IMMIGRATION AND NATIVES' SKILL UPGRADE

CRISTINA CATTANEO, CARLO V. FIORIO

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PRELIMINARY AND INCOMPLETE

Abstract

This paper empirically analyses the extent to which native workers respond to the inflow of foreigners in the labor market by upgrading their skills, i.e. moving into occupation with higher skill content. Using data on a sample of European countries during the 1990s we find that an increase in the share of foreign workers is associated with a higher likelihood of natives to move into occupations with a higher skill content. Our results complement the theoretical literature, which predicts adverse wages and employment responses to immigration, and the empirical literature, which either fails to find any negative effect or reports positive effects of immigration on wages.

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1 Introduction

Europe has faced a surge of workers' immigration in recent decades, and new waves of immigrants continuously enter in the EU. The fall of the Soviet bloc and later the inclusion of new accession countries generated a new channel of immigration, which add to the traditional inflows from non-EU countries. Immigration is associated with many advantages for destination countries. First, Europe is an aging zone, and the inflows of young foreign workers sensibly reduces the average age of the population. Foreigners have a high activity rate and tend to gain lower salaries than natives, given their low average education and their employment in low skilled jobs. This has represented an advantage in particular for low productivity firms. Immigrants have allowed greater participation rates for native women, looking after children and elderly people. This fact appears to be particularly relevant in countries of Southern Europe, like Spain, Portugal, Italy and Greece, were women participation in the labor market has been traditionally low. Different studies moreover, have demonstrated that immigration is associated with productivity gains, generated by the existence of complementarities between native workers and immigrants (Ottaviano and Peri, 2005, 2006a; Bellini et al., 2009; Friedberg, 2001). This empirical evidence has introduced a different approach in treating immigration. From considering the inflows of migrants as a major problem for destination countries, the novel perspective looks at the potential advantages brought in by immigration in general, and in the labor market in particular. As the U.S. historically are an important destination for migrants, the majority of the studies has focused on the effects of immigration in the U.S. labor market, whereas only few studies can be quoted for Europe (D'Amuri et al., 2008; Manacorda et al., 2006, among others). Very little is known about the reaction of native

workers to an increased inflow of foreign workers. Will natives move to more skilled occupation? Will they more likely fall into unemployment? This paper aims to assess whether immigration is associated with skill upgrade among natives. This effect can arise as natives put in place some mechanisms to reduce the competition with the foreign workers, including the upgrade of their skills. This hypothesis is tested empirically on a sample of European countries.

The structure of the paper is organised as follows. Section 2 provides a brief review of the literature. Section 3 presents the empirical model. Section 4 presents a preliminary description of the data. Section 5 provides the empirical findings and Section6 offers a summary and conclusions.

2 Related literature

A vast literature exists on possible implications of immigration on destination countries' labor markets.[1] Despite simple theoretical models predict the adjustment of wages and unemployment of competing factors, the empirical evidence is quite mixed and suggesting a small response of native outcomes to the inflow of immigrants (Card, 2001) or alternatively large and negative effects (Borjas et al., 1997). Various explanations have been introduced to reconcile the theory and the empirical findings and additional complexity has been introduced to make the models more in line with the reality. However, a lively debate still exists in particular regarding the degree of substitutability between native and foreigners.

Some authors assume that natives and foreigners, endowed with identical levels of education and experience, are perfect substitute to one other. For example Borjas (2003, 2006); Borjas and Katz (2007) assume perfect substitution

[1] for a more comprehensive review of the existing studies, see Longhi et al. (2005).

of native and foreign workers within each group of education and experience. In the empirical exercise they find that immigrants worsen the labor market opportunities of U.S. native workers. In particular immigration is associated with a three percent loss in the real value of wages in general, and with an even larger loss for workers without a high school degree. Moreover, the increase in the supply of foreign PhD graduates, induced by the immigration of high-skilled workers, produces about three to four percent loss in wages of competing native workers.

On the contrary Card (2009); D'Amuri et al. (2008); Manacorda et al. (2006); Ottaviano and Peri (2006b, 2008) introduce the possibility that individuals of different country of origins and within the same education-experience groups are imperfect substitutes. This feature can be assumed because immigrants tend to chose different set of occupations, they are a selected group from their original population as well as they own some culture specific skills and limits, that create comparative advantage in some jobs and disadvantage in others. Ottaviano and Peri (2008) in particular derive a theory-based approach to provide a precise estimate of the degree of substitution between natives and immigrant workers. The empirical exercise for the U.S. reports a small but significant degree of imperfect substitution between natives and immigrants within education-experience groups. After accounting for capital adjustment to immigration in the long run, they find small negative effects of immigration in the short run and small positive effects in the long run.

The aforementioned studies, which assume imperfect substitution, model the existence of a complementarity between native and foreigners, which derives from intrinsic differences that characterise the two groups even within the same level of experience and education. These differences induce foreigners to chose occupations that differ from those where natives are employed. Such

a clear cut in the types of occupations however can arise also as an ex-post strategy taken by natives, in order to reduce the competition with foreigners. Foreigners possess a comparative advantage in performing manual tasks, given their imperfect acquisition of the host country language and, vice versa, natives have a comparative advantage in performing jobs demanding communication skills. This situation induces natives and foreigners to specialise in different occupations according to their comparative advantages, implying that between natives and foreigners, even among the less educated group, the degree of substitution is limited. Peri and Sparber (2009) model this framework and estimate for the US the extent to which job specialisation exists. They report an increase in the relative supply of communication tasks by native workers, as well as a limited wage loss of native workers as a consequence of large immigration inflows. Moreover, they estimate wage functions and report that the wage loss for U.S. natives appears to be remarkably lower than it would result in a situation of no job specialisation. The process of endogenous skill upgrading is also formalised in Casarico and Devillanova (2003). The model predicts that natives, as a response to the arrival of unskilled workers, move from the unskilled to the skilled labor sector. By changing the skill premium, migration produces an increase in the number of skilled agents among the native population. Job shifts seem to occur not only among the less educated workers, but also among the highly educated workers, as reported in Peri and Sparber (2008). The authors find that the U.S. native workers have responded to immigration by exploiting their comparative advantage in communicative skills and therefore by moving to jobs with less quantitative and more interactive content.

Another branch of the literature that is highly connected with this study deals with the analysis of occupational mobility in general (Campos and

Dabusinskas, 2009; Elliott and Lindley, 2006; Moscarini and Thomsson, 2007; Parrado et al., 2007). For example, Kambourov and Manovskii (2008) document a high and rising occupational mobility in the U.S. over the 1968-1997 period and mention, as potential responsible candidates, shocks in the occupational demand, such as technological changes, globalisation, international trade, changes in government regulation, and labor force unionisation. A further advancement in the literature is introduced by Autor et al. (2003), where shifts in skills rather than occupation is analysed. The objective of their paper is to assess the effect of the adoption of computer-based technologies on the job tasks demand in the U.S. In doing so the authors match individual occupations and their involved tasks, using the Dictionary of Occupational Titles (DOT). They report the existence of polarisation effects, in that technology replaces only routine tasks, but cannot affect non-routine tasks. In particular computer technologies do not substitute but complement those workers, both skilled and unskilled, that perform tasks demanding flexibility, creativity, generalised problem solving capabilities, and complex communication. A similar analysis is conducted for Germany by Spitz-Oener (2006). The authors employ a unique survey-based data, where the link between occupations and tasks is inferred directly, through asking to the employees what they actually do in their jobs. They report that while non-routine cognitive tasks have largely increased, manual and cognitive routine tasks experienced a pronounced decline. Moreover, most of the task changes occurred in occupations in which the popularisation of computers was larger.

For Europe, other studies tried to link occupations with skill levels, using the ISCO-88 occupational classification of the International Labour Office (see, for example Upward and Wright, 2007). In particular Falvey et al. (2008) examines for Portugal whether increasing international competition is respon-

sible for skill upgrade by affecting return to skills. The empirical exercise confirms that trade competition is an important determinant of skill upgrade and emphasises how skill acquisition represents a crucial process to react to external shocks. Interestingly, despite the relevance, no empirical works has been done to assess the effects of an external shock such as immigration on skill mobility in Europe.

3 The empirical model

The main aim of our paper is to assess whether the inflow of foreign workers is associated with more or less skill upgrade among natives. We define skill upgrading the change of occupation of a worker from a job with relatively low skill with another with more skill content. Although we could also consider skill downgrade, we here focus only on skill upgrade and study whether the existence of a relatively larger share of immigrants might be associated to a more or a less likely skill upgrading.

Before empirically define the skill upgrading variable, we need a consistent and accepted way of linking skills with occupations. A standard way of coding occupations is the International Standard Classification of Occupations (ISCO-88) produced by the International Labor Office (ILO, 1990). The ISCO-88 classification is based on two main concepts: the concept of the kind of work performed or job and the concept of skill (Elias and McKnight, 2001). A job represents a basic element in the employment relationship and is defined as a set of tasks or duties to be carried out by an individual. In ISCO-88 skill is defined as the ability to carry out the tasks and duties of a job in a competent manner. Within the ISCO-88 four skill levels are broadly defined. Skill levels are approximated by the length of time deemed necessary for a person

to become fully competent in the performance of the tasks associated with a job. The first skill level is defined by the competence associated with a good general education, usually acquired by the completion of compulsory education. Examples of occupations defined at the first skill level include elementary occupations such as postal workers, hotel porters, cleaners, and catering assistants. The second skill level covers a large group of occupations, all of which require the knowledge as for first skill level, but in addition typically have a longer period of worker-related training or work experience. Occupations classified at this level include machine operation, driving, caring occupations, retailing, and clerical and secretarial occupations. The third skill level applies to occupations that normally require a body of knowledge associated with a period of post-compulsory education but not to degree level. A number of technical occupations fall into this category, as do a variety of trades occupations and proprietors of small businesses. In the latter case, educational qualifications at sub-degree level or a lengthy period of vocational training may not be a necessary prerequisite for competent performance of tasks, but a significant period of work experience is typical. The fourth skill level relates to what are often termed professional occupations and managerial positions in corporate enterprises or national/local government such as legislators, senior officials and managers. Occupations at this level normally require a degree or equivalent period of relevant work experience (for a table summarising the ISCO-88 classification, see Table 1).

As we do not know the exact level of individual skill upgrade, S_i^*, we assume that skill upgrade is generated by a latent variable model:

$$S_i^* = \beta_0 + \mathbf{x}_i'\beta + e_i$$

where $i = 1, ..., N$ for a sample of N individuals, $\mathbf{x}_i'\beta = \beta_1 x_{i1} + ... + \beta_k x_{ik}$ includes a set of individual controls and fixed effects, and e_i is a continuously distributed variable independent of $\mathbf{x_i}$, and accounts for unobserved heterogeneity. As S^* is latent for each individual i, one can only observe $S_i = 1$ (i.e. $S_i^* > 0$), where $1[\cdot]$ is equal to 1 if the argument is true and equal to zero otherwise. Assuming that e_i is distributed as a standard normal we obtain the probit model:

$$\Pr(S = 1|\mathbf{x}) = \Pr(e > \beta_0 - \mathbf{x}\beta|\mathbf{x}) = 1 - \Phi(\beta_0 - \mathbf{x}\beta) \equiv p(\mathbf{x}) \tag{1}$$

where Φ is the standard normal cumulative density function.

Although we ignore downgrading of skills, we consider the possibility that an individual from year t to year $t + 2$ falls into unemployment and aim at assessing whether this event might be more or less likely depending on the stock of foreigners in the labour market. Hence, we define a categorical variable, Y_i that equals to -1 if the individual fall into unemployment at time $t + 2$ after being employed at time t, equals 0 if no change occurs in the two years and equals 1 if a skill upgrade occurs. Under the assumption of independently distributed error terms, an underlying score is estimated as a linear function of the independent variables and a set of cutpoints. For individual i, the probability of observing outcome r corresponds to the probability that the estimated linear function, plus the idiosyncratic random error, u_i, is within the range of the cutpoints estimated for the outcome:

$$Pr(Y = r) = Pr(\kappa_{r-1} < \mathbf{x}\gamma + \mathbf{u} \leq \kappa_{\mathbf{r}}), \tag{2}$$

where κ_0 is defined as $-\infty$ and κ_3 is defined as $+\infty$. Assuming that the error terms are normally distributed, we estimate the vector of coefficients γ,

together with the two cutpoints κ_1, κ_2 by maximum likelihood. Hence, the probability of a given observation is:

$$Pr(Y = r) = Pr(\kappa_{r-1} < \mathbf{x}\gamma + \mathbf{u} \leq \kappa_{\mathbf{r}}) = \mathbf{\Phi}(\kappa_{\mathbf{r}} - \mathbf{x}\gamma) - \mathbf{\Phi}(\kappa_{\mathbf{r-1}} - \mathbf{x_i}\gamma)$$

.

As the estimated coefficients do not have an economic interpretation, results are presented estimating the partial effects of most relevant dependent variables, where in case of discrete dependent variables partial changes are caused by unit changes. Similarly to Friedberg (2001) all models are estimated correcting standard errors for clustering by year and occupation, following Moulton (1986).

4 The data

We use data from the European Community Household Panel (ECHP), a European survey that interviews annually a representative panel of households and individuals on a standard range of topics, including income, health, education, housing, demographics and employment characteristics. The survey, designed as a longitudinal panel, started in 1994 and ended in 2001, for a total of eight waves. A useful characteristic of the survey is the use of a standardised methodology, yielding comparable information across countries. For this analysis, two reference waves of the ECHP panel have been selected, namely the first (year 1994), the sixth (1999) and job mobility has been assessed tracking sampled workers two years later, i.e. in 1996 and 2001. This allows us to analyse skill upgrading in separate periods, the early and late 1990s (i.e. the beginning and the end of the period covered by the data set), experiencing some degree of job mobility but holding the attrition rate of the data set

to a minimum. The countries included in our sample are Denmark, France, Germany, Greece, Ireland, Italy, The Netherlands, Portugal, and Spain, representing all zones of Western Europe, as well basins of both strong and low immigration pressure. Only working-age people (older than 15 and younger than 65) are considered.

The main variables used in this paper are individual occupation, which is used to identify the skill level of the occupation as discussed in Section 3 and citizenship of the worker. Individuals are recorded as natives, EU citizen, or non-EU, which is the highest detail allowed in the survey. A preliminary description of the distribution of individuals in the three citizenship groups in the four waves, reveals that the number of foreigners, both EU and non-EU did not vary substantially and sometimes declined. In some countries the share of foreigners increased, like in Germany, and partially in Italy, but in all other cases it decreased, though only marginally. The small declining variation in shares is also confirmed by the distribution for overall Europe (see Table 2).

In Table 3 the distribution of natives, EU citizens and non-EU in the four different skill groups across the four waves considered is reported. It shows that from 1994 to 2001 natives tend to be less represented in the first skill group, as indicated by the falling shares. The share of natives in the second skill group remains stable, whereas an increasing trend is revealed in the third and fourth skill groups, providing evidence of some skill upgrade during 1990s. As for foreigners, a specular picture emerges. Both EU and especially non-EU citizens display increasing shares in the first skill group and this happens irrespective to their falling overall shares (recall Table 2). This means that proportionately more foreigners are employed in occupations which require very basic skills, such as sales and services elementary occupations, or occupations in agriculture and fishing, mining, construction, manufacturing and transport. EU foreigners

decrease their participation in the second skill group through the time interval, while increasing their participation in both the third and in the fourth. Non-EU foreigners show declining shares both in the second and the third skill groups, while keeping their participation in the forth skill group constant.

Table 4 reports the distribution of citizenship of workers in the whole population and by skill groups. The proportion of natives in the first skill group is lower by about 2% points, compared to the whole population. Natives are more than proportionately represented in the third and fourth skill groups. This picture is valid irrespective to the period considered. On the contrary, EU and in particular non-EU citizens have comparatively large shares in the first skill group. For example, in 1994, non-EU foreigners comprise 1.91 percent of the total sample, but they constitute 3.24 percent of the first skill population. In proportion, their incidence in the first skill compared to the average sample increased from 1994 to 2001, being the spread 1.33 and 1.58 percentage points, respectively, in the two years. Conversely, the two groups of citizens are less than proportionately represented in the top two skills. This picture is not surprising, as foreigners, in particular coming from non-EU countries, either own only elementary education, or alternatively own qualifications that are not fully exploitable in destination countries. At the same time, occupations that are recorded among the third and fourth skills require a body of knowledge associated with graduate and postgraduate degrees. These qualifications can sometimes be substituted with a period of relevant work experience, but foreigners often lack long track of tenure in destination labor markets.

The descriptive analysis seems to reinforce the empirical literature that highlights imperfect substitutability between natives and foreigners. First, natives appear to progressively abandon low skilled jobs, in favour of higher skilled ones, where the competition with foreigners is lower. Second, this shift

occurred along with an increase in participation of foreigners in low skilled jobs. Even if the number of foreigners did not increase, its composition changed with a relatively larger proportion in less skilled occupations. This conclusion are reinforced by looking at the individual mobility. Table 5 shows the share of individuals who upgrade skills between year t and $t+2$, where $t = 1994, 1996$. While slightly less than 3% of individuals experienced a one step upgrade in 1994, namely from one to two, from two to three and from three to four, in 1999 the share rose to nearly seven percent. The transition matrix in Table 6 reveals that many shifts occurred from skill one to skill two. In 1994, 14.18% of individuals in skill one upgrade to skill two, 1.42% in skill two move to skill three, and 3.06% in skill three move to skill four. In 1999, mobility experienced a large increase, as shares became 28.93, 4.35 and 11.83 respectively.

Finally, the analysis can be conducted adding those individuals who were unemployed either at time t or at $t+2$. The share of natives who belonged to skill one in 1994 and then fell into unemployment was 9.7 and declined to 6.1 in 1999, despite the participation of foreigners in skill one increased from 1994 to 1999. These figures might suggest that foreigners do not cause greater unemployment among natives, possibly as they possess different skills, which make them imperfectly substitute to natives.

5 Results

We estimated the probability of upgrading from a lower skill occupation to a higher on using the probit model (1), controlling for a set of individual characteristics, such as age, gender, highest education level achieved (primary, secondary and tertiary), marital status (married, divorced, single, widowed), a categorical variable for experience in current job (less than 3, between 3

and 5, more than 5 years), and industry and country dummies. The key control variable is the citizenship which is defined as foreigner, foreigner but EU citizen, foreigner and non-EU citizen.

Table 8 (first column) estimates the probability of mobility in the early 1990s, showing that an increase of the share of foreigners by 1% is correlated with a 0.5% probability increase of a native workers moving from an occupation with higher skill content. Interestingly, breaking down the foreign population between foreigners from the EU and from outside the EU, it is found that while the increasing share of both groups have a positive effect on the probability of skill upgrade, it is highly statistically significant only in the case of an increase of people with non-EU citizenship. As expected, skill upgrade is more likely for younger workers and for workers with little work experience. A similar analysis was performed on 1999-2001 data showing a similar patter, with even stronger statistical significance and coefficient values (Table 9).

Finally, we tested whether, considering the possibility that an individual, apart from experiencing no change or skill upward mobility, may also experience the fall into unemployment, we estimated some ordinal probability models similar to (2), where -1 means that an individual who was employed in year t falls into unemployment in period $t + 2$, and values 0 and 1 as before.

Table 10 reports marginal effects showing that an increase of the share of foreign citizens in working age population reduces the probability of unemployment of natives, by 0.1-0.5 percent, with high significance level, while the positive correlation with skill upgrade remains. This is particularly evident in the mid 1990s, while it presents the same sign but lower statistical significance in the sample at the end of the decade (Table 11). In this latter case the effect is stronger for foreigners with non-EU citizenship.

6 Conclusions

Using data from the European Community Household Panel, this paper empirically analyses the extent to which native workers respond to the inflow of foreigners in the labor market by upgrading their skills. We find that a larger share of immigrants is correlated with higher probability of skill upgrade among natives. We also find that a larger share of immigrants is correlated with lower probability of natives falling into unemployment.

The existence of a process of skill upgrade to some extent provides a reconciliation of the theoretical literature, which predicts adverse wages and employment responses to immigration, and the empirical literature, which either fails to find any negative effect or reports positive effects. The fact that natives react to the inflow of foreigner by upgrading their skills, would reduce the substitutability between natives and foreigners in the labor market, implying a lower degree of competition between the two groups. The empirical findings are in line with this hypothesis, as far as a larger share of migrants is found to produce a larger chance of natives' mobility among skills.

References

Autor, D. H., Levy, F., and Murnane, R. J. (2003). The skill content of recent technological change: An empirical exploration. *The Quarterly Journal of Economics*, 118(4):1279–1333.

Bellini, E., G.I.P.Ottaviano, D.Pinelli, and Prarolo, G. (2009). Cultural diversity and economic performance: Evidence from European regions. Working Papers 2009.63, Fondazione Eni Enrico Mattei.

Borjas, G., Freeman, R., Katz, L., DiNardo, J., and Abowd, J. (1997). How much do immigration and trade affect labor market outcomes? *Brookings Papers on Economic Activity*, 1:1–90.

Borjas, G. and Katz, L. (2007). *The Evolution of the Mexican-Born Workforce*

in the United States. National Bureau of Economic Research Conference Report, Cambridge Ma.

Borjas, G. J. (2003). The labor demand curve is downward sloping: Reexamining the impact of immigration on the labor market. *The Quarterly Journal of Economics*, CXVIII(4):1335–1374.

Borjas, G. J. (2006). Immigration in high skill labor markets: The impact of foreign students on the earnings of doctorates. NBER Working Paper 12085, National Bureau of Economic Reserach.

Campos, N. F. and Dabusinskas, A. (2009). So many rocket scientists, so few marketing clerks: Estimating the effects of economic reform on occupational mobility in estonia. *European Journal of Political Economy*, 25(2):261 – 275.

Card, D. (2001). Immigrant inflows, native outflows, and the local labor market impacts of higher immigration. *Journal of Labor Economics*, 19(1):22–64.

Card, D. (2009). Immigration and inequality. NBER Working Paper 14683, National Bureau of Economic Research, Inc.

Casarico, A. and Devillanova, C. (2003). Social security and migration with endogenous skill upgrading. *Journal of Public Economics*, 87(3-4):773–797.

D'Amuri, F., I.P.Ottaviano, G., and Peri, G. (2008). The labor market impacts of immigration in western germany in the 1990's. NBER Working Paper 13851, National Bureau of Economic Research, Inc.

Elias, P. and McKnight, A. (2001). Skill measurement in official statistics: recent developments in the uk and the rest of europe. *Oxford Economic Papers*, 3:508–540.

Elliott, R. J. R. and Lindley, J. (2006). Skill specificity and labour mobility: Occupational and sectoral dimensions. *Manchester School*, 74(3):389–413.

Falvey, R., Greenaway, D., and Silva, J. (2008). International competition, returns to skill and labor market adjustment. Discussion Papers 08/10, University of Nottingham, GEP.

Friedberg, R. M. (2001). The impact of mass migration on the israeli labor market. *The Quarterly Journal of Economics*, 116(4):1373–1408.

ILO (1990). Isco-88: International standard classification of occupations. Technical report, ILO Geneve.

Kambourov, G. and Manovskii, I. (2008). Rising occupational and industrial mobility in the united states: 1968-97. *International Economic Review*, 49(1):41–79.

Longhi, S., Nijkamp, P., and Poot, J. (2005). A meta-analytic assessment of the effect of immigration on wages. *Journal of Economic Surveys*, 19(3):451–477.

Manacorda, M., Manning, A., and Wadsworth, J. (2006). The impact of immigration on the structure of male wages: Theory and evidence from britain. IZA Discussion Papers 2352, Institute for the Study of Labor (IZA).

Moscarini, G. and Thomsson, K. (2007). Occupational and job mobility in the us. *Scandinavian Journal of Economics*, 109(4):807–836.

Moulton, B. R. (1986). Random group effects and the precision of regression estimates. *Journal of Econometrics*, XXXII(1):385–397.

Ottaviano, G. I. and Peri, G. (2008). Immigration and national wages:claryfing the theory and the empirics. NBER Working Paper 14188, National Bureau of Economic Research.

Ottaviano, G. I. P. and Peri, G. (2005). Cities and cultures. *Journal of Urban Economics*, 58(2):304–337.

Ottaviano, G. I. P. and Peri, G. (2006a). The economic value of cultural diversity: Evidence from US cities. *Journal of Economic Geography*, 6:9–44.

Ottaviano, G. I. P. and Peri, G. (2006b). Rethinking the effects of immigration on wages. NBER Working Paper 12497, National Bureau of Economic Research.

Parrado, E., Caner, A., and Wolff, E. N. (2007). Occupational and industrial mobility in the united states. *Labour Economics*, 14(3):435–455.

Peri, G. and Sparber, C. (2008). Highly-educated immigrants and native occupational choice. CReAM Discussion Paper Series 0813, Centre for Research and Analysis of Migration (CReAM), Department of Economics, University College London.

Peri, G. and Sparber, C. (2009). Task specialization, immigration, and wages. *American Economic Journal: Applied Economics*, 1(3):135–69.

Spitz-Oener, A. (2006). Technical change, job tasks, and rising educational demands: Looking outside the wage structure. *Journal of Labor Economics*, 24(2):235–270.

Upward, R. and Wright, P. (2007). Snakes or ladders? skill upgrading and occupational mobility in the us and the uk during the 1990s. Discussion Papers 07/38, University of Nottingham, GEP.

Tables

Table 1: The skill content of occupations.

ISCO skill level	**ISCO Occupation**	**Description**
First skill level	9. Elementary occupations; Armed Forces	Competence associated with general education usually acquired by completion of compulsory education
Second skill level	4. Clerks; 5. Service workers and shop and market sales workers; 6. Skilled agricultural and fishery workers; 7. Craft and related trades workers; 8. Plant and machine operators and assemblers	Requires knowledge as for first skill level, but in addition typically have a longer period of worker-related training or work experience
Third skill level	3. Technicians and associate professionals	Requires a body of knowledge associated with a period of post-compulsory education but not to degree level
Fourth skill level	1. Legislators, senior officials and managers; 2. Professionals	Normally requires a degree or an equivalent period of relevant work experience

Table 2: Shares of natives, EU and non-EU citizens by year and place of residence

		1994	**1996**	**1999**	**2001**
Denmark	Natives	97.74	97.88	98.79	98.88
	EU	0.68	0.84	0.61	0.72
	non-EU	1.58	1.27	0.61	0.4
	Total	*100.00*	*100.00*	*100.00*	*100.00*
France	Natives	94.86	95.31	96.35	96.43
	EU	2.32	2.06	1.95	1.82
	non-EU	2.82	2.64	1.7	1.75
	Total	*100.00*	*100.00*	*100.00*	*100.00*
Germany	Natives	88.72	88.01	86.1	85.91
	EU	4.43	4.38	5.32	5.17
	non-EU	6.85	7.61	8.59	8.91
	Total	*100.00*	*100.00*	*100.00*	*100.00*
Greece	Natives	98.94	99.51	99.43	99.45
	EU	0.22	0.12	0.12	0.07
	non-EU	0.84	0.37	0.45	0.48
	Total	*100.00*	*100.00*	*100.00*	*100.00*
Ireland	Natives	98.42	98.56	98.82	98.67
	EU	1.42	1.25	1.01	1.3
	non-EU	0.16	0.19	0.17	0.03
	Total	*100.00*	*100.00*	*100.00*	*100.00*
Italy	Natives	99.93	99.66	99.73	99.82
	EU	0.03	0.13	0.06	0.07
	non-EU	0.03	0.21	0.21	0.11
	Total	*100.00*	*100.00*	*100.00*	*100.00*
The Netherlands	Natives	98.80	98.68	99.72	99
	EU	0.55	0.58	0	0.47
	non-EU	0.65	0.73	0.28	0.53
	Total	*100.00*	*100.00*	*100.00*	*100.00*
Portugal	Natives	99.44	99.53	99.73	99.82
	EU	0.23	0.20	0.15	0.12
	non-EU	0.32	0.27	0.12	0.06
	Total	*100.00*	*100.00*	*100.00*	*100.00*
Spain	Natives	99.26	99.42	99.44	99.26
	EU	0.35	0.28	0.31	0.36
	non-EU	0.40	0.30	0.25	0.37
	Total	*100.00*	*100.00*	*100.00*	*100.00*
Total	Natives	96.75	96.60	97.44	97.21
	EU	1.36	1.35	1.08	1.16
	non-EU	1.89	2.05	1.49	1.63
	Total	*100.00*	*100.00*	*100.00*	*100.00*

Source: authors' calculations on ECHP.

Table 3: The distribution of skill groups, by years and citizenship.

Natives	**Skill level**	**1994**	**1996**	**1999**	**2001**
	First	10.72	10.18	10.01	9.47
	Second	56.70	56.45	56.70	56.43
	Third	13.72	14.44	14.09	14.70
	Fourth	18.85	18.92	19.19	19.40
	Total	*100.00*	*100.00*	*100.00*	*100.00*
EU	**Skill**	**1994**	**1996**	**1999**	**2001**
	First	13.23	12.21	14.18	14.98
	Second	63.33	65.27	59.43	60.31
	Third	9.48	9.41	10.95	10.12
	Fourth	13.96	13.10	15.44	14.59
	Total	*100.00*	*100.00*	*100.00*	*100.00*
non-EU	**Skill**	**1994**	**1996**	**1999**	**2001**
	First	18.47	20.37	20.79	21.13
	Second	66.03	62.55	64.60	63.93
	Third	7.23	9.36	6.98	6.74
	Fourth	8.28	7.72	7.62	8.20
	Total	*100.00*	*100.00*	*100.00*	*100.00*

Source: authors' calculations on ECHP.

Table 4: The distribution of citizenship of workers in skills groups, in different years.

			1994		
	All skills	**Skill 1**	**Skill 2**	**Skill 3**	**Skill 4**
Natives	96.49	94.82	96.00	97.86	97.94
EU	1.60	1.94	1.78	1.12	1.20
non-EU	1.91	3.24	2.22	1.02	0.85
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
			1996		
	All skills	**Skill 1**	**Skill 2**	**Skill 3**	**Skill 4**
Natives	96.71	94.70	96.30	97.83	98.21
EU	1.47	1.73	1.70	0.97	1.04
non-EU	1.82	3.57	2.01	1.19	0.75
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*
			1999		
	All skills	**Skill 1**	**Skill 2**	**Skill 3**	**Skill 4**
Natives	97.37	95.44	97.12	98.33	98.43
EU	1.24	1.72	1.29	0.97	1.01
non-EU	1.40	2.85	1.59	0.70	0.56
Total	*100.01*	*100.01*	*100.00*	*100.00*	*100.00*
			2001		
	All skills	**Skill 1**	**Skill 2**	**Skill 3**	**Skill 4**
Natives	97.40	95.14	97.15	98.51	98.47
EU	1.26	1.94	1.34	0.87	0.95
non-EU	1.34	2.92	1.52	0.62	0.57
Total	*100.00*	*100.00*	*100.00*	*100.00*	*100.00*

Source: authors' calculations on ECHP.

Table 5: Individual mobility. Natives, EU and non-EU.

Mobility 94-96	**Natives**	**EU**	**non-EU**
-3	0.04	-	0.13
-2	0.56	0.62	0.27
-1	2.05	2.65	2.13
0	93.82	94.54	93.34
1	2.57	1.25	3.2
2	0.88	0.78	0.67
3	0.08	0.16	0.27
Total	*100.00*	*100.00*	*100.00*
Mobility 99-01	**Natives**	**EU**	**non-EU**
-3	0.09	0.25	-
-2	1.62	2.46	0.89
-1	5.25	4.43	6.01
0	83.77	85.22	84.41
1	6.88	5.17	6.46
2	2.22	2.46	2
3	0.16	-	0.22
Total	*100.00*	*100.00*	*100.00*

Source: authors' calculations on ECHP.

Table 6: Transition matrix. Natives.

Natives			**Skill 96**		
Skill 94	**1**	**2**	**3**	**4**	**Total**
1	84.02	14.18	0.92	0.87	*100.00*
2	1.86	95.31	1.42	1.42	*100.00*
3	0.42	4.37	92.15	3.06	*100.00*
4	0.22	2.51	1.78	95.50	*100.00*
Natives			**Skill 96**		
Skill 94	**1**	**2**	**3**	**4**	**Total**
1	66.38	28.93	2.95	1.74	*100.00*
2	3.70	88.51	4.35	3.44	*100.00*
3	0.59	12.68	74.90	11.83	*100.00*
4	0.45	7.82	6.78	84.95	*100.00*

Source: authors' calculations on ECHP.

Table 7: Transition matrix, including unemployment status. Natives.

Natives			**Skill 96**			
Skill 94	**0**	**1**	**2**	**3**	**4**	**Total**
0	54.7	9.0	27.8	4.5	4.0	*100.00*
1	9.7	76.2	12.6	0.8	0.8	*100.00*
2	5.2	1.7	90.5	1.3	1.3	*100.00*
3	2.8	0.4	4.1	89.8	3.0	*100.00*
4	2.1	0.2	2.4	1.7	93.5	*100.00*
			Skill 01			
Skill 99	**0**	**1**	**2**	**3**	**4**	**Total**
0	49.8	8.5	31.0	5.7	5.0	*100.00*
1	6.1	62.4	27.0	2.8	1.7	*100.00*
2	3.8	3.5	85.2	4.2	3.3	*100.00*
3	2.4	0.6	12.4	73.1	11.5	*100.00*
4	1.7	0.4	7.7	6.6	83.6	*100.00*

Source: authors' calculations on ECHP.

Table 8: Probit models for upgrade mobility between years 1994 and 1996.

	Probit models Marginal effects		
Foreigner	0.005**		
	[0.012]		
Foreigner, EU citiz.		0.009	
		[0.124]	
Foreigner, non EU citiz			0.008***
			[0.000]
Age	-0.001***	-0.001***	-0.001***
	[0.000]	[0.000]	[0.000]
Gender: male	-0.004	-0.004	-0.004
	[0.193]	[0.169]	[0.208]
Education: secondary	-0.001	-0.002	0.000
	[0.938]	[0.839]	[0.994]
Education: tertiary	0.012	0.007	0.013
	[0.425]	[0.637]	[0.362]
Divorced	0.004	0.004	0.004
	[0.507]	[0.530]	[0.497]
Single	0.009***	0.009***	0.009***
	[0.002]	[0.001]	[0.002]
Widowed	-0.021***	-0.019**	-0.022***
	[0.010]	[0.024]	[0.006]
2<Work experience<6	-0.031***	-0.031***	-0.031***
	[0.000]	[0.000]	[0.000]
Work experience≥6	-0.032***	-0.032***	-0.032***
	[0.000]	[0.001]	[0.000]
Industry fixed effects	yes	yes	yes
Country fixed effects	yes	yes	yes
Observations	27875	27875	27875
R-squared			
Log-likelihood	-3930.091	-3979.473	-3906.993
Pseudo R-squared	0.119	0.108	0.124

Robust p-values in brackets
St. Err. adjusted for 24 clusters
*** p<0.01, ** p<0.05, * p<0.1
Source: our calculations on ECHP data.

Table 9: Probit models for upgrade mobility between years 1999 and 2001.

	Probit models		
	Marginal effects		
Foreigner	0.009**		
	[0.011]		
Foreigner, EU citiz.		0.025***	
		[0.003]	
Foreigner, non EU citiz			0.011***
			[0.003]
Age	-0.002***	-0.002***	-0.002***
	[0.007]	[0.001]	[0.002]
Gender: male	0.007	0.002	0.001
	[0.526]	[0.855]	[0.929]
Education: secondary	0.011	0.014	0.013
	[0.580]	[0.266]	[0.333]
Education: tertiary	0.016	0.014	0.012
	[0.633]	[0.590]	[0.658]
Divorced	0.021	0.027*	0.028**
	[0.116]	[0.067]	[0.033]
Single	0.013*	0.021***	0.021***
	[0.080]	[0.001]	[0.002]
Widowed	0.020	0.009	0.013
	[0.545]	[0.685]	[0.607]
2<Work experience<6	-0.027***	-0.027***	-0.027***
	[0.001]	[0.004]	[0.004]
Work experience≥6	-0.025**	-0.025**	-0.022*
	[0.049]	[0.040]	[0.080]
Industry fixed effects	yes	yes	yes
Country fixed effects	yes	yes	yes
Observations	18141	13903	13903
Log-likelihood	-5630.741	-4005.448	-4029.875
Pseudo R-squared	0.0761	0.114	0.109

Robust p-values in brackets
St. Err. adjusted for 24 clusters
*** p<0.01, ** p<0.05, * p<0.1
Source: our calculations on ECHP data.

Table 10: Ordered probit models for upgrade mobility between years 1994 and 1996.

	Ordered probit models Marginal effects					
	Skill upgrade	Fall into unemployment	Skill upgrade	Fall into unemployment	Skill upgrade	Fall into unemployment
Foreigner	0.001***	-0.001***				
	[0.002]	[0.001]				
Foreigner, EU citiz.			0.004***	-0.005***		
			[0.010]	[0.008]		
Foreigner, non EU citiz					0.001***	-0.001***
					[0.004]	[0.002]
Age	-0.001***	0.001***	-0.001***	0.001***	-0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Gender: male	0.005*	-0.005*	0.005*	-0.005*	0.004*	-0.005*
	[0.090]	[0.085]	[0.088]	[0.087]	[0.091]	[0.086]
Education: secondary	0.009***	-0.012**	0.009***	-0.012**	0.009***	-0.012**
	[0.007]	[0.035]	[0.009]	[0.039]	[0.006]	[0.034]
Education: tertiary	0.018***	-0.020***	0.017***	-0.019**	0.018***	-0.020***
	[0.003]	[0.007]	[0.007]	[0.011]	[0.003]	[0.007]
Divorced	-0.004	0.005	-0.004	0.005	-0.004	0.005
	[0.208]	[0.234]	[0.199]	[0.225]	[0.211]	[0.236]
Single	-0.002	0.002	-0.002	0.002	-0.002	0.002
	[0.578]	[0.590]	[0.566]	[0.578]	[0.582]	[0.594]
Widowed	0.001	-0.001	0.001	-0.001	0.001	-0.001
	[0.885]	[0.884]	[0.849]	[0.847]	[0.892]	[0.892]
2<Work experience<6	0.001	-0.001	0.001	-0.001	0.001	-0.001
	[0.873]	[0.874]	[0.871]	[0.872]	[0.875]	[0.876]
Work experience≥6	0.008**	-0.009**	0.008**	-0.009**	0.008**	-0.009**
	[0.023]	[0.045]	[0.024]	[0.046]	[0.023]	[0.045]
Industry fixed effects	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes
Observations	28901		28901		28901	
Log-likelihood	-9063.229		-9062.379		-9064.345	
Pseudo R-squared	0.014		0.014		0.014	

Robust p-values in brackets
St. Err. adjusted for 24 clusters
*** p<0.01, ** p<0.05, * p<0.1
Source: our calculations on ECHP data.

Table 11: Ordered probit models for upgrade mobility between years 1999 and 2001.

	Ordered probit models Marginal effects					
	Skill upgrade	Fall into unemployment	Skill upgrade	Fall into unemployment	Skill upgrade	Fall into unemployment
Foreigner	0.002	-0.001*				
	[0.101]	[0.084]				
Foreigner, EU citiz.			0.003	-0.002		
			[0.623]	[0.632]		
Foreigner, non EU citiz					0.003*	-0.001*
					[0.073]	[0.051]
Age	-0.001***	0.001***	-0.002***	0.001***	-0.001***	0.001***
	[0.006]	[0.007]	[0.000]	[0.000]	[0.006]	[0.007]
Gender: male	0.013	-0.006	0.011	-0.005	0.013	-0.006
	[0.132]	[0.110]	[0.291]	[0.259]	[0.135]	[0.111]
Education: secondary	0.014	-0.007	0.014	-0.007	0.014	-0.007
	[0.388]	[0.436]	[0.162]	[0.197]	[0.393]	[0.439]
Education: tertiary	0.025	-0.011	0.019	-0.009	0.025	-0.011
	[0.340]	[0.353]	[0.272]	[0.281]	[0.327]	[0.340]
Divorced	0.014	-0.006	0.021**	-0.010**	0.014	-0.006
	[0.121]	[0.110]	[0.019]	[0.015]	[0.122]	[0.109]
Single	0.008	-0.003	0.016***	-0.007***	0.008	-0.003
	[0.284]	[0.259]	[0.008]	[0.008]	[0.279]	[0.255]
Widowed	0.024	-0.009	0.022	-0.010	0.023	-0.009
	[0.352]	[0.274]	[0.380]	[0.289]	[0.356]	[0.281]
2<Work experience<6	0.012*	-0.006*	0.008	-0.005	0.012*	-0.006*
	[0.091]	[0.099]	[0.350]	[0.370]	[0.089]	[0.098]
Work experience≥6	0.025***	-0.012**	0.024**	-0.012**	0.025***	-0.012**
	[0.004]	[0.018]	[0.023]	[0.044]	[0.004]	[0.018]
Industry fixed effects	yes	yes	yes	yes	yes	yes
Country fixed effects	yes	yes	yes	yes	yes	yes
Observations	18758		14406		18758	
Log-likelihood	-8656.443		-6515.160		-8653.696	
Pseudo R-squared	0.033		0.045		0.033	

Robust p-values in brackets
St. Err. adjusted for 24 clusters
*** p<0.01, ** p<0.05, * p<0.1
Source: our calculations on ECHP data.