

An Analysis of Trends in Spatial Mobility of Dutch Graduates

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ABSTRACT *Considerable attention in the literature has been devoted to spatial mobility as a mechanism in the transition from study to work. In this paper, the relationships between migration and both regional economic circumstances and individual characteristics are investigated using a micro-dataset on Dutch college and university graduates. Over the last decade, some Dutch regions have retained increasingly higher proportions of college graduates. We find that the presence of a large labour market is the most important structural economic determinant for these higher retention rates. Cyclical determinants appear to affect university graduate migration more than college graduate migration.*

Une analyse des tendances dans la mobilité spatiale de diplômés de l'éducation supérieure aux Pays-Bas

RÉSUMÉ *Différentes publications se sont consacrées dans une grande mesure à la mobilité spatiale, en tant que mécanisme pour la transition de l'étude à la pratique. Dans la présente communication, on se penche sur les rapports entre d'une part la migration, d'autre part des circonstances économiques régionales ainsi que des caractéristiques individuelles, en appliquant un micro fichier sur des diplômés de collèges et universités des Pays-Bas. Au cours des dix dernières années, certaines régions des Pays-Bas ont retenu une proportion toujours plus élevée de diplômés de collèges. Nous avons établi que la présence d'un important marché du travail est l'élément économique structurel le plus déterminant pour justifier ces taux de rétention élevés. Des déterminants cycliques semblent affecter la migration de titulaires de diplômes universitaires plus qu'ils n'affectent la migration de diplômés de collèges.*

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Análisis de las tendencias de movilidad espacial de los egresados del sistema holandés de educación superior

RESUMEN *En las publicaciones especializadas se ha tratado con mucha atención la movilidad espacial como un mecanismo de la transición del estudio al trabajo. En esta investigación se analiza la relación entre la migración, las circunstancias económicas regionales y las características individuales, utilizando un micro conjunto de datos de egresados de universidades y colegios holandeses. Durante la última década, algunas regiones de Holanda mantienen cuotas cada vez más altas de egresados de colegios. Creemos que la presencia de un mercado laboral amplio es el determinante económico estructural más importante para estos índices de retención mayores. Parece que los determinantes cíclicos afectan en mayor medida la migración de egresados universitarios que la migración de egresados de colegios.*

荷兰高等教育毕业生的空间流动趋势分析

摘要 本文常常将空间流动作为从学习到工作的过渡机制。本文利用荷兰学院和大学毕业生的微观数据,研究了人口流动与地区经济条件及个人情况之间的关系。过去十年里,荷兰某些地区吸引的学院毕业生越来越多。笔者发现,大规模的劳动力市场是吸引毕业生较多的最重要的结构经济因素。循环因素对大学毕业生流动的影响看起来多过学院毕业生的流动。

KEYWORDS: *Internal migration; regional labour markets; human capital; graduates*

JEL CLASSIFICATION: R23; J24; J61

1. Introduction

Considerable attention has been paid in the literature to the determinants of migration, and in particular the location choice of the highly skilled has been studied from a variety of perspectives. The literature on endogenous growth (Romer, 1986; Lucas, 1988) stresses the importance of learning and skills in regions. Glaeser & Saiz (2004) describe why skilled cities in the United States have done so well in this respect. Similarly, other literature has focussed on the role of institutions of higher education in regions in relation to regional economic growth. It seems that, in their respective regions, cities that have institutions for higher education within their borders may serve as an escalator for the surrounding region (Fielding, 1992). In the typical situation, prospective students are attracted to a city and its education opportunities. After graduation, they then capitalize on the investment they have made in their human capital. Faggian & McCann (2006) investigated whether economic spillover results from higher education institutions in the United Kingdom and found little evidence of direct effects. While the main function of institutions of higher education appears to be guiding talented young individuals into a region, retaining these individuals within the region is not a given. Various studies, for example Gottlieb & Joseph (2006) for the United States and Détang-Dessendre (1999) for France, indicate that, especially for younger individuals, economic considerations are of major importance in location decisions.

In this study, we investigate the effect of various economic characteristics on the migration of Dutch graduates using a recent dataset spanning 1997–2008. Our findings indicate that the availability of a large labour market is a key factor in location decisions made by Dutch graduates. However, alongside this rather

structural element, we find a variety of effects of a more cyclical nature. Thirdly, our findings indicate that, over time, graduates are becoming less spatially mobile. This trend is explained by regional economic developments rather than by the background characteristics of individual graduates.

The structure of this paper is as follows. In Section 2 we discuss the literature on the mobility of individuals with a high level of human capital, and highly-educated graduates specifically, in relation to general economic circumstances. In Section 3, we describe our data and methods, followed by a multivariate analysis in Section 4. Section 5 discusses our findings, and our conclusions are reported in Section 6.

2. Literature Review

In the literature, migration has been approached from both an equilibrium as well as a disequilibrium point of view (Hunt, 1993). Graves & Linneman (1979), adopting the former view, see migration as being driven by changes in preferences for what they refer to as 'non-tradable goods', i.e. site-specific amenities. Dynamics at the level of individual households, or indeed individual workers, may lead to changes in location preferences, and henceforth to migration if this change satisfies a sufficiently strong preference for goods or a quality of life that cannot be obtained in the current location.

Conversely, in a disequilibrium framework, migration occurs when there are regional disparities in, for example, income levels or labour market opportunities. Under certain assumptions, the flow of labour from one region to another is then thought to serve as an equalizing force (Greenwood, 1975). Sjaastad (1962) found that migrants responded to income differentials between regions in a US study. However, he questioned whether the ensuing flows were really sufficient to equalize labour market differentials across the economy. This led him to the conclusion that costs and benefits are key to the functioning of such a system: what is the 'return on investment' that an individual migrant may expect from moving, and how does that relate to regional differences in income levels? More often than not, in these types of studies, migration is linked to changes in the status of the labour market. Bartel (1979) points out that the relationship between migration and income differentials may even hinge on the type of labour market change that is underlying the move, be it redundancy or a more voluntary change.

Others, including Clark & Cosgrove (1991), have shown that both approaches can contribute to explaining migration. The relative importance of these distinct approaches however remains a source of debate in the literature. This debate centres on the sources of urban growth and, more specifically, the potential of cities to attract highly skilled workers. Relatively recently, Glaeser & Gottlieb (2006) have provided evidence that the availability of amenities plays a crucial role in attracting highly skilled people and the authors introduce the concept of 'consumer cities'. However, Storper & Scott (2009) criticize the dominant role attributed to amenities, and Scott (2010) states that employment opportunities outweigh amenities in determining the spatial behaviour of engineers in the US. Partridge (2010) compares their work with the performance of New Economic Geography, and the amenity-based approach, in explaining post-war growth rates in the more peripheral areas of the United States, and concludes that the growth patterns are predominantly amenity-driven.

From the perspective of the individual migrant, the relative importance of economics or amenities is likely to be determined by their stage in the life course as well as their level of human capital. It is now generally accepted from a theoretical point of view, and confirmed in many empirical studies, that migration is dependent on age (see for instance the review by Plane (1993)). Young people might be more mobile because they are starters in the labour market, and may also move to find a partner. From the human capital theory viewpoint, young people might be more willing to migrate because they have a longer potential payback period to see a return on such investments than older people do. The peak in propensity to migrate occurs in one's early twenties and steadily declines thereafter. Given the patterns found, alongside age, age-squared is also often used in empirical studies. In their study of Italian graduates, Coniglio & Prota (2008) indeed found significant effects for age (positive) and for age² (negative). Whisler *et al.* (2008) relate back to the more equilibrium, or amenity-driven, approaches to migration research and show, for an American sample, how the outmigration probabilities of individuals with high human capital change along the life course as a result of shifting preferences.

In recent years, an important focus in migration research has been on the mobility of young individuals with high human capital, i.e. higher education graduates. Faggian *et al.* (2006, 2007a, 2007b) studied graduate migration in the United Kingdom, focussing on differences between the genders, ethnic minorities and institutional explanatory variables. Haapanen & Tervo (2009) have studied the effect of residence duration with a sample of Finnish graduates spanning 1991–2003. They found that the propensity to move is especially high during the graduation year and for up to two years thereafter. It could be argued that it is precisely these higher rates of mobility for new graduates that make such individuals so sought after. In their phase in the life course, location decisions are made which may be influenced by policy. However, attracting students to a region does not guarantee success, as was shown by Hansen *et al.* (2003) who discussed the problems that the Pittsburgh region was having in retaining graduates for the local labour market. A survey among 'stayers' pointed towards regional economic conditions, opportunities for further education and low-cost housing as important 'keep' factors. Push factors were a lack of advancement options and few opportunities for women and those from minority groups. Gottlieb & Joseph (2006) applied a mixed logit model to the migration of American technical graduates and doctorate holders and found that amenities are more important for the latter group. The authors point to the relative economic independence, or bargaining power based on their unique human capital, of these doctorate holders as a possible explanation for the weaker effects of labour market characteristics. They also found that amenities play a relatively weak role in graduate migration.

From the above, it seems that, especially for young graduates, regional and wider economic conditions are a key element in mobility and location decisions. Adverse regional and national economic circumstances may stimulate spatial mobility, as migrants may need to search further afield for work. For Canada, Coulombe (2006) found that interprovincial migration was primarily driven by structural rather than cyclical factors. Migration, for all age groups, tends to flow from areas with fewer job opportunities and lower productivity levels to more urbanized areas. Conversely, very little effect on migration was found for what are referred to as asymmetric shocks, or short-term economic opportunities and threats: 'Canadians ... do not propose structural responses (migration) to solve short run problems' (Coulombe,

2006, p. 219). Van der Gaag & Van Wissen (2008) studied the determinants of internal migration rates in a range of European countries, including the Netherlands. In their study, the hypothesis that migration increases in times of economic upswing was supported, albeit to a limited extent. The authors found a stable and positive relationship between migration rates and GDP per capita levels, alongside a somewhat weaker negative relationship between migration and unemployment rates.

Some studies have focussed more specifically on unemployment, and have shown that unemployment does not always lead to higher levels of mobility, due to what is referred to as the 'discouraged worker effect' (Van Ham *et al.*, 2001). In such a situation, an unemployed worker will exert less spatial search effort, assuming that efforts are futile on the premise that circumstances are bad everywhere. Détang-Dessendre (1999) investigated whether migration is an attempt to end unemployment, or whether migration is driven by a known new job, using a sample of French youth. She found that most migration was contract bound, and that migration by the unemployed does not always help to change their situation. Effects differed depending on the training level, with the highly-trained often needing to move in order to find suitable employment. Alongside this work influence, some are bound to a region, for example by home ownership (Helderman *et al.*, 2006), and this potentially keeps the unemployed from leaving their regions. Antolin & Bover (1997) showed that, in Spain, recipients of unemployment benefits are less likely to move, with regional unemployment only serving as a push factor for those unemployed and not on benefits.

Overall, therefore, especially when considering Europe, results are somewhat mixed. Further, early studies (Blanchard & Katz, 1992; Decressin & Fatás, 1995) have shown that, for European countries, adjustment after a labour demand shock is achieved primarily through changing participation rates rather than migration, unlike in the United States where spatial mobility is the prime adjustment mechanism. Broersma & Van Dijk (2002) found that the Netherlands fitted this 'European' pattern.

Nevertheless, effort put into spatially searching may serve to increase the probability of a good match on the labour market (Büchel & Van Ham, 2003). Hensen *et al.* (2009) show that, for the Netherlands, school leavers who are spatially more mobile obtain better job-matches than those who stay in the region of study. However, the extent of search success does not depend on effort or on regional economic characteristics alone. Several studies point to individual characteristics as equally, or even more, important in determining labour market outcomes. Pekkala & Tervo (2002) show that a successful outcome depends primarily on unobserved personal characteristics, or endogenous migrant selectivity, and not on the move as such. Venhorst & Cörvers (2010) show that controlling for self-selection all but negates the apparent effect of spatial mobility on the quality of the job match in a sample of Dutch graduates. Détang-Dessendre *et al.* (2004) found that highly educated French people self-select migration into opportunity-rich regions.

In this paper, we focus on the relationship between spatial mobility and regional economic characteristics using a sample of recent Dutch college and university graduates. The Dutch higher education system is split between universities and vocational colleges (HBOs). Universities as a group are comparable to the research universities in the United States context. The HBOs are more comparable to the United States' four-year colleges, or polytechnics in many countries. We use the terms 'university' and 'college' to refer to these two layers in the Dutch higher

education system which are analysed separately in this paper. Earlier research has shown that university graduates are more spatially mobile than college graduates (Venhorst *et al.*, 2010). We would therefore expect college graduates to be more affected by regional economic developments than their more 'footloose' university counterparts.

We have seen that young individuals are particularly spatially mobile and that, for this group, economic considerations play an important role, notwithstanding the fact that the role of these economic considerations may be driven by unobserved individual characteristics. It has been found that over 70% of college graduates find employment at higher or scientific levels (Allen *et al.*, 2009). The number of jobs at this level in the study region is therefore thought to be an important 'keep' factor, and is expected to relate negatively to the probability of spatial mobility. Alongside this, we would also expect relatively favourable regional economic circumstances to translate into lower outmigration rates among graduates. However, as has become clear from the previous research, the business cycle generally has little effect on migration. Amenity-based approaches have highlighted the need to take into account a desire to live in certain regions. In this study, desirability is operationalized as the average regional housing price. The Dutch housing market is highly institutionalized and can be characterized as inelastic. In this situation, the level of housing prices can reflect both the lack of stock-responsiveness to demand shocks, as well as demand for living in specific regions. As such, it can also be thought of as a push factor, in the sense that the high costs of living may be prohibitive for some. In this sense, it is not obvious whether positive or negative effects on migration can be expected.

In this paper, we control for both demographic characteristics as well as for factors associated with the graduates' degree programmes, as some of these factors may be expected to impact, either directly or indirectly, on the relationship between economic circumstances and migration. Men and women differ in subject choice, and logically therefore also in the ensuing need to be spatially mobile to compensate for potential labour market disadvantages (Faggian *et al.*, 2007b). Further, for the Dutch situation, it is anticipated that graduates from ethnic minorities will be less spatially mobile given their perceived attachment to a limited number of large cities in the west of the country. Venhorst *et al.* (2010) however do show that these graduates are more likely than native students to move abroad. Particularly for research which includes moving abroad as an option, this is an important control variable.

Venhorst *et al.* (2010) also demonstrate that there are substantial differences in the tendency to be spatially mobile among the possible fields of study. The best graduates who have studied teaching are less likely than other teaching graduates to move to the central economic area in the Netherlands. Conversely, graduates in engineering subjects and economics are more focussed on moving to the economic centre of the country, especially the best economics students. For such students, completing an internship or having relevant work experience facilitates the transition from study to work. This could lead to a reduction in search effort, including in a spatial sense. Conversely, it could lead to a reduction in the risks associated with a move over greater distances, and therefore stimulate spatial mobility. Enrolling in further education may or may not entail spatial mobility. In the Netherlands, most university bachelor students who go on to pursue a master programme stay at the same university, a decision mostly related to institutional factors. Key to this process is the efficient links between existing bachelor and

master programmes within an institution, or sometimes with other close-by colleges. Courses available in the present study area may also be preferred to potentially better tuition elsewhere as a result of mobility costs. Therefore we expect a relatively low level of spatial mobility for those currently passing through the further education system.

Having considered various factors that we think might influence migration, we weigh these factors against each other in a multivariate analysis of graduate migration. We use data that enable us to study the effects of regional economic circumstances on graduate migration over the period 1997–2008, while taking into account a variety of factors at the level of individual graduates. Focussing on this recent decade provides an opportunity to study the effects of an economic recession as the Netherlands experienced such a downturn between 2001 and 2005. In the next section, we present our data and our measure for spatial mobility. We then present the independent variables for this analysis and the related hypotheses regarding their expected effects on graduate mobility.

3. Data and Methods

3.1. Data

Our analysis draws on the ROA School-leaver Information System (ROA-SIS), which contains data from the HBO- and WO-monitors of recent Dutch college and university graduates. For this, graduates are interviewed approximately 18 months after graduation. In the survey, information is collected pertaining to both the study period and current employment. The survey can be characterized as an annually repeated cross-section approach, able to provide us with data spanning the period 1997–2008, or, to look at it another way, graduation years from 1995–1996 up to and including 2006–2007. For university graduates, this sample has been restricted to the data-collection years 1998–2007, since not all universities participated in the excluded cycles. As noted previously, this period allows us to study the effects of economic recession on migration. From the data, we have selected students aged 30 or less at the time of graduation who had undergone full-time study. Older graduates, as well as those having followed part-time education, often exhibit socioeconomic characteristics that are quite different from the more ‘standard’ graduate entering the labour market and, as a result, their migration patterns, and presumably the factors that drive their spatial mobility, are expected to differ considerably from our sample and were therefore excluded to avoid confounding factors. These selection criteria left us with a sample of over 120,000 college graduates and over 63,000 university graduates, spread throughout the aforementioned years. In the following subsections we will introduce our measure of spatial mobility and the explanatory variables. Sample statistics are provided in Tables 1–4.

3.2. Measuring Spatial Mobility

In this study, we consider a graduate to be spatially mobile if their working NUTS 2 region at the time of the interview was different from that in which they had studied. In Figure 1, we present a map of the Netherlands, which marks the delineation of the NUTS 1 and NUTS 2 regions, as well as the locations of institutions of higher education. The Netherlands consists of four NUTS 1 regions

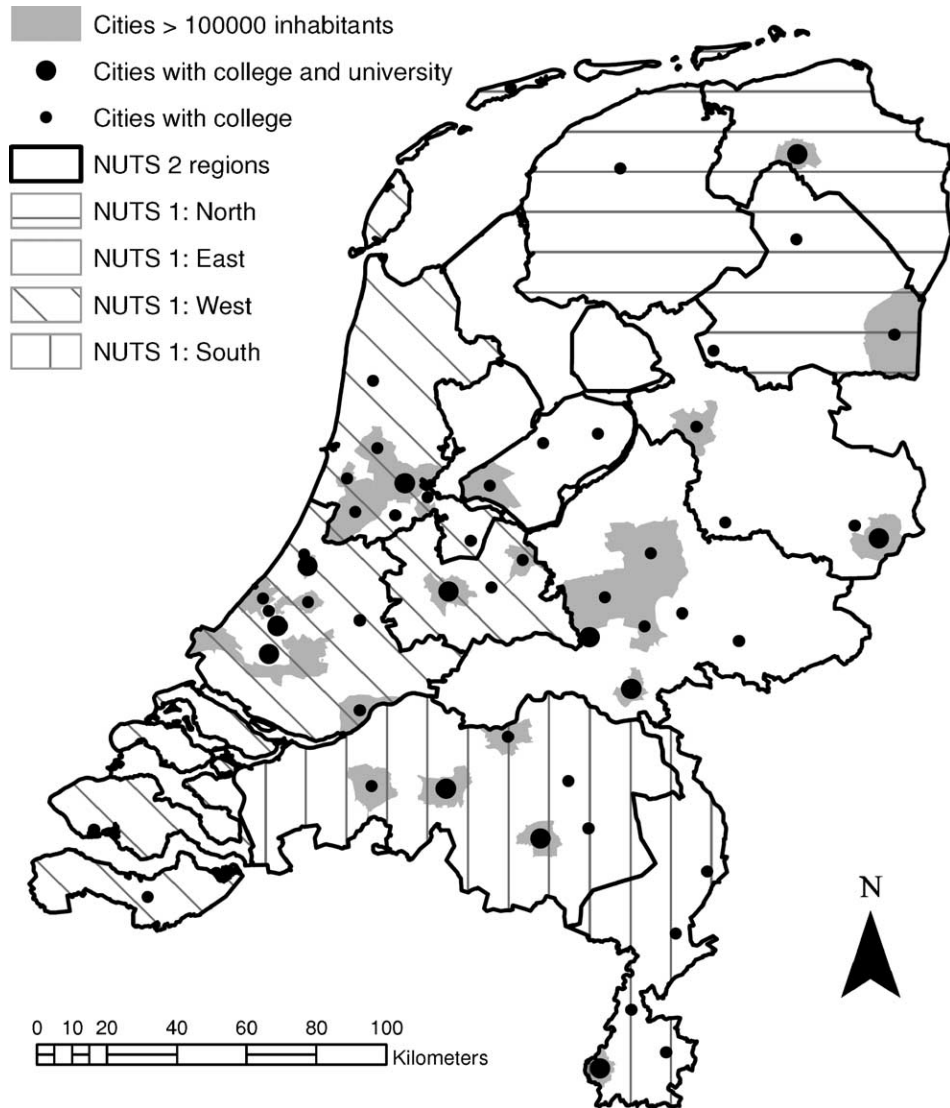


Figure 1. Map of the Netherlands: NUTS 1 and NUTS 2 regions, location of major cities, colleges and universities.

(North, East, West and South) which are further subdivided into a total of 12 NUTS 2 regions. We distinguish four possible moves: 'Remaining in the NUTS 2 study region'; 'Moving within the NUTS 1 study region' (i.e. working in a different NUTS 2 region but the same NUTS 1 region as where one studied); 'Moving to a different NUTS 1 region' and 'Moving Abroad'. In so doing, we do not consider either the possibility of commuting from current residence to current work (across NUTS boundaries), or whether the graduate had to move house in making the transition from study to work. The classification applied in this study is based on administrative regions rather than functional, or labour market, regions. Cörvers *et al.* (2009) investigated under which circumstances functional regions would be preferable to administrative regions for such studies. Based on their

Table 1. Spatial mobility of college graduates, sample incidence

	Stay in NUTS 2 study region	Move within NUTS 1 study region	Move between NUTS 1 regions	Move abroad
Total	58%	17%	23%	3%
<i>Over time:</i>				
1997	55%	16%	25%	4%
1998	56%	16%	25%	3%
1999	56%	17%	25%	3%
2000	56%	17%	25%	2%
2001	57%	18%	23%	2%
2002	59%	17%	23%	2%
2003	61%	16%	21%	2%
2004	58%	17%	21%	3%
2005	58%	15%	24%	3%
2006	58%	17%	22%	3%
2007	58%	17%	22%	3%
2008	60%	16%	21%	3%
<i>By NUTS 1 study region</i>				
North	42%	21%	35%	3%
East	46%	16%	35%	3%
West	66%	20%	12%	2%
South	60%	10%	26%	4%

Source: ROA-SIS, 1997–2008, own computations.

findings, we concluded, for the Netherlands and for the economic indicators of interest, that administrative regions would not perform significantly worse than functional or labour market regions.

For reasons of conciseness, in Tables 1 and 2, for the categories given, the sample incidences are presented both over time as well as averaged across NUTS 1 study regions, rather than the NUTS 2 study regions that are the true focus of this

Table 2. Spatial mobility of university graduates, sample incidence

	Stay in NUTS 2 study region	Move within NUTS 1 study region	Move between NUTS 1 regions	Move abroad
Total	45%	20%	30%	4%
<i>Over time:</i>				
1998	45%	19%	33%	4%
1999	43%	20%	35%	3%
2000	44%	20%	32%	4%
2001	45%	21%	31%	3%
2002	47%	20%	30%	3%
2003	47%	18%	31%	4%
2004	47%	19%	30%	4%
2005	47%	20%	29%	5%
2006	45%	21%	28%	6%
2007	44%	21%	29%	6%
<i>By NUTS 1 study region</i>				
North	26%	13%	58%	3%
East	32%	6%	57%	4%
West	55%	29%	13%	4%
South	42%	10%	42%	6%

Source: ROA-SIS, 1998–2007, own computations.

Table 3. Sample means for independent variables, college graduates

Variable	Mean or % share	Std. dev.	Min	Max
<i>Demographics</i>				
Male	0.41		0	1
Foreign	0.06		0	1
Age	24.52	1.74	20	30
<i>Field of study</i>				
Agriculture	0.05		0	1
Teaching	0.12		0	1
Engineering	0.20		0	1
Economics	0.32		0	1
Health	0.12		0	1
Behavioural Sciences (ref)	0.15		0	1
Humanities	0.03		0	1
<i>Study: background information</i>				
Completed internship	0.98		0	1
Relevant work experience	0.46		0	1
In further education	0.16		0	1
Completed further education	0.03		0	1
Study duration	47.58	11.05	3	120
Months graduation to questionnaire	17.52	3.10	2	52
<i>Regional and national economic characteristics</i>				
Number of higher or scientific jobs	0.253	0.132	0.026	0.484
Relative cost of living	0.007	0.136	-0.340	0.250
Relative regional GDP growth rate	0.000	0.013	-0.059	0.059
Unemployment rate college graduates	0.044	0.014	0.010	0.100
National GDP growth rate	0.029	0.014	0.001	0.047
N total	120,624			

Source: Statistics Netherlands, ROA-SIS, 1997–2008, own computations.

paper. From the tables it can be seen that Dutch university graduates are more spatially mobile than college graduates (see also Venhorst *et al.*, 2010). In our sample of Dutch graduates, about 42% of the college graduates and about 55% of the university graduates left their NUTS 2 study region after graduation. Further, around one-quarter of the college graduates leave the larger NUTS 1 region, compared to approximately one-third of the university graduates who move to another NUTS 1 region or go abroad. From Table 1 (college graduates) it can be seen that the share of college graduates who remain in their NUTS 2 study region has increased slightly over time, from roughly 56% at the beginning to about 59% at the end of the research period. Conversely, the number that move between NUTS 1 regions shows a slight decline. In Table 2, we see a similar slight increase in the proportion of university graduates staying in their NUTS 2 study region during the recession years of 2001–2005, and also a growth in numbers moving abroad.

Tables 1 and 2 indicate however that there are considerable regional variations. Figure 1 includes the locations of the cities with more than 100,000 inhabitants because higher and scientific level jobs tend to be concentrated in these cities. Generally, our findings indicate that graduate retention rates are higher in those regions which feature the ‘opportunity-rich’ larger cities. Overall, for the Dutch situation, it is clear that graduate migration is largely regional: relatively large numbers of graduates work reasonably close to where they studied. This is particularly true for graduates in the region NUTS 1: West, which contains the four largest cities in the Netherlands.

Table 4. Sample means for independent variables, university graduates

Variable	Mean or % share	Std. dev.	Min	Max
<i>Demographics</i>				
Male	0.47		0	1
Age	26.13	1.67	20	30
<i>Field of study</i>				
Agriculture	0.04		0	1
Engineering	0.17		0	1
Economics	0.17		0	1
Health	0.12		0	1
Behavioural Sciences (ref)	0.21		0	1
Humanities	0.10		0	1
Law	0.11		0	1
Natural Sciences	0.08		0	1
<i>Study: background information</i>				
Relevant work experience	0.43		0	1
In further education	0.21		0	1
Completed further education	0.05		0	1
Study duration	62.24	20.89	1	298
Months graduation to questionnaire	18.30	3.86	1	63
<i>Regional and national economic characteristics</i>				
Number of higher or scientific jobs	0.275	0.136	0.052	0.479
Relative cost of living	0.006	0.144	-0.340	0.250
Relative regional GDP growth rate	-0.001	0.014	-0.058	0.034
Unemployment rate college graduates	0.034	0.012	0.000	0.060
National GDP growth rate	0.026	0.015	0.001	0.047
N total	63,474			

Source: Statistics Netherlands, ROA-SIS, 1998–2007, own computations.

3.3. Explanatory Variables

From the literature review it was clear that migration is related to demographic characteristics alongside factors related to the graduates' study periods. Our data, enriched with data from Statistics Netherlands, are sufficiently detailed to enable us to control for these factors. Summary statistics can be found in Tables 3 and 4 for college and university graduates respectively.

3.3.1. Demographic controls. In our analysis, we control for a range of demographic characteristics. The sample contains a majority of women (41% of the college graduates were male, 47% of the university graduates). The average age at the time of interview was around 24.5 years for the college graduates whereas university graduates were slightly older (26.1 years). Apart, in some cases, from longer nominal study durations, this difference reflects the fact that university enrolment starts at age 18 whereas students can enrol in colleges from the age of 17.

About 6% of the college graduates were born outside the Netherlands, or have at least one parent born outside of the Netherlands. Regrettably, comparable information is not available for the university graduates for the full period of the sample. Using the data for the college graduates, we ran a sensitivity analysis which indicated that although this factor was significant, ignoring it when running the analysis did not affect the results for our key variables (see Appendix 1).

3.3.2. Study controls. 'Behavioural and Social Sciences' was selected as the model reference category for both university and college graduates since earlier

work has shown that graduates in this field are generally the least spatially mobile (Venhorst *et al.*, 2010).

Almost all (98%) college graduates completed an internship during their studies. This variable is not recorded for the university graduates over the full length of our sample but, as above, sensitivity analysis shows that its omission does not affect the results for the other independent variables (see Appendix 1). The proportion of graduates with work experience relevant to their career is about 46% (college) and 43% (university).

We include two dummy variables to indicate whether a graduate was participating in further education at the time of interview, or whether such education had already been completed. As one might expect, only a very small percentage of interviewees indicated that, only 18 months after completion of their primary studies, they had already completed further education (3% of college graduates, 5% of university graduates). The salient reference category for the further education dummies is thus 'no further education'.

We also controlled for study duration. The college graduates took a little over 47 months on average to complete their programmes, whereas university graduates took a little over 62 months on average, but there is considerable spread in the data. Most Dutch college programmes take four years to complete, although some are a little shorter. Technical programmes at the university level take a nominal 60 months. Next, we controlled for the window of observation: graduates were, on average, observed 18 months after graduation, but there is a spread of some months. Graduates who were questioned after longer intervals exhibited significantly higher mobility rates.

3.3.3. Regional characteristics. Tables 3 and 4 continue with the mean values for the regional economic characteristics, the key variables in this analysis. We see the variables as measuring prevailing conditions in the source NUTS 2 study regions. Theoretically, they are expected to act as either pure 'push' or pure 'keep' factors. We distinguish between structural effects and cyclical effects. Unless stated otherwise, the regional economic data were obtained through Statistics Netherlands, the governmental statistical service. All economic indicators are entered with a one year lag, so as to more closely reflect the situation at the time of graduation rather than the time of interview.

Firstly, we enter the number of workers in higher and scientific jobs in the region's active labour force. This variable reflects the number of job opportunities in the study region, and it is expected that graduates are pulled towards regions with large labour markets. This variable is entered to control for this structural process.

Secondly, we enter the region's relative cost of living. The variable (COL) is operationalized by taking the average value, on the NUTS 2 level, of family homes as a percentage of the national average. If $P_{i,t}$ is the average house price in region i at time t , then

$$\text{COL}_{i,t} = (P_{i,t} - P_{NL,t})/P_{NL,t}$$

The result is a variable with mean annual values close to 0. Positive values indicate that house prices in the study region are relatively high.

Thirdly, the regional economic growth rate (based on regional GDP) is entered, again relative to the national growth rate. This results in an indicator with a zero average value, and positive values for regions with relatively favourable

developments. If $R_{i,t}$ is the rate of growth in a region's GDP, and $R_{NL,t}$ the rate of growth in national GDP at time t :

$$\text{REGG}_{i,t} = R_{i,t} - R_{NL,t}$$

This variable (REGG) is intended to pick up cyclical effects at the regional level that differ from what is happening nationally.

Fourth, the regional unemployment rate, $U_{i,t}$, is entered as a measure of cyclical differences in employment opportunities across regions. Calculated using the ROA-SIS dataset, it is computed as the percentage of college or university graduates participating in the labour force but looking for work (i.e. actively seeking work). In peripheral areas, unemployment rates are generally higher. During the recession covered, these areas also suffered the sharpest increases in unemployment rates (Allen *et al.*, 2009). The unemployment rates among college graduates are, on average, slightly higher than those found for university graduates (4.4% versus 3.4%).

Fifth, we enter the national economic growth rate (GDP), $R_{NL,t}$, as an indicator of position in the business cycle.

Our sixth entry, and our final aspect, is a linear trend variable. This variable is intended to pick up any remaining trends in the dependent variable that are not covered by the other explanatory variables.

4. Multivariate Analysis

4.1. Method

In this section, we present our multivariate analysis of graduate migration. The dependent variable is the four-way measure of the degree of mobility presented earlier. We estimate a multinomial logit model, including the explanatory variables presented in Section 3. The results are presented in Table 5 (college graduates) and 6 (university graduates). The reference category in the multinomial logit models is 'Remaining in the NUTS 2 study region', with the three other option categories reflecting varying degrees of spatial mobility relative to this 'stay-put' option. All the continuous variables (i.e. age, study duration, and time between graduation and questionnaire), and all the regional and other economic variables were entered as z -scores, that is they were standardized to have a mean of zero and a unity standard deviation. This makes it easier to judge the relative effect strengths by comparing model coefficients with different options within a model.

Further, coefficients in multinomial logit models are defined only up to a level and hence cannot be directly compared between models. Moreover, as opposed to the dummy variables, it is not intuitively straightforward, using the coefficients, to judge the effect of continuous covariates on the various probabilities. Therefore, the results of the estimation were used to compute the probability of moving for a reference group of graduates (here, females who studied economics, completed an internship and not in further education), with all the continuous variables given the standardized mean of zero. We then computed, for this reference group, the effect size, for each of the regional economic variables, on the probabilities of either staying or moving, all other things being equal. The effect sizes reflect the percentage points change in probability of selecting an option, relative to the mean, when letting a specific variable run from its lowest to its highest observed value. Alternatively, the effect sizes can be studied by looking at the effect of a one unit

change, in this case the equivalent one standard deviation change, in the variable, or by computing the relevant marginal effects. Choosing this option would not substantially change our analysis or the conclusions. We selected the approach we did based on its ease of interpretation. Compared to model coefficients, these effect sizes give a more readily interpretable indication of the economic significance of individual results. Further, they allow us to directly compare the results of college and university graduates. In Tables 5 and 6, we only show the effect sizes for the variables that are of major interest in this study. The effect sizes for all variables included in these two models are reported in Appendix 2.

4.2. Results for Control Variables

Before turning to the variables that are the main focus of this paper, we briefly discuss the other control variables. The results for the demographic controls are somewhat mixed. Male college graduates are less likely to move between NUTS 1 regions, and male university graduates are also more likely to move abroad than females. The relationship with age is generally shaped like an inverse U. For college graduates we were able to include a dummy indicating whether they were ‘foreign’ or not, with foreigners less likely to move between NUTS 1 regions, whereas male university graduates are more likely to move abroad than female university graduates.

Generally, the results indicate that graduates from all the other fields considered are significantly more mobile than the reference category of ‘Behavioural and Social Sciences’, although there are some deviations from this pattern, such as the ‘Teaching’ category among college graduates and ‘Healthcare’ and ‘Humanities’ among the university graduates. Law and Natural Sciences are not taught at college level. Conversely, there were too few observations related to ‘Teaching’ at the university level, and so this was combined with the reference category. Having completed an internship or having relevant work experience generally serves to increase the likelihood of a move. Unfortunately, we did not have any information on the location of these internships, but we would expect the majority to take place within a reasonable distance of the institution of higher education. Our results seem to indicate that these (sometimes extra-curricular) activities do not necessarily help to retain graduates in their study region and may even have the opposite effect. Perhaps, internships and work experience ease spatial mobility through an increase in levels of human capital. Conversely, actively participating in further education reduces spatial mobility among both college and university graduates. However, completing such education increases the likelihood of a move abroad. With this further education often taking place at an institution in the original study region, the presence of such opportunities increases retention rates, at least in the short term. Graduates that have taken a relatively long time to complete their studies are also more likely to stay in the area, and are particularly unlikely to move to a different NUTS 1 region or abroad. Graduates that were interviewed relatively late have a higher probability of spatial mobility.

Generally, these results are in line with our expectations as well as the findings in Venhorst *et al.* (2010), even though that study was restricted to the mobility of graduates from the more peripheral NUTS 1 regions of the Netherlands. They are also in line with earlier findings for the UK (Faggian *et al.*, 2007a, 2007b).

Table 5. Estimation results, MNL model, college graduates

Multinomial logit	College 1997–2008			
	Stay in NUTS 2 (reference)	Move within NUTS 1	Move between NUTS 1	Move abroad
<i>Demographic controls</i>				
Male		−0.01	−0.16***	0.01
Foreign		0.00	−0.13***	0.25***
Age		0.18	0.09	1.56***
Age squared		−0.11	−0.02	−1.34***
<i>Field of study</i>				
Agriculture		0.63***	1.43***	1.88***
Teaching		0.12***	0.06**	−0.19
Engineering		0.33***	0.60***	1.22***
Economics		0.20***	0.60***	1.48***
Health		0.22***	0.37***	1.81***
Humanities		0.60***	0.50***	1.93***
Law				
Natural Sciences				
<i>Study: other controls</i>				
Completed internship		0.18***	0.11**	−0.08
Relevant work experience		0.05***	0.07***	0.31***
In further education		−0.19***	−0.12***	−0.75***
Completed further education		−0.08*	−0.03	0.35***
Study duration		−0.01	−0.07***	−0.15***
Months graduation to questionnaire		0.03***	0.03***	0.06***
<i>Regional economic controls</i>				
Number of higher or scientific jobs		−0.42***	−0.67***	−0.39***
Relative cost of living		0.03***	0.18***	0.09***
Relative regional GDP growth rate		0.00	−0.04***	−0.03*
Unemployment rate college graduates		−0.02**	0.06***	0.08***
Trend		0.04***	0.03***	0.00
National GDP growth rate		0.00	0.03***	0.02
Intercept		−1.60***	−1.46***	−4.33***
N				120,624
Pseudo R ²				0.05
LR chi ² (66)				12,732.49
Prob > chi ²				0.00
<i>Predicted probabilities</i>	54.9%	16.3%	25.9%	2.9%
<i>Effect size as variable moves from Min to Max value</i>				
Number of higher or scientific jobs	44.8%	−8.2%	−35.4%	−1.2%
Relative cost of living	−12.7%	−1.6%	13.8%	0.4%
Relative regional GDP growth rate	5.1%	1.5%	−6.0%	−0.6%
Unemployment rate college graduates	−5.3%	−3.8%	7.7%	1.3%
Trend	−2.4%	1.5%	1.0%	−0.1%
National GDP growth rate	−1.6%	−0.5%	2.0%	0.1%

Table 6. Estimation results, MNL model, university graduates

Multinomial logit	University 1998–2007 Excl foreign and internships			
	Stay in NUTS 2 (reference)	Move within NUTS 1	Move between NUTS 1	Move abroad
<i>Demographic controls</i>				
Male		−0.02	−0.02	0.22***
Age		0.86***	1.72***	0.87
Age squared		−0.76***	−1.64***	−0.82
<i>Field of study</i>				
Agriculture		−0.88***	1.12***	1.75***
Teaching				
Engineering		0.11***	0.58***	1.31***
Economics		0.11***	0.55***	0.91***
Health		0.01	0.12***	0.11
Humanities		−0.09**	−0.11***	0.77***
Law		0.16***	0.06*	0.01
Natural Sciences		0.30***	−0.07	0.77***
<i>Study: other controls</i>				
Relevant work experience		0.05**	−0.03	0.13***
In further education		−0.58***	−0.51***	−0.07
Completed further education		−0.02	0.02	0.63***
Study duration		−0.06***	−0.11***	−0.04*
Months graduation to questionnaire		0.01	0.03***	0.05**
<i>Regional economic controls</i>				
Number of higher or scientific jobs		−0.11***	−0.95***	−0.35***
Relative cost of living		0.08***	0.00	−0.11***
Relative regional GDP growth rate		0.00	−0.08***	−0.09***
Unemployment rate university graduates		0.09***	−0.10***	−0.03
Trend		0.02	0.00	0.26***
National GDP growth rate		0.09***	0.00	0.07***
Intercept		−0.75***	−0.67***	−3.25***
N				63,474
Pseudo R ²				0.09
LR chi ² (66)				12,989.91
Prob > chi ²				0.00
<i>Predicted probabilities</i>	39.8%	20.9%	35.4%	3.8%
<i>Effect size as variable moves from min to max</i>				
Number of higher or scientific jobs	41.5%	15.6%	−57.6%	0.5%
Relative cost of living	−2.1%	6.0%	−1.8%	−2.1%
Relative regional GDP growth rate	8.4%	4.8%	−11.7%	−1.5%
Unemployment rate university graduates	3.9%	11.9%	−15.6%	−0.2%
Trend	−1.8%	0.3%	−1.5%	3.0%
National GDP growth rate	−2.6%	4.2%	−2.2%	0.6%

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

4.3. Results for Economic Variables

We now turn to a discussion on the key regional economic variables in our analysis. Firstly, there is a negative relationship between the number of higher and scientific level jobs in the study region and the probability of moving. Graduating in a NUTS 2 region with a large labour market is linked to a substantially lower probability of outmigration. From both the z -standardized coefficients in our models, as well as the full effect size table (Appendix 2), it is clear that this is the most substantial effect among our economic variables. For our reference group of female economics graduates, the probability of staying in the NUTS 2 study region increases by 44.8 percentage points for college graduates as we move from low to high numbers of jobs along the spectrum of Dutch NUTS 2 regions. Put differently, the probability of staying for this group lies roughly between 32.5% ($54.9\% - (44.8\% / 2)$) in regions with a small labour market, and 77.3% ($54.9\% + (44.8\% / 2)$) in those regions with the largest labour markets. Among university graduates, this spread is only slightly narrower at 41.5 percentage points. In contrast to college graduates, the likelihood that a university graduate moves within a NUTS 1 region increases (15.6 percentage points difference between the smallest and largest labour markets) with the strength of the labour market. This result is indicative of the non-linearities that are inherent to the multinomial model. Although we end up with a negative coefficient, relative to the reference option, for moving *within* the NUTS 1 region, the reduction in the likelihood of moving *beyond* the NUTS 1 region dominates this effect, resulting in job numbers having a marginal but positive effect on the likelihood of moving within the NUTS 1 region, all other things being equal. We will return to this rather surprising result in our discussion. The likelihood of moving to a new NUTS 1 region is lower for graduates from those study regions with large labour markets than in those with fewer opportunities, again by a quite substantial margin.

We found that a relatively high cost of living, as measured by the average value of housing in the study region, serves to increase the probability of outmigration by college graduates. The relationship is less clear for university graduates. A high cost of living does increase the likelihood of moving to a neighbouring NUTS 2 region, but not further afield to another NUTS 1 region, for the latter group. University graduates from relatively expensive study regions are less likely to move abroad. In terms of effect sizes, for college graduates the probability of staying decreases 12.7 percentage points when comparing the most inexpensive to the most expensive region. Outmigration as a result of high costs is almost all towards other NUTS 1 regions. With university graduates, the main effect is found to be a lot smaller, and focussed more on relatively short distance moves to another NUTS 2 region within the same NUTS 1 area. In general, university graduates earn more than their college counterparts and, maybe, the smaller effect sizes for the former indicate that the cost of living is less critical in location decisions. The effect that was found related to shorter distance moves. Overall, the results indicate that graduates move away from expensive, or high in demand, regions, rather than towards them. This does not lend support to arguments for an amenity-driven migration flow for this particular group.

Having a relatively high regional GDP growth rate reduces the probability of a move beyond the NUTS 1 region, or a move abroad, for both college and university graduates. In contrast to the cost of living measure, in terms of effect sizes, this factor appears to be relatively more important for the university graduates,

with the reduction in the likelihood of leaving the NUTS 1 region almost double that of college graduates: a reduction of 11.7 percentage points versus 6.0 percentage points. Again the neighbouring NUTS 2 regions seem to benefit somewhat, in terms of an inflow of university graduates, from relatively high regional economic growth rates in a graduate's study region.

The results when considering unemployment rates among recent graduates are mixed. In terms of the model coefficients, for college graduates, high unemployment rates reduce the probability of a move to a neighbouring NUTS 2 region, but increase the likelihood of a move to a different NUTS 1 region or abroad. For university graduates, we find a more-or-less reversed pattern. This is especially apparent when looking at the effect sizes. Moving from the lowest to the highest unemployment rates sees the likelihoods of staying put or moving to a neighbouring NUTS 2 region reducing by 5.3 and 3.8 percentage points for college graduates, whereas we find increases of 3.9 and 11.9 percentage points, respectively, for university graduates. For college graduates, the dominant effect of local unemployment appears to be to leave the NUTS 2 study region and, since moving costs will be incurred, to move lengthy distances. For the university graduates, the dominant response is to move shorter distances, to a neighbouring NUTS 2 region or, to a lesser extent, to stay despite the high unemployment rates. This perhaps reflects the broader range of possibilities, in addition to spatial mobility, open to university graduates in dealing with the risk of unemployment. One such option would be to accept work at a lower (i.e. college graduate) level. Such competition may also be at the root of the higher outmigration effect we found for college graduates.

Despite our various controls, we still have significant trends remaining in terms of Dutch graduate migration. The signs, however, are surprising to some extent, given the arguments presented in Section 3.2. For college graduates, we find a persistent positive trend in the probability of moving to either a neighbouring NUTS 2 region, or to a different NUTS 1 region, as opposed to staying within the NUTS 2 study region. For university graduates, we find a relatively strong positive trend in the probability of moving abroad. In terms of absolute effect size these trends are of limited magnitude. Nevertheless, there are some interesting implications. First, the sample statistics presented in Section 3 indicate a positive trend in the likelihood of college graduates staying in their NUTS 2 study region. However, after correcting for both economic factors as well as characteristics on the level of individual graduates, this is reversed into a modest negative effect of 2.4 percentage points over the time span of the study. We also find a rather similar 1.8 percentage point reduction for the university graduates. A second interesting finding is the 3.0 percentage points increase in the probability of university graduates moving abroad. Compared to the baseline probability of 3.8% for our reference group, this is a substantial effect, and one which has not been explained by the other independent variables in our model. Arguably, the missing indicator in the university model of 'being foreign' could play a role here, even though comparative analysis for the college graduates did not reveal a substantial relationship between this and the trend parameter. Further, even though the enrolment of foreign students in Dutch universities has increased substantially over the last decade, the full effect of this will not have been captured by our data since many of these students are only just starting to complete their programmes. As such, the cause of this positive trend with university graduates is largely unexplained and would make an interesting topic for further research, for example in

considering the effects of internationalization programmes and travel scholarships on universities.

Finally, the effects of up- or down-swings in the business cycle, as measured by the national GDP growth rate, also appear to be relatively modest. This is in line with earlier studies. For college graduates, the likelihood of moving to a different NUTS 1 region increases with an upswing in the business cycle by 2.0 percentage points. In contrast, the equivalent probability decreases by a similar amount for university graduates. Interestingly, for the latter group, moving to an adjacent NUTS 2 region seems to be a relatively favourable option in an economic upswing. As the probability of staying decreases for both groups, it can cautiously be concluded that spatial mobility is generally encouraged by economically favourable circumstances, a finding in contrast with the search effort hypothesis.

5. Discussion

In this section we return to two separate issues that transpired from our results as presented in Section 4. These are, firstly, the relative importance of the various sets of explanatory variables in our models and, secondly, the surprising signs found for some of our economic push and keep factors.

As opposed to the initially negative trends in graduate mobility observed in Section 3, we find either an insignificant or a positive trend after controlling for individual and regional economic characteristics. We ran a stepwise analysis, adding groups of control variables to a baseline model that only featured the trend and business cycle variables, to investigate whether the changes observed in Section 3.2 could be explained by composition effects in our sample (i.e. due to characteristics of the individuals involved) or by economic variables. The results are reported in detail in Appendix 3. Essentially, after entering the regional economic characteristics, these variables became insignificant in their influence, or even changed sign from the simpler analysis. From this, it can be concluded that regions that are doing relatively well economically are more likely to retain local graduates.

Then regarding some of the surprising effect signs of our economic explanatory variables: in some instances, our economic ‘push’ or ‘keep’ factors influence the decision to stay and the decision to move the relatively short distances within a NUTS 1 region similarly. If we interpret these findings in terms of pure ‘keep’ or ‘push’ factors we arrive at hypotheses that require these effects to have opposite signs. This, however, is only found for job numbers (and only for college graduates), cost of living and national growth rate (university graduates only), and the trend indicator (both groups). These findings can be interpreted in two ways. Firstly, this result could be indicative of spatial spillover effects, with graduates’ evaluations of the economic circumstances in their study regions affecting the attractiveness of nearby NUTS 2 regions, perhaps for example with an eye to future return migration. A second interpretation is that NUTS 2 regions which share certain economic characteristics are co-located within the same NUTS 1 region. We ran Wald tests on both models to ascertain whether our model categories are sufficiently different, and this was confirmed. Studying the effect of there being greater economic opportunities in neighbouring regions, as well as the influence of possible future return migration, is a promising avenue for future research. In general, however, our findings indicate that regional economic circumstances can only be interpreted as clear ‘keep’ or ‘push’ factors when long distance migration is considered.

6. Conclusions

From this analysis a number of insights emerge. Firstly, graduate migration in the Netherlands is primarily dependent on the spatial distribution of suitable jobs and, as such, should be regarded as structural in nature. Graduates are pulled towards areas where there are more jobs. For college graduates, the second most important factor is regional differences in costs of living, which again can be regarded as structural. For university graduates, cyclical elements such as regional economic growth and unemployment rates play a stronger role. The positive trend in spatial mobility, albeit of modest proportions in an absolute sense, is all the more interesting given this largely structural backdrop.

A second, somewhat more surprising, result is the relatively strong role that most of the considered economic characteristics in our model play in a decision to move within the NUTS 1 study region for university graduates compared to college graduates. The sample statistics presented in Section 3 show that such a move is, in general, more frequent among college graduates. Only for the NUTS 1: West region did we find a substantially higher proportion of university graduates on the move (Tables 1 and 2). Based on these findings, it would appear that for those university graduates who do move within their NUTS 1 region, this decision is strongly determined by economic circumstances. Conversely, for college graduates this is not a strong factor in the decision.

From a policy perspective, a key result in this analysis is the importance of what can be interpreted as an opportunity-rich labour market in attracting or retaining recent graduates. This could be viewed as an aspect that is hard for local policymakers to influence given the large structural flows of graduates towards the economic centre of the Netherlands. Nevertheless, we have shown that graduates are becoming less migratory, and that this can be explained by economic developments in the various regions: graduates are retained as regions do better. Local policymakers are trying to improve the supply of suitable housing, or enhance living surroundings in general, but, in the highly institutionalized Dutch context, this is sometimes difficult to achieve. Overall, the cost of housing is only a weak influence on migration, especially of university graduates, although there is a tendency for graduates to move out of expensive regions. It is, however, the second most important factor when it comes to college graduates who migrate longer distances. On the other hand, university graduates appear to be more sensitive to cyclical aspects of the regional economy, such as the unemployment and growth rates. However, higher unemployment does not necessarily cause outmigration among university graduates. One idea is that this is due to their greater flexibility in finding work, given their higher levels of human capital, and that this allows these graduates to be somewhat more risk-taking in their location decisions. Their stronger response to the national business cycle is also indicative of this. These are important factors to take into account when considering policies aimed at attracting or retaining graduates.

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Appendix 1: Sensitivity Analysis with Respect to Omitted Variables and Years

In Table A1, the estimation results are presented for two alternative specifications of the model in Table 5 (college graduates). Both model specifications exclude the dummies for ‘foreign’ and ‘completed internship’, whereas the right hand columns also feature the results for a reduced time period. In Table A2 we compare the effect sizes with those reported for the model in Table 5 and the differences are minimal.

Appendix 2: Effect Sizes All Variables

After age, the effect size of job availability is the highest in the model. Although we found a stronger effect for age, this was countered by age squared, resulting in a modest U shaped age-migration relationship. We also found relatively strong effects for the ‘field of study’ dummies and for the correction factors related to study duration and interval between graduation and questionnaire (see Table A3).

Appendix 3: Trend and Business Cycle Analysis

In Table A4, we show the results from four variants of the models presented in Tables 5 and 6. Model 1 contains only the trend and national GDP growth rate variables and, through models 2 and 3, progressively more groups of control variables are added, resulting in the final model (4) in the far right column. The focus is on the effects of the control variables on the trend and business cycle variables.

In model 1, we find a general negative trend in migration between NUTS 1 regions, a strong positive trend for moving abroad for university graduates, and a positive effect of the business cycle on migration in our baseline models. This is generally in line with our presentation in Section 3.2. Adding the demographic and study controls, as well as information on internships, work experience and further education in models 2 and 3 does not lead to substantial changes in the estimates related to trend and national GDP growth rate. However, on entering the economic covariates, more substantial changes occur for the trend variable. For college graduates, we now find positive trends. Less dramatically, for university graduates, the negative trend in longer distance migration becomes insignificant. As such, regions appear to be able to retain graduates when they are doing better economically. Nevertheless, we still find that graduates are more mobile when the economy is doing well, the only exception being the probability of moving between NUTS 1 regions for university graduates where an insignificant effect is found.

Table A1. Estimation results, MNL models, college graduates, differing specifications

Multinomial logit Reference: stay in study region	College 1997–2008 Excl foreign and internships			College 1998–2007 Excl foreign and internships		
	Move within NUTS 1	Move between NUTS 1	Move abroad	Move within NUTS 1	Move between NUTS 1	Move abroad
<i>Demographic controls</i>						
Male	–0.01	–0.16***	0.00	–0.01	–0.16***	–0.02
Age	0.19	0.10	1.53***	0.13	0.05	1.35***
Age squared	–0.12	–0.03	–1.30***	–0.07	0.02	–1.12**
<i>Field of study</i>						
Agriculture	0.63***	1.44***	1.87***	0.58***	1.45***	1.79***
Teaching	0.12***	0.06**	–0.20	0.09***	0.09***	–0.23*
Engineering	0.33***	0.60***	1.22***	0.33***	0.60***	1.13***
Economics	0.20***	0.60***	1.48***	0.20***	0.61***	1.41***
Health	0.22***	0.38***	1.80***	0.21***	0.38***	1.64***
Humanities	0.56***	0.49***	1.94***	0.59***	0.48***	1.97***
<i>Study: other controls</i>						
Relevant work experience	0.05***	0.07***	0.31***	0.05***	0.06***	0.30***
In further education	–0.19***	–0.12***	–0.74***	–0.20***	–0.13***	–0.82***
Completed further education	–0.07	–0.03	0.35***	–0.04	–0.03	0.47***
Study duration	–0.01	–0.06***	–0.15***	–0.01	–0.06***	–0.15***
Months graduation to questionnaire	0.03***	0.03***	0.06***	0.04***	0.03***	0.06***
<i>Regional economic controls</i>						
Number of higher or scientific jobs	–0.42***	–0.67***	–0.38***	–0.44***	–0.68***	–0.36***
Relative cost of living	0.03***	0.18***	0.09***	0.03***	0.18***	0.07***
Relative regional GDP growth rate	0.00	–0.04***	–0.03*	0.01	–0.04***	0.00
Unemployment rate college grads	–0.02**	0.06***	0.08***	–0.04***	0.04***	0.06***
Trend	0.04***	0.02***	0.01	0.05***	0.02	0.07***
National GDP growth rate	0.00	0.03***	0.02	0.00	0.04***	0.03***
Intercept	–1.42***	–1.36***	–4.39***	–1.41***	–1.36***	–4.33***
N			120,624			99,045
Pseudo R ²			0.05			0.05
LR chi ² (66)			12,687.01			10,400.66
Prob > chi ²			0.00			0.00

Table A2. Effect size as variables move from minimum to maximum values

	College (model Table 5) 1997–2008				College 1997–2008 Excl foreign and internships				College 1998–2007 Excl foreign and internships			
	Stay in NUTS 2 (reference)	Move within NUTS 1	Move between NUTS 1	Move abroad	Stay in NUTS 2 (reference)	Move within NUTS 1	Move between NUTS 1	Move abroad	Stay in NUTS 2 (reference)	Move within NUTS 1	Move between NUTS 1	Move abroad
Multinomial logit												
<i>Predicted probabilities</i>	54.9%	16.3%	25.9%	2.9%	55.0%	16.3%	25.7%	3.0%	54.9%	16.3%	25.8%	3.0%
<i>Effect size as variable moves from min to max value</i>												
Number of higher or scientific jobs	44.8%	– 8.2%	– 35.4%	– 1.2%	44.8%	– 8.2%	– 35.4%	– 1.2%	45.1%	– 8.8%	– 35.5%	– 0.9%
Relative cost of living	– 12.7%	– 1.6%	13.8%	0.4%	– 12.6%	– 1.6%	13.8%	0.4%	– 12.2%	– 1.6%	13.6%	0.2%
Relative regional GDP growth rate	5.1%	1.5%	– 6.0%	– 0.6%	5.1%	1.5%	– 6.0%	– 0.6%	3.6%	3.1%	– 6.9%	0.3%
Unemployment rate college grads	– 5.3%	– 3.8%	7.7%	1.3%	– 5.3%	– 3.8%	7.7%	1.4%	– 1.7%	– 4.5%	5.1%	1.1%
Trend	– 2.4%	1.5%	1.0%	– 0.1%	– 2.4%	1.6%	0.8%	0.0%	– 2.5%	1.8%	0.1%	0.6%
National GDP growth rate	– 1.6%	– 0.5%	2.0%	0.1%	– 1.6%	– 0.5%	2.0%	0.1%	– 1.9%	– 0.4%	2.0%	0.3%

Table A3. Effect size as variable moves from minimum to maximum value, main models, all variables

	College (model Table 5) 1997–2008				University (model Table 6) 1998–2007			
	Stay in NUTS 2 (reference)	Move within NUTS 1	Move between NUTS 1	Move abroad	Stay in NUTS 2 (reference)	Move within NUTS 1	Move between NUTS 1	Move abroad
Multinomial logit								
<i>Predicted probabilities</i>	54.9%	16.3%	25.9%	2.9%	39.8%	20.9%	35.4%	3.8%
<i>Effect size as variable moves from min to max value</i>								
Male	2.2%	0.6%	– 2.9%	0.1%	0.1%	– 0.3%	– 0.7%	1.0%
Foreign	1.3%	0.5%	– 2.6%	0.9%				
Age	– 53.6%	– 6.4%	– 17.4%	77.4%	– 95.5%	5.1%	89.4%	1.0%
Age squared	28.1%	0.2%	11.3%	– 39.7%	89.5%	4.1%	– 94.0%	0.5%
Agriculture	– 29.2%	– 1.9%	25.0%	6.1%	– 17.6%	– 16.1%	25.2%	8.5%
Teaching	– 1.7%	1.5%	0.8%	– 0.6%				
Engineering	– 14.2%	0.6%	9.2%	4.4%	– 11.5%	– 4.3%	9.6%	6.2%
Economics	– 11.1%	0.2%	8.8%	2.1%	– 9.6%	– 2.4%	10.1%	1.9%
Health	– 12.9%	– 0.8%	2.9%	10.8%	– 1.9%	– 0.8%	2.5%	0.3%
Humanities	– 17.7%	3.8%	3.2%	10.8%	0.4%	– 1.6%	– 3.4%	4.6%
Law					– 2.3%	2.3%	0.2%	– 0.2%
Natural Sciences					– 3.3%	4.9%	– 5.3%	3.7%
Completed internship	– 3.0%	2.0%	1.4%	– 0.4%				
Relevant work experience	– 2.0%	0.3%	0.8%	0.9%	– 0.2%	0.9%	– 1.2%	0.5%
In further education	4.3%	– 1.7%	– 1.2%	– 1.4%	12.3%	– 5.6%	– 7.6%	0.9%
Completed further education	0.4%	– 1.1%	– 0.6%	1.3%	– 1.3%	– 1.1%	– 0.6%	3.1%
Study duration	12.9%	1.9%	– 11.4%	– 3.5%	28.5%	– 4.0%	– 24.9%	0.4%
Months graduation to questionnaire	– 13.8%	4.3%	6.9%	2.6%	– 10.1%	– 1.1%	9.3%	1.9%
Number of higher or scientific jobs	44.8%	– 8.2%	– 35.4%	– 1.2%	41.5%	15.6%	– 57.6%	0.5%
Relative cost of living	– 12.7%	– 1.6%	13.8%	0.4%	– 2.1%	6.0%	– 1.8%	– 2.1%
Relative regional GDP growth rate	5.1%	1.5%	– 6.0%	– 0.6%	8.4%	4.8%	– 11.7%	– 1.5%
Unemployment rate c or u graduates	– 5.3%	– 3.8%	7.7%	1.3%	3.9%	11.9%	– 15.6%	– 0.2%
Trend	– 2.4%	1.5%	1.0%	– 0.1%	– 1.8%	0.3%	– 1.5%	3.0%
National GDP growth rate	– 1.6%	– 0.5%	2.0%	0.1%	– 2.6%	4.2%	– 2.2%	0.6%

Table A4. Model versions, varying sets of control variables, effect on trend and business cycle indicators, college and university graduates

Controls entered		Multinomial logit model versions (stay is reference category)											
Demographic controls	No				Yes				Yes				Yes
Field of study	No				Yes				Yes				Yes
Study duration and observation window	No				Yes				Yes				Yes
Internships, work experience, further education	No				No				Yes				Yes
Regional economic characteristics	No				No				No				Yes
		Model 1			Model 2			Model 3			Model as per Table 5		
		Move within NUTS 1	Move between NUTS 1	Move abroad	Move within NUTS 1	Move between NUTS 1	Move abroad	Move within NUTS 1	Move between NUTS 1	Move abroad	Move within NUTS 1	Move between NUTS 1	Move abroad
College													
Trend		-0.02*	-0.08***	-0.09***	0.00	-0.06***	-0.04**	0.01	-0.05***	-0.05**	0.04***	0.03***	0.00
National GDP growth rate		0.01*	0.03***	0.02	0.01	0.02**	0.00	0.01	0.02**	-0.01	0.00	0.03***	0.02
		Model 1			Model 2			Model 3			Model as per Table 6		
		Move within NUTS 1	Move between NUTS 1	Move abroad	Move within NUTS 1	Move between NUTS 1	Move abroad	Move within NUTS 1	Move between NUTS 1	Move abroad	Move within NUTS 1	Move between NUTS 1	Move abroad
University													
Trend		0.05***	-0.04***	0.24***	0.04***	-0.06***	0.25***	0.05***	-0.05***	0.24***	0.02	0.00	0.26***
National GDP growth rate		0.08***	0.03***	0.08***	0.06***	0.02**	0.09***	0.06***	0.02*	0.08***	0.09***	0.00	0.07***