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Spatial mobility and job access in a polycentric metropolis

DRAFT

ABSTRACT

In this paper three elements are connected: employment change, job access and labour related migration. The Dutch economic urban landscape has developed into a polynucleated urban structure in which urban concentrations of employment opportunities are located at relatively short distance from each other. Recently, trends of deconcentration of total employment opportunities and at the same time concentration of high qualified and specialised jobs in urban nuclei can be observed. The resulting spatial distribution of job opportunities has an influence on job access at the individual level. Good job access from the residence increases the probability that someone finds a suitable job at relatively short distance. This means there is less 'need' for human capital related migration from locations with good job access. In the paper, the hypothesis is tested that regional differences in human capital related migration can be fully explained by variation in job access. The bivariate analysis showed that human capital related migration is lowest in the Randstad and highest in the more peripheral regions. To test whether these regional differences can be explained by regional differences in job access, a multivariate regression model has been used. The results show that not region explains the variation in migration, but regional differences in job access. The job access effect appeared even to be significant after controlling for effects of individual characteristics like age, education and household situation. This is an important indication that job access as a geographical context variable plays an important role in human capital related migration.

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INTRODUCTION

In job access geography matters. At the macro-level job access is determined by the spatial distribution of employment opportunities. At the individual level job access is the result of the location of the residence in relation to locations of employment opportunities and the commuting tolerance of individuals. Due to the poly-nucleated structure of urbanisation in the Netherlands, the distribution of employment opportunities takes the form of geographical islands (urban nuclei) at varying distances, connected by road and rail infrastructure. Because of the recent rise of the information economy there is a renewed high growth of employment in urban regions and a concomitant specialisation of employment between the urban nuclei. The nuclei in the Randstad, the most urbanised part of the Netherlands, shows a concentration of knowledge intensive activities as well as a concentration of employment in advanced producer services. These employment opportunities affect the pattern of job access. As we will show, the pattern of job access in general differs from the pattern of job access for high qualified jobs and for jobs in the advanced producer service sector. The number of jobs that can be accessed from a given residential location depends on this specific structure and on the commuting tolerance of the job researchers. We will show that given an acceptable commuting tolerance of 30 minutes, the best residential locations are not necessarily found in the urban nuclei.

This might have consequences for the residential location choice of the labour population. We expect a relation between job access and job related migration because people living in locations with low job access will have a lower probability to find an acceptable job within reasonable commuting time. We will interpret job related migration as a mean to escape from unemployment or underemployment. In other words, people move for a job in order to utilise their accumulated human capital more optimally. From the opposite point of view, good job access from the location of residence increases the probability to find a suitable job within reasonable commuting time. In that case there is less >need= for job related migration. We expect a lower level of job related migration from locations with a high rate of job access. We hypothesise that regional differences in labour related migration, can be fully explained by variation in job access.

In this paper we connect three elements: employment change, job access and labour related migration. First, we will discuss in conceptual terms the connection between these three elements and give a short elaboration of the theoretical base of our research. Second, we will describe the pattern of regional economic specialisation in the Netherlands. Third, the pattern of job access will be dealt with. The fourth part of the paper deals with the main question of this paper: to which extent does job access influence job related migration, after controlling for individual characteristics? We will conclude this paper with a short summary of the results of our research.

CONCEPTUAL FRAMEWORK

In our research we make a connection between the regional distribution of employment opportunities and the regional distribution of the labour population. If both are not completely correlated there will be a spatial mismatch between where workers live and where jobs are located. As a consequence of this mismatch, mobility and congestions problems have arisen. The geographical gap between jobs and people also contributes to unemployment and underemployment for certain groups in society (Pugh, 1998; Rich & Coughlin, 1998; Ong & Bluemberg, 1998). Nevertheless, according to Fisher & Nijkamp (1987) theories about labour markets were originally developed for economic rather than geographical spaces. In the Netherlands Van der Laan (1991) has focussed on the spatial aspects of labour markets by using a heterodox explanation model, in which he combined several theoretical assumptions about the functioning of regional labour markets. One of the outcomes of his analysis is that the degree of urbanisation is still of great importance with respect to the characteristics of the regional labour market; not in a direct way but as an expression of the function of urban regions within the national economic system. His model uses information on an aggregated level and ignores the micro-level.

On the micro-level there are two kinds of spatially expressed behavioural responses on spatial mismatch on the regional labour market: commuting and migration. Both kinds of spatial behaviour function as substitutes for each other, but this substitution is not complete for everybody and in every region (Evers & Van der Veen, 1986). Characteristics of people as well as characteristics of regions do influence the choice to commute or to migrate for labour or even to make use of either one of these possibilities. Those people become unemployed or underemployed in their existing region of residence. In his research about labour migration Van Dijk (1986) also made a distinction between labour market behaviour on the individual level (labour related migration) and the analysis of labour markets on the macro-level (regional differences of employment or unemployment and streams of migrations between regional labour markets). Van Dijk stated that decisions on the individual level are mutual connected with circumstances on the macro-level. The decision to migrate is influenced by a context of social, institutional, geographical and economic factors. These factors are the aggregate result of many individual decisions.

In our research we focus on the geographical context, that is to say the urban pattern of employment opportunities. To describe this pattern the Netherlands has a long tradition of using centre-periphery models. In this tradition, the three large cities in the Randstad were seen as the economic centre of the country, surrounded by a suburban intermediate region (the so-called Halfway region). Regions in the northern, eastern and southern part of the country were qualified as peripheral regions. This centre-periphery model no longer fits the current spatial economic structure of the Netherlands. Deconcentration of metropolitan areas has increased distance and complexity of the spatial links involved (Hooimeijer, 1996). There is a growing doubt about the validity of centre-periphery models for the Netherlands. In the post-industrial époque, based on the information economy, a monocentric model is no longer valid and has to be replaced by polycentric models of urbanisation (Dieleman & Faludi, 1998). This view is not completely new in respect to the Randstad. In his famous book 'The World Cities' Hall (1966) described the Randstad as an example of a nascent polycentric urban agglomeration. In his eyes, good job access and therefore a maximum choice of job opportunities is an important quality of these kind of polynucleated urban agglomerations. As a result of urban sprawl since the sixties, when Hall published his book, the qualification of polynucleated urban structure does not longer concern only the Randstad. Employment growth spread out over a great part of the Netherlands. Due to the deconcentration of employment and population, the national urban system has become a complex fabric of multiple centres of employment and dispersed residential locations (Van der Laan et al., 1998). However, the result of the deconcentration of employment is not an amorphous urban

economic structure. Most of the cities in the Netherlands are still centres of employment. De-concentration of employment means in the Netherlands a selective dispersal of economic activities. Manufacturing industries and goods-handling activities show a spatial shift towards regions outside the Randstad. But at the same time cities remain perfect locations for new kinds of economic specialisation such as high qualified, advanced producer services.

As Hall stated, changes in the urban economic landscape have consequences for the pattern of job access. If the employment opportunities are spread over multiple centres at varying distances, more employment opportunities come in reach of the dispersed living labour population. This is true by a given commuting tolerance of job searchers. Job search by itself is not only a matter of job access, but also a matter of career orientation on the individual level. According to the human capital theory, people search less for jobs with increasing tenure and age. Aside from this, search behaviour is influenced by the household situation. In couples, a working partner can be seen as a household resource which makes it less necessary to search for a (another) job. The household context may also restrict job search, for instance by the presence of children (Van Ham, 1998).

Migration can be seen as a specific result of job search. Micro-economic theories of geographic mobility are based on the premise that migration is the result of rational decision making driven by a desire for social mobility (Shihadeh, 1991). Sjaastad (1962) placed job related migration in an investment context by introducing a theoretical structure which takes both the costs and returns of migration in consideration. According to Sjaastad, migration is the result of an individual cost-benefit calculation in which both monetary and non-monetary costs and benefits are weighted before a residential move will be undertaken. People only move for a job when the expected future returns of migration are positive.

So, job related migration is the behavioural outcome of job search. It was recognised early that job search is one of the main factors behind labour mobility (Stigler, 1961, 1962). When job search is placed within a spatial context it becomes clear that job access has an influence on the outcome of the job search process. Good access to jobs from the residence will increase the probability that someone finds a suitable job at a relatively short distance. It is therefore expected that with increasing job access the probability of job related migration decreases.

By adding skill to the definition of the job search area of workers, Simpson (1992) added an important principle to the theoretical framework within which job access of individuals can be understood. According to the human capital theory (Becker, 1962), workers invest in productivity enhancing skills, and strive at maximising lifetime income. The stock of human capital people accumulate during their life has three main components. First, general human capital, second, sector-specific human capital and, third, enterprise-specific human capital. Because people differ in level and specialisation of their human capital, and jobs differ in level as well, not all jobs are valued equally and thus only a subset of the total available jobs is suitable for an individual job searcher. Börsch-Supan (1990) found skill to have a double-edged impact on labour mobility. On the one hand, the probability of a job change decreases with increasing levels of human capital. On the other hand, however, Börsch-Supan found that geographic mobility increases with the level of human capital. Higher educated people change jobs more often over a large distance than lower educated people do.

It is expected that with increasing levels of human capital the probability of job related migration increases. Higher educated people have a larger job search area because of the lower spatial density of specialised jobs. Therefore, higher educated people are expected to have a higher probability to move residence when they change jobs. At the same time it is expected that with increasing age the probability of job related migration decreases. First, with increasing age the probability of a good match increases and second the cost of a job change increases with age.

Within the above sketched spatial elaboration of the human capital theory, access to suitable jobs is expected to be an important determinant of job related migration. In reality the use of the term job related migration is too narrow, because from a point of view of the life career most people first get well educated before they make career on the labour market. Next to labour related migration we have to distinct education related migration. We will make this distinction in our analysis and call both forms of migration together ‘human capital related migration’.

The main hypothesis to test in this paper is the expectation that in particular during a period of a changing geography of employment opportunities, the difference in job access is still an important circumstance to explain the amount of human capital related migration. Even if employment opportunities were stable over space, a redistribution of human capital is to be expected due to young people that enter the labour market and move to location with higher job access (see part three of this paper). We expect that increasing job access will decrease the probability of human capital related migration. We also hypothesise that regional variation in human capital related migration is the result of variation of job access across regions. This hypothesis will be tested in part four of the paper.

EMPLOYMENT CHANGE: INFORMATION ECONOMY AND URBAN STRUCTURE

The Dutch economy develops into an informational economy. The emergence of the information economy leads to major changes in labor demand, especially to shifts in the sectoral and functional composition. Over the last decades there was an important loss of employment in agriculture, manufacturing and construction industries and a large expansion of employment in the service industries.

Table 1 Shifts in sectoral employment composition in the Netherlands, 1960-1990 (x1,000 jobs)

	Male 1990		Female 1990		Total 1990		Growth 1960-90		
	Abs.	%	Abs.	%	Abs.	%	Abs.	%	
Agriculture	212.2	5.5	-200.7	74.8	3.2	-17.3	287.0	4.6	-218.0
Manufacturing	969.1	25.0	-50.6	243.2	10.3	17.2	1,212.3	19.4	-33.4
Construction	291.1	7.6	-56.0	18.1	0.8	13.7	309.2	5.0	-42.3
Good handling ¹	1,087.0	28.0	434.3	643.5	27.3	416.5	1,730.5	27.8	850.8
Consumer services ²	462.9	11.9	218.1	862.2	36.6	527.0	1,325.1	21.3	745.1
Information services ³	734.8	18.9	410.0	424.3	18.0	338.6	1,159.1	18.5	748.6
Other	122.5	3.2	-115.9	87.2	3.7	78.3	209.7	3.4	-37.6
Total	3,879.7	100.0	639.2	2,353.3	100.0	1,374.0	6,232.9	100.0	2,013.2

Source: Oomens & den Bakker, 1994

¹Goods handling: wholesale trade, retail, transport

²Consumer services: hotel and catering, public health, education, housekeeping

³Information services: publishing, art production, banking and insurance, public administration

Since the sixties the Dutch economy became a strong service economy. In international perspective the economy is based on trade services and transportation ('The Netherlands, Gateway to Europe=). On the interior market the prosperous development of the welfare economy pushed up the employment in retail services and consumer services. In both sectors there is a relatively high proportion of part time jobs, filled in by women. As a result half of the Dutch employment belongs to the goodshandling and consumer service industries. Although these service industries are overrepresented in cities, the link between urbanisation and employment distribution became weaker. Transportation and wholesale services show a spatial shift towards regions outside the cities and mainports like the airport Schiphol and the harbour of Rotterdam. Retail services did follow the dispersed population towards the suburban locations.

Despite the ongoing spatial deconcentration of total employment most of the cities in the Netherlands are still important centres of employment. Nearly all the polycentric cities show an employment rate (jobs/labour population) above 1 (table 2). This means that in these cities there are more jobs than labour population. The relative fast growing employment in the information services supports the urban economy in the Netherlands. Most of the Dutch cities show an overrepresentation of employment in information services (see table 2).

Table 2 Employment characteristics of polycentric urban nuclei in the Netherlands*

Total employment			Concentration of specialised employment	
N. of	Employment	Growth	Information	High qualified

	jobs 1997 (x1,000)	rate 1997	1993- 1997 %	Services 1997	1994
Amsterdam	406.0	1.22	11.3	1.58	1.34
Amstelveen	34.9	1.01	18.0	1.76	1.18
Haarlemmermeer	95.6	1.71	16.6	0.81	1.02
Zaanstad	53.1	0.84	7.7	0.85	0.87
Haarlem	62.5	0.91	5.9	1.28	1.11
Hilversum	44.9	1.25	14.8	1.01	1.18
Leiden	50.5	0.94		1.07	1.61
			7.9		
's Gravenhage	206.8	1.07		1.84	1.41
			4.7		
Delft	45.3	1.06		1.17	1.74
			7.3		
Rotterdam	305.7	1.26		1.28	1.08
			1.7		
Dordrecht	49.6	0.97		0.98	0.83
			9.7		
Utrecht	175.6	1.54	10.5	1.54	1.47
Amersfoort	55.4	0.96		1.31	1.20
			10.8		
Apeldoorn	70.8	1.04		1.39	1.20
			11.3		
Arnhem	81.4	1.38		1.68	1.25
			8.2		
Nijmegen	75.4	1.17		0.96	1.31
			6.3		
's Hertogenbosch	79.9	1.38		1.30	1.11
			19.4		
Eindhoven	124.3	1.43		1.17	1.38
			13.0		
Tilburg	87.3	1.08		1.04	1.00
			10.4		
Breda	76.9	1.10		1.16	0.47
			6.4		
Groningen	98.1	1.26		1.29	1.38
			6.6		
Enschede	60.3	1.02		0.98	0.93
			6.7		
Maastricht	61.1	1.18		1.06	1.23
			10.9		
Heerlen	44.7	1.17		1.43	0.95
			2.8		
Totaal	2,445.9	1.24	8.7	1.18	1.24
Rest of the Netherlands	3,621.9	0.77	11.1	0.87	0.83

Source: CBS/REJ & EBB

* Location quotient (in relation to the share of the employment in the Netherlands)

The specialised economic function of large cities becomes more clear if we do not use figures about employment for the information services in general, but instead use the more specified figures about employment in the advanced producer service industries (computer services, law and economic services and technical consultancy). The growth of employment in this very knowledge intensive sector is twice as high as in the total service sector. Between 1993 and 1997 the number of jobs in this sector in the Netherlands increased from 233.600 tot 314.200 (35%). Unfortunately, at the city level there are only figures for the four largest cities available (table 3). In these four largest cities the number of jobs in the advanced producer services (APS) doubled over the period 1993-1997. Especially the cities Utrecht and The Hague show a high overrepresentation of employment in advanced producer services. The city region of Utrecht seems to be the strongest performer for this sector.

Table 3 Concentration of employment in advanced producer services in the four largest city regions in the Netherlands, 1997 (x 1,000 jobs)

	Cities		Surrounding		Total city region	
	N. of jobs	L.C.	N. of jobs	L.C.	N. of jobs	L.C.
Amsterdam	29.9	1.12	13.3	0.84	43.2	1.02
Utrecht	17.2	1.60	27.8	1.51	45.0	1.54
Rotterdam	19.6	1.07	10.3	0.86	29.9	0.99
The Hague	14.2	1.33	13.4	1.18	27.6	1.26

Source: CBS/REJ

L.C.: Location Quotient (in relation to the share of the total employment in the commercial service sector)

Besides for information services and the advanced producer services, cities are perfect locations for high qualified employment (table 2). Half of the high qualified jobs in the Dutch economy is located in the 24 urban nuclei which as a group represent 40% of the total employment in the Netherlands. The concentration of qualified work is the highest in the 4 largest cities, with the exception of Rotterdam, and in the middle-sized university cities like Leiden, Delft, Nijmegen, Eindhoven and Groningen. High qualified work is underrepresented in traditional manufacturing cities like Zaanstad, Dordrecht, Breda, Enschede and Heerlen. Although Dutch cities have lost a lot of manufacturing employment in general, they remain centres of management and qualified staff personnel in this sector. In absolute numbers of jobs the capital cities of Amsterdam, the international harbour city of Rotterdam and the city of Eindhoven (in 1994 still the location of the headquarter of the Philips company, now shifted towards the city of Amsterdam) are the main centres of qualified manufacturing employment in the Netherlands. Large cities are also primary locations for qualified jobs in the commercial service sector. Especially the city of Amsterdam, the governmental city of The Hague and the city of Utrecht (centrally located within the Dutch market) are foci of managerial functions in the commercial service sector. The non-commercial service industry contributes also to the urban concentration of professional employment. This is because over 30% of the jobs in this sector is highly qualified. Nevertheless highly qualified jobs in this sector are located in cities as well as in suburban or even rural areas. In general terms it seems that de-concentration of employment mainly applies to the middle ranged and lower functions.

The urban economic pattern of the Netherlands develops as a result of the combined effects of regional dispersion and urban specialisation of employment. Over the last years the cities undergo a selective socio-economic evolution towards a stronger presence of higher qualified employment, in a broad spectrum of economic activities, while medium skilled and low skilled employment, particularly in sectors as manufacturing and goodshanding, has left to other regions and countries. To interpret these changes one has to look at the whole system of cities. Agglomeration economies are still observable within the polycentric urban system of the Netherlands, but one has to investigate them in a broader perspective than in each of the urban centres separately. The economic urban landscape in the Netherlands seems to be transformed into a polycentric urban field, which reaches over the boundaries of the Randstad.

This polycentric urban system can offer several economic advantages. One of the advantages might be that the spatial economy can evolve along relatively free locational lines. Nevertheless, spatial policy makers and physical planners in the Netherlands have a strong preference to persuade firms to locate within or in the direct neighbourhood of cities to revitalise the city economy in a more or less natural way of urban economic evolution. Another advantage might be better job access than in mono-nucleated urban structures.

RESIDENTIAL LOCATION, COMMUTING TOLERANCE AND JOB ACCESS

Job access is determined by the location of the residence in relation to locations of employment opportunities and by individual commuting tolerance. Processes of deconcentration and specialisation have caused the spatial distribution of employment opportunities in the Netherlands to change in the past few decades. The Randstad, however, still remains dominant within the national urban structure and contains the bulk of national employment: 45% of total employment in the Netherlands. Because larger cities increasingly specialise, it is expected that job access for specific levels of employment or economic sectors, differs greatly in the Netherlands. One would expect that job access is highest in the city centres as most of the employment is still concentrated in or close to the cities. In case of a polynucleated pattern of urbanisation in which various 'labour islands' are located close to one another, a different pattern might show up. Given an acceptable commuting distance, the suburban areas in between two cities will give access to the employment opportunities in both cities. In this paragraph it will be tested whether residents of cities in polynucleated regions still have the highest level of job access, as opposed to suburban residents.

Theoretically, the residence is the starting point for individual spatial labour market behaviour. Therefore, determining individual job access should start from the residence. In this paper, as a proxy for residential locations, very small administrative regions are used: the almost 4000 four-digit Dutch postal code areas. The size of the potential labour market, which can be reached from these postal code areas, is determined by commuting tolerance. People differ strongly in the time they want to spend on commuting, but for the purpose of this paper a general commuting tolerance of 30 minutes is used. In the Netherlands, 80% of the working population commutes less than 30 minutes one way.

The data on the spatial distribution of jobs in the Netherlands is taken from a unique data set: the National Information System on Employment¹ (LISA). This is a registration of nearly all establishments in the Netherlands, including government and other non-commercial organisations. An establishment is defined as an individual plant, store or office; multi-establishment firms have separate listings for each establishment. The data set includes information on total employment per establishment, type of economic activity and the address

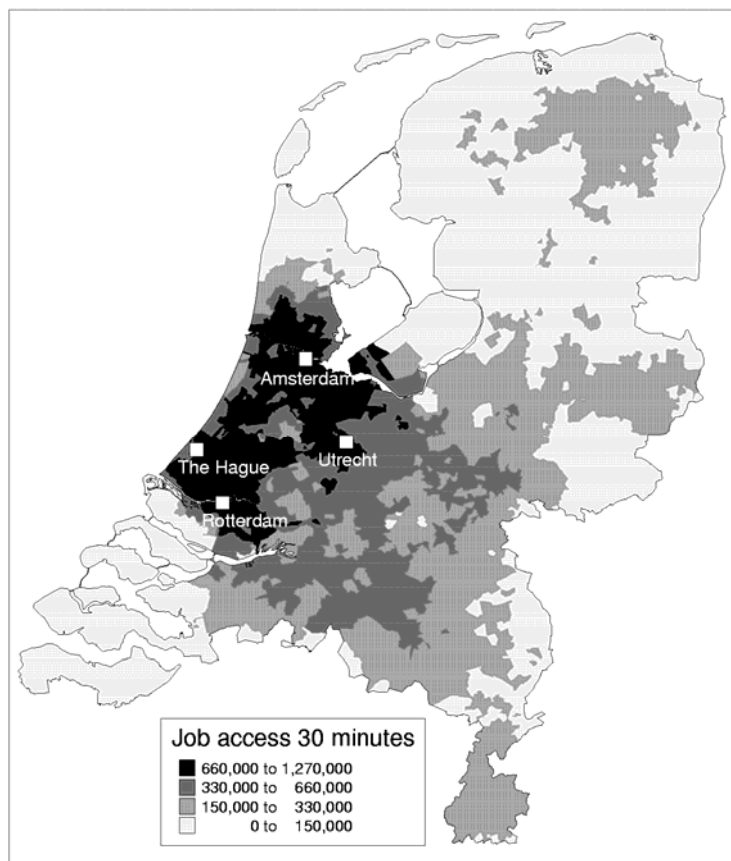
¹ The LISA data sets have been obtained from the RIVM, Bilthoven, for the 'Ruimtescanner' project.

of each job site. To estimate job access on the basis of the LISA data set, all establishments are geo-coded to a postal code area using work site addresses. Data was available for 1991 and 1994. Since the 1994 data set does not cover the whole Netherlands, additional data is used from the 1991 data set for the provinces of Noord-Holland and Zeeland. Additional data on job levels is taken from the Dutch Labour Force Survey (EBB 1994, 1995 and 1996), held every year by Statistics Netherlands.

Job access was estimated in a two step process. In the first step travelling times between postal code areas were calculated. For the purpose of this paper travelling times by car over a road network were used. The road network includes data on average driving speeds per road segment. With the software package FLOWMAP (De Jong et al., 1998) a matrix was constructed with travelling times by car from the centroid of each postal code area to all other postal code areas over the road network. In the second step, FLOWMAP identified for each postal code all other postal codes whose centroids are within 30 minutes travelling time over the road network by car (a so-called proximity count) and added up all jobs within this area. This process was done for all of the almost 4000 postal code areas in the Netherlands. The result is a variable which measures job access at the level of four-digit postal codes with a unique value of job access for each postal code area.

In figure 1 job access has been mapped for all jobs. Despite the deconcentrated pattern of employment there are large differences in job access in the Netherlands. From locations in the Randstad up to a million jobs can be reached within 30 minutes. The Randstad holds a dominant position in the Dutch economy; it contains the major concentrations of employment opportunities. In contrast, the northern and the southwestern part of the Netherlands have job access below 150,000 jobs. The map clearly shows the influence of the polynucleated metropolitan structure of the Randstad on job access. In the Randstad, four major urban concentrations of employment opportunities - Amsterdam, The Hague, Rotterdam and Utrecht - are located in close proximity of each other. Because of this proximity, the locations in between the four main cities have good job access. From these locations several concentrations of employment can be reached within 30 minutes.

Figure 1 Job access, 30 minutes



As was stated before, jobs by professional level and economic sector are not evenly spread over the country. It has been mentioned that in urban regions, especially in the Randstad, a trend of specialisation towards advanced producer services and professional, high level jobs can be seen. It is, therefore, expected that on a national scale the employment structure of jobs within reach will differ strongly. Because not all jobs are equally suitable for an individual with a certain level of education, this means that depending on your level of human capital, some locations are more favourable than others. To illustrate this, a location coefficient is mapped for access to jobs which require a higher educational level, and jobs in the advanced producer services (figure 2 and 3). The location coefficient shows whether jobs on this level or in this sector are over or underrepresented in the total amount of jobs within reach from each postal code area, compared to the national share of these jobs. Figure 2 shows that jobs requiring a higher educational level are clearly overrepresented in the total amount of jobs within reach from locations in the Randstad as a whole and especially from locations in the Northern wing of the Randstad (city regions of Amsterdam and Utrecht). Jobs in the advanced producer services are over represented in the total amount of jobs within reach from locations in and around the city of Utrecht (figure 3).

The maps show large differences in job access within the Netherlands. The four large cities in the Randstad and locations in between these four cities show the highest job access. Moreover, the Randstad is a favourable place for access to high level and specialised jobs. Based on theory it is expected that people living in these 'high-job-access locations' show the least human capital related migration.

Figure 2 Job access, high level jobs

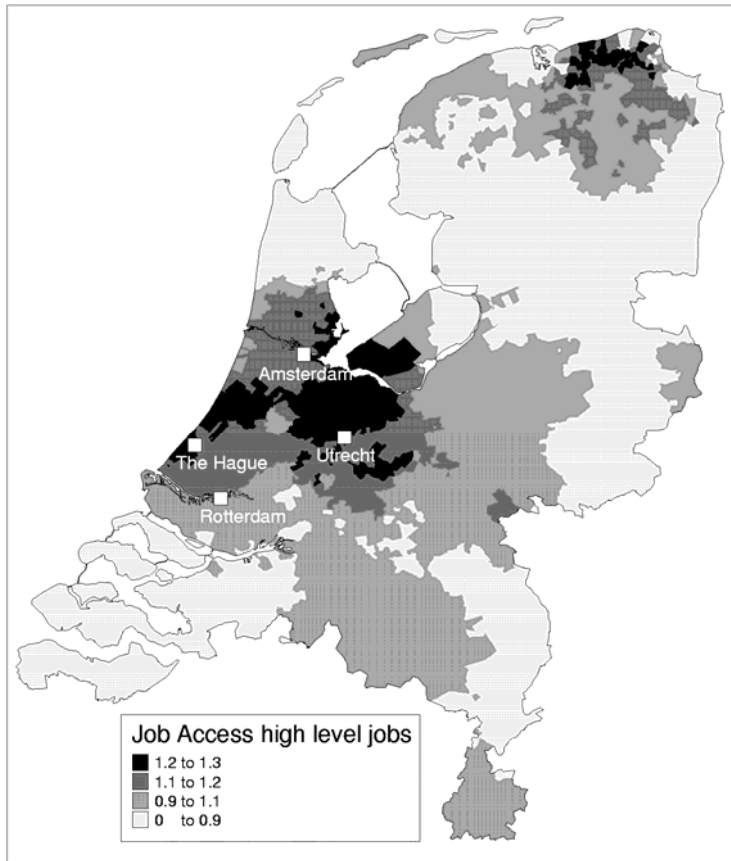
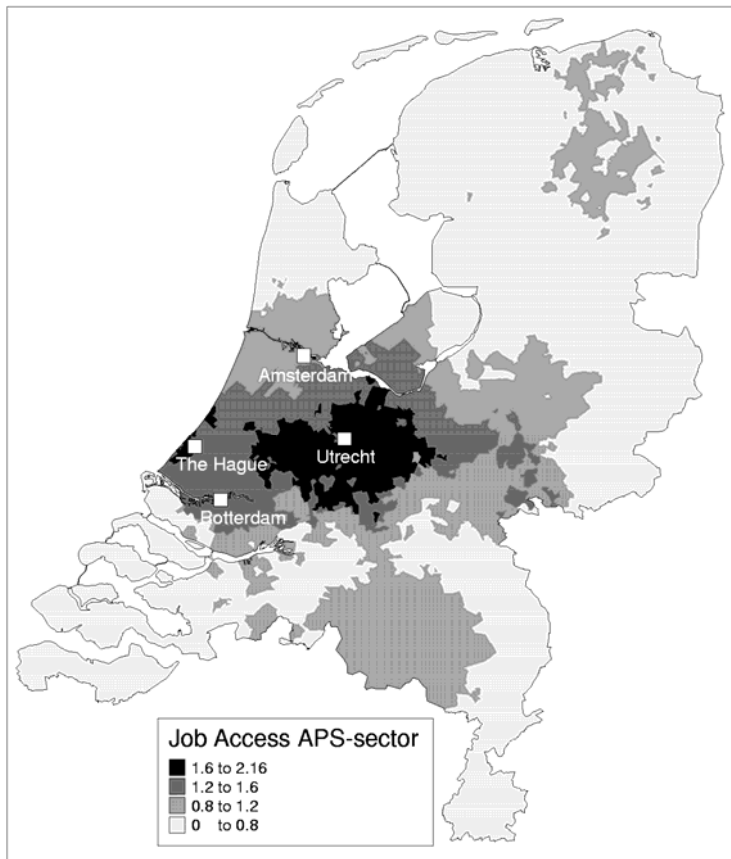


Figure 3 Job access Advanced Producer Services



HUMAN CAPITAL RELATED MIGRATION

Both job related migration and education related migration are analysed simultaneously as human capital related migration². The idea behind this is that education related migration is a ‘filtering process’, which precedes job related migration. Of all movers in the age group 18-24 years, 5% moves for reasons of work and 14% moves for reasons of education. Young people move out of regions with low job access because these regions have less institutes for higher education. Once situated in a region with high job access after their studies, there is less need to move for a job.

Migration is determined by both individual and context characteristics. To isolate the influence of job access on human capital related migration a multivariate analysis is used with job access as an independent variable. First, attention is paid to data and methodology, second, bivariate results are presented, and third, the results of the multivariate analysis are discussed.

Data and methodology

The data used were taken from the Housing Demand Survey (Woning Behoeft Onderzoek) conducted in 1990 by Statistics Netherlands (CBS) among a sample of some 54.000 individuals. The WBO is representative of the Dutch population aged 18 and over and not living in institutions. The data set includes detailed information on individual and household characteristics and on present and past location of residence. For the analysis all respondents between 18 and 55 years old were selected. The research population consists of all respondents who have *not* moved in the four years before the interview and all respondents who did move for reasons of work or education in this four-year period. People who moved for other reasons are not included in the analysis. The dependent variable in the analysis indicates whether people moved for human capital related reasons. A suitable technique to predict such a binary dependent variable from a set of independent variables is logistic regression. In logistic regression it is possible to estimate the probability of moving residence for human capital related reasons from a set of independent variables.

Five independent variables are included in the analysis: household situation, age, educational level, region of residence and job access. The household situation refers to the situation before the move for movers and the situation at the moment of the interview for non-movers. Age and educational level refer to the moment of the interview. The regional variable and the job access variable refer to the situation before the move for movers and at the situation at the moment of the interview for non-movers. Job access is a continuous variable (which is mapped in figure 1) divided by 100,000. The average job access over the Netherlands is 460,000 jobs within 30 minutes.

Results

Table 4 shows the bivariate relation between several variables and human capital related migration. According to theory it can be expected that people living on their own move more often than people living in couples. Singles are less ‘tied’ and are, therefore, more free to move for their working career. The results confirm this hypothesis. Children living with their parents (household members in table 4) have the lowest probability to move. The human capital theory predicts the probability of human capital related residential mobility to decrease with age, because with age the pay-off period of migration costs gets shorter. In table 4 can be seen that indeed the probability to move decreases with age. Only the youngest age group shows a lower probability than expected. The human capital theory also predicts that

² Readers who are interested in separate analysis for job related migration and education related migration are referred to the appendix.

especially the higher educated will move for jobs. Higher educated people change job less often than lower educated people, but when they do change job they will do so over relatively large distances because high level jobs have a low spatial density; a job change over a large distance often implies a residential move. As expected, the results show that the probability to move decreases with decreasing educational level.

Table 4 Percentage human capital migration

Household position	Single	Couple	Hh-member	
	24.3%	5.6%	2.9%	
Age	18-24 year	25-34 year	35-44 year	45-54 year
	9.8%	10.4%	4.6%	1.9%
Education	University	Polytechnic	Middle	Low
	16.3%	11.1%	7.8%	2.7%
Region	Periphery	Halfway	Randstad	
	7.0%	6.5%	5.3%	
Job access	0-150,000	150,000-330,000	330,000-660,000	660,000-1,270,000
	7.6%	6.7%	5.8%	5.3%

It is expected that regional variation in human capital migration exists. In the central metropolitan area of the Randstad migration will be low. Migration will be higher with increasing distance from this area. The Netherlands has been roughly divided in three regions (see figure 1): the Randstad with the highest job access, a halfway zone and a peripheral region with the lowest job access. The results show that indeed people living in the peripheral region show a higher probability of human capital related migration than people living in the Randstad. To test whether these regional differences in labour related migration can be fully explained by job access, as was stated in the introduction of this paper, a multivariate regression technique must be used. This way, the effect of job access on the probability to move for human capital related reasons can be isolated. The results are presented in table 5. In model 1 the regional variable is included in the analysis and in model 2 both region and job access are included.

The multivariate results for household position, age and education are roughly the same as the bivariate results. In the multivariate analysis, the age effect is almost perfectly linear. The probability of human capital related migration sharply decreases with age. The difference with the bivariate analysis is caused because now the effects are controlled for household position. In model 1, the variable region performs as expected: people living in the Randstad show the lowest probability to move and people living in the periphery show the highest probability to move. Conceptually these regional differences in the probability to move can be ascribed to regional variation in job access. Entering job access in the model as an independent variable can test this hypothesis. The results are shown in model 2. The effects for household position, age and education hardly change. Striking, however, is that the regional effect disappears completely and job access ‘takes over’ its explanatory power. With increasing job access the probability of human capital related migration decreases. As expected, regional differences in human capital related migration can be fully explained by variation in job access.

Table 5 Human Capital related migration

	Model 1			Model 2	
	B	R		B	R
Hhposition		0.1509	Hhposition		0.1542
Single	0.0454		Single	0.0286	
Couple	-0.9116*		Couple	-0.9216*	

Hh-member	0.8664*		Hh-member	0.8930*	
Age		0.1864	Age		0.1865
18-24	1.2248*		18-24	1.2204*	
25-34	0.4356*		25-34	0.4404*	
35-44	-0.4099*		35-44	-0.4092*	
45-54	-1.2505*		45-54	-1.2516*	
Education		0.1943	Education		0.1964
Low	-1.0251*		Low	-1.0364*	
Middle	-0.1015*		Middle	-0.1094*	
Polytechnic	0.3927*		High	0.4002*	
University	0.7339*		University	0.7456*	
Region		0.0689	Region		0.0000
Randstad	-0.2962*		Randstad	0.0256	
Halfway	0.0925		Halfway	0.0152	
Periphery	0.2037*		Periphery	-0.0408	
			Job Access**		-0.0450
			x100,000	-0.0937*	
Constant	-2.5475*		Constant	-2.1347*	
Initial -2 Log Likelihood: 13031			Initial -2 Log Likelihood: 13031		
Improvement: 1560			Improvement: 1588		
* significant at the 0.05 level					
**average job access in the Netherlands = 460,000					

The analysis confirmed the hypothesis that good job access decreases the probability of job related migration. The effect of job access even appeared to be significant after controlling for the effects of individual characteristics like age, education and household situation. This is an important indication that job access, as a context variable, indeed plays a role in job related migration. Future additional research should take in consideration that not all jobs are equally suitable. Because people differ in their level of education, different job access variables should be constructed on the basis of job level. Such research might become more important when the present trend of reconcentration of high paid, high level, and highly specialised jobs in city regions continues. If this is the case, job access variables may become even more important for the higher educated.

CONCLUSIONS

The Dutch economic urban landscape shows a polynucleated structure as was already predicted by Hall in the sixties. However, the current picture differs from the future image he has given. The polynucleated structure does not only count for the Randstad but it encloses a larger part of the Netherlands. Nevertheless, the Randstad still remains dominant within the national urban structure. Within this polynucleated structure the larger cities are becoming centres of specialised employment, for instance jobs in advanced producer services and high qualified work in general. Another difference with Hall's future image relates to the function of cities as the most desirable residential location for labour population. Job access, at the individual level, is determined by the location of the residence in relation to locations of employment opportunities and by individual commuting tolerance. Under condition of an acceptable commuting tolerance of 30 minutes, it turned out that even in a deconcentrated, polynucleated urban system as in the Netherlands, job access differs strongly between residential locations. Not only the cities, but also the suburban locations between cities have a

high level of job access. This is particularly true for specialist jobs in the knowledge intensive information economy, which are growing fast in the Netherlands.

Good job access from the residence increases the probability that someone finds a suitable job at relatively short distance. This means there is less 'need' for human capital related migration from locations with good job access. In the paper, the hypothesis was tested that regional differences in human capital related migration can be fully explained by variation in job access. The bivariate analysis showed that human capital related migration is lowest in the Randstad and highest in the more peripheral regions. To test whether these regional differences can be explained by regional differences in job access, a multivariate regression model has been used. The results show that not region explains the variation in migration, but regional differences in job access. The job access effect appeared even to be significant after controlling for effects of individual characteristics like age, education and household situation. This is an important indication that job access as a geographical context variable plays an important role in human capital related migration.

In the analysis only total job access was looked at. Future additional research should take in consideration that not all jobs are equally suitable. Of particular interest for future research is the migration behaviour of high qualified workers and the effect of access to high qualified and specialised jobs. There seems to be a mutual spatial connection between high qualified work and high qualified workers. Companies and institutions with a lot of high qualified work are attracted by the urban concentration of young, high educated workers. The workers, on their turn, are attracted by cities and their surroundings because of good access to suitable jobs. There is even a 'filtering process' of education related behaviour which precedes job related migration. Many young people move to the larger cities to study at polytechnics and universities. After finishing their education their existing urban residential location is a favourable starting point for access to qualified jobs. After a couple of years many of them will choose a location for living and working, which maximises their consumption of housing as well as the utilisation of their human capital. Then suburban locations in between the larger cities are attractive places to live. From these locations they have good job access and housing is not so expensive as is the case in mono-centric cities like London or Paris. It is expected that because the total amount of high qualified employment will increase fast, the pressure on the urban housing market will increase as well. In this situation it will be very difficult for physical planners in the Netherlands to accommodate the housing demand of this growing part of the labour population within the concentrated context of existing cities. In the Netherlands we have to accept the polynucleated urban structure, although this structure produces problems in relation to the compact shape of urbanisation, preferred by policy makers.

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APPENDIX

Table 6 Job related migration

	Model 1			Model 2	
	B	R		B	R
Hhposition		0.1233	Hhposition		0.1258
Single	0.2943*		Single	0.2788*	
Couple	-1.1239*		Couple	-1.1328*	
Hh-member	0.8296*		Hh-member	0.8540*	
Age		0.1761	Age		0.1766
18-24	0.5225*		18-24	0.5187*	
25-34	0.6582*		25-34	0.6623*	
35-44	-0.1637*		35-44	-0.1633*	
45-54	-1.0170*		45-54	-1.0177*	
Education		0.1737	Education		0.1759
Low	-0.8583*		Low	-0.8687*	
Middle	-0.1665*		Middle	-0.1751*	
High	0.4451*		High	0.4519*	
University	0.5797*		University	0.5919*	
Region		0.0590	Region		0.0000
Randstad	-0.2631*		Randstad	0.0356	
Halfway	0.0848		Halfway	0.0134	
Pheriphery	0.1783*		Pheriphery	-0.0490	
			Job Access**		-0.0408
			x100,000	-0.0869*	
Constant	-3.0349*		Constant		
Initial -2 Log Likelihood: 10174			Initial -2 Log Likelihood: 10174		
Improvement: 1022			Improvement: 1041		
*significant at the 0.05 level **average job access in the Netherlands = 460,000					

Table 7 Education related migration

	Model 1			Model 2	
	B	R		B	R
Age		0.0691	Age		0.0683
18-19	-0.1369		18-19	-0.1368	
20-21	0.3039*		20-21	0.3016*	
22-24	-0.1670*		22-24	-0.1648*	
Education		0.2621	Education		0.2631
Low	-1.7937*		Low	-1.8024*	
Middle	0.0962		Middle	0.0927	
High	0.3635*		High	0.3696*	
University	1.3340*		University	1.3401*	
Region		0.0705	Region		0.0000
Randstad	-0.3248*		Randstad	-0.0535	
Halfway	0.0790		Halfway	0.0144	
Pheriphery	0.2458*		Pheriphery	0.0391	
			Job Access**		-0.0300
			x100,000	-0.0804*	
Constant	-2.4550*		Constant	-2.1128*	
Initial -2 Log Likelihood: 2953			Initial -2 Log Likelihood: 2953		

Improvement: 323	Improvement: 328
*significant at the 0.05 level **average job access in the Netherlands = 460,000	