

# Immigrant Overeducation: Evidence from Denmark\*

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## Abstract

Anecdotes abound in the Danish public debate about well-educated immigrants that are in jobs they are formally overqualified for. Using a 1995-2002 panel data set based on Danish registers, this study attempts to find out how large a problem immigrant overeducation is in the context of the Danish labor market. More specifically, three questions are posed: First, to what extent are immigrants overeducated and are they more likely to be so than native Danes? Second, why are some immigrants more likely to become overeducated than others? And finally, what are the consequences of overeducation for individual wages? We find that among wage earners with at least a vocational education or higher, 25% of male non-Western immigrants are overeducated. The same applies for 15% of native Danes. Particularly immigrants with a foreign-acquired education risk becoming overeducated – here the share is 30% among those with a vocational education or higher. We find that Danish labor market experience is extremely important in reducing the likelihood of becoming overeducated. Years spent in the country without accumulating labor market experience do not improve an individual's chances of an appropriate job-to-education match. In terms of earnings consequences, the study concludes that years of overeducation do increase wages for immigrants, but much less so than years of adequate education. This is also true for native Danes, but the relative penalty for overeducation is much larger for immigrants than for Danes.

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## 1. Introduction

Anecdotes abound in the Danish public debate about well-educated immigrants who cannot seem to obtain jobs that match their formal qualifications. An individual, who has a job that he is formally overqualified for, is said to be overeducated. That is, he has more education than is strictly required for his position. Whether or not this is a problem depends on the underlying reason for this occupation-to-education mismatch, whether it is a temporary or permanent phenomenon experienced by the individual, and whether it is a structural feature of the labor market as a whole. Concern arises when overeducation leads to reduced job satisfaction, which in turn may lower worker productivity and thereby also wages. Furthermore, being overeducated for a longer period of time may lower the labor market value of an individual's formal qualifications if these skills become outdated. Overeducation can have macroeconomic implications as well. The skills of an overeducated worker are underutilized and therefore overeducation can be thought of as a form of skill-related underemployment. Hence, overeducation can be costly for the economy at large because human capital resources are allocated in an inefficient manner. Consequently, widespread and persistent overeducation can lead to lower overall productivity and economic growth.

Against this background, it is relevant to ask how large a problem immigrant overeducation is in the context of the Danish labor market. More specifically, three questions are addressed:

- (1) To what extent are immigrants overeducated?
- (2) Why are some immigrants more likely to become overeducated than others?
- (3) What are the consequences of overeducation for individual wages?<sup>1</sup>

This study fills a gap in the existing literature by examining the phenomenon of immigrant overeducation for the case of Denmark. Most European studies on overeducation – concerning both immigrants and natives – consider the cases of Germany, the Netherlands, Portugal, Spain, Sweden and the United Kingdom (see e.g. Büchel et al. 2003 for a recent overview).<sup>2</sup> In terms of methodology, this study builds on the existing literature, using panel data from administrative registers and applying econometric methods to address the questions posed above. This study distinguishes itself by proposing an alternative measure of overeducation and by having access to a large register-based data set.

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<sup>1</sup> In Denmark assimilation of immigrants in the labour market is typically evaluated in relation to employment rates because high effective minimum wages make it difficult for low-skilled workers (and thereby certain groups of immigrants) to obtain employment. Wage consequences are a “standard” topic in the overeducation literature, however, which makes comparisons with other studies interesting. Moreover, “[o]ne of the most striking empirical regularities that has emerged from comparative analyses of the earnings of immigrants and the native born is that the partial effect on earnings of a year of schooling is lower for the foreign born than for the native born.” (Chiswick and Miller 2005, p.2) Therefore, in this study we investigate what job-to-education mismatches mean for wages and whether there are differences between immigrants and native borns.

<sup>2</sup> As far as the author is aware, studies on immigrant overeducation in Denmark limit themselves to two studies concerning young second-generation immigrants whose parents came to Denmark from Turkey, Pakistan and the former Yugoslavia in the late 1960s and early 1970s (Jakobsen 2004, Schmidt and Jakobsen 2000).

The paper proceeds as follows: The next section provides an overview of the most common explanations of overeducation in the literature, while the third section describes the data, focusing in particular on educational attainment and occupational status. Section 4 describes the empirical methods used to measure overeducation, to identify determinants of overeducation, and to assess the earnings consequences of overeducation. Section 5 presents and discusses the results of the empirical analysis, and the final section concludes.

## 2. Literature review

Two strands of literature form the backdrop for this paper, namely migration and overeducation. Within the topic of migration, the present analysis is related to what is known as the assimilation literature, which is concerned with the economic and social performance of immigrants in the host country. In the present context, interest centers on assessments of how immigrants adapt to the host country labor market. Many studies use earnings as the main measure of labor market performance and compare immigrant earnings profiles with those of the native born (see e.g. Borjas 1985, 1994, 1995, Baker and Benjamin 1994, Longva and Raaum 2003). In this paper, we also compare the performance of immigrants and natives, but our main measure of labor market performance is job-to-education match.

Several of the more recent labor market assimilation studies mentioned above conclude on a rather pessimistic note, pointing out that immigrant and native earnings profiles are rather disperse and that assimilation is typically rather slow. Among the explanations given are changing compositions of immigrant cohorts (e.g. declining ability, imperfect transferability of skills from specific countries of origin) and lower returns to experience for foreign-educated immigrants (see e.g. Baker and Benjamin 1994).<sup>3</sup> In this paper, we also distinguish between foreign-educated and Danish-educated immigrants, and labor market experience is a key explanatory variable in determining which of these two groups of immigrants is more likely to experience job-to-education mismatch.

Immigration policy also plays a central role. Borjas (1994), for example, finds that countries that actively select more skilled and better educated immigrants through e.g. a points system (e.g. Canada and Australia) do indeed attract workers that do well in the labor market. They have higher wages and they are less likely to be dependent on public assistance. By contrast, immigrants in host countries that have not in the past used such “sorting mechanisms” (e.g. Germany and other European countries) do less well. Their wages are lower than their native counterparts and there is little evidence of convergence. Denmark has not to any large extent actively sought to attract well-educated immigrants. Therefore, there is no reason to expect the average immigrant entering Denmark to be particularly well-suited to tackle the challenges of entering and performing well in the labor market.

Another relevant measure of labor market performance is occupational outcomes. Green (1999), for example, studies the occupational attainment of immigrants in Canada. Somewhat contrary to other more recent studies on immigrant performance in Canada, Green (2005) finds very little

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<sup>3</sup> Also considering returns to labour market experience, Chiswick (1978) - one of the very early assimilation studies - found that experience acquired in English-speaking countries of origin was rewarded more in the United States than experience acquired in non-English-speaking countries of origin.

evidence of immigrants being underrepresented in more skilled occupations relative to native-born workers with comparable education and experience profiles. Differences in occupational attainment in this study are found to be closely related to whether or not the immigrant has been assessed under the skills-based point system and related to linguistic fluency. Acknowledging the importance of language skills for labor market performance, we include in this present study proxies for how well foreign-educated immigrants master the Danish language.

Also concerned with occupational attainment, Mattoo et al. (2005) specifically investigate the incidence of unskilled employment among educated immigrants in the United States. They find notable differences in occupational attainment of immigrants with comparable educational backgrounds but from different source countries. In explaining these findings, they separate country-level differences into components related to varying quality of foreign-accumulated human capital and selection effects. Borjas (1987) also investigates how immigrant performance (measured by earnings) differs by country of origin and finds these differences to be related to variations in political and economic conditions in the source country at the time of emigration.

As mentioned above, our main interest is in job-to-education match as the main measure of immigrant labor market performance. This is where the literature on overeducation becomes relevant. Despite a rather substantial research effort, the phenomenon of overeducation is not yet fully explained nor understood. There is no cohesive theory of overeducation. Rather, the overeducation literature draws on existing labor market theories to explain why overeducation occurs, whether it is a permanent or a temporary phenomenon for the individual and for the labor market as a whole, whether it is an equilibrium or disequilibrium feature of the labor market, whether it is a result of economic inefficiencies or not, and how it may impact on individual earnings. In the following, an overview of the most common explanations will be given (see e.g. Linsley (2005), Jakobsen (2004), and Büchel and Mertens (2000) for useful overviews of the various perspectives on overeducation). These explanations, of course, are not mutually exclusive.<sup>4</sup>

***Human capital theory*** builds on the notion that education is a form of investment. An individual is willing to incur costs in the short run (foregone earnings and education-related expenses) in return for higher expected benefits in the long run. It follows that earnings rise with the level of human capital (or else the incentive for students to invest in more education would disappear). Human capital consists not only of formal education, but also labor market experience and on-the-job training. Hence, according to this theory, workers that are educationally overqualified tend to be less experienced and have less job training. Any “excess” human capital from schooling is in fact compensating deficiencies in other substitutable human capital forms (Sicherman 1991).<sup>5</sup> In the case of immigrants, these “deficiencies” might relate to lack of host-

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<sup>4</sup> The focus of this paper is on overeducation. The literature does not seem to deal very well with explaining undereducation, although some empirical studies (e.g. Jakobsen 2004) find that substantial undereducation among immigrants exists. See e.g. Büchel and Mertens (2000), Duncan and Hoffman (1981), and Sloane et al. (1999) for discussions on undereducation.

<sup>5</sup> If an empirical study includes only some components of human capital (e.g. years of schooling) and takes only imperfect account of other forms of human capital such as experience, on-the-job training, and language skills, the apparent overeducation phenomenon may simply be a result of an omitted variables problem. Similarly, it is obvious that educational requirements are not the only requirements for a job and so by using this as the point of reference,

country labor market experience and inadequate host-country language skills. Therefore, one may expect to observe a process of assimilation whereby immigrants initially experience higher over education, which is then eroded over time as they gain host-country-specific human capital (language, knowledge about the functioning of the labor market, etc.).

There may also be a quality dimension, in the sense that apparent overeducation is in fact compensating for a lower quality of immigrants' formal education obtained in their home country. Following this line of thought, one might expect a higher incidence of overeducation among immigrants who have obtained their formal education in countries that are characterized by lower quality of education. The study by Mattoo et al. 2005, for example, focuses on whether the incidence of overeducation differs with country of origin, and if so, how much of such differences can be explained by differences in the quality of education in these countries. In their empirical analysis, Mattoo et al. 2005 use two variables as indicators of educational quality: the level of tertiary education expenditure per student and whether or not English is spoken in the country. Borjas (1987) also discusses "quality" of immigrants in a self-selection framework.

The human capital model sees overeducation as a temporary disequilibrium phenomenon. Overeducation is believed to occur when there is an increase in the overall educational level of workers (without a corresponding increase in qualification requirements on the demand side of the labor market), causing the relative wage of high-skilled workers to fall. Employers substitute away from low-skilled to high-skilled workers as they face a cheaper supply of educated labor, and so well-educated workers end up taking positions that were previously occupied – more appropriately – by low-skilled workers (Linsley 2005). In the human capital model, wages are determined by the worker's educational attainment, experience and training. Hence, in its simplest form, human capital theory predicts positive returns to overeducation.

**Career mobility theory**, a variation of human capital theory, sees overeducation as a temporary phenomenon experienced by new entrants to the labor market. In the present context, first-generation immigrants may be viewed as new entrants to the host-country labor market. Such individuals willingly and consciously accept positions for which they are formally overeducated, while they accumulate experience and occupation-specific training enabling them to advance to "higher level positions in which they can make full use of their qualifications" (Linsley 2005 p. 4). As such, this view is simply an extension of the investment concept presented above. A new labor market entrant optimizes by choosing a job for which he is overeducated in order to improve his future labor market prospects. Clearly, the validity of the career mobility theory would require that overeducated workers do in fact realize a change to a better matching job within a reasonable period of time.<sup>6</sup> Referring to evidence from the existing literature, however, Büchel and Mertens (2000, p. 3) argue that "substantial parts of the overeducated workforce fail to realize a change to jobs with a better match within a longer period of several years." According to these authors, careers seem to follow the path they started from, with no evidence

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one may be underestimating the true skill requirements level for "overeducated" workers and overestimating requirements for "undereducated" workers (Korpi and Tählin 2006).

<sup>6</sup> A core statement of the career mobility theory is that "part of the returns to education is in the form of higher probabilities of occupational upgrading, within or across firms." Consequently, "individuals may choose an entry level in which the direct returns to schooling are lower than those in other feasible entry levels if the effect of schooling on the probability of promotion is higher in this firm." Sicherman and Galor (1990, pp. 169 & 177).

of extraordinary career moves for the overeducated workers. This is of course an empirical question.

While human capital theory and career mobility theory offer primarily supply side explanations of overeducation, *job competition theory* focuses on the demand side. Firms compete for high productivity workers and workers in the applicants' queue are ranked by their potential training costs for the firm. Formal education and on-the-job training are assumed to be complements, and therefore training costs are lower for individuals with more education. Applicants are ranked by education level and the firm matches well-educated persons to high paying jobs (Linsley 2005 and Thurow 1975). As in human capital theory, overeducation occurs when there is an increase in the overall educational level of workers (but without a corresponding increase in requirements on the demand side). The distribution of workers in the labor queue shifts, forcing low-skilled workers to be "bumped down" into lower wage jobs or 'crowded out' of the labor market into unemployment" (Linsley 2005 p.5). According to job competition theory, this situation forces high-skilled workers to accept jobs lower in the job queue. In other words, overeducation is not voluntary nor part of a conscious, optimizing decision made by individuals like the career mobility theory asserts. Earnings in this model are determined by the job characteristics and not the individual's level of education or underlying productivity. Hence in a situation of excess supply of highly skilled workers, they will face lower returns on their educational investment. In order to defend their position in the labor queue it is rational for individuals to continue to invest in education despite lower returns. According to job competition theory overeducation is a persistent phenomenon that creates "suboptimal investments in education, allocative inefficiencies, and increased income inequalities" (Linsley 2005 p. 6).

The *assignment approach* considers both demand and supply side factors in analyzing overeducation (Sattinger 1993). The underlying assumption is that worker productivity is positively related to education, but that "not all similarly educated workers are equally productive in all jobs. Indeed, workers have a comparative advantage in specific jobs. The problem of overeducation arises when workers are not allocated to jobs in which they have a comparative advantage." (Linsley 2005 p. 6). Just like the job competition approach, overeducation in the assignment model is also viewed as a form of allocative inefficiency whereby skills are underutilized. Consequently, overeducation persists until a more efficient match between individuals and specific jobs is achieved.

Theories of *labor market discrimination* are also used to explain overeducation and consequential earnings differentials among immigrants and natives.<sup>7</sup> One type of discrimination is termed statistical discrimination.<sup>8</sup> Employers have limited information on the skills and productivity levels of job applicants and therefore, when hiring and placing workers, they let simple observable characteristics such as ethnicity and gender affect the decision, based on the notion that such characteristics are correlated with performance. "The employer's assessment of a worker's skills depends on his/her perception of the average qualifications in the group to

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<sup>7</sup> Discrimination in the labour market can be defined as a situation in which workers who are equally productive in a physical or material sense are treated unequally in a way that is related to an observable characteristic such as race, ethnicity or gender (Altonji and Blank 1999). "Unequal" in this context means that workers receive different wages or face different demands for their labour services at a given wage (Jakobsen 2004).

<sup>8</sup> For discussions on other forms of discrimination see e.g. Becker (1971) and Altonji and Blank (1999).

which the worker belongs and his perception of the reliability of the indicator for the members of the concerned group.” (Jakobsen 2004 p. 4, see also Cain 1986). If immigrants find it more difficult to acquire any job at all (due to discrimination), they are more likely to accept a job that does not match their qualifications. Consequently, one might expect a higher share of immigrants to be overeducated compared to natives if discrimination is present.

One must of course be careful in determining what effects are related to discrimination per se. Employers cannot, for example, have perfect knowledge about the content or quality of a given education obtained in a foreign country. Faced with a choice between imperfect knowledge about the skills of an individual educated abroad and perfect (or at least less imperfect) knowledge about the (average) quality of the skills of an individual educated in Denmark, it is feasible that an employer would make what he perceives to be a “safe” choice by employing workers with a Danish education. This may not be due directly to discrimination, but rather to problems of imperfect information. Indeed, the immigrant literature stresses the importance of sources of human capital. “Skills generated through education or work experience in the source country cannot directly be transferred to the host country, resulting in apparently well-qualified immigrants holding low-paying jobs.” (Ferrer et al. 2006, p.380-1). Credential problems and mismatches in technological requirements can mean that education and experience obtained in most other countries are not as productive in Denmark as education and experience acquired in Denmark (see also Friedberg 2000, Duleep and Regets 1997, and Green 1995 for studies about transferability of credentials). This suggests that one should separate education and experience obtained abroad from education and experience obtained in Denmark in the empirical analysis. Moreover, an immigrant having completed a Danish formal education reveals important information about his Danish language skills.<sup>9</sup> This may explain why immigrants with a foreign education tend to have lower employment and labor market participation rates compared to immigrants who have taken their education in Denmark. Whether immigrants with a foreign education also tend to have a higher probability of being overeducated is an empirical question, to which we will return below.

Human capital theory rests on the notion that education enhances the productivity of an individual. Alternatively, it may be that education simply reveals – or signals – the inherent productivity of an individual (Spence 1973). *Signalling* in the labor market occurs because an employer can never be completely sure of an applicant’s true productivity, which may even remain unclear long after an employee is hired. An employer can, however, observe certain indicators that firms have experienced (or otherwise believe) to be correlated with productivity. Such indicators include age, gender, ethnicity, experience, education, and other personal characteristics (Ehrenberg and Smith 1994). According to the job signaling model, the level of education can be used as a screening device, which employers use initially to sort job applicants. The source of education (country, university, etc.) can also be used as a screening mechanism. Furthermore, in countries where higher education is publicly financed (like in Denmark), it may be rational for (relatively) low-ability individuals to attend university to obtain a degree

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<sup>9</sup> Ferrer et al. (2006) have detailed information on literacy skills of both immigrants and native Canadian and find that literacy skills have a significant impact on earnings. Immigrants do not receive lower returns to literacy skills than do otherwise equivalent native-born workers. Controlling for literacy does not, however, affect the relative patterns of returns to foreign and Canadian-acquired labour market experience. The authors conclude that lower returns to foreign experience still play an important role in explaining immigrant-native earnings differentials.



(notwithstanding its poor quality) in order to be able to send a signal to potential employers. Such individuals may end up being overeducated, but this could be better (in terms of earnings, for example) than being adequately matched with a lower level of education. Such a strategy is possible because society in this case – not the individual – bears the cost of providing the signal (Chevalier 2003).

Related to this discussion is the process of *self-selection*.<sup>10</sup> Overeducated workers may be characterized by below-average ability compared with adequately matched workers with the same level of education.<sup>11</sup> As Büchel and Mertens (2000) argue, why should the overeducated, whose career path until now has revealed that they are not able to get a job that matches their formal qualifications, perform differently in the future? According to this view, overeducation should be seen as an indicator of underachievement. If this is the case, there is reason to be concerned about the future career prospects of overeducated workers. Sloane et al. (1999), for example, do not find evidence that the matches of overeducated workers improve with a change of employer. Rather, overeducated workers seem more prone to dismissal and have more unemployment spells. This view does not, however, take account of other factors such as discrimination, which may (as discussed above) force immigrants to take jobs for which they are overqualified simply to get a job at all.

Summing up, the existing literature presents a patchwork of possible explanations for overeducation – some complementary, others contradictory. In the following, we will conduct an empirical investigation of the phenomenon as it plays itself out in the context of the Danish labor market.

### 3. Data description

The empirical analysis uses two large data sets originating from administrative registers. The first data set contains information on the entire population of immigrants living in Denmark. The second data set consists of a 10% sample of the native Danish population. Young individuals are added to the sample each year, ensuring that the sample is representative each year. Both data sets used in this study cover the period 1995-2002. We have chosen to restrict the two data sets as follows: We examine only first-generation, non-Western immigrants because this is the group of foreigners that have the greatest difficulties in terms of labor market integration. Moreover, most second-generation immigrants in Denmark are still fairly young and therefore have not yet

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<sup>10</sup> Concerning immigrants, self-selection may also occur in the migration decision itself. Given the costs (economic and social) involved in migrating, it may be that the abilities of migrants from different source countries differ because they self-select from “different sections of the skill distribution of their home countries.” (Mattoo et al. p.2) With reference to the U.S. labour market, Mattoo et al. (2005) argue that “[f]or higher GDP countries, the opportunity cost of migrating is high, and so only individuals with high income potential would emigrate to and remain in the United States.” [...] “For countries with per capita GDP substantially lower than that of the United States, the relative distribution of income is irrelevant and it can be assumed that both low and high ability individuals would wish to migrate. But it is conceivable that in some of the poorest countries only the more capable have the means to migrate.” (Mattoo et al. 2005, p.16)

<sup>11</sup> Conversely, undereducated workers are taken to exert above-average abilities and to be more successful in their career, up to the point of time when their qualification mismatch was observed, than what can be expected from their (relatively low) educational attainments. As Büchel and Mertens (2000) argue, why should they not continue to be extraordinarily successful in their future career?

accumulated much labor market experience. Our sample is restricted to males because the employment and earnings situations for female immigrants are considerably different from those of male immigrants. The age group considered consists of individuals aged 30-57. The lower age limit is set to take account of the rather high age at which Danish students on average finish their post-secondary school education compared to students in other countries. The upper age limit is set to avoid selection problems related to early retirement. Individuals who are undertaking full-time education and individuals for whom information about their highest attained education is not available are excluded. For roughly one third of the immigrants in the sample, we do not have information about their highest attained level of education, either because they do not have a Danish education or because they have not responded to surveys conducted by Statistics Denmark in 1999 and 2003 about their foreign-acquired education. Despite efforts by Statistics Denmark to impute values for the levels of education for these individuals, we have chosen not to include them in our analysis.<sup>12</sup> Incidentally, it must be stressed that we have no way of ascertaining the quality of the survey-based information on immigrants' foreign-acquired education. We restrict our analysis to include only wage-earners who have worked what corresponds to at least two months full-time in a given year<sup>13</sup> and we exclude wage-earners who are employed in the military or as legislators, senior officials and managers<sup>14</sup>. The reason for the former restriction is that we do not want the results to be affected by short-term employment spells such as summer-time jobs, which may be characterized by higher degrees of overeducation than more permanent jobs. The reason for the latter restriction is that these two occupational groups are so heterogeneous that it does not make sense to attempt to define which levels of educations are appropriate for these jobs. Appendix Tables A1 and A2 detail the number of observations lost in each step of this sample selection process. In the forthcoming text, we will use the term "immigrants" to refer to this particular sample and so the reader must bear in mind its restrictions, particularly because the final sample cannot be taken as being representative of the immigrant population. In the econometric estimations, the samples are restricted even further by considering only individuals who have either a vocational education or a short, medium, or long higher education (the reason for this is discussed in more detail in section 5.2). Appendix Table A3 shows mean values and standard deviations of the sample used in the econometric estimations, whilst Appendix Table 4 compares – for selected variables – the samples resulting from the first selection process (shown in Appendix Tables A1 and A2 and used in the descriptive Tables 1-15 below), the sample used in the econometric estimations (results of which are reported in Tables 16-17), and a comparison sample consisting of male 30-57 year-old first-generation immigrants from non-Western countries.

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<sup>12</sup> The original survey conducted in 1999 covered approximately 160,000 individuals. The overall response rate was 49.7%, but it varied quite substantially from group to group. It was especially low among Turks (30.1%) and Somalis (31.5%), but also fairly low for Moroccans (38.2%), Lebanese (35.1%) and Pakistanis (38.8%). (Mørkeberg 2000). It is therefore important to stress that the sample used in this study is not a representative sample of male immigrants in Denmark. For immigrants who did not respond to the survey (and who do not have a Danish education), information about their education has been imputed by Statistics Denmark based on their country of origin, age at migration, current age and sex. Because of serious concerns about the quality of this imputation, however, we have chosen to delete these individuals from the analysis.

<sup>13</sup> Some individuals have unreliable registered wages. These are excluded from the sample.

<sup>14</sup> These are DISCO (the Danish equivalent to the International Standard Classification of Occupations, ISCO) codes 0 and 1.

Key variables used in this study include labor market participation status, occupational category, hourly wages, Danish labor market experience, highest attained level of education<sup>15</sup>, source of education (Denmark or home country), age, marital status, number of children, and for immigrants the country of origin, year of entry, and initial placement level on Danish language courses. Danish language courses are offered to all immigrants with insufficient Danish skills. Immigrants under the 1999 Integration Act who receive so-called introductory benefits are required to participate. The language courses are organized as a three-track study programmed. Placement on the three tracks is based on an individual's expected prerequisites for learning the Danish language. The first track is for individuals who have not learned to read and write their mother tongue, or for individuals who have not learned to read and write the Latin alphabet. The second track is for individuals with no more than a short higher education from their home-country, whilst the third track is for individuals who have a medium-long or long higher education from their home country. The variable shows the track placement of an individual at the start of his Danish language training.

### ***3.1. Educational attainment and occupational status***

We will begin by considering the patterns of educational attainment of immigrants and compare them with that of native Danes. At the aggregate level, Table 1 shows that the distribution of educational attainment among immigrants in this particular sample (see discussion on sample selection criteria in the previous section) does not differ substantially from that of Danes except for one particular category. The share of Danes with a vocational education is almost 14 percentage points higher (47.5%) than that of immigrants (33.9%). The immigrant sample has somewhat larger shares of individuals both at the lower end of the scale (primary or secondary education) and at the higher end (short, medium or long higher education) compared to the Danish sample. There are of course large differences between different ethnic groups. Around 60% of Turkish immigrants, for example, have no more than primary schooling. Immigrants from Iran and Iraq, by contrast, are well-educated: 64% and 53%, respectively, have a higher education (short, medium or long), compared with just 26% for native Danes. Table 2 shows that there are large differences in educational attainment depending on whether immigrants have taken their education in their home country or in Denmark. Two points are worth mentioning. First, among immigrants with foreign-acquired education, a higher share (42%) has no more than either primary or secondary schooling compared with immigrants with a Danish education (25%). Second, among immigrants with a Danish education, a substantially higher share has a medium-long or long higher education (32%) compared with immigrants with a foreign degree (18%).

With this educational background in mind, let us now turn to the next question of how these immigrants fare in the Danish labor market. Table 3 reveals that despite the overall level of education of immigrants in this sample, a larger share of immigrants are employed in jobs that require only elementary qualifications (22%) compared to Danes (14%). Digging into the ethnic differences, we find that 32% of Turkish immigrants are employed in jobs that require no more than elementary qualifications. This is not surprising, of course, given their low levels of education. It is somewhat more surprising that 41% of Iranian immigrants are in jobs that require

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<sup>15</sup> The highest attained level of education is converted into effective years of schooling. Each degree/diploma or level of education is measured as the minimum years of schooling necessary to obtain that degree/diploma.

elementary or low levels of qualifications, given their generally high levels of education. Considering the difference between immigrants who have attained their degree in their home country with those who have attained it in Denmark, Table 4 shows that 42% of immigrants with a Danish education are employed in jobs requiring high or medium level qualifications, whilst the share is 13% for those educated in their home country (and 37% for ethnic Danes).

Tables 5-8 cross-tabulate educational attainment and job skill level to provide a sense of the degree of job-to-education mismatch among native Danes, immigrants in general, immigrants with a Danish education, and immigrants with a foreign-acquired education, respectively. Table 6, for example, shows that among immigrants with a long higher education, 21% are employed in jobs requiring just elementary or a low level of qualifications. Among Danes with a long higher education (Table 5) only 4% are employed in such jobs. There are, however, large differences between the two groups of immigrants. While 44% of immigrants with a foreign-acquired long higher education are employed in jobs requiring just elementary or a low level of qualifications, only 4% of immigrants with a Danish long higher education are in such a situation. Similar patterns are found for individuals with short and medium-length higher educations with the most striking differences again being between native Danes and immigrants with foreign credentials. The job-to-education match of immigrants with a Danish education tends to be more similar to that of native Danes. Calculating the column percentages (not shown in the tables), it is worth noting that among individuals employed in jobs that require only elementary qualifications, 22% of immigrants with foreign credentials have a higher level of education (short, medium or long). To compare, such a mismatch applies for only 3% of native Danes and 6% of immigrants with a Danish education employed in elementary jobs.

## **4. Empirical methods**

### ***4.1. Measuring overeducation***

Measuring overeducation is by no means a straightforward exercise.<sup>16</sup> Indeed, this measurement issue is one of the most controversial aspects of the overeducation literature. Three different techniques to measure overeducation are typically used: job analysis (JA), realized matches (RM), and worker self-assessment (WA) (see e.g. Linsley 2005, Verhaest and Omey 2004, Battu and Sloane 2002). The JA approach is based on the assessment by professional job analysts of the education and training requirements for different occupations and compares this with the actual educational attainment of individual workers. In principle, this is an appealing approach because of its “explicit goal of objectivity, clear definitions and detailed measurement instructions”, yet in practice it runs into several problems (Hartog 2000 p.132). In particular, occupational categories in conventional data sets are typically quite broad, resulting in a great deal of heterogeneity in job requirements within the same occupational title.

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<sup>16</sup> Some researchers make a point of distinguishing between educational mismatch and skill mismatch. These two concepts are of course related, yet Allen and de Weert (2005) stress that educational mismatch is neither a necessary nor a sufficient condition for skill mismatch. Based on a survey performed in Spain, Germany, the Netherlands, UK and Japan, they find that the wage effects of educational mismatches are much stronger and more consistent across countries than the effects of skill mismatches.

The Danish occupation-to-qualifications mapping based on what amounts to a JA approach maps all major occupational groups (DISCO codes at the one-digit level) to just four different qualification requirement levels.<sup>17</sup> Similar mappings for other countries are somewhat richer in detail. For the Netherlands, for example, van der Meer (2002) describes a mapping into seven different qualification levels. Moreover, there are difficulties in translating job requirements into years of schooling (a key variable in the econometric analysis below) because not all jobs require very much formal schooling, but may be characterized by more on-the-job training. Also, different educations that are equally appropriate for a given type of job (with a given qualification-level requirement) are characterized by very different lengths of schooling (measured in years), which makes it difficult to create relevant limits. Finally, such classifications are rapidly outdated. In the case of Denmark, this classification makes use of a mapping between DISCO-88 and ISCED-76<sup>18</sup> classifications and Statistics Denmark is only now in the process of updating this to the DISCO-08 and ISCED-97 classifications. For all these reasons, the JA approach is not very attractive for the case of Denmark.

The WA approach uses surveys to ask workers how much education or schooling is required to perform (or obtain) their particular job. These responses are then used to compare the level of education workers *believe* is required to perform (or obtain) their job with their actual education level. On the positive side, this method is up-to-date and specific to each individual's job. On the negative side, this is a highly subjective measure, and it is commonly known that individuals have a tendency to inflate reported educational requirements. They may also simply be restating actual hiring practices or at least what they believe to be so. Furthermore, there may be systematic biases in how job requirements are assessed across genders and other groupings.<sup>19</sup> In any case, subjective survey-based information on job-to-education mismatch in an individual's current or previous job, overall job satisfaction and other relevant issues is not available for this current study.<sup>20</sup>

The RM approach derives the "adequate" education level as the mean or median (and sometimes the modal value) of the observed distribution of actual educational attainment (measured in years of schooling) in each occupational category. As such, it measures the outcome of the actual matching process (the interplay between labor demand and supply) as determined by current hiring standards and labor market conditions. For this reason the RM measure must be interpreted differently from the WA and the JA measures.<sup>21</sup> An individual is then taken to be overeducated if his actual level of schooling is greater than the norm, or reference, level of education in his occupational category (with undereducation similarly defined). Several authors

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<sup>17</sup> The four levels of qualification requirements are those used in Tables 3-8, i.e. elementary, low, medium and high.

<sup>18</sup> ISCED: International Standard Classification of Education.

<sup>19</sup> Based on survey information, Chevalier (2003) and Chevalier and Lindley (2006) distinguish between apparent overeducation and genuine overeducation, by asking respondents to comment on their satisfaction with the match between their education and their job. They assume that formally overeducated employees are only apparently overeducated if they are satisfied with this match, whilst formally overeducated employees are genuinely overeducated if they are dissatisfied with the match.

<sup>20</sup> Analysing the case of Sweden, Böhlmark (2003) finds that overeducation is associated with lower job satisfaction. Also, he finds that workers who improve their education-to-job match over time become more satisfied with their jobs.

<sup>21</sup> Verhaest and Omey (2004) argue that the RM approach is an appropriate estimate of the privately optimal level of education only if labour markets are flexible and efficient. Otherwise, the RM measure may systematically either over- or underestimate the complexity level of jobs.

choose to operate with a band around the mean or median level of education by defining an individual as overeducated (undereducated) if his educational attainment is more than one standard deviation above (below) the mean or median (e.g. Verdugo and Verdugo 1989, Lindley and Lenton 2006). A clear disadvantage of this approach is that the band imposes symmetry on the matching distribution, which is quite a strong assumption.

Each of the three approaches described above has its shortcomings and the choice is often dictated by data availability (see e.g. Hartog 2000 for a discussion). Clearly, the method of measurement will influence the results and their interpretation (see e.g. Rubb 2003a; Verhaest and Omeij 2004).<sup>22</sup> Therefore, good understanding of the pros and cons of the measure applied is necessary when interpreting the empirical results and drawing conclusions.

For the current study, a modified version of the RM approach is adopted. The RM approach is used to define an individual as being “adequately” matched if he has the “typical” level of education defined as a band around the median value of education observed in his current occupational category. To avoid the assumption of symmetry, we suggest using the following distribution rule, which distributes twice the standard deviation in a way that reflects the potential asymmetry of the distribution.<sup>23</sup>

An individual is overeducated if:

$$S_{Actual} > Median + \left( \frac{75\%decile - Median}{75\%decile - 25\%decile} \right) \times (2 \times Std.Dev.)$$

An individual is undereducated if:

$$S_{Actual} < Median - \left( \frac{Median - 25\%decile}{75\%decile - 25\%decile} \right) \times (2 \times Std.Dev.)$$

An individual is adequately educated if:

$$Median - \left( \frac{Median - 25\%decile}{75\%decile - 25\%decile} \right) \times (2 \times Std.Dev.) \leq S_{Actual} \leq Median + \left( \frac{75\%decile - Median}{75\%decile - 25\%decile} \right) \times (2 \times Std.Dev.)$$

To avoid having too few observations in some occupations, we use the DISCO-88 categorization at the 2-digit level for occupations with at least 10 observations. This gives us 30 occupational categories.<sup>24</sup> Table 9 details the median years of education for each occupation as well as the lower and upper limits defining under- and overeducation, respectively. These limits are calculated for native Danish wage-earners who have worked for what corresponds to at least two

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<sup>22</sup> Groot and Maassen van den Brink (2000) find that while the choice of definition does affect the incidence of overeducation (RM approaches yield the lowest estimates, while WA approaches yield the highest estimates), there is not much effect on the estimates of wage earning differentials. Rubb (2003a), by contrast, suggests that the definition of required education may in fact affect the estimates of the returns from overeducation.

<sup>23</sup> Symmetric limits have also been calculated and the two approaches do result in different limits.

<sup>24</sup> For some individuals, information about occupation is only provided at the 1-digit DISCO-88 level, and hence over- and undereducated limits are calculated separately for these “not elsewhere classified” categories.

months full-time work in a given year.<sup>25</sup> Hence in this context an individual is said to be overeducated if he possesses more education than the “Danish norm” in his occupation category.

Table 9 shows that there is large variation in how broad and narrow the limits defining adequate education are in the various occupation categories. Among individuals employed as ‘Stationary plant and related operators’ (DISCO 81), for example, adequate education is anywhere between 8.5 and 14.1 years of schooling, respectively, whereas individuals employed as ‘Models, salespersons and demonstrators’ are adequately educated if they have precisely 13 years of schooling. Also, the categories vary according to how asymmetric the definition of adequate education is relative to the median. Among “Agricultural, fishery and related workers” (DISCO 92), for example, the median is closer to the lower limit, while for “Life science and health associate professionals” (DISCO 32) the median is closer to the upper level. In particular, note that individuals with less than 13.0 years of education (i.e. individuals with no more than either primary or secondary schooling) cannot, by this definition, be overeducated. All the upper limits defining adequate education are at least 13.0 years.

#### ***4.2. Determinants of overeducation***

After having presented the method used to determine the incidence of overeducation (results of which are presented and discussed in Section 5.1 below), this section describes the econometric method used to identify important determinants of overeducation. As the review in Section 2 showed, there are a number of possible explanations as to why overeducation occurs, for which types of workers and under which particular circumstances. While there are no clear-cut conclusions, we can formulate some expectations about which factors are important in determining an individual’s risk or probability of being overeducated. These are labor market experience, age, ethnicity, language skills, source of education<sup>26</sup> and years since migration. Yet, the review also left open the possibility that part of the remaining reason for being overeducated may well simply be caused by individual heterogeneity.<sup>27</sup> Within a group of workers with the same education, some are more skilled (in aspects that are not necessarily captured by formal education), more motivated and more able than others. Examples of relevant, but for the researcher unobservable, personal characteristics could be health, leadership skills, management skills, ability to work in teams, creativity, and IT-skills.

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<sup>25</sup> We have chosen to base the limits on native Danes so as not to let the large differences between immigrants with a Danish and a foreign education interfere with the overall picture.

<sup>26</sup> In the available data, we can observe whether an immigrant has obtained his degree in his home country or in Denmark. What we cannot observe is the quality or applicability/relevance of a foreign degree in the Danish labour market. This may affect the probability of becoming overeducated, but we lack the information necessary to disclose such effects.

<sup>27</sup> Böhlmark (2003) finds evidence in the Swedish labour market that there is a great deal of unobserved heterogeneity among the overeducated. Examining transitions over time, he finds that more than 50% of workers found to be overeducated at the beginning of the study period are still poorly matched 10 years later (based on data for individuals observed in 1981 and 1991 and then for individuals observed in 1991 and 2000). Yet, the remaining half leaves overeducation and manages to close the initial wage-gap relative to adequately matched workers with the same level of education. These results serve to underline the unobserved heterogeneity among the group of overeducated workers.

Individual characteristics such as these may well influence the probability of a worker accepting a job for which he is formally overeducated as measured by his level of education. It is not clear, however, which way such an effect goes. On the one hand, overeducated individuals may be the most motivated and eager to work (among individuals who find it difficult to obtain a job either generally or specifically during a period where the labor market is depressed) and thereby take the chance to demonstrate their skills and qualifications on-the-job (e.g. motivated by the line of thought presented by the career mobility theory in Section 2). On the other hand, the overeducated may be so precisely because they have (partly unobserved) individual characteristics that make them unable to obtain a job that matches their formal qualifications.

There are several possible strategies to account for such unobserved individual heterogeneity. A few authors in the overeducation literature attempt to find proxies for otherwise unobserved individual heterogeneity. Korpi and Tåhlin (2006), for example, include survey-based information on health and verbal ability.<sup>28</sup> Chevalier (2003) and Chevalier and Lindley (2006) also attempt to find proxies for unobserved ability differences. For this present study we do not have survey information from which to obtain such proxies. Yet, the panel aspect of our data set, where we are able to follow the same individuals over a period of time, allows us to take account of this inherent omitted variables problem and deal with unobserved individual heterogeneity so as to avoid obtaining biased estimates.

To briefly present the issue at hand, consider a linear model, with the unobserved individual effect,  $c_i$ , entering additively:

$$y_{it} = \mathbf{x}_{it}\boldsymbol{\beta} + c_i + u_{it}, \quad t=1,2,\dots,T.$$

In panel data models, the individual effect  $c_i$  is interpreted as capturing features of an individual such as cognitive ability and motivation, etc. that are given and assumed constant over time. These models rest on the assumption that the  $\mathbf{x}_{it}$  variables are strictly exogenous conditional on the unobserved effect  $c_i$ . In other words, once  $\mathbf{x}_{it}$  and  $c_i$  have been controlled for,  $\mathbf{x}_{is}$  has no partial effect on  $y_{it}$  for  $s \neq t$  (Wooldridge 2002).

$$E(y_{it} | \mathbf{x}_{i1}, \mathbf{x}_{i2}, \dots, \mathbf{x}_{iT}, c_i) = E(y_{it} | \mathbf{x}_{it}, c_i) = \mathbf{x}_{it}\boldsymbol{\beta} + c_i \quad \text{for } t=1,2,\dots,T.$$

A key issue is whether or not  $c_i$  is uncorrelated with the observed explanatory variables  $\mathbf{x}_{it}$ ,  $t=1,2,\dots,T$ . The so-called Random Effects estimator assumes that  $c_i$  is uncorrelated with  $\mathbf{x}_{it}$ , whereas the so-called Fixed Effects estimator allows  $c_i$  to be correlated with  $\mathbf{x}_{it}$ . Allowing correlation between  $c_i$  and  $\mathbf{x}_{it}$ , the fixed effects approach is more robust than the random effects approach. This robustness comes at a price, however. First of all, one cannot include time-constant factors in  $\mathbf{x}_{it}$ , because there is no way of distinguishing the effect of time-constant observables from the time-constant unobservable  $c_i$ . Hence, characteristics such as ethnicity and initial Danish language training placement cannot be included in  $\mathbf{x}_{it}$ . Another downside of the fixed effects model – and one that is potentially more serious than the previous one – is that identification relies on individual variation over time and thereby discards all information

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<sup>28</sup> Inclusion of these variables, nevertheless, leaves all the educational estimates in their analysis completely unaffected. Their survey information also includes several measures of on-the-job training, advancement prospects and job satisfaction, which they use to try to capture career-based explanations for overeducation.



represented by cross-sectional variation. This is because the random effects approach conducts between-person comparisons, while the fixed effects approach considers within-person comparisons. Very few individuals in this data set change status from being e.g. adequately matched to being overeducated during the observed period of time and therefore we choose to use a random effects estimation method, despite its more restrictive assumption that  $c_i$  is uncorrelated with  $\mathbf{x}_{it}$ .<sup>29</sup>

To identify key determinants of overeducation, we estimate a set of random effects logit models for the probability of being overeducated (the alternative being either adequately educated or undereducated). Assuming a normal distribution,  $N(0, \sigma_c^2)$  for the random effects  $c_i$ , the model to be estimated is:

$$\Pr(y_{it} = 1 | x_{it}, c_i) = \Lambda(x_{it}\beta + c_i) = \frac{\exp(x_{it}\beta + c_i)}{1 + \exp(x_{it}\beta + c_i)}, \quad t = 1, 2, \dots, T$$

Separate models are estimated for four groups: Immigrants in total, immigrants with a Danish education, immigrants with a foreign-acquired education, and finally, for comparison purposes, ethnic Danes. As explanatory variables, we consider the effects of age, Danish labor market experience<sup>30</sup>, initial placement level on Danish language courses, years since migration, ethnicity dummies, year dummies, marital status, and number of children. For each of these variables, we can make educated guesses (based on the overview provided above) about the effects on the probability of being overeducated. It is important to stress that the relationship is not necessarily causal, but serves to identify important correlations in the data.

### 4.3. Earnings consequences of overeducation

In the third and final step of our empirical analysis, we estimate a set of random effects linear regression models to investigate the implications that overeducation has on individual wages. Following the existing overeducation literature, we take the Mincer earnings equation (also known as the human capital earnings equation) as our starting point. The Mincer equation is based on a formal model of investment in human capital (see e.g. Heckman et al. 2003 and Willis 1986), leading to the following equation, which regresses log earnings ( $w_{it}$ ) on a constant term, a linear term in years of schooling ( $s_{it}$ ), and linear and quadratic terms in years of labor market experience ( $x_{it}$ ). The individual unobserved effect  $v_i$  is included in the equation since individuals may differ in unobserved earnings ability.

$$\ln[w_{it}(s_{it}, x_{it})] = \alpha_0 + \alpha_s s_{it} + \beta_0 x_{it} + \beta_1 x_{it}^2 + v_i + \varepsilon_{it}$$

<sup>29</sup> Using a fixed-effects approach (excluding age,  $\text{age}^2/100$  as well as the time-invariant variables) yields similar results for the experience and YSM coefficients presented in Section 5.2 below.

<sup>30</sup> Note that we consider *actual* labour market experience in Denmark as opposed to *potential* labour market experience, which is the most common approach taken in the literature due to lack of data.

The Mincer earnings equation has become a cornerstone of empirical labor economics. It has been estimated in various forms for virtually all countries for which cross-section data exist.<sup>31</sup> The basic model rests upon a number of simplifying assumptions, among which the most important are as follows: Education is assumed to last for a given number of years, there is no distinction between different types of education, and the decision to be educated is an all-or-nothing decision, i.e. either you work or you study full-time.<sup>32</sup>

The overeducation literature<sup>33</sup> proceeds by decomposing the *actual years of schooling* variable in the traditional Mincer equation into three parts (ignoring subscripts for the moment):  $s = s^R + s^O - s^U$ , where  $s^R$  is required schooling (i.e. the level of education required for the job the individual has),  $s^O$  is over-schooling (i.e. the number of years of schooling the individual might have in excess of  $s^R$ ), and  $s^U$  is under-schooling (i.e. the number of years of schooling the individual might have less than  $s^R$ ). The equation reduces to  $s = s^R$  for adequately matched workers,  $s = s^R + s^O$  for overeducated workers, and  $s = s^R - s^U$  for undereducated workers. Given our use of a buffer around the median level of schooling in each occupation category, the upper and lower limits, respectively, are used to calculate the number of overeducation-years and undereducation-years of each overeducated and undereducated individual, respectively. For adequately match individuals, it is their actual years of schooling that is taken as the adequate level. Introducing this decomposition into the traditional Mincer equation yields what is commonly known as the ORU-equation:

$$\begin{aligned} \ln[w_{it}(s_{it}, x_{it})] &= \alpha_0 + \alpha_s(s_{it}^R + s_{it}^O - s_{it}^U) + \beta_0 x_{it} + \beta_1 x_{it}^2 + \nu_i + \varepsilon_{1i} \\ &= \alpha_0 + \alpha_s s_{it}^R + \alpha_s s_{it}^O - \alpha_s s_{it}^U + \beta_0 x_{it} + \beta_1 x_{it}^2 + \nu_i + \varepsilon_{1i} \\ &= \alpha_0 + \alpha_1 s_{it}^R + \alpha_2 s_{it}^O - \alpha_3 s_{it}^U + \beta_0 x_{it} + \beta_1 x_{it}^2 + \nu_i + \varepsilon_{1i} \end{aligned}$$

In terms of interpreting the coefficients,  $\alpha_1$  indicates the return to schooling for adequately matched workers. The coefficients  $\alpha_2$  and  $\alpha_3$  are to be interpreted in conjunction with  $\alpha_1$  to obtain the total impact of education for mismatched workers. This decomposition has the attractive conceptual property that it combines information on attained and required education whilst retaining the continuous character of both dimensions.

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<sup>31</sup> The popularity of the Mincer equation is due to several desirable features (see Chiswick 1997). First of all, it is not an ad hoc specification, but derived from human capital theory. Moreover, it is both sparse in terms of data requirements and it is also flexible in the sense that additional explanatory variables can be included as seen appropriate for the particular study. Finally, it provides a convenient semi-logarithmic relationship between earnings and length of schooling, which makes econometric estimation straightforward.

<sup>32</sup> A word of caution concerning interpretation is necessary. The coefficient of the schooling variable is often interpreted as the rate of return from schooling. As Chiswick (1997 p.5) points out, this is only true under specific circumstances, namely “if the investment in schooling equals the full-year potential earnings if there were no further investment.” This can occur, for example, if there are no direct schooling costs and the foregone earnings equal a full year’s earnings. In general, however, the coefficient of schooling simply estimates the average percent increase in earnings per year of schooling. This caveat notwithstanding, we will loosely use the term “returns to schooling” in this paper.

<sup>33</sup> The original formulation of this specification was proposed by Duncan and Hoffman (1981) and was an ad hoc formulation without an explicit theoretical underpinning. It did not refer to the idea of human capital compensation. A rationale based on viewing overeducation as part of a human capital investment strategy in the Mincer (1974) tradition was provided later by Sicherman and Galor (1990).

The relabeling of the coefficients (from  $\alpha_s$  to  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$ ) in the final ORU equation above shows that the traditional Mincer equation imposes the following restriction:  $H1: \alpha_1 = \alpha_2 = \alpha_3$ . Accepting hypothesis H1 amounts to saying that the return to (an additional year of) schooling is the same for all individuals with the same level of schooling, regardless of whether the individual is in a job that matches his qualifications or whether he is over- or undereducated. It is his actual schooling that matters – not the match. Another hypothesis one can test is:  $H2: \alpha_2 = \alpha_3 = 0$ . This amounts to saying that “excess” and “deficit” years of schooling (compared to job requirements) are neither rewarded nor penalized. It is the education requirements of the job ( $s^R$ ) alone that have an impact on earnings.

Intuition tells us that earnings vary not only with education level and labor market experience but also by other factors. For this reason, estimations of the ORU equation often control for a range of other variables in addition to the standard human capital variables.<sup>34</sup> The same explanatory variables used in the logit models described in the previous section are also used in the wage equations.

In empirical implementations of the Mincer (and related) earnings equation, schooling is treated as exogenous despite the fact that education is clearly an endogenous choice variable in the underlying human capital theory.<sup>35</sup> Recall that the sample population analyzed here includes only wage-employed individuals. It is obvious that these individuals may differ systematically in their characteristics from the entire population and especially from the sub-populations of e.g. self-employed or individuals outside the labor force. In other words, it is not a random sample of the population that is employed. Nor can it be assumed that it is a random sample of the employed population that is overeducated. Regarding the first selection bias, it might be that it is the most able and motivated individuals who succeed in obtaining employment. This self-selection process may result in an upward bias of the effect of education on wages. In this application, we only consider employed persons and therefore we have “jumped over” this first selection bias hurdle. Regarding the second selection bias, there are numerous possible sources. On the one hand, it might be the less able individuals (among those who are able to get a job to begin with) that end up being overeducated and so this will show up as an apparently small reward to excess years of education. On the other hand, it may be that if immigrants find it difficult to get a job at all (perhaps due to discrimination), they may be willing to accept a job for which they are formally overeducated, simply as means of entering the labor market. This may also bias the results and lead to potentially erroneous conclusions when comparing returns to overeducation for immigrants with that of native Danes.

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<sup>34</sup> It is of course important to bear in mind that the coefficients of the primary variables will typically depend on which other variables are included in the equation to “hold everything else constant” (Thurow 1983). The key identifying assumption in the earnings function is that the observable characteristics included as controls are the *only* reason why the random part of individual earnings potential and schooling are correlated. In other words, this is the “selection on observables” assumption, where the regressor of interest (schooling) is assumed to be determined independently of potential outcomes after taking account of a set of observable characteristics (Angrist and Krueger 1999).

<sup>35</sup> “It is worth reiterating that this is no different from the rest of the immigrant earnings literature which rarely if ever addresses education endogeneity.” (Ferrer et al. 2006 p. 386).

It would of course be desirable to take account of this selectivity in the present analysis. This is not a straightforward task, however, and therefore several authors choose not to address the issue at all (see e.g. Chevalier 2003, Chevalier and Lindley 2006 for discussions). The problem lies in choosing a suitable instrument, i.e. a variable which affects an individual's overeducation outcome but not his wage. Usually, economic theory guides the choice of instrument, but as the overview in Section 2 demonstrates, there is no clearcut view of what leads some individuals to be overeducated and not others. A number of studies use family-related variables as instruments (e.g. number of children), but these are often found to be weak (see e.g. Harmon et al. 2000 for a discussion of instrument choice). The study by Silles and Dolton (2002) is one of the few that attempt to take account of the endogeneity of the overeducation variable. They rely on mobility between region of education and region of employment as an instrument, but find that accounting for selectivity into overeducation produces results that are not significantly different from their OLS results. This conclusion may well be drawn because the choice of weak instruments leads to imprecise results. Korpi and Tählén (2006) also attempt an instrumental variables approach to dealing with endogeneity of the education variable, but they too find that their instruments are weak: sibship size, place of residence during childhood, economic problems in the family of origin, and disruption in the family of origin. Finally, it is important to note that choosing an invalid instrument does not only fail to correct, but may even aggravate the selection bias. In this analysis we therefore refrain from attempting to estimate the ORU model using instrumental variables techniques.

In choosing whether to estimate the ORU equation using a fixed effects or a random effects estimator, as discussed in the previous section, the question centers on whether or not one believes that the individual heterogeneity captured in  $v_i$  is correlated with  $\mathbf{x}_{it}$  or not. In this case,  $v_i$  is unobserved earnings ability, which can of course be correlated with the overeducation variable, ethnicity or any of the other explanatory variables. The fixed effects estimator is immune to such correlation, but as discussed in the previous section, the fixed effects estimator uses only within-person variation. A person who changes his job to a different occupational category, but without changing his level of education, will possibly have different values of  $s^R$ ,  $s^O$  and  $s^U$ . But by construction, the sum of these three components  $s^R + s^O - s^U$  is equal to  $s$  (i.e. actual schooling) which is constant. Thus, the within-individual variation in  $s^R$ ,  $s^O$  and  $s^U$  is characterized by perfect multi-collinearity for persons whose education level is constant in the estimation period. Consequently, a fixed effects approach would only identify the effect of overeducation from information on individuals who change their level of education within the sample period. This is a very unattractive feature for our current study since only very few persons in our sample of persons aged 30 and above do that, and those who do are typically out of our sample for several years while they are enrolled in education. We therefore choose to estimate the model using a random effects approach.

## 5. Results

### 5.1. Incidence of overeducation

Applying the limits defined in Section 4.1 and detailed in Table 9, we find that 16% of the immigrants in our sample are overeducated, compared with 11% of native Danes (Table 10).<sup>36</sup> It is important to note that these overeducation shares are based on the full samples, i.e. including workers who have only primary or secondary schooling. As discussed in Section 4.1, such workers cannot – by the definition used here – be overeducated, and so they pull the shares down. Below (in Table 13) we calculate overeducation shares based on the sub-sample of workers with either vocational or higher education, i.e. for those who can in fact – by the definition used here – risk being overeducated. These shares are of course somewhat higher than those reported in Table 10 (and Tables 11-12).

Returning to Table 10, we find that there are of course differences related to ethnicity. While 24% of Iraqi immigrants are overeducated, only 8% of Turkish immigrants are so. Low levels of education among Turks mean that many of them cannot, by definition, be overeducated. In fact 38% are undereducated. Furthermore, the quality of the job-to-education match seems to depend on where an immigrant has his education from. Among those with a Danish education, 73% are adequately matched compared with 60% of those with foreign-acquired education (Table 11). Table 12 shows the share of overeducated immigrants by ethnic origin and source of education. With two exceptions (immigrants from Vietnam and Iraq) higher shares of overeducated workers are found among immigrants with a foreign-acquired education compared with immigrants with a Danish education. The largest differences are observed for immigrants from Iran, Former Yugoslavia and Somalia.

As discussed above, individuals with either primary or secondary schooling as their highest attained level of education cannot – by the definition used here – be overeducated. Indeed, in Table 13, which shows the incidence of overeducation at different levels of education, one sees that the shares of overeducated among individuals with primary or secondary schooling are zero. If one calculates the shares of overeducated in relation to the sub-sample of individuals with either a vocational education or a higher education (short, medium or long) as opposed to measuring the shares of overeducated in relation to the full sample (i.e. including those with primary or secondary schooling), one finds that the shares of overeducated are somewhat higher: 15% for native Danes and 25% for immigrants (‘Weighted total’ in Table 13). Once again, there

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<sup>36</sup> In their meta-analysis of studies on overeducation, which covers all three types of measurement approaches (JA, WA, RM), Groot and Maassen van den Brink (2000) find that the incidence of overeducation varies from 10% to 42% and the average is lower in Europe (21.5%) than in the United States (26.3%). For the case of Australia, Linsley (2005) finds, using the WA approach, that close to 30% are overeducated. Using a JA approach, Green et al. (2005) find that less than 10% of native Australian are overeducated, whilst the figures are markedly higher for immigrants (19%-27%) and especially for immigrants from non-English speaking countries (32%-40% for different entry cohorts). For UK immigrants, Lindley and Lenton (2006) find, using the RM approach, that 63% of male immigrants are overeducated against 37% of male natives. Using a different and older survey on ethnic minorities in Britain, Battu and Sloane (2002), also using a form of RM approach, find that around a third of non-whites are overeducated, with significant differences between the various ethnic groups. Importantly, they find that when incorporating foreign qualifications into their measure, all ethnic minority groups display levels of overeducation above 30%. There is a decreasing trend in the US, (Gottschalk and Hansen 2003 and Handel 2003), while there seems to be evidence of an increasing trend in Europe (see e.g. Green 2006 on Britain and le Grand et al. 2004 on Sweden).

are differences depending on the source of immigrants' education: 30% of immigrants with a foreign-acquired education (vocational or higher) are overeducated, against 20% of immigrants with a Danish education (vocational or higher). It must be stressed that apart from the row labeled 'Weighted total' in Table 13, the other shares shown in Tables 10-14 are based on the full sample of individuals (i.e. including those with primary and secondary education as their highest level of attained education) and must be interpreted as such.

Returning to Table 13, we see that only one out of ten workers with a vocational education is in a job for which he is overeducated and the differences between immigrants and Danes are small. For workers with a short higher education, we see that while 25% of ethnic Danes are overeducated, the share is 41% for immigrants. The differences between native Danes and immigrants are even larger for workers with medium-length higher educations. While 12% of native Danes with a medium higher education are overeducated, the share is 33% among immigrants. At this level of education, there are also large differences between the two groups of immigrants. Almost 60% of immigrants with a foreign medium-length higher education are overeducated, while this is true for only 20% of immigrants with a Danish education. Although the incidence is greater, the same pattern holds for individuals with a long higher education: Immigrants with a Danish education are overeducated to roughly the same extent as native Danes with similar levels of education, but immigrants with foreign-acquired credentials are substantially more so. The consistent finding that immigrants with a foreign education fare worse than immigrants with a Danish education could in principle be more apparent than real. This would be true if the apparent overeducation experienced by these individuals is in fact compensating for lower quality of these foreign credentials as discussed in Section 2 on human capital theory explanations for overeducation. For this study, however, we do not have any way of assessing the true quality of the individual immigrant's foreign-acquired qualifications.

Table 14 details the shares of overeducated workers by occupational category. The first thing to note is that the shares are very different in the various categories. High shares of overeducated workers are found in categories such as 'teaching professionals', 'teaching associate professionals', 'office clerks', 'customer service clerks', 'drivers and mobile plant operators' and 'laborers in mining, construction, manufacturing and transport'. This pattern is similar for both native Danes and immigrants, although the levels are higher for immigrants. To put these shares into perspective, the table also shows the distribution of workers in our sample across the different occupational categories. The category 'office clerks' (DISCO 41), for example, employs 5% of the sample and is characterized by a high share of overeducated (36%). Another example is the category 'laborer in mining, construction, etc.' (DISCO 93), which employs 6% of the sample of immigrants and in which 31% are overeducated.

There are indications in our data that the phenomenon of overeducation is quite persistent. Table 15 shows, for workers who were overeducated in each of the years 1995-1997, their job-to-education match five years later. In general we find that 70-74% of native Danes are still overeducated five years later. The share is slightly higher for immigrants: 74-76%. Once again there are differences between immigrants with Danish and foreign educations. The persistence of overeducation among immigrants with a Danish education is similar to that of native Danes, whereas the persistence of overeducation is stronger among immigrants with a foreign degree:

78-83% of those who were overeducated in one of the years 1995-1997 were still overeducated five years later.<sup>37</sup>

## ***5.2. Determinants of overeducation***

The results of the random effects logit model estimations are shown in Table 16. Note that the estimations are performed only for a sub-sample of individuals who have either a vocational education or a short, medium or long higher education. The reason for this is that the results concerning the incidence of overeducation in Section 5.1 revealed that the share of overeducated among those with no more than a primary or a secondary education is zero (see Table 13 and the comment regarding Table 9 in the text). As mentioned earlier, the mean sample values for this particular sub-sample are shown in Appendix Table A3.

Table 16 shows the results in terms of the estimated coefficients as well as their marginal effects. Coefficients in a logit model cannot be interpreted directly as marginal probabilities as they would in a linear regression and therefore their marginal effects have been calculated. Marginal effects show the change in the probability of being overeducated (in percentage points) caused by a one unit change in each of the explanatory variables evaluated at the mean values of all the explanatory variables.

In contrast with most other overeducation studies we are able to account directly for labor market experience in the host country, and therefore we have chosen to include all three variables: age, labor market experience, and years-since-migration (YSM) (and their squares)<sup>38</sup> in the equations.<sup>39</sup> This allows us to distinguish between labor-market relevant years spent in Denmark and years spent “just being here”. As a consequence, we generally find that age does not significantly affect the probability of being overeducated.<sup>40</sup> Danish labor market experience, on the other hand, has a strongly significant negative impact on the probability of being overeducated for both sub-groups of immigrants.

Since we can account directly for labor market experience acquired in Denmark, we find that YSM has a positive yet diminishing effect on the probability of being overeducated. This result is significant for immigrants with a foreign education, but not so for immigrants with a Danish

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<sup>37</sup> Analysing overeducation in Sweden, Böhlmark (2003) finds that more than 50% of workers found to be overeducated at the beginning of the study period are still poorly matched 10 years later (based on data for individuals observed in 1981 and 1991 and then for individuals observed in 1991 and 2000). Also, he finds that a considerable share of adequately matched workers that make transitions do so to poorer matches. See e.g. Rubb (2003b) for an analysis on the persistence of overeducation in the United States.

<sup>38</sup> We start by describing the linear results separately and thereafter in combination with their squared counterparts.

<sup>39</sup> Other studies which do not account explicitly for labour market experience capture this effect indirectly in the YSM variable, which therefore has a negative sign. In the study by Lindley and Lenton (2006), for example, this leads the authors to conclude that there is evidence of assimilation in overeducation. Although immigrants are more likely to be overeducated than natives upon arrival to (in this case) the UK, higher skilled immigrant workers tend to reduce this likelihood with duration in the UK. Our results are able to be more precise about the assimilation process by demonstrating that it is labour market attachment that reduces the likelihood of higher skilled immigrants being overeducated. Battu and Sloane (2004) include age rather than YSM or labour market experience (also for the case of Britain) and therefore their results are parallel to those of Lindley and Lenton (2006).

<sup>40</sup> An exception is for immigrants with foreign-acquired educations, where age has a negative and diminishing impact.

education. Combined with the results for labor market experience reported above, this may be interpreted as saying that “just” living in the country is not enough to ensure an adequate job-to-education match. It is concrete labor market experience that is needed to increase the chances of an appropriate match. It follows that years spent in Denmark outside the labor force reduce an immigrant’s chances of securing an adequate job-to-education match. This can be explained by formal human capital skills being depreciated during long periods of unemployment, although some of the time may of course be spent accumulating other labor-market relevant skills such as Danish language proficiency.

Note that the three continuous variables age, experience and YSM enter the equations as polynomials and therefore they ought to be interpreted together with their squared counterparts. Also, these three variables are closely correlated – another reason why they should be interpreted together. To provide the “full picture” we have calculated the effect of accumulating labor market experience in Denmark for immigrants with a Danish education and for immigrants with a foreign education. Our first example is a “typical” educated 40-year-old immigrant with a Danish education (with YSM = 20, a vocational or a higher education, and a probability of being overeducated = 20.3%). Accumulating 10 years of labor market experience (and taking account of the simultaneous effects of increased age and increased YSM) reduces his probability of being overeducated by 11.8 percentage points. Not accumulating any labor market experience at all over a period of 10 years, on the other hand, increases the likelihood of becoming overeducated by 6.4 percentage points. Our second example is a “typical” educated 40-year-old immigrant with a foreign education (with YSM = 10, a vocational or a higher education, and a probability of being overeducated = 29.6%). Accumulating 10 years of labor market experience (and taking account of the simultaneous effects of increased age and increased YSM) reduces his probability of being overeducated by 3.4 percentage points. Not accumulating any labor market experience at all over a period of 10 years, on the other hand, increases his likelihood of becoming overeducated by 3.9 percentage points.

These results point out that it is extremely important for both groups of immigrants to gain experience on the Danish labor market in order to reduce their risk of becoming overeducated. But both the benefits of having experience and the adverse effects of not having any experience are larger for immigrants with a Danish education. Indeed these results suggest that immigrants with a foreign education have a difficult time affecting their risk of overeducation, even through accumulation of labor market experience. These findings fit well with the results of the equation for immigrants in total, showing that having a foreign-acquired education strongly increases the risk of being overeducated (a result also found in other studies such as Battu and Sloane, 2004 and Lindley and Lenton, 2006). Foreign qualifications do not seem to be valued very highly by Danish employers. It is worth noting that the probability of being overeducated does not increase monotonically with the length of education for native Danes and for immigrants with a Danish education. First of all, there are relatively few individuals with a short higher education on which to base the estimate. But more importantly, medium-length higher educations in Denmark are typically extremely vocationally oriented and include educations such as nurse training, school teachers and kindergarten teachers – all of which are educations directly oriented towards specific occupations. This is most certainly one reason why the probability of being overeducated is lower for individuals with a medium-length higher education compared with individuals with either a short or a long higher education.



Turning to the equation for immigrants with foreign education, one sees that being placed initially on Track 1 of the Danish language training programmed slightly reduces one's risk of being overeducated, whilst being placed on Track 2 significantly increases it. The reference category is Track 3.<sup>41</sup> Recall that it is individuals who have not learned to read and write their mother tongue or the Latin alphabet who are placed on Track 1. In this sub-sample this would typically be workers with vocational training, whose risk of being overeducated is low. The second track is for individuals with a short higher education from their home-country. The results here suggest that workers initially placed on Track 2 are more at risk of becoming overeducated compared with workers initially placed on Track 3.

Other studies, such as Green et al. (2005), show that immigrants to Australia, who do not have English as their primary language, have a significantly reduced chance of being employed at all. So it seems safe to say that strong language skills are important in terms of labor market attachment and therefore those that do secure a job (almost regardless of the match) probably have at least a minimum level of Danish language skills necessary to perform that particular job. In any case, our results in section 5.1 indicated that fewer immigrants with a Danish education are overeducated compared with immigrants with a foreign education. This result is probably due to a combination of two effects: First, employers are more at ease about employing individuals with a Danish education because they are familiar with the content and are able to assess the quality hereof because they know the grading and evaluation systems being used. Second, individuals who have completed a Danish education have thereby proved to master the Danish language at a certain level.

Finally, note that in all four estimations, we find that the correlation coefficient  $\rho$  is large and highly significant. This means that there are substantial unobserved individual effects that affect the probability of being overeducated.<sup>42</sup>

### ***5.3. Earnings consequences of overeducation***

The main results of the random effects wage regressions are presented in Table 17, while the complete results may be found in Appendix Tables A5-A8. There are separate estimations for each of the four groups: immigrants in total, immigrants with a Danish education, immigrants with a foreign education, and native Danes. As for the logit estimations, we restrict ourselves to the sub-sample of workers with either a vocational education or a short, medium or long higher

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<sup>41</sup> The track variables are only included in the equation for immigrants with a foreign education because this is where it is most relevant. In general, immigrants who have completed a Danish education must be assumed to have sufficient Danish language skills and do not need the type of general language training provided by the public authorities. Also, this particular language training programme has only been provided (and registered) since 1999. Most immigrants who have completed a Danish education will probably have arrived in Denmark some time before 1999 and will therefore have participated in other Danish language training programmes. Indeed, the data show that less than 2% of immigrants with a Danish education are placed on one of the tracks in this language training programme.

<sup>42</sup> The results also show e.g. an increasing tendency for native Danes to experience overeducation during the period 2000-2002 compared to earlier years. This result is most probably due to a data break in the DISCO variable. As of the year 2000, certain sources of information used to construct the DISCO variable are no longer available to Statistics Denmark, resulting in a reduced number of individuals with relevant DISCO classifications. This problem, however, is judged to be of minor importance for this analysis.

education. In the first set of regressions, we include attained (actual) schooling as a single variable. In the second set of regressions, we split attained (actual) years of schooling into the three components described in Section 4.3 above: adequate education, overeducation and undereducation.

To begin with, it is worth noting that the results are generally in accordance with the “stylized facts” in the existing overeducation literature (Hartog 2000, Rubb 2003a):

- (1) Returns to adequate schooling (Regression II) are higher than returns to actual education (Regression I).
- (2) Returns to overeducation are positive, but smaller than to adequate education.
- (3) Returns to undereducation are negative and smaller in magnitude than the returns to adequate education.<sup>43</sup>

In other words, one typically finds that overeducated workers earn more than adequately matched workers in the same kinds of jobs, but less than adequately matched workers with similar amounts of education.

Starting with Regression I, we find that the return to each year of schooling for immigrants with a Danish education (7.2%) is not very different from that of native Danes (7.4%). The returns to schooling for immigrants with a foreign education are notably lower (4.3%). When splitting years of acquired schooling into the three components in Regression II we find that there are virtually no difference between the estimated coefficients on adequate schooling for Danes and immigrants – irrespective of source of education. But here we find more striking differences regarding the return to overeducation. Immigrants with a Danish education are rewarded by only a 3.7% increase in wages per year of overeducation (less than half the return to a year of adequate education), whereas native Danes are rewarded by 5.4% per year of overeducation (two thirds of the return to a year of adequate education). In other words, the penalty for being overeducated is more severe for immigrants with a Danish education compared with native Danes. Immigrants with a foreign education are penalized even more for being overeducated in that each year of excess education brings about only 1.1% higher wages.<sup>44</sup>

Language skills are an important determinant of wages, a result also found in other studies such as Battu and Sloane (2004). In the regressions for immigrants with foreign credentials, the impact of not being enrolled in Danish language courses (i.e. Danish missing = 1) is positive and

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<sup>43</sup> One result that is not in accordance with these stylized facts is that the coefficient on the undereducation variable is positive and significant for immigrants with a foreign education. An explanation for this somewhat surprising result could be selection problems (see the discussion in Section 4). If undereducated workers are primarily to be found among those who earn higher wages, we will be underestimating the adverse impact of being undereducated on wages. Also, it is worth recalling that for immigrants with a foreign education, information about their level of education is self-reported (see the data description in section 3) and could therefore be misreported. One should therefore be cautious when interpreting these results.

<sup>44</sup> A relevant question to ask is whether the lower returns to overeducation can simply be attributed to a concave wage-schooling profile because quadratic terms are not included in the model (not only here but in all overeducation studies that take the ORU wage equation as its point of departure). Investigating this empirically for this particular data set shows that the wage profile is actually convex in actual schooling and convex in adequate schooling for both native Danes and immigrants. The wage profile is convex in overeducation for immigrants with a foreign education. For immigrants with a Danish education, the wage profile is linear in overeducation, whilst it is concave in overeducation for native Danes. See Belzil and Hansen (2002) for a more general investigation of the shape of the wage-schooling relationship.

significant. One possible explanation for this result is that e.g. well-educated researchers or IT specialists from e.g. China or India may work in Danish companies or institutes where English is the main language and they therefore do not need to learn Danish to do well. Another possible explanation is that Danish courses for individuals in such positions are paid and organized by the company and provided by private language schools instead of the (free) public language schools because the latter do not match the needs of these particularly high-skilled workers. Conversely, being enrolled in either Track 1 or 2 of Danish language courses (rather than the reference Track 3) significantly reduces wages.

In Section 4.3, two hypotheses were put forth:  $H1: \alpha_1 = \alpha_2 = \alpha_3$  and  $H2: \alpha_2 = \alpha_3 = 0$ . Accepting hypothesis H1 amounts to saying that the return to (an additional year of) schooling is the same for all individuals with the same level of schooling, regardless of whether the individual is in a job that matches his qualifications or whether he is over- or undereducated. It is his actual schooling that matters – not the match. The second hypothesis H2 amounts to saying that “excess” and “deficit” years of schooling (compared to job requirements) are neither rewarded nor penalized. It is the education requirements of the job ( $s^R$ ) alone that have an impact on earnings. Tests of the two hypotheses are strongly rejected for all estimations, which simply goes to saying that both required and acquired education are part of the wage story.

Comparing the results in the Appendix Tables A6 and A7, i.e. immigrants with Danish and foreign educations, respectively, it can be concluded that while age and experience have virtually the same positive effects on wages for both sub-groups, years-since-migration has a greater negative effect for immigrants with a foreign education compared with immigrants with a Danish education. This is not surprising because years-since-migration (given labor market experience in Denmark) for the latter group reflect, at least partly, years spent in the Danish education system obtaining a qualifying education, while for immigrants without a Danish education years-since-migration would typically be years outside the labor market and education system.

## 6. Discussion and conclusions

This paper has investigated three questions related to immigrant overeducation in Denmark. First, to what extent are immigrants employed in jobs for which they are formally overqualified? Using a measure based on realized job-to-education matches, we find that out of the full sample of workers 16% of immigrants are overeducated compared with 11% of native Danes. A third of the immigrants in our sample, however, have no more than primary or secondary schooling and cannot therefore – by our definition – be overeducated. We have therefore also calculated overeducation shares for the sub-sample of workers who have vocational or higher education. We find that 25% of male first-generation non-Western immigrants with a vocational or a higher education are overeducated. Fewer immigrants with a Danish (vocational or higher) education (20%) are overeducated compared with immigrants with a foreign (vocational or higher) education (30%). The incidence of overeducation is notably higher for immigrants than for native Danes, which is estimated to be around 15% for workers with a vocational or a higher education. These findings are consistent with the existing literature.

In trying to understand why some individuals are more likely to become overeducated than others, we estimated a set of random effects logit models. We found that Danish labor market

experience is extremely important in reducing the probability of becoming overeducated. Furthermore, once having taken account of labor market experience, we find that years spent in the country not necessarily on the labor market (as measured by a years-since-migration variable) actually increase the probability of being overeducated. Combined, these results can be interpreted as meaning that it is concrete years spent in the labor market that determine your chances of an appropriate job-to-education match, not general assimilation accumulated by “just being here”.

Our final question concerned the wage consequences of overeducation. For this purpose we estimated a series of random effects wage regressions. Our study finds that years of overeducation do increase wages for native Danes and for immigrants with Danish educations, but much less so than years of adequate education. In particular, the penalty for overeducation is much larger for immigrants (particularly for those with foreign credentials) than for native Danes. These results are in accordance with our expectations, i.e. that an overeducated worker earns more than an adequately matched worker in the same type of job, but less than he could earn if he secured a job that matched his level of schooling.

The validity of these results is of course limited by the precision with which we can measure overeducation and the degree of reliability we can attach to the information we have on foreign-acquired education. In any case, it must be stressed that workers are very heterogeneous with regard not only to observable qualifications, but most certainly also with regard to unobservable skills, abilities, etc. Moreover, jobs within a specific occupational category are also heterogeneous in terms of which qualifications are required to perform them. Therefore, with the data available for this study it is difficult to say how much of our measured overeducation is more apparent than real and whether overeducation among immigrants is in fact even more common than our results indicate. For this we would have to supplement our register-based data with survey-based information on specific job-related skills (e.g. entrepreneurial, teamwork, management and leadership skills), quality of the attained degree (through e.g. grades), pre-degree measures of ability, etc. as well as information on how these qualifications and skills are used in each person’s job. In particular, we lack more concrete information about how foreign qualifications are being assessed and used in the Danish labor market. How many immigrants with foreign qualifications have sought to have them assessed through official channels and what were the outcomes? How do Danish employers view individuals with foreign-acquired qualifications – officially assessed or not? Research from Australia shows that official assessments of foreign qualifications can potentially reduce the risk of overeducation for some immigrant groups (Green et al. 2005). Indeed, these are interesting topics for future research on immigrant overeducation in Denmark pending data availability.

These caveats notwithstanding, our results lead us to draw up three policy recommendations. First of all, it is important to strengthen the focus on recognizing foreign qualifications. All immigrants with a foreign-acquired education and labor market experience ought to have their qualifications assessed through e.g. CIRIUS, an authority within the Danish Ministry of Education, which undertakes such tasks. It is conceivable that an official evaluation of an immigrant’s skills and qualifications would help him find a job that matches his “true” qualifications and skills. Second, an official assessment may not be enough for some groups of immigrants. Our results show that years-since-migration significantly increases the risk of being

overeducated for immigrants with foreign qualifications once having taken account for labor market experience. This is probably in part because during years spent getting settled in the country and learning the language, an immigrant's formal skills may easily become depreciated or outdated. In certain cases it may therefore be appropriate to offer supplementary training to upgrade and increase the relevance of his foreign-acquired qualifications for a Danish context. Individuals with a long higher education have a relatively high probability of being overeducated and the costs (i.e. in terms of wasted education-related investments) are relatively large if these individuals do not secure an appropriately matched job. This leads us to the third and final policy recommendation. It may be worth providing intensive Danish language training to especially those immigrants with higher levels of education, enabling them to enter the labor market in appropriate jobs quickly and thereby ensure the continued relevance of their educational backgrounds.

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Table 1. Educational attainment of native Danes and immigrants, 1995-2002, percent

|                             | Primary | Secondary | Vocational | Higher education, short | Higher education, medium | Higher education, long | All | N       |
|-----------------------------|---------|-----------|------------|-------------------------|--------------------------|------------------------|-----|---------|
| Native Danes                | 23.1    | 3.8       | 47.5       | 5.3                     | 12.4                     | 8.0                    | 100 | 520,677 |
| Immigrants, all non-Western | 25.9    | 7.8       | 33.9       | 7.9                     | 14.2                     | 10.3                   | 100 | 65,909  |
| Turkey                      | 58.9    | 4.6       | 20.9       | 4.4                     | 8.7                      | 2.5                    | 100 | 9,841   |
| Pakistan                    | 39.2    | 18.5      | 24.7       | 4.0                     | 7.7                      | 5.7                    | 100 | 3,774   |
| Vietnam                     | 23.9    | 2.9       | 47.5       | 8.8                     | 12.4                     | 4.5                    | 100 | 4,791   |
| Iran                        | 5.6     | 4.9       | 25.5       | 12.2                    | 31.5                     | 20.4                   | 100 | 7,357   |
| Iraq                        | 11.6    | 9.8       | 25.7       | 10.5                    | 22.3                     | 20.2                   | 100 | 2,413   |
| Ex-Yugoslavia               | 22.1    | 7.3       | 48.4       | 6.3                     | 9.7                      | 6.3                    | 100 | 12,347  |
| Somalia                     | 16.3    | 19.9      | 34.3       | 9.3                     | 8.6                      | 11.6                   | 100 | 594     |
| Stateless                   | 15.9    | 8.5       | 37.1       | 9.0                     | 16.0                     | 13.6                   | 100 | 1,819   |
| Other non-Western           | 21.1    | 9.0       | 33.8       | 9.0                     | 14.0                     | 13.1                   | 100 | 22,973  |

Note: The data set covers male wage earners aged 30-57, with what amounts to at least 2 months of full-time employment in a given year. Individuals undertaking education and individuals employed in the military or in management positions are excluded. The data set includes first-generation non-Western immigrants with either a Danish education or a foreign acquired education, for which Statistics Denmark has survey-based information. Immigrants for whom Statistics Denmark has calculated imputed levels of education because they have not responded to the education surveys conducted in 1999 and 2003 are not included.

Table 2. Educational attainment of native Danes and immigrants, 1995-2002, percent

|                                     | Primary | Secondary | Vocational | Higher education, short | Higher education, medium | Higher education, long | All | N       |
|-------------------------------------|---------|-----------|------------|-------------------------|--------------------------|------------------------|-----|---------|
| Native Danes                        | 23.1    | 3.8       | 47.5       | 5.3                     | 12.4                     | 8.0                    | 100 | 520,677 |
| Immigrants, all non-Western         | 25.9    | 7.8       | 33.9       | 7.9                     | 14.2                     | 10.3                   | 100 | 65,909  |
| – Immigrants with Danish education  | 21.9    | 2.6       | 34.1       | 9.2                     | 19.8                     | 12.4                   | 100 | 30,740  |
| – Immigrants with foreign education | 29.4    | 12.2      | 33.8       | 6.8                     | 9.3                      | 8.4                    | 100 | 35,169  |

Note: See note for Table 1.

Table 3. Level of wage-earner occupation of native Danes and immigrants by job skill level, 1995-2002, percent

|                             | Elementary qualification | Lower level qualification | Med. level qualification | High level qualification | All | N       |
|-----------------------------|--------------------------|---------------------------|--------------------------|--------------------------|-----|---------|
|                             | n                        | n                         | n                        | n                        |     |         |
| Native Danes                | 13.6                     | 49.9                      | 17.6                     | 18.9                     | 100 | 520,677 |
| Immigrants, all non-Western | 22.0                     | 51.3                      | 10.9                     | 15.8                     | 100 | 65,909  |
| Turkey                      | 32.1                     | 54.2                      | 5.5                      | 8.3                      | 100 | 9,841   |
| Pakistan                    | 31.6                     | 52.1                      | 6.4                      | 9.8                      | 100 | 3,774   |
| Vietnam                     | 10.9                     | 66.3                      | 11.5                     | 11.3                     | 100 | 4,791   |
| Iran                        | 7.9                      | 32.9                      | 25.4                     | 33.8                     | 100 | 7,357   |
| Iraq                        | 14.9                     | 43.8                      | 10.5                     | 30.8                     | 100 | 2,413   |
| Ex-Yugoslavia               | 24.8                     | 63.0                      | 5.7                      | 6.5                      | 100 | 12,347  |
| Somalia                     | 17.5                     | 51.0                      | 9.3                      | 22.2                     | 100 | 594     |
| Stateless                   | 15.7                     | 48.5                      | 12.7                     | 23.1                     | 100 | 1,819   |
| Other Non-Western           | 22.8                     | 47.5                      | 11.9                     | 17.8                     | 100 | 22,973  |

Note: See note for Table 1.

Table 4. Level of wage-earner occupation of native Danes and immigrants by job skill level, 1995-2002, percent

|                                     | Elementary qualification | Lower level qualification | Med. level qualification | High level qualification | All | N       |
|-------------------------------------|--------------------------|---------------------------|--------------------------|--------------------------|-----|---------|
|                                     | n                        | n                         | n                        | n                        |     |         |
| Native Danes                        | 13.6                     | 49.9                      | 17.6                     | 18.9                     | 100 | 520,677 |
| Immigrants, All non-Western         | 22.0                     | 51.3                      | 10.9                     | 15.8                     | 100 | 65,909  |
| – Immigrants with Danish education  | 12.7                     | 45.4                      | 18.5                     | 23.4                     | 100 | 30,740  |
| – Immigrants with foreign education | 30.1                     | 56.5                      | 4.2                      | 9.2                      | 100 | 35,169  |

Note: See note for Table 1.

Table 5. Educational attainment and wage-earner job skill level of native Danes, 1995-2002, percent

|                          | Elementary qualification | Lower level qualification | Med. level qualification | High level qualification | All | N       |
|--------------------------|--------------------------|---------------------------|--------------------------|--------------------------|-----|---------|
| Primary                  | 31.4                     | 57.9                      | 8.0                      | 2.7                      | 100 | 120,055 |
| Secondary                | 10.1                     | 35.3                      | 30.9                     | 23.7                     | 100 | 19,679  |
| Vocational               | 11.5                     | 66.5                      | 16.5                     | 5.4                      | 100 | 247,539 |
| Higher education, short  | 3.6                      | 44.0                      | 40.6                     | 11.9                     | 100 | 27,436  |
| Higher education, medium | 1.5                      | 8.0                       | 30.1                     | 60.4                     | 100 | 64,485  |
| Higher education, long   | 1.0                      | 3.4                       | 11.4                     | 84.2                     | 100 | 41,483  |
| All native Danes         | 13.6                     | 49.9                      | 17.6                     | 18.9                     | 100 | 520,677 |

Note: See note for Table 1.

Table 6. Educational attainment and wage-earner job skill level of immigrants, 1995-2002, percent

|                            | Elementary qualification | Lower level qualification | Med. level qualification | High level qualification | All | N      |
|----------------------------|--------------------------|---------------------------|--------------------------|--------------------------|-----|--------|
| Primary                    | 36.1                     | 60.4                      | 2.0                      | 1.6                      | 100 | 17,090 |
| Secondary                  | 29.3                     | 55.5                      | 6.6                      | 8.5                      | 100 | 5,117  |
| Vocational                 | 20.7                     | 68.9                      | 6.9                      | 3.6                      | 100 | 22,368 |
| Higher education, short    | 18.0                     | 47.2                      | 26.8                     | 8.0                      | 100 | 5,226  |
| Higher education, medium   | 8.5                      | 19.7                      | 30.7                     | 41.2                     | 100 | 9,340  |
| Higher education, long     | 7.1                      | 14.1                      | 10.3                     | 68.5                     | 100 | 6,768  |
| All non-Western immigrants | 22.0                     | 51.3                      | 10.9                     | 15.8                     | 100 | 65,909 |

Note: See note for Table 1.

Table 7. Educational attainment and wage-earner job skill level of immigrants with Danish education, 1995-2002, percent

|                          | Elementary qualification | Lower level qualification | Med. level qualification | High level qualification | All | N      |
|--------------------------|--------------------------|---------------------------|--------------------------|--------------------------|-----|--------|
| Primary                  | 34.3                     | 60.0                      | 3.7                      | 2.1                      | 100 | 6,740  |
| Secondary                | 17.9                     | 45.0                      | 19.9                     | 17.3                     | 100 | 811    |
| Vocational               | 10.6                     | 75.1                      | 10.7                     | 3.5                      | 100 | 10,481 |
| Higher education, short  | 8.5                      | 40.8                      | 42.9                     | 7.8                      | 100 | 2,825  |
| Higher education, medium | 1.5                      | 6.4                       | 42.1                     | 50.0                     | 100 | 6,072  |
| Higher education, long   | 0.5                      | 3.2                       | 10.4                     | 85.9                     | 100 | 3,811  |
| All                      | 12.7                     | 45.4                      | 18.5                     | 23.4                     | 100 | 30,740 |

Note: See note for Table 1.

Table 8. Educational attainment and wage-earner job skill level of immigrants with foreign education, 1995-2002, percent

|                          | Elementary qualification | Lower level qualification | Med. level qualification | High level qualification | All | N      |
|--------------------------|--------------------------|---------------------------|--------------------------|--------------------------|-----|--------|
| Primary                  | 37.3                     | 60.7                      | 0.9                      | 1.2                      | 100 | 10,350 |
| Secondary                | 31.4                     | 57.5                      | 4.2                      | 6.9                      | 100 | 4,306  |
| Vocational               | 29.6                     | 63.4                      | 3.4                      | 3.6                      | 100 | 11,887 |
| Higher education, short  | 29.3                     | 54.8                      | 7.7                      | 8.2                      | 100 | 2,401  |
| Higher education, medium | 21.6                     | 44.2                      | 9.4                      | 24.8                     | 100 | 3,268  |
| Higher education, long   | 15.5                     | 28.2                      | 10.1                     | 46.2                     | 100 | 2,957  |
| All                      | 30.1                     | 56.5                      | 4.2                      | 9.2                      | 100 | 35,169 |

Note: See note for Table 1.

Table 9. Defining occupation-to-education mismatch using the adjusted RM approach, measured in years of education. Based on education level of native Danes, 1995-2002

| Wage-earner occupation category                              | 2-digit DISCO -88 code | Lower limit defining undereducation | Median years of education | Upper limit defining overeducation |
|--|------------------------|-------------------------------------|---------------------------|------------------------------------|
| <b>Professionals</b>   |                        |                                     |                           |                                    |
| Physical, mathematical and engineering science professionals | 21                     | 15.0                                | 15.0                      | 18.6                               |
| Life science and health professionals                        | 22                     | 15.8                                | 17.8                      | 19.7                               |
| Teaching professionals                                       | 23                     | 12.2                                | 16.0                      | 16.0                               |
| Social science and humanities professionals                  | 24                     | 12.7                                | 15.0                      | 17.3                               |
| Other professionals, nec.                                    | 2                      | 13.1                                | 16.0                      | 17.9                               |
| <b>Technicians and associate professionals</b>               |                        |                                     |                           |                                    |
| Physical and engineering science associate professionals     | 31                     | 11.4                                | 14.0                      | 15.3                               |
| Life science and health associate professionals              | 32                     | 12.6                                | 15.0                      | 16.2                               |
| Teaching associate professionals                             | 33                     | 10.5                                | 14.0                      | 14.0                               |
| Sales and service associate professionals                    | 34                     | 13.0                                | 13.0                      | 16.9                               |
| Other technicians and associate professionals, nec.          | 3                      | 10.6                                | 13.7                      | 15.2                               |
| <b>Clerks</b>  |                        |                                     |                           |                                    |
| Office clerks  | 41                     | 8.3                                 | 13.0                      | 13.0                               |
| Customer service clerks                                      | 42                     | 9.5                                 | 13.0                      | 13.0                               |
| Other clerks, nec.   | 4                      | 9.4                                 | 13.0                      | 13.0                               |
| <b>Service workers and shop and market sales workers</b>     |                        |                                     |                           |                                    |
| Personal and protective services workers                     | 51                     | 10.9                                | 13.0                      | 15.1                               |
| Models, salespersons and demonstrators                       | 52                     | 13.0                                | 13.0                      | 13.0                               |
| Other service and sales workers, nec.                        | 5                      | 9.5                                 | 13.0                      | 14.2                               |
| <b>Skilled agricultural and fisheries workers</b>            |                        |                                     |                           |                                    |
| Market-oriented skilled agricultural and fishery workers     | 61                     | 8.7                                 | 12.0                      | 13.8                               |
| <b>Craft and related trades workers</b>                      |                        |                                     |                           |                                    |
| Extraction and building trade workers                        | 71                     | 13.7                                | 13.7                      | 17.3                               |
| Metal, machinery and related trades workers                  | 72                     | 14.0                                | 14.0                      | 14.0                               |
| Precision, handicraft, printing and related trades workers   | 73                     | 10.6                                | 14.0                      | 14.0                               |
| Other craft and related trades workers                       | 74                     | 10.7                                | 13.7                      | 15.2                               |
| Other craft and related trades workers, nec.                 | 7                      | 9.2                                 | 13.0                      | 14.3                               |
| <b>Plant and machine operators and assemblers</b>            |                        |                                     |                           |                                    |

| Wage-earner occupation category                               | 2-digit DISCO-88 code | Lower limit defining undereducation | Median years of education | Upper limit defining overeducation |
|---|-----------------------|-------------------------------------|---------------------------|------------------------------------|
| Stationary plant and related operators                        | 81                    | 8.5                                 | 13.0                      | 14.1                               |
| Machine operators and assemblers                              | 82                    | 8.7                                 | 12.2                      | 14.2                               |
| Drivers and mobile plant operators                            | 83                    | 7.4                                 | 10.0                      | 13.0                               |
| Other plant and machine operators, nec.                       | 8                     | 8.9                                 | 10.0                      | 14.1                               |
| <b>Elementary occupations</b>                                 |                       |                                     |                           |                                    |
| Sales and services elementary occupations                     | 91                    | 8.6                                 | 13.0                      | 14.1                               |
| Agricultural, fishery and related laborers                    | 92                    | 8.8                                 | 10.0                      | 13.7                               |
| Laborers in mining, construction, manufacturing and transport | 93                    | 8.1                                 | 10.0                      | 13.5                               |
| Other elementary occupations, nec.                            | 9                     | 7.8                                 | 10.0                      | 13.3                               |

Note (a): See note for Table 1.

Note (b): In the data, the length of a given education is given as the maximum number of months required to obtain that education.

Note (c): For some individuals, information about occupation is only provided at the 1-digit DISCO-88 level, and hence limits are calculated separately for these “not elsewhere classified (nec.)” categories, e.g. 2, 3, 4.

Table 10. Occupation-to-skill match among native Danes and immigrants, 1995-2002, percent

|                             | Overeducated | Adequately educated | Undereducated | Total |
|-----------------------------|--------------|---------------------|---------------|-------|
| Native Danes                | 11.0         | 71.1                | 17.9          | 100.0 |
| Immigrants, all non-Western | 16.3         | 66.1                | 15.6          | 100.0 |
| Turkey                      | 8.2          | 54.2                | 37.6          | 100.0 |
| Pakistan                    | 10.3         | 71.3                | 18.4          | 100.0 |
| Vietnam                     | 10.4         | 75.0                | 14.6          | 100.0 |
| Iran                        | 21.3         | 72.4                | 6.3           | 100.0 |
| Iraq                        | 23.9         | 59.9                | 16.2          | 100.0 |
| Ex-Yugoslavia               | 18.4         | 64.3                | 17.3          | 100.0 |
| Somalia                     | 15.5         | 65.8                | 18.7          | 100.0 |
| Stateless                   | 16.7         | 72.1                | 11.2          | 100.0 |
| Other non-West.             | 18.6         | 67.6                | 13.8          | 100.0 |

Note: See note for Table 1.

Table 11. Occupation-to-skill match among native Danes and immigrants, 1995-2002, percent

|                                     | Overeducated | Adequately educated | Undereducated | Total |
|-------------------------------------|--------------|---------------------|---------------|-------|
| Native Danes                        | 11.0         | 71.1                | 17.9          | 100.0 |
| Immigrants, total                   | 16.3         | 66.1                | 15.6          | 100.0 |
| – Immigrants with Danish education  | 15.3         | 72.7                | 12.0          | 100.0 |
| – Immigrants with foreign education | 17.3         | 60.3                | 22.4          | 100.0 |

Note: See note for Table 1.

Table 12. Percentage overeducated immigrants by ethnic origin and source of education, 1995-2002, percent

|                             | All  | Danish education | Foreign education |
|-----------------------------|------|------------------|-------------------|
| Immigrants, all non-Western | 16.3 | 15.3             | 17.3              |
| Turkey                      | 8.2  | 6.4              | 9.6               |
| Pakistan                    | 10.3 | 8.6              | 11.6              |
| Vietnam                     | 10.4 | 10.9             | 8.4               |
| Iran                        | 21.3 | 20.0             | 27.9              |
| Iraq                        | 23.9 | 28.1             | 22.0              |
| Ex-Yugoslavia               | 18.4 | 14.3             | 19.7              |
| Somalia                     | 15.5 | 11.2             | 17.6              |
| Stateless                   | 16.7 | 16.5             | 17.0              |
| Other non-Western           | 18.6 | 18.2             | 18.9              |

Note: See note for Table 1.



Table 13. Percentage overeducated by level and source of education among native Danes and immigrants, 1995-2002

| Overeducated                  | Native Danes | Immigrants, total | Immigrants with Danish education | Immigrants with foreign education |
|-------------------------------|--------------|-------------------|----------------------------------|-----------------------------------|
| Primary                       | 0.0          | 0.0               | 0.0                              | 0.0                               |
| Secondary                     | 0.0          | 0.0               | 0.0                              | 0.0                               |
| Vocational                    | 10.7         | 10.5              | 9.3                              | 11.6                              |
| Short higher education        | 25.1         | 40.8              | 43.8                             | 37.3                              |
| Medium higher education       | 12.3         | 33.3              | 19.6                             | 58.8                              |
| Long higher education         | 38.5         | 47.0              | 34.2                             | 63.4                              |
| All                           | 11.0         | 16.3              | 15.3                             | 17.3                              |
| Weighted total <sup>(b)</sup> | 15.0         | 24.6              | 20.3                             | 29.6                              |

Note (a): See note for Table 1.

Note (b): The 'Weighted total' shows the shares of overeducated among the sub-sample of individual who have either a vocational education or a higher education (short, medium or long). By contrast, the row labeled 'All' contains the shares of overeducated among the total sample, i.e. including those with a primary or a secondary education.

Table 14. Incidence of overeducation among native Danes and immigrants by occupation, 1995-2002

| Wage-earner<br>Occupation category                           | 2-digit<br>DISCO-<br>88 code | Danes             |               | Immigrants        |               |
|--|------------------------------|-------------------|---------------|-------------------|---------------|
|  |                              | %<br>overeducated | %<br>employed | %<br>overeducated | %<br>employed |
| <b>Professionals</b>   |                              |                   |               |                   |               |
| Physical, mathematical and engineering science professionals | 21                           | 2.7               | 6.3           | 4.0               | 6.75          |
| Life science and health professionals                        | 22                           | 7.1               | 1.4           | 4.4               | 3.1           |
| Teaching professionals                                       | 23                           | 23.9              | 5.8           | 31.4              | 3.7           |
| Social science and humanities professionals                  | 24                           | 4.0               | 5.2           | 4.3               | 1.9           |
| Other professionals, nec.                                    | 2                            | 11.7              | 0.2           | 14.2              | 0.35          |
| <b>Technicians and associate professionals</b>               |                              |                   |               |                   |               |
| Physical and engineering science associate professionals     | 31                           | 13.1              | 6.0           | 27.4              | 4.8           |
| Life science and health associate professionals              | 32                           | 3.2               | 0.7           | 6.8               | 1.1           |
| Teaching associate professionals                             | 33                           | 24.5              | 1.7           | 41.4              | 2.5           |
| Sales and service associate professionals                    | 34                           | 6.2               | 8.9           | 15.5              | 2.2           |
| Other technicians and associate professionals, nec.          | 3                            | 15.4              | 0.5           | 21.1              | 0.3           |
| <b>Clerks</b>  |                              |                   |               |                   |               |
| Office clerks  | 41                           | 24.8              | 4.8           | 35.8              | 5.1           |
| Customer service clerks                                      | 42                           | 15.7              | 0.5           | 42.7              | 0.2           |
| Other clerks, nec.   | 4                            | 20.6              | 0.7           | 35.8              | 0.8           |
| <b>Service workers and shop and market sales workers</b>     |                              |                   |               |                   |               |
| Personal and protective services workers                     | 51                           | 1.9               | 4.0           | 8.6               | 5.7           |
| Models, salespersons and demonstrators                       | 52                           | 16.8              | 1.6           | 24.1              | 0.7           |
| Other service and sales workers, nec.                        | 5                            | 5.4               | 0.1           | 7.9               | 0.3           |
| <b>Skilled agricultural and fisheries workers</b>            |                              |                   |               |                   |               |
| Market-oriented skilled agricultural and fishery workers     | 61                           | 9.2               | 1.0           | 30.4              | 0.2           |
| <b>Craft and related trades workers</b>                      |                              |                   |               |                   |               |
| Extraction and building trade workers                        | 71                           | 0.1               | 8.3           | 0.0               | 3.1           |
| Metal, machinery and related trades workers                  | 72                           | 4.4               | 10.9          | 7.7               | 7.5           |

| Wage-earner<br>Occupation category                            | 2-digit<br>DISCO-<br>88 code | Danes             |               | Immigrants        |               |
|---|------------------------------|-------------------|---------------|-------------------|---------------|
|   |                              | %<br>overeducated | %<br>employed | %<br>overeducated | %<br>employed |
| Precision, handicraft, printing and related trades workers    | 73                           | 5.6               | 0.9           | 21.7              | 0.6           |
| Other craft and related trades workers                        | 74                           | 0.5               | 1.2           | 5.1               | 0.8           |
| Other craft and related trades workers, nec.                  | 7                            | 15.6              | 1.9           | 16.8              | 1.9           |
| <b>Plant and machine operators and assemblers</b>             |                              |                   |               |                   |               |
| Stationary plant and related operators                        | 81                           | 6.7               | 1.1           | 10.1              | 1.4           |
| Machine operators and assemblers                              | 82                           | 2.7               | 6.2           | 8.9               | 13.7          |
| Drivers and mobile plant operators                            | 83                           | 26.2              | 5.0           | 28.3              | 4.3           |
| Other plant and machine operators, nec.                       | 8                            | 2.4               | 1.8           | 9.2               | 5.0           |
| <b>Elementary occupations</b>                                 |                              |                   |               |                   |               |
| Sales and services elementary occupations                     | 91                           | 25.2              | 2.8           | 11.6              | 8.6           |
| Agricultural, fishery and related laborers                    | 92                           | 11.8              | 0.5           | 26.8              | 0.5           |
| Laborers in mining, construction, manufacturing and transport | 93                           | 28.6              | 6.5           | 30.8              | 6.4           |
| Other elementary occupations, nec.                            | 9                            | 50.6              | 3.8           | 25.6              | 6.5           |
| <b>All</b>  |                              | <b>11.0</b>       | <b>100.0</b>  | <b>16.3</b>       | <b>100.0</b>  |

Note (a): See note for Table 1.

Note (b): In the data, the length of a given education is given as the maximum number of months required to obtain that education.

Note (c): For some individuals, information about occupation is only provided at the 1-digit DISCO-88 level, and hence limits are calculated separately for these “not elsewhere classified (nec.)” categories, e.g. 2, 3, 4.

Table 15. Persistence of overeducation among native Danes and immigrants, 1995-2002

| Overeducated in year                     | Adequately matched<br>5 years later | Overeducated<br>5 years later | Undereducated<br>5 years later |
|--|-------------------------------------|-------------------------------|--------------------------------|
|  | Percent                             |                               |                                |
| <b>Danes</b>                             |                                     |                               |                                |
| 1995                                     | 29.5                                | 69.9                          | 0.6                            |
| 1996                                     | 29.4                                | 70.0                          | 0.6                            |
| 1997                                     | 25.7                                | 73.6                          | 0.7                            |
|  |                                     |                               |                                |
| <b>Immigrants, total</b>                 |                                     |                               |                                |
| 1995                                     | 26.0                                | 73.8                          | 0.2                            |
| 1996                                     | 25.3                                | 74.0                          | 0.7                            |
| 1997                                     | 23.3                                | 76.2                          | 0.5                            |
|  |                                     |                               |                                |
| <b>Immigrants, Danish<br/>education</b>  |                                     |                               |                                |
| 1995                                     | 35.6                                | 64.4                          | 0.0                            |
| 1996                                     | 34.4                                | 65.2                          | 0.4                            |
| 1997                                     | 25.3                                | 73.7                          | 1.0                            |
|  |                                     |                               |                                |
| <b>Immigrants, foreign<br/>education</b> |                                     |                               |                                |
| 1995                                     | 17.3                                | 82.3                          | 0.4                            |
| 1996                                     | 16.4                                | 82.5                          | 1.1                            |
| 1997                                     | 21.6                                | 78.4                          | 0.0                            |

Note (a): See note for Table 1.

Note (b) Calculated only for those who are overeducated in the given year and wage-employed with at least 2 months full-time employment (not military nor management) five years later.

Table 16. Results of random effects logit model estimations

| Immigrants, total      |         |     |           |                                     | Native Danes           |          |     |           |                                     |
|------------------------|---------|-----|-----------|-------------------------------------|------------------------|----------|-----|-----------|-------------------------------------|
|                        | Coeff.  | p   | Std. err. | Marginal effect (percentage points) |                        | Coeff.   | p   | Std. err. | Marginal effect (percentage points) |
| Age                    | -0.09   |     | 0.07      | -0.14                               | Age                    | -0.027   |     | 0.03      | -0.01                               |
| Age <sup>2</sup> /100  | 0.15    |     | 0.09      | 0.24                                | Age <sup>2</sup> /100  | 0.071    | *   | 0.03      | 0.02                                |
| Experience             | -0.05   | *   | 0.03      | -0.08                               | Experience             | -0.101   | *** | 0.01      | -0.03                               |
| Exp. <sup>2</sup> /100 | 0.07    |     | 0.08      | 0.12                                | Exp. <sup>2</sup> /100 | 0.069    | *   | 0.03      | 0.02                                |
| YSM                    | 0.07    | **  | 0.03      | 0.11                                |                        |          |     |           |                                     |
| YSM <sup>2</sup> /100  | -0.20   | *** | 0.06      | -0.32                               |                        |          |     |           |                                     |
| Children (#)           | -0.16   |     | 0.47      | -0.26                               | Children (#)           | -0.388   | *   | 0.17      | -0.10                               |
| Single                 | -0.06   |     | 0.10      | -0.09                               | Single                 | 0.186    | *** | 0.04      | 0.05                                |
| Short high ed          | 5.84    | *** | 0.17      | 72.81                               | Short high ed          | 3.732    | *** | 0.07      | 7.57                                |
| Med high ed            | 5.85    | *** | 0.17      | 61.41                               | Med high ed            | 0.469    | *** | 0.06      | 0.15                                |
| Long high ed           | 6.47    | *** | 0.16      | 78.94                               | Long high ed           | 4.135    | *** | 0.07      | 9.35                                |
| Foreign educ           | 1.62    | *** | 0.13      | 2.97                                |                        |          |     |           |                                     |
| Turkey                 | 0.13    |     | 0.22      | 0.22                                |                        |          |     |           |                                     |
| Pakistan               | -0.61   | *   | 0.24      | -0.75                               |                        |          |     |           |                                     |
| Vietnam                | -0.82   | *** | 0.20      | -0.95                               |                        |          |     |           |                                     |
| Iran                   | -1.09   | *** | 0.16      | -1.25                               |                        |          |     |           |                                     |
| Iraq                   | -0.88   | *** | 0.25      | -0.97                               |                        |          |     |           |                                     |
| Ex-Yugoslavia          | 0.62    | *** | 0.15      | 1.19                                |                        |          |     |           |                                     |
| Somalia                | -0.09   |     | 0.45      | -0.14                               |                        |          |     |           |                                     |
| Stateless              | -0.60   |     | 0.32      | -0.73                               |                        |          |     |           |                                     |
| 1996                   | 0.05    |     | 0.13      | 0.08                                | 1996                   | -0.091   | *   | 0.04      | -0.02                               |
| 1997                   | -0.03   |     | 0.13      | -0.05                               | 1997                   | -0.249   | *** | 0.04      | -0.06                               |
| 1998                   | -0.04   |     | 0.12      | -0.06                               | 1998                   | -0.145   | *** | 0.04      | -0.04                               |
| 1999                   | 0.10    |     | 0.13      | 0.16                                | 1999                   | 0.004    |     | 0.04      | 0.00                                |
| 2000                   | 0.20    |     | 0.13      | 0.35                                | 2000                   | 0.549    | *** | 0.04      | 0.18                                |
| 2001                   | 0.08    |     | 0.13      | 0.14                                | 2001                   | 0.537    | *** | 0.04      | 0.17                                |
| 2002                   | 0.17    |     | 0.14      | 0.29                                | 2002                   | 0.556    | *** | 0.04      | 0.18                                |
| Constant               | -6.72   | *** | 1.52      |                                     | Constant               | -5.429   | *** | 0.52      |                                     |
|                        |         |     |           |                                     |                        |          |     |           |                                     |
|                        |         |     |           |                                     |                        |          |     |           |                                     |
| Rho                    | 0.89    |     | 0.003     |                                     | Rho                    | 0.881    |     | 0.001     |                                     |
| LR chi2(27)            | 3,551.4 |     |           |                                     | LR chi2(16)            | 12,012.7 |     |           |                                     |
| Prob > chi2            | 0.0     |     |           |                                     | Prob > chi2            | 0.0      |     |           |                                     |
| Log Likelihood         | -       |     |           |                                     | Log Likelihood         | -        |     |           |                                     |
| Obs.                   | 43,702  |     |           |                                     | Obs.                   | 380,943  |     |           |                                     |

Legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

Note: (a) The estimations are performed using a sub-sample consisting of workers with either a vocational education or a short, medium, or long higher education.

(b) The reference category for ethnic origin is “Other non-Western countries”.

Table 16. (cont.) Results of random effects logit model estimations

| Immigrants with Danish education |        |     |           |                                     | Immigrants with foreign education         |        |      |           |                                     |
|----------------------------------|--------|-----|-----------|-------------------------------------|---|--------|------|-----------|-------------------------------------|
|                                  | Coeff. | p   | Std. err. | Marginal effect (percentage points) |   | Coeff. | p    | Std. err. | Marginal effect (percentage points) |
| Age                              | -0.012 |     | 0.10      | -0.01                               | Age                                       | -0.29  | *    | 0.11      | -0.68                               |
| Age <sup>2</sup> /100            | 0.073  |     | 0.12      | 0.05                                | Age <sup>2</sup> /100                     | 0.37   | **   | 0.14      | 0.87                                |
| Experience                       | -0.138 | *** | 0.03      | -0.09                               | Experience                                | -0.22  | ***  | 0.04      | -0.52                               |
| Exp. <sup>2</sup> /100           | 0.048  |     | 0.10      | 0.03                                | Exp. <sup>2</sup> /100                    | 0.39   | **   | 0.14      | 0.92                                |
| YSM                              | 0.078  |     | 0.04      | 0.05                                | YSM                                       | 0.28   | ***  | 0.04      | 0.66                                |
| YSM <sup>2</sup> /100            | -0.192 |     | 0.10      | -0.13                               | YSM <sup>2</sup> /100                     | -0.53  | ***  | 0.10      | -1.24                               |
| Children (#)                     | -1.213 | *   | 0.60      | -0.83                               | Children (#)                              | -0.88  |      | 0.68      | -2.07                               |
| Single                           | -0.399 | **  | 0.14      | -0.25                               | Single                                    | 0.01   |      | 0.16      | 0.02                                |
| Short high ed                    | 5.467  | *** | 0.24      | 45.55                               | Short high ed                             | 4.83   | ***  | 0.29      | 62.28                               |
| Med high ed                      | 3.563  | *** | 0.24      | 8.55                                | Med high ed                               | 8.89   | ***  | 0.30      | 97.15                               |
| Long high ed                     | 4.415  | *** | 0.22      | 21.50                               | Long high ed                              | 8.50   | ***  | 0.29      | 96.55                               |
|                                  |        |     |           |                                     | Danish Track 1                            | -1.65  | *    | 0.79      | -1.96                               |
|                                  |        |     |           |                                     | Danish Track 2                            | 1.58   | ***  | 0.35      | 7.44                                |
|                                  |        |     |           |                                     | Danish-missing                            | 0.07   |      | 0.19      | 0.17                                |
|                                  |        |     |           |                                     | Danish-missing and arrived after 1.1.1999 | -2.57  |      | 2.32      | -2.23                               |
| Turkey                           | -0.301 |     | 0.30      | -0.18                               | Turkey                                    | 0.16   |      | 0.27      | 0.40                                |
| Pakistan                         | -0.142 |     | 0.30      | -0.09                               | Pakistan                                  | -0.99  | **   | 0.31      | -1.56                               |
| Vietnam                          | -0.815 | *** | 0.24      | -0.43                               | Vietnam <sup>#</sup>                      | -      | -    | -         | -                                   |
| Iran                             | -0.918 | *** | 0.20      | -0.52                               | Iran                                      | 1.04   | **   | 0.39      | 3.97                                |
| Iraq                             | 2.154  | *** | 0.33      | 4.70                                | Iraq                                      | -1.50  | ***  | 0.25      | -2.03                               |
| Ex-Yugoslavia                    | 0.930  | *** | 0.22      | 0.97                                | Ex-Yugoslavia                             | 0.06   |      | 0.21      | 0.13                                |
| Somalia                          | -1.590 | *   | 0.73      | -0.56                               | Somalia                                   | -0.74  |      | 1.14      | -1.26                               |
| Stateless                        | -1.542 | *** | 0.32      | -0.58                               | Stateless                                 | -0.46  |      | 0.44      | -0.89                               |
| 1996                             | 0.212  |     | 0.17      | 0.16                                | 1996                                      | -0.10  |      | 0.19      | -0.23                               |
| 1997                             | 0.036  |     | 0.17      | 0.03                                | 1997                                      | -0.02  |      | 0.19      | -0.05                               |
| 1998                             | 0.007  |     | 0.17      | 0.01                                | 1998                                      | 0.01   |      | 0.18      | 0.02                                |
| 1999                             | 0.213  |     | 0.17      | 0.16                                | 1999                                      | 0.13   |      | 0.18      | 0.33                                |
| 2000                             | 0.395  | *   | 0.17      | 0.31                                | 2000                                      | 0.25   |      | 0.18      | 0.65                                |
| 2001                             | 0.404  | *   | 0.18      | 0.32                                | 2001                                      | 0.03   |      | 0.19      | 0.08                                |
| 2002                             | 0.648  | *** | 0.18      | 0.56                                | 2002                                      | -0.02  |      | 0.19      | -0.06                               |
| Constant                         | -7.201 | *** | 2.12      |                                     | Constant                                  | -2.36  |      | 2.30      |                                     |
|                                  |        |     |           |                                     |   |        |      |           |                                     |
|                                  |        |     |           |                                     |   |        |      |           |                                     |
| Rho                              | 0.901  |     | 0.01      |                                     | Rho                                       | 0.90   | 0.01 |           |                                     |
| LR chi2(26)                      | 1182.7 |     |           |                                     | LR chi2(29)                               | 2528.4 |      |           |                                     |
| Prob > chi2                      | 0.0    |     |           |                                     | Prob > chi2                               | 0.0    |      |           |                                     |
|                                  |        |     |           |                                     |   |        |      |           |                                     |
| Log Likelihood                   | 6231.3 |     |           |                                     | Log Likelihood                            | 5675.1 |      |           |                                     |
| Obs.                             | 23,189 |     |           |                                     | Obs.                                      | 20,513 |      |           |                                     |

Legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

# This variable has been left out of the estimation due to collinearity. Vietnamese individuals have in this case been assigned a value in the “Other non-Western” category instead.

Note: (a) The estimations are performed using a sub-sample consisting of workers with either a vocational education or a short, medium, or long higher education.

(b) The reference category for ethnic origin is “Other non-Western countries”.

Table 17. Summary of results of random effects wage regressions

| Ln(wage)  | Immigrants<br>Total  | Native<br>Danes      | Immigrants<br>Danish<br>education | Immigrants<br>foreign<br>education |
|---|----------------------|----------------------|-----------------------------------|------------------------------------|
| <b>Regression I</b>                             |                      |                      |                                   |                                    |
| Schooling                                       | 0.061***<br>(0.001)  | 0.074***<br>(0.001)  | 0.072***<br>(0.002)               | 0.043***<br>(0.002)                |
| Foreign educ.                                   | -0.061***<br>(0.005) |                      |                                   |                                    |
| Danish Track 1                                  |                      |                      |                                   | -0.074*<br>(0.031)                 |
| Danish Track 2                                  |                      |                      |                                   | -0.045***<br>(0.013)               |
| Danish-missing                                  |                      |                      |                                   | 0.015<br>(0.009)                   |
| Danish-missing<br>and arrived<br>after 1.1.1999 |                      |                      |                                   | 0.018*<br>(0.086)                  |
| R2 Overall                                      | 0.219                | 0.127                | 0.259                             | 0.145                              |
| Obs.  | 43,702               | 380,943              | 23,189                            | 20,513                             |
| <b>Regression II</b>                            |                      |                      |                                   |                                    |
| Adequate  | 0.077***<br>(0.001)  | 0.079***<br>(0.001)  | 0.079***<br>(0.002)               | 0.072***<br>(0.003)                |
| Overeduc  | 0.023***<br>(0.002)  | 0.054***<br>(0.001)  | 0.037***<br>(0.003)               | 0.011***<br>(0.003)                |
| Undereduc                                       | -0.010<br>(0.005)    | -0.047***<br>(0.002) | -0.032***<br>(0.007)              | 0.019*<br>(0.008)                  |
| Foreign educ.                                   | -0.051***<br>(0.005) |                      |                                   |                                    |
| Danish Track 1                                  |                      |                      |                                   | -0.067*<br>(0.029)                 |
| Danish Track 2                                  |                      |                      |                                   | -0.036**<br>(0.012)                |
| Danish-missing                                  |                      |                      |                                   | 0.020*<br>(0.009)                  |
| Danish-missing<br>and arrived<br>after 1.1.1999 |                      |                      |                                   | 0.154<br>(0.081)                   |
| R <sup>2</sup> Overall                          | 0.278                | 0.141                | 0.288                             | 0.238                              |
| Obs.  | 43,702               | 380,943              | 23,189                            | 20,513                             |

Note: (a) In the regression for native Danes, controls variables included, but not reported here, are age, (age squared)/100, experience in Denmark, (experience in Denmark squared)/100, number of children, marital status and year dummies. In addition to these, immigrant equations include YSM (years since migration), YSM<sup>2</sup> and ethnicity dummies. Legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001

(b) The estimations are performed using a sub-sample consisting of workers with either a vocational education or a short, medium, or long higher education.

(c) The reference category for ethnic origin is "Other non-Western countries".

## Appendix tables

Table A1. Selected sample used in the descriptive Tables 1-15: Danes

| Selection criteria  | Number of observations | Percentage reduction |
|---|------------------------|----------------------|
| Original sample   | 4,269,913              |                      |
| Male  | 2,112,293              | 50.5                 |
| $30 \leq \text{Age} \leq 57$                                | 879,573                | 58.4                 |
| Valid information on highest attained education             | 856,015                | 2.7                  |
| Valid information on occupational category                  | 771,685                | 9.9                  |
| Not in full-time education                                  | 756,596                | 2.0                  |
| Wage-earner   | 597,449                | 21.0                 |
| Excl. management and military                               | 556,177                | 6.9                  |
| Employed equivalent to at least 2 months full-time per year | 520,677                | 6.4                  |
| <b>Final sample</b>   | <b>520,677</b>         |                      |

Table A2. Selected sample used in the descriptive Tables 1-15: Immigrants

| Selection criteria  | Number of observations | Percentage reduction |
|---|------------------------|----------------------|
| Original sample   | 2,973,377              |                      |
| First-generation  | 2,339,039              | 21.3                 |
| Non-western   | 1,434,711              | 38.7                 |
| Male  | 742,413                | 48.3                 |
| $30 \leq \text{Age} \leq 57$                                | 399,348                | 46.2                 |
| Valid information on highest attained education             | 337,054                | 15.6                 |
| Valid information on occupational category                  | 212,880                | 36.8                 |
| Not in full-time education                                  | 205,666                | 3.4                  |
| Not imputed education                                       | 122,668                | 40.4                 |
| Wage-earner   | 78,234                 | 36.2                 |
| Excl. management and military                               | 77,364                 | 1.1                  |
| Employed equivalent to at least 2 months full-time per year | 65,909                 | 14.8                 |
| <b>Final sample</b>   | <b>65,909</b>          |                      |



Table A3. Mean sample values of samples used in the empirical analyses\*  
(Results shown in Tables 16-17)

|                                | <b>Danes</b> |           | <b>Immigrants</b> |           | <b>Immigrants with Danish education</b> |           | <b>Immigrants with foreign education</b> |           |
|--------------------------------|--------------|-----------|-------------------|-----------|---|-----------|--|-----------|
|                                | Mean         | Std. Dev. | Mean              | Std. Dev. | Mean                                    | Std. Dev. | Mean                                     | Std. Dev. |
| Overeducation rate             | 0.15         | 0.36      | 0.25              | 0.43      | 0.20                                    | 0.40      | 0.30                                     | 0.46      |
| Age                            | 42.78        | 7.95      | 40.36             | 6.94      | 39.81                                   | 6.80      | 40.98                                    | 7.04      |
| Age <sup>2</sup> /100          | 18.93        | 6.87      | 16.77             | 5.89      | 16.31                                   | 5.76      | 17.29                                    | 5.99      |
| Experience                     | 19.50        | 8.06      | 8.21              | 7.15      | 9.15                                    | 7.24      | 7.15                                     | 6.89      |
| Exp. <sup>2</sup> /100         | 4.45         | 3.20      | 1.19              | 1.96      | 1.36                                    | 2.08      | 0.99                                     | 1.79      |
| YSM                            |              |           | 16.84             | 10.33     | 21.05                                   | 8.83      | 12.08                                    | 9.82      |
| YSM <sup>2</sup> /100          |              |           | 3.90              | 3.64      | 5.21                                    | 3.42      | 2.42                                     | 3.29      |
| Children (#)                   | 0.09         | 0.10      | 0.12              | 0.12      | 0.12                                    | 0.12      | 0.12                                     | 0.12      |
| Single                         | 0.20         | 0.40      | 0.21              | 0.41      | 0.23                                    | 0.42      | 0.19                                     | 0.39      |
| Log wage                       | 5.24         | 0.31      | 5.11              | 0.30      | 5.16                                    | 0.30      | 5.06                                     | 0.29      |
| Schooling (yrs)                | 14.28        | 1.41      | 14.47             | 1.62      | 14.61                                   | 1.78      | 14.31                                    | 1.40      |
| Adequate (yrs)                 | 14.17        | 1.28      | 14.19             | 1.43      | 14.41                                   | 1.62      | 13.94                                    | 1.13      |
| Overeduc (yrs)                 | 0.14         | 0.47      | 0.32              | 0.75      | 0.23                                    | 0.61      | 0.43                                     | 0.87      |
| Underedu (yrs)                 | 0.04         | 0.23      | 0.04              | 0.25      | 0.03                                    | 0.23      | 0.06                                     | 0.28      |
| Vocational edu                 | 0.65         | 0.48      | 0.51              | 0.50      | 0.45                                    | 0.50      | 0.58                                     | 0.49      |
| Short higher ed                | 0.07         | 0.26      | 0.12              | 0.32      | 0.12                                    | 0.33      | 0.12                                     | 0.32      |
| Med. higher ed                 | 0.17         | 0.37      | 0.21              | 0.41      | 0.26                                    | 0.44      | 0.16                                     | 0.37      |
| Long higher ed                 | 0.11         | 0.31      | 0.15              | 0.36      | 0.16                                    | 0.37      | 0.14                                     | 0.35      |
| Foreign educ                   |              |           | 0.47              | 0.50      |   |           |  |           |
| Danish Track 1                 |              |           |                   |           |   |           | 0.01                                     | 0.09      |
| Danish Track 2                 |              |           |                   |           |   |           | 0.08                                     | 0.27      |
| Danish Track 3                 |              |           |                   |           |   |           | 0.12                                     | 0.32      |
| Danish-missing                 |              |           |                   |           |   |           | 0.79                                     | 0.40      |
| Danish-missing & arrive ≥ 1999 |              |           |                   |           |   |           | 0.00                                     | 0.02      |
| Turkey                         |              |           | 0.08              | 0.27      | 0.07                                    | 0.25      | 0.10                                     | 0.30      |
| Pakistan                       |              |           | 0.04              | 0.19      | 0.03                                    | 0.17      | 0.04                                     | 0.20      |
| Vietnam                        |              |           | 0.08              | 0.27      | 0.13                                    | 0.34      | 0.02                                     | 0.14      |
| Iran                           |              |           | 0.15              | 0.36      | 0.25                                    | 0.43      | 0.04                                     | 0.19      |
| Iraq                           |              |           | 0.04              | 0.20      | 0.03                                    | 0.17      | 0.06                                     | 0.24      |
| Ex-Yugoslavia                  |              |           | 0.20              | 0.40      | 0.08                                    | 0.27      | 0.33                                     | 0.47      |
| Somalia                        |              |           | 0.01              | 0.09      | 0.01                                    | 0.08      | 0.01                                     | 0.11      |
| Stateless                      |              |           | 0.03              | 0.17      | 0.04                                    | 0.20      | 0.02                                     | 0.14      |
| Oth non-West                   |              |           | 0.37              | 0.48      | 0.36                                    | 0.48      | 0.38                                     | 0.48      |
| Number of observations         | 380,943      |           | 43,702            |           | 23,189                                  |           | 20,513                                   |           |

\* Compared to the samples selected for the descriptive analyses (shown in Appendix Tables A1 and A2) the samples for the empirical analyses consider only individuals with a vocational education or a short, medium, or long higher education. See Section 5.2 for a discussion.

Table A4. Selected mean values of the immigrant samples used in the descriptive statistics, the empirical estimations and a comparison sample

|                        | <b>Sample used in descriptive statistics (Tables 1-15)</b> | <b>Sample used in empirical estimations (Tables 16-17)</b> | <b>Comparison sample (males, aged 30-57, non-Western immigrants)*</b> |
|------------------------|--|--|---|
|                        | Mean   | Mean   | Mean  |
| Age                    | 40.0   | 40.4   | 40.4  |
| Experience             | 8.9  | 8.2  | 5.0   |
| YSM                    | 17.7   | 16.8   | 28.8  |
| Foreign educ           | 53.4   | 46.9   | 38.7  |
| Schooling (yrs)        | 12.7   | 14.5   | 11.9  |
| Primary edu            | 25.9   | 0.0  | 33.2  |
| Secondary              | 7.8  | 0.0  | 11.3  |
| Vocational edu         | 33.9   | 51.2   | 29.8  |
| Short higher ed        | 7.9  | 12.0   | 7.3   |
| Med. higher ed         | 14.2   | 21.4   | 10.5  |
| Long higher ed         | 10.3   | 15.5   | 7.9   |
|                        |  |  |   |
| Number of observations | 65,909   | 43,702   | 337,054   |

\* With valid (i.e. non-missing) information about highest level of education attained.

Table A5. Results of random effects wage regressions: Native Danes

| <b>Ln(wage)</b>        | Co-<br>efficients | p   | Std. err. | <b>Ln(wage)</b>        | Co-<br>efficients | p   | Std. err. |
|------------------------|-------------------|-----|-----------|------------------------|-------------------|-----|-----------|
| Schooling              | 0.074             | *** | 0.001     | Adequate               | 0.079             | *** | 0.001     |
|                        |                   |     |           | Overeduc               | 0.054             | *** | 0.001     |
|                        |                   |     |           | Undereduc              | -0.047            | *** | 0.002     |
| Age                    | 0.029             | *** | 0.001     | Age                    | 0.029             | *** | 0.001     |
| Age <sup>2</sup> /100  | -0.037            | *** | 0.001     | Age <sup>2</sup> /100  | -0.036            | *** | 0.001     |
| Experience             | 0.014             | *** | 0.000     | Experience             | 0.014             | *** | 0.000     |
| Exp. <sup>2</sup> /100 | -0.018            | *** | 0.001     | Exp. <sup>2</sup> /100 | -0.018            | *** | 0.001     |
| Children (#)           | 0.068             | *** | 0.005     | Children (#)           | 0.067             | *** | 0.005     |
| Single                 | -0.002            | *   | 0.001     | Single                 | -0.003            | *   | 0.001     |
| 1996                   | 0.007             | *** | 0.001     | 1996                   | 0.007             | *** | 0.001     |
| 1997                   | -0.003            | **  | 0.001     | 1997                   | -0.003            | **  | 0.001     |
| 1998                   | 0.031             | *** | 0.001     | 1998                   | 0.031             | *** | 0.001     |
| 1999                   | 0.032             | *** | 0.001     | 1999                   | 0.032             | *** | 0.001     |
| 2000                   | 0.041             | *** | 0.001     | 2000                   | 0.041             | *** | 0.001     |
| 2001                   | 0.060             | *** | 0.001     | 2001                   | 0.060             | *** | 0.001     |
| 2002                   | 0.059             | *** | 0.001     | 2002                   | 0.060             | *** | 0.001     |
| Constant               | 3.424             | *** | 0.018     | Constant               | 3.368             | *** | 0.018     |
|                        |                   |     |           |                        |                   |     |           |
|                        |                   |     |           |                        |                   |     |           |
| rho                    | 0.825             |     |           | rho                    | 0.818             |     |           |
| Wald chi2 (14)         | 35,668.3          |     |           | Wald chi2 (16)         | 36975.18          |     |           |
| Prob > chi2            | 0.0               |     |           | Prob > chi2            | 0.0               |     |           |
| Obs.                   | 380,943           |     |           | Obs.                   | 380,943           |     |           |
| R2: Within             | 0.075             |     |           | R2: Within             | 0.074             |     |           |
| Between                | 0.129             |     |           | Between                | 0.145             |     |           |
| Overall                | 0.127             |     |           | Overall                | 0.141             |     |           |

Note: (a) In the regression for native Danes, controls variables included, but not reported here, are age, (age squared)/100, experience in Denmark, (experience in Denmark squared)/100, number of children, marital status and year dummies. In addition to these, immigrant equations include YSM (years since migration), YSM<sup>2</sup> and ethnicity dummies. Legend: \* p<0.05; \*\* p<0.01; \*\*\* p<0.001.

(b) The estimations are performed using a sub-sample consisting of workers with either a vocational education or a short, medium, or long higher education.

(c) The reference category for ethnic origin is “Other non-Western countries”.

Table A6. Results of random effects wage regressions: All immigrants

| <b>Ln(wage)</b>        | Co-<br>efficients | p   | Std. err. | <b>Ln(wage)</b>        | Coefficients | p   | Std. err. |
|------------------------|-------------------|-----|-----------|------------------------|--------------|-----|-----------|
| Schooling              | 0.061             | *** | 0.001     | Adequate               | 0.077        | *** | 0.001     |
|                        |                   |     |           | Overeduc               | 0.023        | *** | 0.002     |
|                        |                   |     |           | Undereduc              | -0.010       |     | 0.005     |
| Age                    | 0.021             | *** | 0.002     | Age                    | 0.020        | *** | 0.002     |
| Age <sup>2</sup> /100  | -0.029            | *** | 0.003     | Age <sup>2</sup> /100  | -0.028       | *** | 0.003     |
| Experience             | 0.029             | *** | 0.001     | Experience             | 0.028        | *** | 0.001     |
| Exp. <sup>2</sup> /100 | -0.054            | *** | 0.003     | Exp. <sup>2</sup> /100 | -0.053       | *** | 0.003     |
| YSM                    | -0.008            | *** | 0.001     | YSM                    | -0.008       | *** | 0.001     |
| YSM <sup>2</sup> /100  | 0.016             | *** | 0.002     | YSM <sup>2</sup> /100  | 0.016        | *** | 0.002     |
| Children (#)           | -0.005            |     | 0.014     | Children (#)           | -0.011       |     | 0.014     |
| Single                 | 0.000             |     | 0.003     | Single                 | -0.001       |     | 0.003     |
| Foreign educ           | -0.061            | *** | 0.005     | Foreign educ           | -0.051       | *** | 0.005     |
| Turkey                 | -0.051            | *** | 0.009     | Turkey                 | -0.051       | *** | 0.008     |
| Pakistan               | 0.024             | *   | 0.012     | Pakistan               | 0.025        | *   | 0.011     |
| Vietnam                | -0.029            | **  | 0.010     | Vietnam                | -0.031       | **  | 0.009     |
| Iran                   | 0.040             | *** | 0.008     | Iran                   | 0.031        | *** | 0.007     |
| Iraq                   | 0.037             | *** | 0.011     | Iraq                   | 0.033        | **  | 0.010     |
| Ex-Yugoslavia          | -0.015            | *   | 0.006     | Ex-Yugoslavia          | -0.015       | *   | 0.006     |
| Somalia                | -0.060            | **  | 0.020     | Somalia                | -0.056       | **  | 0.019     |
| Stateless              | -0.016            |     | 0.013     | Stateless              | -0.017       |     | 0.012     |
| 1996                   | 0.002             |     | 0.004     | 1996                   | 0.002        |     | 0.004     |
| 1997                   | -0.005            |     | 0.004     | 1997                   | -0.005       |     | 0.004     |
| 1998                   | 0.025             | *** | 0.004     | 1998                   | 0.025        | *** | 0.004     |
| 1999                   | 0.029             | *** | 0.004     | 1999                   | 0.029        | *** | 0.004     |
| 2000                   | 0.046             | *** | 0.004     | 2000                   | 0.047        | *** | 0.004     |
| 2001                   | 0.055             | *** | 0.004     | 2001                   | 0.056        | *** | 0.004     |
| 2002                   | 0.053             | *** | 0.004     | 2002                   | 0.055        | *** | 0.004     |
| Constant               | 3.771             | *** | 0.053     | Constant               | 3.575        | *** | 0.052     |
|                        |                   |     |           |                        |              |     |           |
|                        |                   |     |           |                        |              |     |           |
| rho                    | 0.711             |     |           | rho                    | 0.679        |     |           |
| Wald chi2 (25)         | 6799.1            |     |           | Wald chi2 (27)         | 7,960.0      |     |           |
| Prob > chi2            | 0.0               |     |           | Prob > chi2            | 0.0          |     |           |
| Obs.                   | 43,702            |     |           | Obs.                   | 43,702       |     |           |
| R2: Within             | 0.096             |     |           | R2: Within             | 0.090        |     |           |
| Between                | 0.226             |     |           | Between                | 0.293        |     |           |
| Overall                | 0.219             |     |           | Overall                | 0.278        |     |           |

Note: See note for Appendix Table A5.

Table A7. Results of random effects wage regressions:  
Immigrants with Danish education

| <b>Ln(wage)</b>        | Co-<br>efficients | p   | Std.<br>err. |  | <b>Ln(wage)</b>        | Co-<br>efficients | p   | Std.<br>err. |
|------------------------|-------------------|-----|--------------|--|------------------------|-------------------|-----|--------------|
| Schooling              | 0.072             | *** | 0.002        |  | Adequate               | 0.079             | *** | 0.002        |
|                        |                   |     |              |  | Overeduc               | 0.037             | *** | 0.003        |
|                        |                   |     |              |  | Undereduc              | -0.032            | *** | 0.007        |
| Age                    | 0.019             | *** | 0.003        |  | Age                    | 0.019             | *** | 0.003        |
| Age <sup>2</sup> /100  | -0.028            | *** | 0.004        |  | Age <sup>2</sup> /100  | -0.028            | *** | 0.004        |
| Experience             | 0.029             | *** | 0.001        |  | Experience             | 0.029             | *** | 0.001        |
| Exp. <sup>2</sup> /100 | -0.056            | *** | 0.004        |  | Exp. <sup>2</sup> /100 | -0.055            | *** | 0.004        |
| YSM                    | -0.004            | *** | 0.001        |  | YSM                    | -0.005            | *** | 0.001        |
| YSM <sup>2</sup> /100  | 0.008             | **  | 0.003        |  | YSM <sup>2</sup> /100  | 0.009             | **  | 0.003        |
| Children (#)           | -0.015            |     | 0.020        |  | Children (#)           | -0.021            |     | 0.020        |
| Single                 | -0.001            |     | 0.004        |  | Single                 | -0.002            |     | 0.004        |
| Turkey                 | -0.048            | *** | 0.013        |  | Turkey                 | -0.049            | *** | 0.013        |
| Pakistan               | 0.070             | *** | 0.018        |  | Pakistan               | 0.064             | *** | 0.017        |
| Vietnam                | -0.029            | **  | 0.011        |  | Vietnam                | -0.032            | **  | 0.011        |
| Iran                   | 0.041             | *** | 0.009        |  | Iran                   | 0.033             | *** | 0.009        |
| Iraq                   | 0.031             |     | 0.018        |  | Iraq                   | 0.029             |     | 0.017        |
| Ex-Yugoslavia          | -0.028            | *   | 0.012        |  | Ex-Yugoslavia          | -0.029            | **  | 0.011        |
| Somalia                | -0.019            |     | 0.032        |  | Somalia                | -0.022            |     | 0.031        |
| Stateless              | -0.019            |     | 0.015        |  | Stateless              | -0.024            |     | 0.015        |
| 1996                   | 0.002             |     | 0.005        |  | 1996                   | 0.003             |     | 0.005        |
| 1997                   | -0.005            |     | 0.005        |  | 1997                   | -0.005            |     | 0.005        |
| 1998                   | 0.028             | *** | 0.005        |  | 1998                   | 0.028             | *** | 0.005        |
| 1999                   | 0.036             | *** | 0.005        |  | 1999                   | 0.037             | *** | 0.005        |
| 2000                   | 0.058             | *** | 0.005        |  | 2000                   | 0.059             | *** | 0.005        |
| 2001                   | 0.073             | *** | 0.005        |  | 2001                   | 0.074             | *** | 0.005        |
| 2002                   | 0.069             | *** | 0.006        |  | 2002                   | 0.070             | *** | 0.006        |
| Constant               | 3.632             | *** | 0.074        |  | Constant               | 3.526             | *** | 0.074        |
|                        |                   |     |              |  |                        |                   |     |              |
|                        |                   |     |              |  |                        |                   |     |              |
| rho                    | 0.70              |     |              |  | rho                    | 0.68              |     |              |
| Wald chi2 (24)         | 4778.9            |     |              |  | Wald chi2 (26)         | 5142.8            |     |              |
| Prob > chi2            | 0.0               |     |              |  | Prob > chi2            | 0.0               |     |              |
| Obs.                   | 23,189            |     |              |  | Obs.                   | 23,189            |     |              |
| R2: Within             | 0.135             |     |              |  | R2: Within             | 0.132             |     |              |
| Between                | 0.259             |     |              |  | Between                | 0.295             |     |              |
| Overall                | 0.259             |     |              |  | Overall                | 0.288             |     |              |

Note: See note for Appendix Table A5.

Table A8. Results of random effects wage regressions:  
Immigrants with foreign education

| <b>Ln(wage)</b>                   | Co-<br>efficients | p   | Std. err. | <b>Ln(wage)</b>                   | Co-<br>efficients | p   | Std.<br>err. |
|-----------------------------------|-------------------|-----|-----------|-----------------------------------|-------------------|-----|--------------|
| Schooling                         | 0.043             | *** | 0.002     | Adequate                          | 0.072             | *** | 0.003        |
|                                   |                   |     |           | Overeduc                          | 0.011             | *** | 0.003        |
|                                   |                   |     |           | Undereduc                         | 0.019             | *   | 0.008        |
| Age                               | 0.019             | *** | 0.004     | Age                               | 0.016             | *** | 0.004        |
| Age <sup>2</sup> /100             | -0.025            | *** | 0.004     | Age <sup>2</sup> /100             | -0.022            | *** | 0.004        |
| Experience                        | 0.028             | *** | 0.002     | Experience                        | 0.026             | *** | 0.002        |
| Exp. <sup>2</sup> /100            | -0.040            | *** | 0.005     | Exp. <sup>2</sup> /100            | -0.038            | *** | 0.005        |
| YSM                               | -0.008            | *** | 0.001     | YSM                               | -0.007            | *** | 0.001        |
| YSM <sup>2</sup> /100             | 0.003             |     | 0.004     | YSM <sup>2</sup> /100             | 0.002             |     | 0.003        |
| Children (#)                      | -0.002            |     | 0.021     | Children (#)                      | -0.009            |     | 0.020        |
| Single                            | 0.001             |     | 0.005     | Single                            | 0.000             |     | 0.005        |
| Danish Track 1                    | -0.074            | *   | 0.031     | Danish Track 1                    | -0.067            | *   | 0.029        |
| Danish Track 2                    | -0.045            | *** | 0.013     | Danish Track 2                    | -0.036            | **  | 0.012        |
| Danish-missing                    | 0.015             |     | 0.009     | Danish-missing                    | 0.020             | *   | 0.009        |
| Danish-missing &<br>arrive ≥ 1999 | 0.183             | *   | 0.086     | Danish-missing &<br>arrive ≥ 1999 | 0.154             |     | 0.081        |
| Turkey                            | -0.052            | *** | 0.012     | Turkey                            | -0.047            | *** | 0.011        |
| Pakistan                          | -0.027            |     | 0.016     | Pakistan                          | -0.012            |     | 0.015        |
| Vietnam                           | -0.039            |     | 0.025     | Vietnam                           | -0.046            |     | 0.024        |
| Iran                              | 0.014             |     | 0.017     | Iran                              | 0.018             |     | 0.016        |
| Iraq                              | 0.048             | *** | 0.013     | Iraq                              | 0.036             | **  | 0.012        |
| Ex-Yugoslavia                     | -0.026            | *** | 0.008     | Ex-Yugoslavia                     | -0.021            | **  | 0.007        |
| Somalia                           | -0.079            | **  | 0.025     | Somalia                           | -0.070            | **  | 0.024        |
| Stateless                         | -0.005            |     | 0.023     | Stateless                         | 0.004             |     | 0.021        |
| 1996                              | 0.002             |     | 0.006     | 1996                              | 0.002             |     | 0.006        |
| 1997                              | -0.004            |     | 0.005     | 1997                              | -0.005            |     | 0.005        |
| 1998                              | 0.023             | *** | 0.005     | 1998                              | 0.023             | *** | 0.005        |
| 1999                              | 0.022             | *** | 0.005     | 1999                              | 0.023             | *** | 0.005        |
| 2000                              | 0.034             | *** | 0.006     | 2000                              | 0.036             | *** | 0.006        |
| 2001                              | 0.037             | *** | 0.006     | 2001                              | 0.040             | *** | 0.006        |
| 2002                              | 0.037             | *** | 0.006     | 2002                              | 0.043             | *** | 0.006        |
| Constant                          | 4.001             | *** | 0.079     | Constant                          | 3.653             | *** | 0.078        |
|                                   |                   |     |           |                                   |                   |     |              |
|                                   |                   |     |           |                                   |                   |     |              |
| rho                               | 0.714             |     |           | rho                               | 0.674             |     |              |
| Wald chi2 (28)                    | 1870.9            |     |           | Wald chi2 (30)                    | 2545.6            |     |              |
| Prob > chi2                       | 0.0               |     |           | Prob > chi2                       | 0.0               |     |              |
| Obs.                              | 20,513            |     |           | Obs.                              | 20,513            |     |              |
| R2: Within                        | 0.0551            |     |           | R2: Within                        | 0.047             |     |              |
| Between                           | 0.1506            |     |           | Between                           | 0.252             |     |              |
| Overall                           | 0.1447            |     |           | Overall                           | 0.238             |     |              |

Note: See note for Appendix Table A5.