DO THE BEST GRADUATES LEAVE THE PERIPHERAL AREAS OF THE NETHERLANDS?

VIKTOR VENHORST, JOUKE VAN DIJK & LEO VAN WISSEN

Faculty of Spatial Sciences, Department of Economic Geography & Department of Demography, Urban and Regional Studies Institute, University of Groningen, the Netherlands. E-mails: v.a.venhorst@rug.nl; jouke.van.dijk@rug.nl; l.j.g.van.wissen@rug.nl

Received: January 2009; revised May 2010

ABSTRACT

There is more and more empirical evidence to show that highly skilled people are an important determinant of economic growth. Consequently, policy-makers are eager to keep their graduates in the region or attract graduates from elsewhere. It is also well known that people with a higher level of education exhibit high rates of spatial mobility. Much less is known about mobility patterns according to discipline and academic grade. Do the best people stay or leave, and does this vary according to discipline and type of region? This paper investigates the relationship between ability, field of study and spatial mobility using a micro-dataset on Dutch university and college graduates. The findings indicate that there are substantial net flows mainly towards the economic centre of the Netherlands, but that there are also flows between peripheral regions and to other countries. The paper finds that university graduates are more spatially mobile than vocational college level graduates and that when one looks at spatial behaviour according to discipline, there are also striking differences between graduates. This, however, does not necessarily mean that peripheral regions also lose their best graduates. For several disciplines, employers in the peripheral areas are able to retain the graduates with the highest grades, contrary to what the standard human capital framework predicts. However, the study finds that if graduates leave the region, those with the highest grades are more likely to move abroad.

Key words: Migration, higher educated graduates, human capital, the Netherlands, periphery, multinominal logit

INTRODUCTION

It is widely acknowledged that human capital is a key element in modern economic growth theory. In the Lucas (1988) endogenous growth model, sustained economic growth is due to the accumulation of human capital over time. In Romer's (1990) analysis, innovations are generated by the human capital stock. Barro and Sala-i-Martin (1995), provide clear empirical evidence that investments in education have a significant positive effect on economic growth. A recent survey of the relationship between human capital and regional development can be found in Faggian and McCann (2009a).

Given the positive relationship between human capital and regional economic growth, it seems logical that increasing the skill level of the population is an important goal of regional policy-makers. Investment in education could be one way of achieving this goal, but one of the most robust results in the migration literature is that people who have been through higher education are much more spatially mobile than people with a lower level of education. This implies that regions face the risk of people who have been through higher education leaving

Tijdschrift voor Economische en Sociale Geografie – 2010, DOI:10.1111/j.1467-9663.2010.00629.x, Vol. 101, No. 5, pp. 521–537.

Published by Blackwell Publishing Ltd., 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA

the region after graduation. Faggian and McCann (2009b) study the migration aggregate flows of graduates in Great Britain and find that six out of eleven NUTS 1 regions are losing more of their locally educated graduates than are retained. Graduates tend to flow from peripheral regions to London and the South East, but there are also substantial cross-flows between regions.

Berry and Glaeser (2005) show that urban areas with higher levels of human capital have attracted more people who are skilled. This is in line with the empirical evidence provided by Nijkamp and Poot (1998), who find that immigration in general tends to lower growth rates, but that the immigration of highly skilled people has a positive effect on growth. This suggests that the migration of highly skilled people is beneficial to urban areas. Does this also imply, however, that this 'brain drain' is negative for peripheral regions? This is not necessarily the case. It might be that the number of graduates in the periphery exceeds local demand for people who have been through higher education, because the number of jobs for graduates in the region of study is limited. This situation is more likely to occur if the city or university attracts many students from outside the region, such as the University of Groningen in the north of the Netherlands, where about 40 per cent of the students come from outside this region. If the number of graduates exceeds local demand for graduates, out-migration might be beneficial for the individual graduate but also for the peripheral region, because graduates who were to stay in the region would become unemployed. In this case, there is no negative effect of brain drain, and the out-migration of graduates can be seen as a clean export product. The region benefits from the students during their study period via the expenditure effects of the students and the university employees. In addition, there could be an indirect effect whereby the graduates who leave can be seen as ambassadors of the region if they enjoyed their period of study. Furthermore, they might even come back to work in the region at a later stage of their career.

In addition to a quantitative mismatch between supply and demand in a peripheral study region, a mismatch can also be of a qualitative nature if the graduates' fields of study do not match local demand. An economist may face a considerably different spatial distribution of job-market opportunities at the regional, national or international level than a medical doctor would. Some further interesting questions are the following: do the best graduates with the highest grades leave or are they hired by the employers in the study region, and do those with the lowest grades leave the study region if there is not a sufficient number of jobs?

This paper will analyse the migration behaviour of graduates who obtained a college or university degree in the Netherlands. Particular attention will be paid to the spatial behaviour of graduates who obtained their degrees in peripheral regions, and differences by discipline and grade, and the interaction effect between those two variables will be examined. A review of the relevant literature will be presented in the next section; then the data available will be outlined and a descriptive overview of the migratory flows of the graduates by discipline and grade will be presented. In addition, the econometric results of a multivariate analysis by means of a multinominal logit model will be discussed. The final section provides some conclusions and policy implications.

LITERATURE REVIEW

A key notion in migration literature is that migration is strongly selective. Since Becker's (1964) conceptualisation of human capital, this factor has emerged as central to selection processes in migration. First, high human capital individuals are subject to higher opportunity costs when not working or working in a job in which they earn less than their marginal product. Second, this group is more capable of gathering and processing information about options elsewhere. This ability reduces the risks or costs associated with migration, as it reduces the risk of an unsuccessful move. As such, studies often link human capital and migration in terms of the probability of a successful labour-market-related outcome in the destination region, for example, the end of a spell of unemployment (Bartel 1979). See Herzog *et al.* (1993) for an overview of migration and spatial job search and Hensen *et al.* (2009) for a recent study of the job match of Dutch school leavers.

Lippman and McCall (1976, 1979) and Pissarides (1976) developed a search-theoretical framework for job searches.

In terms of interregional migration, a variety of studies have also identified why and how higher levels of human capital generally induce migration in relation to differences in regional economic circumstances, and measured and unmeasured personal characteristics. Detang-Dessendre (1999) studies the relationship between unemployment and migration and notes that migration out of rural areas by young French people is driven by the skill level, whereby the more skilled need to migrate in order to find work whereas the lower skilled do not. In contrast, Kirdar and Saracoglu (2008), find for Turkey that most migrants are unskilled workers who migrate from rural to urban areas. The migration of this unskilled labour to richer regions lowers the growth rates in the rich regions and in this way the migration of unskilled people increases the speed of convergence across Turkish regions.

Van Ham *et al.* (2001) show that what they refer to as 'spatial flexibility' leads to better labour market opportunities, but that not all people are equally prone to being spatially mobile. They find that selection occurs along the gender dimension, and migration is only related to opportunities when controlling for these individual level restrictions. With regard to the migration of graduates by gender, Faggian *et al.* (2007a) find that female graduates are more mobile than male graduates in Great Britain, and these results are also found for Italy by Coniglio and Prota (2008).

It becomes clear from these studies that it is in fact the interplay between human capital, regional economic circumstances and personal characteristics that is important in determining spatial mobility. In addition, a number of studies relating to the circulation of human capital look at graduates and systems of higher education. In the literature, considerable attention has been devoted to the effect of these institutions on the regional economy, with reference to knowledge spillovers between these institutions and networks of high-tech firms in the vicinity. Faggian and McCann (2008), for example, investigate the significance of these effects, and they conclude that universities and other institutions of higher education serve first and foremost to draw high human capital individuals into regions, which in turn has favourable effects on regional innovation.

Both the potential spillovers as well as the high degree of mobility make university graduates an interesting subject of local policy. Policy-makers in more peripheral areas in particular are often faced with negative net migration rates as a result of migration flows to more opportunity-rich regions. The migration of high-potential individuals is more often than not to more opportunity-rich regions, taking the shape of distinct periphery–centre flows of interregional migration. This has been found, for example, for Finland by Ritsilä and Haapanen (2003), for the Italian peripheral region of Basilicata by Coniglio and Prota (2008) and for Great Britain by Faggian and McCann (2009b), and it is in line with what Fielding (1992) refers to as the escalator effect. According to this paradigm, central regions are able to attract human capital in disproportionate numbers. Within these regions workers then experience a degree of upward mobility that is stronger then elsewhere. Later on in their lives these workers then step off the escalator and cash in on their relative prosperity, for example by acquiring property in a more low-cost but high-amenity region. As such, brain drain is not restricted to the international variety alone.

However, theoretically at least, it stands to reason that what constitutes an 'opportunity rich region' does not automatically imply a given country's central economic area for all potential migrants. Migration is a costly event, and as early as Sjaastad (1962), it was pointed out that the net benefits for the migrant are important. From the perspective of potential migrants in more peripheral regions, a job opportunity close by could be preferable to a similar opportunity in the central region. Another mechanism is the job-competition model, as put forward by Thurow (1975). In this model, the labour market is not governed by the wage level in regional labour markets responding to shifts in demand and supply, but it is viewed as a market where a given job is matched to the candidate with the best applicable skills. Potential candidates are ranked according to the expected level of costs required to train them for a given job, task or even career. The model then predicts that can-

didates applying for jobs are queued with the most suitable candidate receiving the job. This result appears to be consistent with Bartel's argument (1979) and the empirical findings of Faggian *et al.* (2007a) that the most highly skilled workers tend to be less mobile than those immediately below them, because these workers normally have first choice of the opportunities available to them. As such, they can take advantage of the very best jobs that are locally available without having to move, thereby forcing others to move. However, Coniglio and Prota (2008) find empirical evidence that those with the highest marks tend to leave the peripheral Italian region of Basilicata. In applications for the Netherlands, Van Ours and Ridder (1995) find some evidence for job competition among people who have been through higher education in the Netherlands, but they do not relate this to migration. Heijke and Koeslag (1999), argue that both job competition and human capital factors are at play as regards the employability of economics and business graduates.

Human capital-based frameworks often approach the labour market from the supply side. In this paper, however, we argue that the job-competition model, essentially operating on the demand side of the labour market, can be extended in a number of interesting ways. First, employers are not always capable of directly observing existing skills, and thus predicting training costs, and they therefore might take readily available information, such as the quality of the degree (university versus the more vocational colleges of higher education), or field of study as an indication of productivity. Second, a theoretical implication of the job-competition model is that in regions where the supply of job opportunities is lagging behind, it is actually the group of workers who have lower skills, and hence, who are further down the labour queue, that find themselves in a position where they have to be more spatially mobile than their counterparts who have a higher level of education.

Within the highly skilled group of recent graduates, factors that determine the relative position in the labour queue would involve not only the graduation grade as an indication of the level of ability but also the field of study. Once more, what exactly constitutes an opportunity-rich region may be strongly affected by this, as the spatial distribution of employment opportunities is likely to differ between sectors and hence between graduates in different disciplines. Some sectors can be expected to benefit strongly from agglomeration economies or clustering, such as the financial sectors in London and Amsterdam, which may attract economics graduates from all over the world. Other sectors are spread spatially more evenly as a result, for example, of factors related to equitable accessibility (schools, hospitals) or economic organisation (retail, consumer services). Therefore, in order to get a good return on the investment in education, the need to migrate to a certain location may differ between fields of study. Some disciplines allow the graduate to be rather flexible in terms of the sectors in which suitable job opportunities can be found (law, economics), whereas others are more restrictive (healthcare, teaching). This may lead to differences between fields of study in the propensity to be spatially mobile. Of the few studies we found that took into account the field of study, Coniglio and Prota (2008) found that graduates in business and engineering have a higher propensity to migrate as jobs in these sectors are underrepresented in peripheral areas. Faggian *et al.* (2007a) found that graduates with arts degrees, which tend to be less specific to employment needs, show lower post-graduation mobility than those with a degree in science or social sciences.

In this paper, we investigate whether human capital drives graduate mobility in the Netherlands or whether the job-competition model is a more suitable framework.

DATA AND EMPIRICAL SETTING

The analysis in this paper is based on data from the 2003–08 waves of the HBO- and WO-Monitor, a representative micro dataset on recent Dutch graduates. Graduates are surveyed approximately 18 months after they have completed their studies, and information is collected not only on their discipline of study and other background information but also on their current job. Together with this, spatial information is also collected. In this paper we define a move as a change between the location

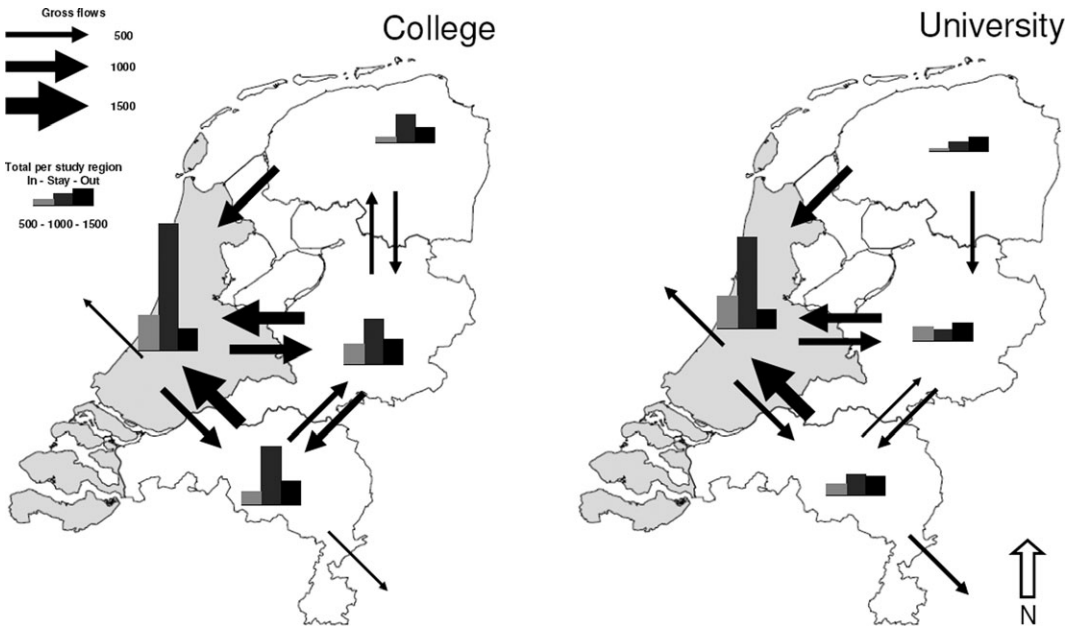

Figure 1. *Migration stocks and flows of graduates, 2003–2008, yearly averages.*

of the studies and the location of the current job, as measured at the level of the four Dutch NUTS 1 regions, or a move abroad.

We selected students aged 20 to 30 at the time of graduation. In this paper we distinguish between graduates from Dutch vocational colleges, similar to the UK colleges of higher education or German 'Fachhochschulen', on the one hand, and universities, on the other hand. This distinction is necessary as, first, colleges are spread more evenly throughout the country than universities, and second, they have a stronger focus on the regional labour markets. As such, we expect to find different migration patterns for the graduates involved, with the university graduates displaying a stronger tendency to be spatially mobile. Sample statistics are presented in Appendix A.

Figure 1 provides a first impression of the magnitude and direction of the migration patterns of graduates, measured in yearly averages over the period 2003–08, separately for college and university graduates. The figure shows both moves within as well as between the central West region and the more peripheral North, East and South regions. For a given study region, the middle bar shows the number of graduates that stay to work in that region. The left-hand bar shows the inflow and the right-hand bar the outflow of graduates who have found a job in another region. The arrows show the magnitude and direction of the migration flows. Flows of less than 100 are not shown.

For university graduates it is clear that the numbers that leave the study region are higher than the number of stayers for the North and East, whereas for the South these numbers are more or less equal. The East and South also show substantial inflow from other regions, whereas inflow to the North is almost negligible. A possible explanation for this is that the only university in the North, the University of Groningen, is a very broad university covering all disciplines, which attracts about 40 per cent of its students from outside the northern region (Van Dijk 2007). This makes it likely that regional labour demand for university graduates can be easily met by graduates from the university in this region, but that there are not enough jobs in the region to accommodate all graduates. A significant number of the Groningen graduates also move to the East.

The West gains graduates: the inflow is twice as high as the outflow, which gives rise to a clear

pattern of net flows towards the economic centre of the Netherlands from the more peripheral North, East and South. Besides to the West, the graduates from the East and South also migrate between these two regions. From the South, a substantial number also goes abroad, but this might be due to the fact that over 30 per cent of the students of the University of Maastricht are of foreign origin (Pellenbarg & Van Steen 2009). It could be that many students, especially those from Germany and Belgium, move back to their home countries after graduation. We will therefore incorporate a variable indicating the foreign origin of the graduates in the empirical analysis.

The spatial pattern of the migration of college graduates is generally comparable to that of university graduates. However, the intensity of migration is a lot lower. Of the college students who graduated in the peripheral regions, about 21 per cent leave the region of study, which includes the three per cent who go abroad. For university students these figures are almost double: 42 per cent leave the region, of which seven per cent go abroad. This is also reflected in the bar chart in Figure 1: for each region, the number of stayers is substantially higher than outflow or inflow. The lower intensity of spatial mobility for college graduates compared to university graduates may be related to the generally observed pattern where spatial mobility increases with the level of education (a human capital effect). In addition, the colleges are spread much more equally over the country than the universities. In addition, some of the universities, such as the Delft University of Technology, the Eindhoven University of Technology, the University of Twente and the Agricultural University of Wageningen only produce graduates in a limited number of disciplines. For the colleges this specialisation is much less marked. Although the number of college graduates that move to another part of the country is lower than the number of university graduates, in absolute numbers the migration figures are of the same magnitude because the number of college graduates is much higher than the number of university students.

Overall, we may conclude that there is substantial spatial mobility among graduates. In order to gain more insight, our next step was to analyse in more detail the type of students who are moving to the central region. In this respect, we analysed whether there is a distinction in spatial pattern by grade and by discipline. We start this analysis by showing some simple graphs of the bivariate relations and we will then present the results of a multivariate econometric analysis using a multinominal logit model.

We are especially interested in the following question: do the best graduates leave the peripheral regions? Therefore, Figure 2 presents the migration behaviour of students by grade for students who graduated from a college or university located outside the western core region. The three separate peripheral NUTS 1 regions clearly have many specifics, for example with respect to the opportunity to study certain disciplines. We have seen above that there are flows of graduates between these regions, arguably as a result of these specificities. In this study, however, we are particularly interested in what drives the spatial mobility of graduates from the more peripheral areas in general. All regions share a common feature in that they exhibit a brain drain *vis-à-vis* the West region. Furthermore, they all share borders with either Belgium or Germany, which for some universities and colleges are important sources of students.

We use information about the graduation grade to measure ability and distinguish between excellent, average and moderate students. The group of excellent students with an average rating[1] of 8 or higher consists of about 20 per cent of the total graduate population, whereas the moderate students form a group of about 11 per cent of the university graduates and 15 per cent of the college graduates. Figure 2 clearly shows that the number of students who leave the peripheral region does not differ when we look at them according to the grade they achieved. However, it confirms that university students are much more mobile than college graduates. In addition, we see an interesting difference within the group of students who leave the region between those who move within the country and those who go abroad. It is clear both for university and college graduates that those with higher grades are much more likely to move abroad, whereas the moderate graduates tend to stay within the country. There is no evidence that the best students

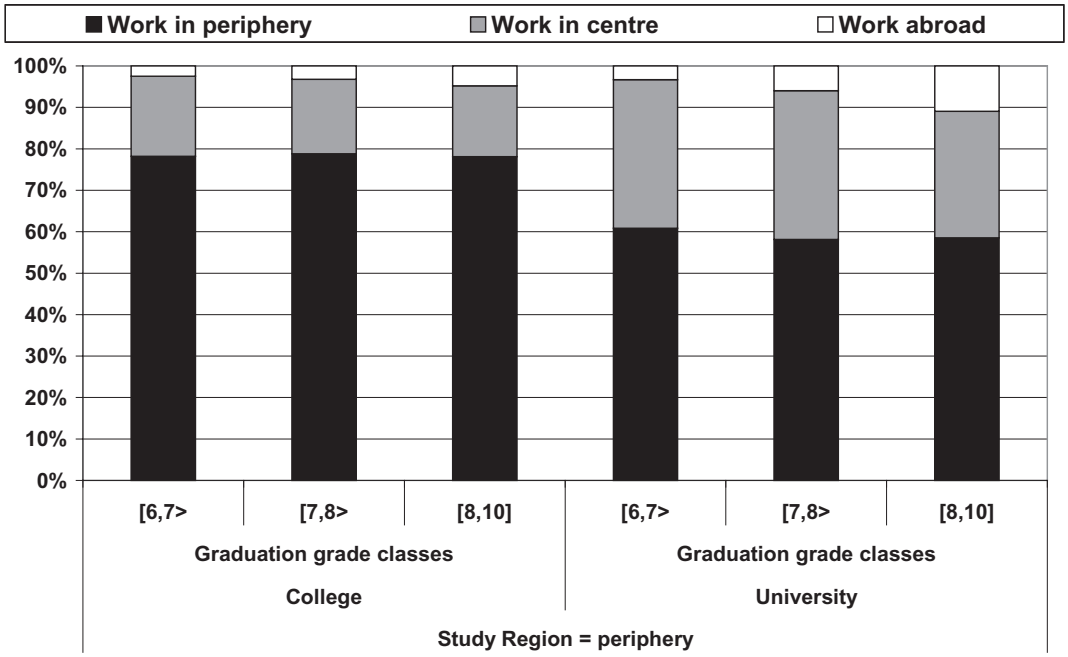

Figure 2. *Choice of work region by grade for graduates who studied in a peripheral region, 2003–2008, yearly averages.*

leave the periphery, but of the students who leave, the best go abroad.

Another important factor that may play a role in the decision to stay in the region of study or to move somewhere else is the degree discipline. For some occupations, the spatial distribution of jobs may be much more equal than for others. In addition, the fact that some disciplines are only available at a limited number of universities or colleges may also have an impact on the migration propensity of the graduates. Figure 3 confirms this, as it shows that there are substantial differences by discipline with regard to the region of work for students who graduated in a peripheral region. Of the university students in economics and agriculture, over 50 per cent move to another region, whereas 70 per cent of the students in healthcare, and behavioural and social sciences (mainly psychologists), stay in the study region. The high mobility rate for agriculture is most likely due to the fact that nearly all of the agriculture students attended Wageningen University, and they need to migrate because the jobs are spread all over the country and often abroad. Wageningen also attracts many students from abroad (about 20 per cent of its students) (Pellenbarg & Van Steen 2009), and the majority presumably chooses to leave the country after graduation. The pattern by discipline for college graduates is similar to the university graduates, but the share that stays in the study region is higher for all disciplines: the most mobile college students are as mobile as the least mobile university students. Of the college graduates, students of agriculture and economics are the most mobile: 70 per cent stay in the region of study. Of the college graduates in teaching, and behavioural and social sciences, more than 85 per cent stay in the study region. Just as with the university graduates, the more equal spatial distribution of jobs in these fields is the most likely explanation for this disciplinary pattern.

In order to reach reliable conclusions, a more formal econometric analysis was carried out with a multivariate multinominal logit model. This also allowed us to test the hypothesis that there are significant interaction effects between grade and discipline. From the theoretical model, the hypothesis was derived that given the conditions on the regional labour

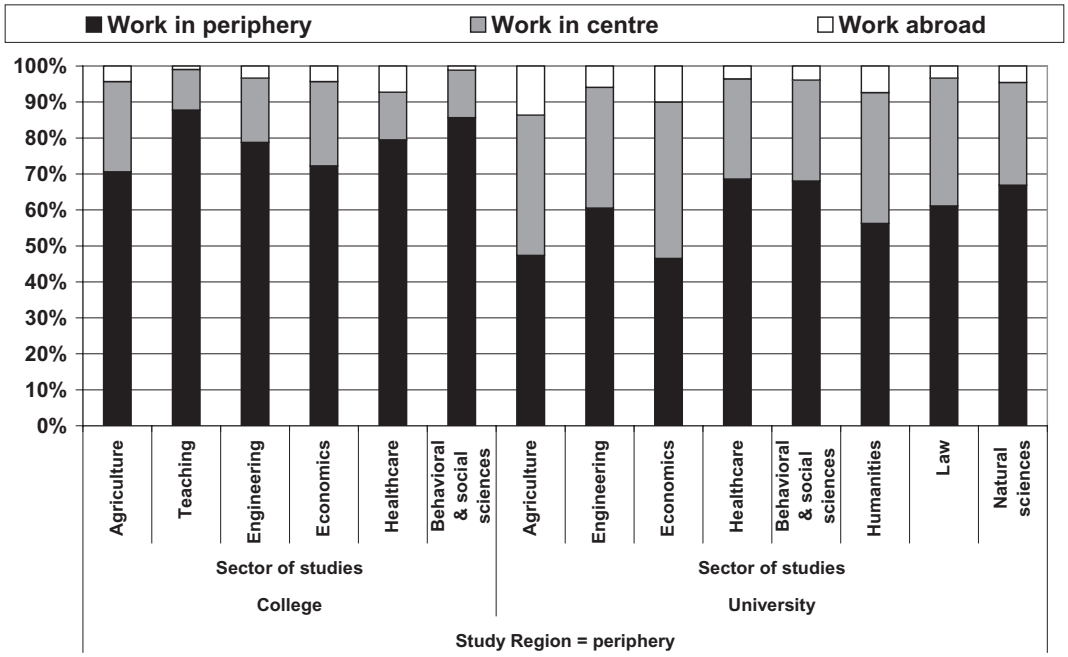

Figure 3. *Choice of work region by discipline for graduates who studied in a peripheral region, 2003–2008, yearly averages.*

market, the most able graduates within a discipline are more prone to stay if job-competition is the dominant selection force.

MULTIVARIATE ANALYSIS

In the econometric analysis, the North, East and South regions continue to be treated as essentially one area, referred to as the periphery. The dependent variable thus consists of three categories that are conceptually sufficiently different to avoid violating the assumption of independence of irrelevant alternatives that underlies the multinomial logit model. These three categories are 'Work in the periphery', 'Work in centre' and 'Work abroad', with 'Work in the periphery' treated as the reference category.

The explanatory variables are based on the theoretical framework discussed earlier. Besides the previously discussed variables of ability and field of study (behavioural studies is taken as the reference category), the personal variables of gender and age in the model are also included. Also include are dummies for 'Born in another European Country' and 'Born outside Europe' (in contrast to 'Born in the Netherlands' as reference group), to take the possible deviations in migration behaviour due to foreign birth into account.

Because the decision to move outside the region may also be influenced by the situation on the regional labour market, the variable of regional economic growth (growth in GDP), has been added as an indicator of the general prosperity of the region. In addition, two variables are included in the model that reflect the labour market situation for graduates, more specifically: the unemployment rate among graduates and the number of higher and scientific jobs in the region. The regional variables are measured at the provincial (NUTS 2) level of the study region in order to reflect the local conditions more accurately. To control for unobserved heterogeneity over time and space time and region dummies have been added to the model to pick up possible fixed effects. Finally, a variable to the model has been added to control for possible biases due to the fact that the interviews with the graduates show some variation over time because not all of the interviews are held exactly one-and-half years after

Table 1. *Multinomial logit analysis for the choice of work region for college graduates who studied in a peripheral region in the period 2003–2008.*

	Work in centre			Work abroad	
	B	Sig.		B	Sig.
Intercept	–0.47			0.74	
Gender: Female (0) Male (1)	–0.12	***		0.00	
Mean centred age	0.05	***		0.07	***
Graduation grade [8,10]	0.04			0.28	*
Respondent born in another European country	0.18	**		1.87	***
Respondent born outside Europe	0.04			0.85	***
Interaction born Europe × grade ≧8	–0.14			0.38	***
Interaction born outside Europe × grade ≧8	–0.01			–0.41	
Sector of studies is agriculture	0.45	***		0.81	***
Sector of studies is teaching	–0.03			0.22	*
Sector of studies is engineering	0.29	***		0.66	***
Sector of studies is economics	0.42	***		0.77	***
Sector of studies is healthcare	0.11	***		0.93	***
Interaction agriculture × grade ≧8	0.07			–0.21	
Interaction teach × grade ≧8	–0.12			–0.57	**
Interaction engineering × grade ≧8	0.02			–0.18	
Interaction economics × grade ≧8	0.10	*		0.01	
Interaction health × grade ≧8	–0.13			–0.50	***
Mean centred regional economic growth	1.34			1.03	
Mean centred reg unemployment rate HE	3.86	**		–12.61	***
Mean centred number of higher and scientific jobs	0.63	***		–1.45	***
Control for observation window			Yes		
Time Fixed effects			Yes		
Chi square (DF = 52)	2498.3				
Prob > ChiSq	0.00				
–LogLikelihood	17090				
N	30241				

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

graduation. All continuous variables were entered as a deviation of their sample means.

Based on the significance of the likelihood ratio test, we may conclude that the overall performance for both the model for college graduates and the model for academics is very good. The controls for the differences in the interview window and the time fixed effects improve the performance of the model, whereas the regional fixed effects did not and thus are not included in the final version of the model results presented in Tables 1 and 2.

The results show that male graduates are significantly less mobile than females with regard to internal migration to the centre. For moves abroad, males with a college degree do not differ significantly from females, but among university graduates, males show significantly higher probabilities of moving abroad. This is in line with the results reported by Faggian *et al.* (2007a), who state that within the UK women use migration to gain access to more and better jobs as a means of partially compensating for gender differences and not because they follow men because of existing or prospective coupling arrangements.

With regard to the age variable, some interesting differences between college and university graduates can be observed. Whereas university graduates are more likely to move to the centre when they are older, age is not significant for the move abroad. In contrast, for college graduates both variables are significant and positive. Other studies have also found

Table 2. *Multinomial logit analysis for the choice of work region for university graduates who studied in a peripheral region in the period 2003–2008.*

	Work in centre			Work abroad	
	B	Sig.		B	Sig.
Intercept	0.26			1.02	
Gender: Female (0) Male (1)	–0.05	**		0.19	***
Mean centred age	0.05	***		0.02	
Graduation grade [8,10]	–0.05			0.24	*
Respondent born in another European country	–0.14			1.85	***
Respondent born outside Europe	0.16	*		1.24	***
Interaction born Europe × grade ≧8	–0.22			–0.29	**
Interaction born outside Europe × grade ≧8	–0.27			–0.41	**
Sector of studies is agriculture	0.52	***		0.96	***
Sector of studies is engineering	0.14	***		0.56	***
Sector of studies is economics	0.41	***		0.48	***
Sector of studies is healthcare	–0.04			–0.09	
Sector of studies is humanities	0.19	***		0.57	***
Sector of studies is law	0.16	***		0.04	
Sector of studies is natural sciences	0.08			–0.08	
Interaction agri × Grade ≧8	–0.12			–0.09	
Interaction engin × Grade ≧8	–0.06			–0.12	
Interaction econ × Grade ≧8	0.15	*		0.28	*
Interaction health × Grade ≧8	0.05			–0.10	
Interaction human × Grade ≧8	0.03			–0.36	*
Interaction law × Grade ≧8	0.18	*		0.24	
Interaction natural science × Grade ≧8	–0.26	**		0.28	
Mean centred regional economic growth	–0.57			–4.93	***
Mean centred reg unemployment rate HE	–13.51	***		2.92	
Mean centred number of higher and scientific jobs	–3.03	***		–3.16	***
Control for observation window			Yes		
Time fixed effects			Yes		
Chi square (DF = 60)	2758.1				
Prob > ChiSq	0.00				
–LogLikelihood	15040				
N	17607				

Notes: *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

mixed effects as regards this variable (for example, Faggian *et al.* 2007b).

The findings for the variables reflecting the regional labour market situation are mixed. As was noted earlier, economic diversity in the Netherlands is low, and as such small differences could drive these results. Regional economic growth as an indicator for the general prosperity of the region has no significant influence on internal migration with the exception of a negative 'keep' effect on the likelihood of moving away from the country for the university graduates. The unemployment rate for graduates is significant in all cases except the move abroad for university graduates, but sign and size show remarkable differences between college and university graduates and move types. Higher unemployment rates in the study region lower the probability of moving to another part of the country for university graduates. For the college graduates, higher unemployment rates stimulate migration within the country, but lower the probability of going abroad.

We will now discuss the multivariate outcomes for the key variables of grade, country of origin and discipline, including the interaction effects of these variables. The results for grade

are largely in line with the discussed outcomes of the bivariate association shown in Figure 2. Those with higher grades both at college and university levels do not leave the peripheral areas to go to the centre more than those with lower grades, but they are significantly more likely to go abroad.

In our model we distinguish between graduates who were born in a European country (other than the Netherlands) and those who come from other continents. For college graduates we find that having been born outside the Netherlands significantly increases the probability of leaving the country. Moreover, we find a significant interaction effect with the graduation grade for the group that was born in another European country, indicating that the best foreign students have an even higher probability of moving away from the Netherlands, namely, a human capital-driven process. With respect to a move to the centre, we only find a significant effect for those born in Europe. Conversely, university graduates born outside of Europe are more likely to move to the centre after graduation. In addition, apart from similarly positive general coefficients, we find negative rather than positive interaction effects for moving abroad. In this case, the labour queue effect dominates, with the labour market for the best foreign university graduates clearing at the national level.

With regard to field of study, the results are perfectly in line with the results described in Figure 3. The magnitude for the significant coefficients is higher for those who go abroad than for those who move to the centre, the reference category being graduates of behavioural and social sciences. The only exception is university graduates of law, who are significantly more likely to move to the centre, but the coefficient for moving abroad is insignificant. This difference can be explained by the fact that the expertise of law students is of a much lower value in other countries due to institutional differences between countries. Students of agriculture and economics are by far the most mobile, both at university and college levels. College graduates in teaching (as far as interregional moves are concerned), and university graduates in healthcare and natural sciences do not differ significantly in spatial behaviour from the reference category of behavioural and social sciences. The coefficients for the remaining disciplines all differ significantly from the reference category.

In conclusion, we will pay some attention to the interaction effect between grade and discipline. A positive interaction effect between grade and discipline implies that for that particular discipline the best students leave, namely, the human capital effect dominates. If the interaction effect is negative, this implies that the best students stay in the region and that the labour queue effect dominates.

For college students most interaction effects are insignificant implying that the general pattern also applies within most disciplines. The exceptions are economics with respect to a move to the centre and both teaching and healthcare regarding a move outside the Netherlands. The negative coefficients for teaching and healthcare indicate that the best graduates in these fields are less likely to go abroad and thus, that the labour queue effect dominates for this particular discipline, at least at the national level. The positive interaction effect for college graduates in economics points to a human capital effect and implies that the best students are more likely to go to the centre.

For university graduates, the only significant coefficients for internal migration are found for economics (again, positive), law (also positive), and natural sciences (negative). This indicates that the human capital effect dominates for economics and law graduates, whereas the labour queue effect is found for graduates in natural sciences. For university graduates in economics we find a significant positive effect and for university graduates in the humanities we find a significant negative effect for working outside the Netherlands, whereas no significant effects are found for the other disciplines over and above the patterns found for graduation grade and field of study in general. These results indicate that the best graduates in economics are not only more likely to leave the periphery, they are also relatively likely to leave the Netherlands altogether, indicating that labour market opportunities for this group clear at the national or even international level. For graduates in the humanities this is an indication that the labour queue effect dominates at least at the national level.

Table 3. *Multinomial logit analysis: predicted work region, by field and ability for college graduates who studied in a peripheral region in the period 2003–2008.*

Grade		Born in the Netherlands			Born in another European country		
		Periphery (%)	Centre (%)	Abroad (%)	Periphery (%)	Centre (%)	Abroad (%)
Behavioural sciences (ref.)							
	≧8	87	13	1	52	8	40
	<8	88	12	1	72	14	14
Agriculture							
	≧8	69	29	2	25	11	64
	<8	73	25	2	40	19	41
Teaching							
	≧8	90	10	0	67	8	25
	<8	88	12	1	67	12	21
Engineering							
	≧8	77	22	2	30	9	61
	<8	79	20	1	47	17	36
Economics							
	≧8	69	29	3	20	9	72
	<8	75	24	2	42	19	39
Health							
	≧8	86	12	2	34	5	61
	<8	83	14	3	39	10	51

Note: Due to rounding up and down not all figures add up to 100%.

In Tables 3 and 4, we illustrate the economic significance of our results by presenting the estimated probabilities of moving by field of study and level of ability; we show this separately for college and university graduates. These probabilities highlight the differences between college and university graduates, of varying fields and levels of ability, in their propensity either to stay and work in the periphery or to move to centre or abroad. The probabilities were computed for female graduates, both those originating from the Netherlands and those originating from another European country, with all continuous individual and regional economic control variables as their sample means.

The tables illustrate the results we discussed earlier. For example, from Table 3, it becomes clear that the best Dutch graduates in economics are 6 percentage points less likely to work in the periphery than their less-talented counterparts. For the subjects of teaching and healthcare we find opposite patterns. In general, graduates born in another European country are very likely to move abroad (return migration). A striking result is the dominance of human-capital-driven mobility away from the country for foreign graduates: those with higher grades are consistently more likely to move abroad, across all disciplines.

From Table 4 it becomes clear that, in general, university graduates are more mobile than college graduates. Across disciplines, the probabilities of staying in the peripheral regions are 10–20 percentage points lower than for the respective college counterparts. Dutch graduates in economics, law and agriculture are the most mobile. Foreign work locations are more likely for the best Dutch graduates and this constitutes a second important difference from the patterns found for the college graduates. With respect to university graduates who were born abroad, the patterns differ substantially between disciplines, with economics, law and natural sciences displaying patterns according to the human capital model, whereas the other disciplines have a stronger labour queue profile, the opposite of the findings for

Table 4. *Multinomial logit analysis: predicted work region, by field and ability for university graduates who studied in a peripheral region in the period 2003–2008.*

Grade		Born in the Netherlands			Born in other European country		
		Periphery (%)	Centre (%)	Abroad (%)	Periphery (%)	Centre (%)	Abroad (%)
Behavioural sciences (ref.)							
	≧8	73	24	3	46	7	47
	<8	72	26	2	42	12	47
Agriculture							
	≧8	51	36	13	14	5	81
	<8	45	46	9	11	8	81
Engineering							
	≧8	67	26	7	28	5	67
	<8	64	31	6	21	8	72
Economics							
	≧8	46	45	9	16	8	76
	<8	53	43	4	22	14	64
Health							
	≧8	73	24	2	54	9	38
	<8	74	25	2	46	12	43
Humanities							
	≧8	64	32	4	36	9	55
	<8	62	33	5	20	8	72
Law							
	≧8	58	37	5	33	10	57
	<8	66	33	2	39	15	47
Natural Sciences							
	≧8	77	17	5	38	4	58
	<8	69	29	2	44	14	42

Note: Due to rounding up and down not all figures add up to 100%.

the college graduates. This is particularly interesting in the case of natural sciences, since this pattern is the opposite of that of the Dutch graduates.

CONCLUSION AND DISCUSSION

In the literature there is more and more empirical evidence to show that the presence of highly skilled people in a region is an important determinant of economic growth. Consequently, policy-makers are eager to try to keep highly skilled people in the region or attract them from elsewhere. It is also well known that people who have been through further education exhibit high spatial mobility rates. Much less is known about the mobility patterns by discipline and by grade. Do the best people leave or stay, and does this vary by discipline and type of region? In this paper, we investigated the relationship between ability, field of study and spatial mobility, using a micro-dataset of Dutch university and college graduates. The findings indicate that there are substantial net flows mainly towards the economic centre of the Netherlands, but there are also flows between peripheral regions and to other countries. This, however, does not necessarily mean that peripheral regions also lose their best graduates.

We find that university graduates are more spatially mobile than college graduates. Those with higher grades both at college and university levels do not leave the peripheral areas to go to the centre more than those with a moderate grade, but they are significantly more likely to go abroad. There are also striking differences between graduates in their spatial

behaviour by discipline. Students in agriculture and economics are by far the most mobile, both at university and college levels. Peripheral retention of graduates differs substantially between fields of study. College graduates in teaching and university graduates in natural sciences are the least mobile together with the reference category of graduates in behavioural and social sciences and graduates in healthcare. As such, grade is only clearly related to a move abroad, where stronger selectivity according to ability is apparent from the analysis. Furthermore, moving abroad is strongly linked to the respondent's own nationality: foreign graduates are far more likely to work outside the Netherlands. Within this group, however, distinct differences can be observed with respect to the relationship with graduation grade.

The interaction effects of grade and discipline allow us to find out whether the best students in a particular discipline stay or leave the region and to test whether the human capital or the labour queue model dominates. For college graduates, we find the best teachers and healthcare graduates are less likely to leave the country and thus, that the labour queue effect dominates for this particular discipline, at least at the national level. Conversely, the positive interaction effect for college graduates in economics points to a human capital effect and implies that the best students are more likely to go to the centre.

For university graduates we find significant interaction effects for internal migration for economics, law (human capital) and natural sciences (labour queue). For university graduates in the humanities we find a significant negative effect for working outside the Netherlands, but no significant effects for internal migration. These results indicate that the best students in this field are less likely to leave the country, although they are not necessarily retained in the study region. This is an indication that the labour queue effect dominates at the national level at least. The reverse is true for the graduates in economics: the positive coefficients indicate that there is a significantly higher probability of the best students moving abroad.

In general, we may conclude that there is little evidence that the best graduates necessarily leave the Dutch peripheral study regions, as the human capital model of migration seems to dictate. The internal migration of graduates is only weakly related to ability as such, with foreign migration being the only exception. This indicates that, at either the national or even the interregional level, the job competition model dominates in a number of fields rather than the human capital model, because the best students stay and employers in the region or the country are able to recruit the best students. The only exception is economics, where the best college students tend to move significantly more often to the centre and the best university graduates move abroad. In this case, the human capital model dominates, as economists appear to maximise their human capital on a worldwide scale.

Another interesting finding is that, in general, male graduates are significantly less mobile than female graduates. This supports the results reported by Faggian *et al.* (2007a), who state that women use migration to gain access to more and better jobs as a means of partially compensating for gender differences and not because they follow men because of existing or prospective coupling arrangements.

These findings clearly provide interesting options for local policy-makers and employers. Migration is costly, and jobseekers are inclined to value the options they have nearby more than similar options further away. Graduates who have selected a more peripheral institution of higher education may not place the same value on the typical urban amenities found in the centre as those who selected a more central study region to begin with. Furthermore, institutions of higher education provide a suitable mechanism by which to judge the productivity, observed or unobserved, of a candidate: a diploma with a designated field and grade. However, universities situated in the periphery are also potential employers. They are well placed to select the best graduates from their respective cohorts as employees in the form of PhD students. As we find labour-queue effects both for college and selected university disciplines, we do not suspect that this particular mechanism is the main driving force behind our results. In general, other potential employers could respond to this local availability of both certain amenities and the supply of and

information about graduates and relocate jobs towards regions that meet these criteria (i.e. 'jobs-follow-people'). This paper has demonstrated that the quest for the job candidate with the highest level of education does not necessarily start in the economic centre.

Acknowledgements

Earlier versions of this paper were presented at the International Workshop on Human Capital, Social Capital and Creative Capital as Sources of Regional Growth, Tinbergen Institute/VU University Amsterdam; ERSA PREPARE Summer school 2008, Pecs (H); ERSA Conference 2008, Liverpool and during the International PhD Course on Economic Geography, University of Utrecht. The work has benefited greatly from comments received at these venues and comments made by anonymous referees. The usual disclaimers apply. This research was partially funded by NICIS Institute, The Hague.

Note

1. The Dutch rating system uses a 10-point scale. The minimum pass grade is 6. Marginal students have a score lower than 7 and excellent (cum laude) students have an average score of 8 or higher.

APPENDIX A. SAMPLE STATISTICS

	College				University			
	Work in periphery	Work in centre	Work abroad	Total	Work in periphery	Work in centre	Work abroad	Total
Gender: Female (0) Male (1)	0.41	0.43	0.44	0.42	0.46	0.49	0.56	0.48
Age at time of interview	24.23	24.41	24.81	24.28	25.87	26.00	26.17	25.93
Graduation grade [8,10]	0.20	0.19	0.28	0.20	0.20	0.17	0.32	0.20
Respondent born in another European country	0.01	0.01	0.32	0.02	0.02	0.01	0.36	0.04
Respondent born outside Europe	0.01	0.01	0.03	0.01	0.01	0.01	0.06	0.01
Interaction Born Europe × grade ≧8	0.00	0.00	0.14	0.01	0.01	0.00	0.14	0.01
Interaction Born outside Europe × grade ≧8	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Sector of studies is agriculture	0.06	0.10	0.09	0.07	0.08	0.12	0.20	0.10
Sector of studies is teaching	0.16	0.09	0.04	0.14				
Sector of studies is engineering	0.19	0.19	0.19	0.19	0.18	0.18	0.17	0.18
Sector of studies is economics	0.29	0.42	0.38	0.32	0.17	0.26	0.31	0.21
Sector of studies is healthcare	0.12	0.09	0.24	0.12	0.13	0.09	0.06	0.12
Sector of studies is behavioural & social sciences (reference cat.)	0.17	0.11	0.05	0.16	0.21	0.15	0.10	0.18
Sector of studies is humanities					0.08	0.08	0.09	0.08
Sector of studies is law					0.10	0.10	0.05	0.10
Sector of studies is natural sciences					0.05	0.03	0.02	0.04
Interaction agriculture × grade ≧8	0.01	0.01	0.02	0.01	0.02	0.02	0.07	0.02

APPENDIX A. *Continued.*

	College				University			
	Work in periphery	Work in centre	Work abroad	Total	Work in periphery	Work in centre	Work abroad	Total
Interaction teach × grade ≧8	0.05	0.03	0.01	0.05				
Interaction engineering × grade ≧8	0.04	0.04	0.05	0.04	0.05	0.04	0.06	0.05
Interaction economics × grade ≧8	0.04	0.07	0.10	0.05	0.02	0.03	0.10	0.03
Interaction health × grade ≧8	0.02	0.02	0.07	0.02	0.04	0.02	0.02	0.03
Interaction behavioural & social sciences × grade ≧8 (Reference cat.)	0.04	0.02	0.02	0.03	0.03	0.02	0.03	0.03
Interaction humanities × grade ≧8					0.02	0.02	0.02	0.02
Interaction law × grade ≧8					0.01	0.01	0.01	0.01
Interaction natural sciences × grade ≧8					0.01	0.01	0.01	0.01
Regional economic growth (%/100)	0.022	0.023	0.022	0.022	0.02	0.02	0.02	0.02
Graduate unemployment rate (%/100)	0.048	0.049	0.047	0.048	0.04	0.04	0.04	0.04
# Higher and scientific jobs (/1000000)	0.196	0.199	0.190	0.196	0.18	0.17	0.17	0.18
# Months between graduation and questionnaire	17.80	17.94	18.01	17.83	18.32	18.65	18.22	18.43
Dummy 2003	0.13	0.14	0.13	0.13	0.17	0.17	0.10	0.17
Dummy 2004	0.19	0.19	0.16	0.19	0.18	0.16	0.13	0.17
Dummy 2005	0.16	0.17	0.20	0.17	0.17	0.16	0.15	0.17
Dummy 2006	0.18	0.18	0.19	0.18	0.19	0.20	0.20	0.19
Dummy 2007	0.14	0.15	0.13	0.14	0.16	0.18	0.23	0.18
Dummy 2008 (reference cat.)	0.20	0.18	0.20	0.20	0.13	0.12	0.20	0.13
N	23809	5484	948	30241	10416	6058	1133	17607
%	*0.79*	*0.18*	*0.03*	*1.00*	*0.59*	*0.34*	*0.06*	*1.00*

REFERENCES

Barro, R.J. & X. Sala-i-Martin (1995), *Economic Growth*. New York: McGraw-Hill.

Bartel, A.P. (1979), The Migration Decision: What Role Does Job Mobility Play? *The American Economic Review* 69, pp. 775–786.

Becker, G. (1964), *Human Capital*. New York: Columbia University Press.

Berry, C.R. & E.L. Glaeser (2005), The Divergence of Human Capital Levels across Cities. *Papers in Regional Science* 83, pp. 407–444.

Coniglio, N.D. & F. Prota (2008), Human Capital Accumulation and Migration in a Peripheral EU Region: The Case of Basilicata. *Papers in Regional Science* 87, pp. 77–96.

Detang-Dessendre, C. (1999), Reciprocal Link between Exit from Unemployment and Geo-

graphical Mobility. *Environment and Planning A* 31, pp. 1417–1431.

Faggian, A. & P. McCann (2008), Human Capital, Graduate Migration and Innovation in British Regions. *Cambridge Journal of Economics* 33, pp. 317–333.

Faggian, A. & P. McCann (2009a), Human Capital and Regional Development. *In:* R. Capello & P. Nijkamp, *Handbook of Regional Growth And Development Theories*, pp. 133–151. Cheltenham: Edward Elgar.

Faggian, A. & P. McCann (2009b), Universities, Agglomerations and Graduate Human Capital Mobility. *Tijdschrift voor Economische en Sociale Geografie* 100, pp. 210–223.

Faggian, A., P. McCann & S. Sheppard (2007a), Some Evidence that Women are More Mobile than Men: Gender Differences in UK Graduate Migration Behavior. *Journal of Regional Science* 47, pp. 517–539.

Faggian, A., P. McCann & S. Sheppard (2007b), Human Capital, Higher Education and Graduate Migration: An Analysis of Scottish and Welsh Students. *Urban Studies* 44, pp. 1–18.

Fielding, A.J. (1992), Migration and Social Mobility: South East England as an Escalator Region. *Regional Studies* 26, pp. 1–15.

Heijke, H. & M. Koeslag (1999), The Labour-market Position of University Education and Higher Vocational Education in Economics and Business Administration: a comparison. *Education Economics* 7, pp. 259–276.

Hensen, M.M., R.M. De Vries & F. Cörvers (2009), The Role of Geographic Mobility in Reducing Education-job Mismatches in the Netherlands. *Papers in Regional Science* 88, pp. 667–683.

Herzog Jr., H.W., A.M. Schlottmann & T.P. Boehm (1993), Migration as Spatial Job-search: A Survey of Empirical Findings. *Regional Studies* 27, pp. 327–340.

Kirdar, M.G. & D.S. Saracoglu (2008), Migration and Regional Convergence: An Empirical Investigation for Turkey. *Papers in Regional Science* 87, pp. 545–567.

Lippman, S.A. & J.J. McCall (1976), The Economics of Job Search: A Survey (Part I), *Economic Inquiry* 14, pp. 155–189.

Lippman, S.A. & J.J. Mccall (1979), *Studies in the Economics of Search.* Amsterdam: North-Holland.

Lucas, R.E. (1988), On the Mechanics of Economic Development. *Journal of Monetary Economics* 22, pp. 3–42.

Nijkamp, P. & J. Poot (1998), Spatial Perspectives on New Theories of Economic Growth. *Annals of Regional Science* 32, pp. 7–37.

Pellenbarg, P. & P. Van Steen (2009), Place and Science in the Netherlands. A Spatial Perspective on Dutch Universities and their Knowledge Output. *Tijdschrift voor Economische en Sociale Geografie* 100, pp. 686–693.

Pissarides, C.A. (1976), Job Search and Participation. *Economica* 43, pp. 33–49.

Ritsilä, J. & M. Haapanen (2003), Where Do the Highly Educated Migrate? Micro-level Evidence from Finland. *International Review of Applied Economics* 17, pp. 437–448.

Romer, P.M. (1990), Endogenous Technological Change. *The Journal of Political Economy* 98, pp. S71–S102.

Sjaastad, L.A. (1962), The Costs and Returns of Human Migration. *The Journal of Political Economy* 70, pp. 80–93.

Thurow, L.C. (1975), *Generating Inequality.* New York: Basic Books Inc.

van Dijk, J. (2007), The Regional Labour Market: Braindrain or Knowledge Export? *In*: G. Ashworth, P. Groote & P. Pellenbarg, eds., *A Compact Geography Of The Northern Netherlands.* Assen: In Boekvorm Uitgevers.

van Ham, M., C.H. Mulder & P. Hooimeijer (2001), Spatial Flexibility in Job Mobility: Macrolevel Opportunities and Microlevel Restrictions. *Environment and Planning A* 33, pp. 921–940.

van Ours, J.C. & G. Ridder (1995), Job Matching and Job Competition: Are Lower Educated Workers at the Back of Job Queues? *European Economic Review* 39, pp. 1717–1731.