding the relationship between immigrants in the BaC industry and pupil enrolment, historical patterns of immigrant employment and settlement are utilised. The results are strengthened after conducting such an exercise. The negative effect of immigration into the BaC industry on enrolment into the BaC programme suggests that pupils do observe and react to increased competition in the labour market by choo-

sing other fields of study that are not as exposed to competition from immigration.

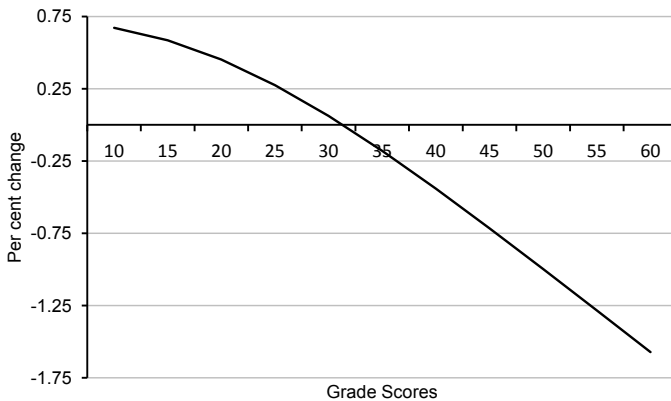
Figure 3. The employment share of immigrants in the BaC industry and in other industries. County average, county with highest (max) and lowest (min) immigrant shares of total employment



Source: Calculations from own register data.

Furthermore, the analyses reveal that the absolute value of this negative relationship between immigration and enrolment increases with the pupils' grade scores (GS) from lower secondary school. This association is presented in Figure 4. As can be seen, the probability of enrolment is positively affected by immigration to the pupils' future labour market for values of GS lower than 30 and negatively affected for values of GS higher than 30. The negative relationship found for the pupils is, on average, explained by the fact that only 14 per cent of all pupils who entered upper secondary school in the period studied had a GS equal to 30 or lower. If we assume that productivity increases with grades, the relationship presented in Figure 4 suggests that the group of pupils who change their field of study as a result of higher immigration is positively selected with respect to productivity.

Figure 4. Per cent change in the probability that upper secondary pupils enter the BaC programme, resulting from a one per cent change in immigration to the BaC industry of their county, conditional on grade score (GS) values



Source: Calculations from own register data.

This suggests that it is the relatively productive natives that move out of the occupations where immigrants move in. This further suggests that the reallocation of labour taking place through the educational channel is productive. A reduction in the wage of BaC workers, following from higher immigration, implies that the economic return on this kind of labour has fallen. Thus, economic growth would be facilitated if the most productive of the BaC pupils invest in alternative skills that pay a relatively higher return in the labour market.

Finally, regarding the second dependent variable, the probability of entering an apprentice position within the BaC programme (conditional on being in the BaC programme), Røed and Schøne's (2012) results show that larger immigration into the BaC industry (their future labour market) is negatively related to the probability of entering an apprentice position, i.e., a similar result compared to the enrolment analyses. Furthermore, and also in line with the enrolment results, the strength of this negative relationship also increases with the pupils' grade scores from lower secondary school.

3. Immigration and investments in country-specific skills

In this section, we review contributions to the research literature that study the effect of immigration on the upgrading of natives' country-specific skill and occupational specialisation. There are no studies on this

topic that are based on Scandinavian data. Therefore, at the end of this section, we present some descriptive evidence from Norway that may serve as a preliminary investigation of this topic in a Scandinavian context.

The starting point for this research literature (Peri and Sparber, 2009; D'Amuri and Peri, 2012) is that natives, compared to immigrants, may have a comparative advantage for work that requires knowledge of country-specific skills. This typically concerns jobs that require a relatively high level of communicative skills. In addition to handling the formal language, effective communication demands the understanding of social and cultural codes, unwritten rules, implicit communication, norms, etc. Thus, according to this literature, natives, and especially less educated natives, may respond to immigration by leaving physical and manual occupations for more communication intensive occupations and tasks.

Since the Scandinavian countries belong to a small language area, natives' comparative advantage related to solving communicative tasks may be particularly large in these countries. In general, however, the technological and organisational evolution in advanced industrialised countries may have increased the scope for exploring such country-specific skills during the last few decades. The introduction of new technologies and work practices are two characteristics of the so-called "new economy" that have emerged. Such changes comprise a move away from traditional assembly-line organisational structures towards production structures characterised by multitasking, job rotation, teamwork, intensive use of computers, reductions in management levels, and decentralisation of responsibilities (Lindbeck and Snower, 2000). Such kinds of technological and organisational practices clearly require greater interpersonal communication than the traditional assembly-line type of production. Accordingly, this development may have both increased the return on such country-specific skills, and the potential for complementarity in the production process between native and immigrant workers.

A study by the OECD (1999) suggests that these types of organisational changes have been more extensive in the Scandinavian countries. Using Norwegian survey data, Rosholm et al. (2013) show that workplaces in Norway that use personal computers intensively, and workplaces that give their employees broad autonomy, hire fewer immigrants who arrived as adults. The negative relationships are especially strong for low-

skilled non-Western immigrants. This result suggests that the introduction of new work practices (measured by personal computers and autonomy) has led to reduced demand for workers that are less endowed with these types of skills, in this case immigrants.

From recent years, there is a small body of literature focusing on the relationship between immigration and upgrading of country-specific skill in the labour market. Peri and Sparber (2009) develop and test the theory of whether immigration of low-skilled labour leads natives with the same level of education to specialise in tasks that demand greater communicative skills. Upon arrival, immigrants are poorly equipped with the language and skills connected to social and cultural codes. These are skills that are important for mastering formal and informal communication in the labour market. If this is true, it may give the native labour force a comparative advantage in areas where these types of communicative skills are well rewarded. Especially, it will give low-skilled natives incentives to invest in and develop these skills. On the other hand, immigrants will have a comparative advantage in tasks that are more manual and routine oriented. Peri and Sparber (2009) test this hypothesis on US data containing detailed information on the complexity of tasks with respect to both communication and manual skills. Their results show that foreign-born workers have specialised in occupations that require manual and physical labour skills, while natives pursue jobs that are more intensive in communication and language skills. The results suggest that immigration is the mechanism behind this pattern. They argue that this specialisation process is partly the explanation for the small wage effects of immigration.

D'Amuri and Peri (2012) analyse the same matter using data from 15 Western European countries during the 1996-2010 period. They also analyse if this kind of occupational adjustment strategies is more prevalent in economies with more flexible labour markets. The 15 European countries give the institutional variation necessary to analyse whether flexible labour markets facilitate the occupational adjustment strategy. Specifically, D'Amuri and Peri analyse whether the occupational response of natives to immigration is stronger in countries with less restrictions and regulations related to hiring, firing and wage setting. Similar to the analysis of Peri and Sparber (2009), their results suggest that, by taking up manual oriented tasks, immigrants push native workers towards more

complex jobs, with more communication and abstract content and that such reallocation takes place without any negative effects on natives' employment rates.

Furthermore, when they split countries into two groups (those with strong employment protection legislation and those with weak employment protection), they find that such reallocation is much higher in countries with more flexible labour laws. This result is consistent with the hypothesis that in countries with high employment regulations (EPL), manual workers tend to remain in simple-manual occupations that are more exposed to wage competition from immigration.

Why then should the degree of natives' immigration induced reallocation towards communication intensive occupations be lower in countries with high EPL? D'Amuri and Peri (2012: 23) argue that "Labour markets with strong employment protection may reduce mobility in and out of employment, they may also keep workers within the boundaries of narrowly defined occupations as workers' protection (via collective contracts) is defined in terms of specific occupations." Referring to Angrist and Kugler (2003), they further argue that more flexible labour markets could increase the absorption of immigrants by facilitating job upgrading and job creation.

In their study of Western European countries, Angrist and Kugler (2003) analyse the interaction between measures of employment regulations, the replacement rate in unemployment benefits and entry barriers in the product markets, on the one side, and the employment effect of immigration, on the other. As one of their conclusions, they state: "Although not entirely clear cut, the empirical results offer some support for the view that reduced flexibility may make immigrant absorption more painful, at least when viewed from the point of view of native employment."

According to our interpretation, Angrist and Kugler's (2003) results indicate that entry-barriers in the product market reinforce the negative employment effects of immigration. However, with regard to employment regulations and the unemployment replacement rate, their results are less strong.

We end this section by presenting some tentative evidence from Norway on the potential for immigration induced reallocation of natives' human capital investments; from manual tasks towards more complex and communicative tasks. Register data from 2005-2010 is utilised. We use

the same construction of complex and simple tasks as in D’Amuri and Peri (2012). The starting point for construction of the task variables is the O*NET data from the US Department of Labor. Different abilities and tasks are assigned to 339 occupations from the Standard Occupation Classification (SOC). These tasks are then used to construct a skill intensity measure for each occupation. From these, we use two measures for the type of ability demanded to solve tasks in different occupations: “complex” and “manual”. Since the SOC codes are more detailed than the European codes of the International Standard Classification of Occupation (ISCO), the SOC codes are collapsed into 21 two-digit ISCO codes. For each task, the intensity can vary between 1 and 100. The 21 occupations with the corresponding task intensities are listed in Table A1 in the Appendix. The interpretation of the task intensities is as follows: Take the occupation “Managers of small enterprises”. It has a complex score equal to 0.97. This indicates that 97 per cent of all workers are using complex skills less intensively than managers of small enterprises.

A necessary starting point for the specialisation mechanism is that immigrants and natives with the same educational level are employed in different occupations with different degrees of complex and manual tasks. Table 1 presents correlations from OLS regressions of the ratio between complex and manual tasks and immigrant status, for all workers and low-skilled workers. The analyses are carried out for all industries (upper half) and for the Building and Construction industry (lower half). We include the Building and Construction (BaC) industry as a separate analysis since this is an industry that has experienced a large influx of immigrants in the period of observation. The dependent variable is the ratio between the index for complex and manual tasks (see Table A1).

Table 1. Correlations between immigrant status and complex/manual tasks 2005 and 2010, OLS, estimated coefficients

	All industries	
	All workers	Workers with low education
Immigrant	-0.309	-0.244
High education	0.729	
	Building and Construction industry	
	All workers	Workers with low education
Immigrant	-0.116	-0.097

High education

0.817

Source: Calculations from own register data.

Note: We use two categories of education: High education (college or university education) and low education (secondary or compulsory level education). All coefficients are significant at the level of 1 per cent.

For all industries, as well as for the BaC industry, there is a negative correlation between being an immigrant and the complex/manual ratio. This is in line with the hypothesis in the task-specialisation literature. The negative correlation applies both for all workers and low-educated workers. Furthermore, and as expected, there is a positive and significant correlation between having higher education and the complex/manual ratio.

Table 2 presents mean values of the complex/manual ratio in 2005 and 2010 for natives and immigrants, respectively. If natives tend to specialise in more complex tasks in response to an increased labour supply of mostly low-skilled immigrants, we would expect this pattern to be especially prevalent in industries that have experienced a large influx of immigrants in the period.

Table 2. Complex and simple tasks of natives and immigrants, all industries and Building and Construction, 2005 and 2010

	2005	2010
All industries		
<i>Natives: Complex/Manual</i>	1.77	1.74
<i>Immigrants: Complex/Manual</i>	1.34	1.33
Building and Construction		
<i>Natives: Complex/Manual</i>	1.14	1.25
<i>Immigrants: Complex/Manual</i>	1.08	1.02

Source: Calculations from own register data.

Note: Complex/Manual is the average of the ratio between an occupation's complex and manual index number.

Looking at all industries, there is a stable pattern when it comes to the complex/manual ratio from 2005 to 2010 for both natives and immigrants. For the BaC industry, there is a tendency that natives move towards more complex tasks (index from 1.14 to 1.25) and immigrants move towards more manual tasks (index from 1.08 to 1.02), as expected if natives specialise in relatively more complex tasks in response to immigration.

In summary, these very simple exercises report results that are in line with the hypothesis in the task-specialisation and country-specific skill-upgrading literature. More thorough analyses are needed to investigate these matters further.

4. Concluding remarks

This article has reviewed the research literature that focuses on how increased labour supply through immigration affects the investment in skills among individuals in the receiving country; either through investment in formal education in the educational system or through skill specialisation in the labour market. One purpose has been to discuss the results from this literature in the context of a welfare state of the Scandinavian type.

The studies by Jackson (2011) and Hunt (2012), based on US data, both indicate that an inflow of disproportionately low-skilled workers from abroad inspires natives to acquire more formal education. A study from Norway (Røed and Schøne, 2012) suggests that the pupils' choice of

programme in upper secondary school is affected by immigration into the local labour market. Larger immigration into the Building and Construction industry (BaC) in the area where they live causes pupils to move away from programmes in upper secondary school that educate workers for the BaC industry.

Therefore, these studies indicate that immigration – through the wage structure mechanism – does affect investments in formal education in the receiving country. We have argued that, due to the compressed income distribution in Scandinavian countries, the influx of labour to this region will be disproportionately low-skilled. Thus, through this mechanism, higher immigration to the Scandinavian countries may increase the native populations' investment in formal education.

By analysing US data, Peri and Sparber (2009) find that immigration induces low-skilled natives to specialise in relatively complex tasks demanding country-specific – and particularly communicative – skills. They argue that this may be the reason why immigration of poorly educated workers has a relatively small negative impact on the wage of similarly skilled natives. Analysing data from 15 European countries, D'Amuri and Peri (2012) find that such a strategic reallocation of country-specific human capital in response to immigration seems to be more prevalent in countries with low employment protection legislation (EPL) in the labour market. Their explanation is that countries with strong EPL may keep workers within narrowly defined occupations, since workers are protected through collective agreements within specific occupations. They argue that this may hamper the absorption of immigrants by not facilitating job upgrading and a productive reallocation of natives.

According to OECD's Indicator of Employment Protection, Norway is only slightly above the OECD average. Furthermore, Angrist and Kugler's (2003) results indicate that it is first of all entry-barriers in the product market that reinforce the negative employment effects of immigration and, according to the OECD (2006), the Scandinavian countries are characterised by well-functioning product markets.

The degree to which immigration creates specialisation effects in the labour market will depend on several factors. Language barriers are one channel through which inhabitants can receive a comparative advantage. This channel may be especially relevant in "small language areas" like Scandinavia.

The study for Norway (Røed and Schøne, 2012) suggests that a significant reallocation of pupils occurs in the educational sector in response to immigration. Therefore, if structures in the labour market limit the reallocation of workers in response to immigration, the educational sector may serve as a compensatory channel in this regard. It may also be that the strongly subsidised educational sector of the Scandinavian countries makes investments in formal education relatively sensitive to changing labour market conditions.

If immigration leads to investments in more education among inhabitants, it will lead to a more educated and more productive inhabitant workforce. This could be considered as positive. One uncertainty is related to the stream of immigrants in the future. The economic growth in many of the sending countries is good. If the welfare gap is considerably reduced, the immigrant stream will also be reduced. Then, the receiving country must rebuild the educational capacity in the fields of study where the immigrants had previously been dominating. If the immigration is mainly low-skilled, it is mainly the educational capacity in low- and semi-skilled studies that must be rebuilt. It is probably easier to rebuild the educational capacity in low- and semi-skilled studies than if the country had to rebuild skill-intensive studies.

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Appendix

Table A1. Skill intensity of occupations

	Manual	Complex
Corporate managers	27	83
Managers of small enterprises	16	97
Physical, mathematical and engineering professionals	34	63
Life science and health professionals	46	89
Other professionals	34	74
Physical, mathematical and engineering associate professionals	36	61
Life science and health associate professionals	63	71
Other associate professionals	15	67
Office clerks	29	44
Customer service clerks	29	46
Personal and protective service workers	59	54
Models, salespeople and demonstrators	18	66
Extraction and building trades workers	62	80
Metal, machinery and related trade work	84	30
Precision, handicraft, craft printing and related trade work	68	35
Other craft and related trade workers	74	22
Stationary plant and related operators	65	40
Drivers and mobile plant operators	82	30
Machine operators and assemblers	88	28
Sales and service elementary occupations	55	28
Labourers in mining, construction, manufacturing and transport	87	49