THE RANDSTAD AS A NETWORK CITY

Jan Ritsema van Eck
Femke Daalhuizen

+31 – 703288755 / +31 – 700328799
ritsemavaneck@rpb.nl / daalhuizen@rpb.nl

Netherlands Institute for Spatial Research
P.O.Box 30312,
2500 GH The Hague
The Netherlands

Abstract

World cities are those cities which have the highest ranking on the most activities. In this ranking of world cities, the Randstad is often mentioned. But does the Randstad function as one world city? If so, this implies that the four cities which form the Randstad each have a specialisation and interact with each other by means of flows of people, goods and information. This complementarity offers the requested mass and diversity to perform as one world city. But, how can this complementarity be measured? In this paper, we explore the possibility to measure complementarity by looking at asymmetric flows of people, travelling between urban regions for various motives.

Key words: Randstad, Network city, Specialisation, Complementarity, Travel behaviour

Introduction

Randstad Holland, the most urbanised area in the western part of the Netherlands, is one of the seven World Cities that were described in Peter Halls famous study of that name. World cities are those cities which have the highest level (in terms of both quantity and quality) of internationally oriented activities. In this ranking of world cities, the Randstad is often mentioned as an example of a polycentric metropolis. But does the Randstad function as one world city, rather than a conglomerate of medium-sized urban regions in close proximity to each other? The network city is supposed to be more than the sum of the constituent urban regions. This implies not only specialisation between these urban regions, but also complementarity and, as a result of this, a high quality (metropolitan) environment for residents, visitors and business. Clearly, the four main urban regions of the Randstad show some degree of functional specialisation. In this paper, the main focus will be on the complementarity. We propose to measure complementarity by analysing flows of people, goods and/or information, specifically focussing on the asymmetric flows, against the background of functional specialisation. Some results are presented for the Randstad Holland as well as some other polycentric urban networks, which are discussed in the context of the debate about the Randstad as a Network City.

From central places to polycentric urban regions

Until the last half of the twentieth century, vertical relationships generated the hierarchical ranking of world cities (Christaller 1933). But with the emergence of technical opportunities and prosperity, activities became more footloose. As a result cities have horizontal relationships as well. *We find the case of multiple hierarchies: city A may rank higher than city B with regard to variable x while the ranking is reversed with regard to variable z. We therefore have two central-place grids interfering with each other. Whether one place is more central to another may depend on the variables under consideration* (Jaeger & Dürrenberger 1991, p.122). In fact, this development illustrates the spatial outcome of our current network society, driven by a 'space of flows' (Castells 1998). With this space of flows polycentric urban regions or network cities emerged, besides the existing monocentric cities. Cities participating in these network cities or polycentric urban regions are within reach of a one our drive of each other, since accessibility is a precondition for generating relationships as described by Christaller (1933) and Jaeger and Dürrenberger (1991). Furthermore, a polycentric urban region consists of at least two cities, of which none is dominant over the other in terms of population, number of employees or firms (Bailey & Turok 2001,

Kloosterman & Lambregts 2001, Batten 1995). Moreover, in order to speak of a polycentric *urban* region, participating cities share more than economical space. The space of flows consists of people, goods and information. Cities of a polycentric urban region are united in their economical environment, living environment and touristic or recreational environment. When these aspects of the urban environment are taken into account, not all cities within each others reach of a one hour drive can be considered as polycentric urban regions. One example is the urban region of Edinburgh and Glasgow, so-called 'Central Scotland': *'yet, the region does not display the strong patterns of specialisation predicted by PUR theory...the region lacks a common cultural or political basis to identify it as a coherent PUR. While it has a strong external identity based on its physical geography, there is no unifying culture or shared identity among residents which is unique to the area'* (Bailey & Turok 2001, p.713).

In contrast, the Randstad is quite often mentioned as an example of a polycentric urban region, for example by Batten (1995) and authors of the special issue of Urban Studies (April 2001).

But these authors all struggle with the question why some cities in accessibility of each other are considered to be polycentric urban regions, such as the Randstad, and others are not, like Central Scotland. In other words, when do neighbouring cities form a polycentric urban region and how can this be measured?

Agglomeration economies, specialisation and relationship of complementarities

Why do polycentric urban regions emerge? Relationships between cities exist in the shape of flows of people, goods and information. Currently, the 'daily urban systems' exceed the urban boundaries. Quite often, citizens do not restrict their living environment to one city. While their home is located in one city, they work or follow an education in on other city. Furthermore, the economical environment of enterprises often exceeds the regional or even national boundaries, because suppliers and customers can originate from other parts of the country or the world. Moreover, visitors looking for various kinds of amusement, such as cinema's or theatres, expand their search to more than one place or to more places than the city where they live. For example, visitors of the North Sea Jazz festival in The Hague spend the night in Amsterdam and some Dutch people go (Christmas)shopping in London (Vromraad 2004, p.38).

This increase in 'daily urban systems', or in other words the enlargement of the economical, living and touristic environment, is caused by 'economies of scale' en 'economies of scope'.

Economies of scale are advantages that can be achieved by allocating similar or, on the opposite, dissimilar activities within each others neighbourhood and accessibility. The accessibility and close proximity decrease the cost of interaction and transaction. In turn, these lower costs reduce the effort of contact between firms or people and simplify the exchange of knowledge and information (Batten 1995, Lambooij 1998). Face-to-face contacts are necessary in generating enough trust and informal meetings in order to exchange knowledge and information. *Since such contacts, despite the fall of costs of other types of communication and exchange, are still particularly costly, clustering in space enables these firms to reap the benefits of scale without being too big themselves to hamper their flexibility and their innovative potential. Being located in close proximity, furthermore, reduces the formal and informal costs of matching demand and supply of adequate labour and the costs of workers moving between firms in the same area* (Kloosterman & Lambregts 2001, p.721). In fact, the same argument goes for inhabitants and visitors of the polycentric urban region. The accessibility and availability of jobs and recreational or touristic facilities make it easier to switch jobs or combine various recreational activities in one trip (Van Ham 2002, Kleyn & Louter 2003). Therefore, people benefit from the proximity and accessibility of several cities.

Economies of scope point out the opportunities for diversification that come along with economies of scale. For example, the frequent exchange of knowledge and information and the jobswitching by employees increase the possibilities for innovation and growth of firms (Lambooij 1998, Kleijn & Louter 2003). Therefore, the unified economical environment, living environment and touristic environment of polycentric urban regions brings along the benefit of diversification (Kleijn & Louter 2003).

Currently, the developments in transport and technology enables polycentric urban regions to create the same economies of scale and economies of scope, the so-called agglomeration economies, as monocentric cities (Batten 1995, Lambooij 1998, Kloosterman & Lambregts 2001). Subsequently, the present mass and diversity in both consumer and producer activities allows each city within the polycentric urban region to specialise in those activities in which they already have a comparative advantage (Bailey & Turok 2001, Porter 1990). As a result, relationships of complementarities are generated, because each city can focus on offering a specific economical, touristic or living environment, while together they offer a complete urban environment of high quality. Precondition for the emerge of relationship of complementarities, based on agglomeration economies and specialisation, is the close proximity and accessibility of participating cities , because the polycentric urban region forms

a 'daily urban system' for its citizens, visitors and firms (Kloosterman & Lambregts 2001, Bailey & Turok 2001).

Operationalisation

Since it is clear how agglomeration economies and specialisation lead to relationships of complementarities between cities, the question raises how these relationships between cities can be measured. And, moreover, when are the relationships of complementarities strong enough to consider the participating cities as a polycentric urban region? So far, the labour market is a frequently used indicator in order to measure relationships between cities, as is illustrated by the following quote: *'All world cities are of a uninodal structure of huge metropolitan areas growing around a major business centre. The Randstad, in contrast, is of a multinodal structure with a large number of business centres dispersed in all its major cities. Thus it will be essential to prove empirically that the Randstad is operating as an integrated economic unit, achieving agglomeration economies and positive externalities through a well-developed transport system and commuting network, making the Randstad a unified spatial labour market'* (Sachar 1994, p.383). Unfortunately, the use of the labour market as an indicator involves two problems. First, there is the issue to what extent the labour market should be unified in order to acknowledge the existence of a polycentric urban region. For example, Dieleman and Faludi (1998) claim labour market analyses show that the Randstad is a polycentric urban region, while Lambooy doubts the existence of the polycentric urban region Randstad on the same grounds in his article in European Planning Studies (1998). So: *'The issue of physically separate but interacting settlements raises a further definitial issue of how interaction should be measured and what minimum thresholds should be applied for a group of cities to qualify as a PUR. A wide range of measures are used in practice, labour market flows being the most common, and no clear thresholds have been defined...'*(Bailey & Turok 2001, p.699). Secondly, the analysis of labour markets does not offer a complete insight in the environment of polycentric urban regions for citizens, visitors and firms. Consumers of the urban environment not only work there, but live and spend their leisure time there as well. *'Clearly, the context for residential decision-making in a PUR [polycentric urban region] is very different from that in the MC [monocentric] model. In the pure version of the latter, all residents have the same single reference point for journeys from their homes. By contrast, in the pure PUR with each of its multiple centres having a relatively specialised role, people will need to travel to different places to reach different types of job and amenity. They will therefore try to locate their homes according to*

the importance that they attach to these various types of facilities' (Champion 2001, p. 665). Therefore, in analysing flows of people between complementary cities it is necessary to involve not only labour-related flows of traffic, but also flows of visitors to various types of facilities, such as shops, educational institutions and recreational and touristic attractions. And, since the preference for specific characteristics of facilities is clearly correlated with social status, income and education, it is also necessary to distinguish a number of different groups in this analysis.

Method

In this paper, we explore the development between the early 1990's and the early 2000's in relationship of complementarities between the urban regions of the Randstad, by analysing trips between urban regions for the purposes of work, shopping, education and recreation.

We do this for the aggregate population as well as for three educational groups: low (primary or elementary vocational education), medium (secondary or intermediate vocational education) and high (university). We prefer to use education over income because the effect of inflation complicates the construction of comparable income classes for different time periods.

As a background for the exploration of complementarities we need to have a picture of the specialisation of the urban regions. In this paper we do this by analysing the total flows to and from each urban region, or more precisely, the number of trip ends for each motive and each educational level. There are of multiple levels of specialisation. Relevant for this paper are specialisation in a specific type of activity or facility, and specialisation in activities of facilities (of a given type) for specific groups.

The specialisation in activities for specific groups is measured by the segregation index: a number between 0% and 100% that indicates the degree to which the distribution of a group over the urban regions differs from the distribution of the total population. In this study we apply this index not to numbers of people, but to numbers of trips starting or ending in an urban region.

For the exploration of complementarities we categorize the trips into three classes: internal trips (destination within the residential urban region), inter-urban trips (Home and destination in two different urban region within the Randstad) and other trips (either home or destination not in one of the nine urban regions of the Randstad). We discard the "other trips" in order to better focus on the complementarities between the Randstad urban regions. The inter-urban trips are of special interest in this study because they might indicate some degree of

complementarity between the urban regions. Between two urban regions, there will usually be trips in both directions. If the number of trips in one direction is significantly larger than in the other direction, this is a clear indication of complementarity. Apparently the destinations in one urban area are more numerous of more attractive than those in the other urban area, relative to the respective populations of both areas. If the numbers of trips in both directions are approximately equal, this may or may not indicate some form of complementarity. It may be the case that the destinations are specialised at some level that is not distinguished in our dataset, so that people that want to visit some specialised type of facility need to travel to the other urban region. Even though our dataset shows that facilities are present in both areas, the specialised type that the visitor is interested in is not present in his residential urban region. On the other hand, it may be that there is no relevant difference between the facilities in both urban regions but people choose to visit facilities in the other region for a variety of regions, for instance because they combine the visit with some others activities for which they do need to travel to the other region. Therefore in this study we will take the asymmetric flows (the net difference between the numbers of trips between two regions) as an indicator for complementarity, without assuming however that the absence of asymmetric flows implies that no complementarity is present.

Data

Before we can analyse specialisation and complementarity between the urban regions of the Randstad, we need to define these regions. The definition we have used is derived from the definition of urban regions used by Statistics Netherlands (which is based on housing and labour market criteria). Eight of the 22 Dutch urban regions so defined are considered to be part of the Randstad. We have added a ninth urban region (Hilversum) and added some municipalities to the other ones in order to get a continuous "ring" of urban regions as shown in figure 1. The Green Heart area in the centre of the Randstad Holland is not analysed here.

Figure 1: Study area

For our analysis we have used the Dutch travel behaviour survey (OVG) by Statistics Netherlands. This is a permanent survey, conducted in the period 1985 – 2003. Apart from a number of background variables at the level of the individual respondent (such as age, level of education) and at the household level (household size, number of jobs, household income, car ownership etc) this survey contains data about all trips that the members of the household have made during one day. For our analysis, we compare two periods which are ten years apart: a period around 1992 (1990 – 1994) and a more recent one around 2002 (2001 – 2003). We needed to take data for several years together in order to get sufficient numbers of cases per cell for some of the more detailed analyses. In the early 1990's the sample size of the OVG was smaller than in the years after 2000, therefore we needed five years around 1992 but only three around 2002.

For these periods, we have selected all trips to and from the nine urban regions of the Randstad with the following destination activities: work, shopping, education and recreation.

Results

In this section, we describe the results by theme. We will go rather deeply into the results for trips to work, and then describe some interesting results for the other motives (education, shopping, recreation) more briefly.

Work trips

Figure 2 shows the number of travel to work trips for each urban region. It is clearly visible that only the four largest urban regions (Utrecht, Amsterdam, Den Haag and Leiden) attract a net flow of workers living outside the region; the smaller regions have approximately a closed balance (Amersfoort and Hilversum) or have a net outflow of workers to jobs outside the region (Haarlem, Leiden and Dordrecht). Since all nine urban regions have a net inflow from workers living in the Green Heart and outside the Randstad, this means that there are significant net flows of workers living in the smaller urban regions and working in the four largest ones.
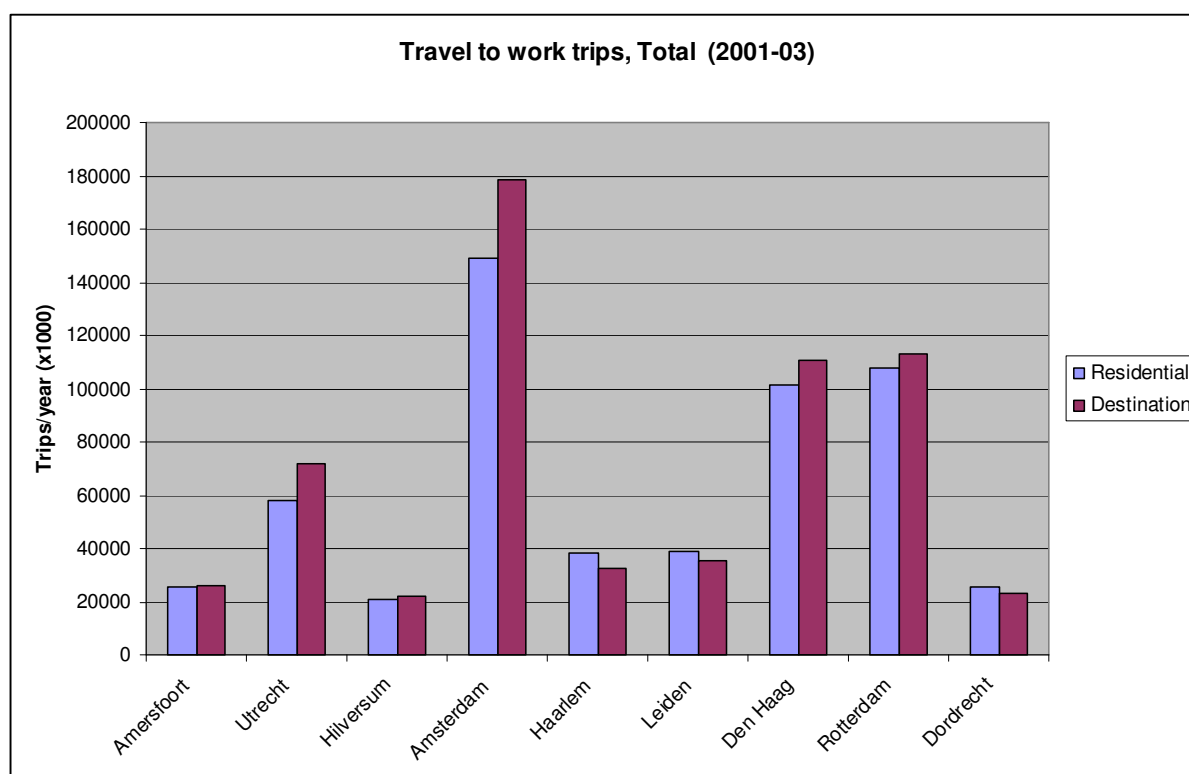

Figure 2: Total travel to works trips by urban region (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Table 1 shows the numbers of trips according to level of education. The segregation index shows that both the lower and the higher educational groups are spread more unevenly than the medium group. More specifically, the lower educational group are overrepresented in Leiden, Rotterdam and Dordrecht (the South Wing of the Randstad, with the exception of Den Haag) whereas the higher educational group are overrepresented in Utrecht, Amsterdam and Den Haag. However, the imbalance index shows a different picture: for the lower educational group the working population is rather well balanced with the number of jobs in all urban

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areas, whereas for the higher educational group there is a clear imbalance in Den Haag. Both in the working population and in the number of jobs this group is overrepresented in Den Haag, but much more so in the number of jobs. This is caused by the function of Den Haag as the seat of the Dutch national government, which also attracts large numbers of government-related agencies and institutes.

	Lower Education		Medium Education		Higher Education		Total	
	Res	Dest	Res	Dest	Res	Dest	Res	Dest
Amersfoort	7213	8239	9218	9340	8854	8350	25284	25930
Utrecht	14525	17707	18132	24386	25589	29648	58245	71741
Hilversum	5948	6275	7671	8317	7176	7277	20795	21868
Amsterdam	41908	49691	52242	63897	54631	64730	148781	178318
Haarlem	10798	10775	14814	12520	12598	9402	38211	32697
Leiden	13020	12486	13012	12478	12567	10225	38599	35189
Den Haag	30347	32440	36032	37706	34866	40800	101245	110945
Rotterdam	37853	38400	41121	42780	28762	31761	107737	112941
Dordrecht	9468	8632	10540	9296	5514	5453	25523	23381
Randstad	171080	184644	202782	220720	190557	207646	564419	613010
Segregation index	5%	5%	3%	2%	6%	6%		
Imbalance	5%		6%		8%		6%	

Table 1: Total travel to work flows, 2001-03, by urban region and educational level (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Figure 3 shows the result of this for the net flows between urban regions: Amsterdam, Den Haag and Utrecht attract large flows of workers living in the other regions. In the case of Amsterdam this concerns workers of all educational levels; in the case of Den Haag mainly highly educated workers; in the case of Utrecht mainly medium educated workers.

Table 2 shows the development of specialisation since the first half of the 1990's. The lower educational group was quite a bit larger then, but it was more evenly spread over the urban regions. In contrast the higher educational group was much smaller, but also more unevenly spread over the urban regions than it is now. Since then, jobs for lower educational groups have been replaced by jobs demanding a higher level of education everywhere, leading to a further concentration of the remaining low level jobs in those regions where they were overrepresented already. For the higher educational group the reverse process is visible: a growth of both the working population and jobs for this group everywhere has somewhat diminished the overrepresentation of this group in regions like Utrecht, Amsterdam and Den Haag. The imbalance index shows little change. In the largest regions, the number of jobs

requiring a higher educational level has grown faster than the working population in this category, leading to a slight growth of the imbalance.
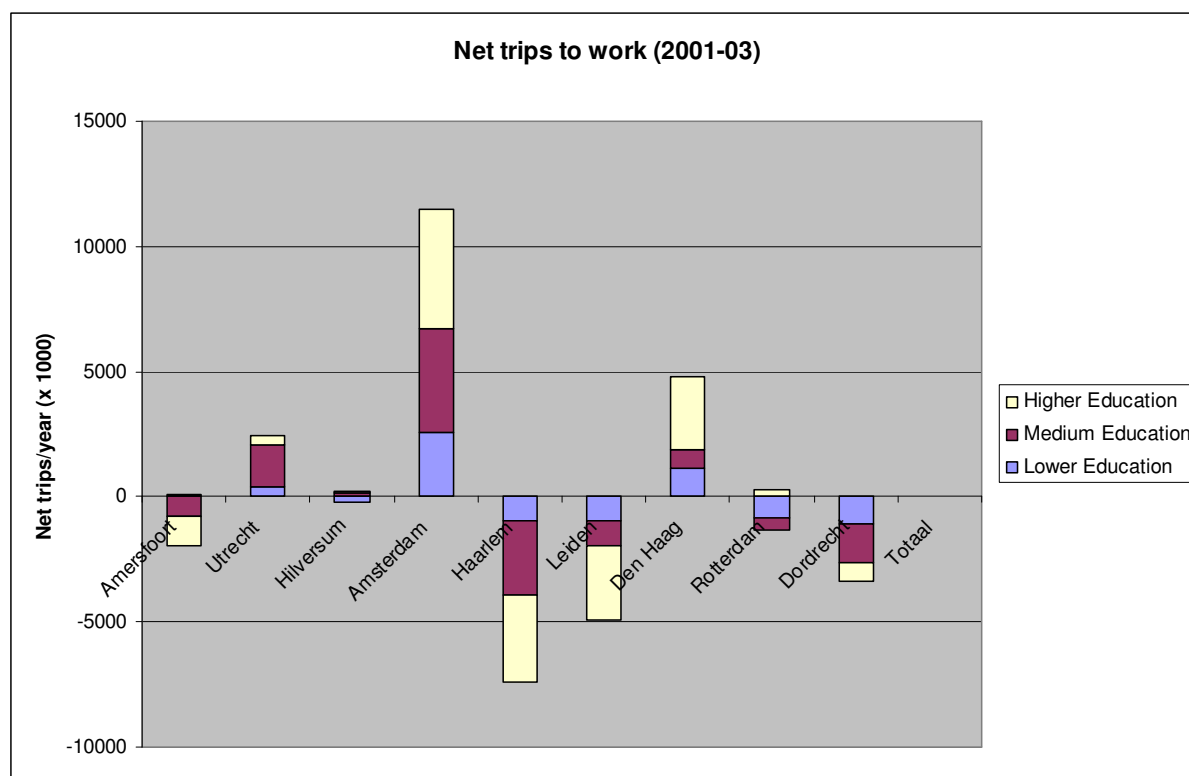

Figure 3: Net trips to work, by urban region and educational level (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

	Lower Education		Medium Education		Higher Education		Total	
	Res	Dest	Res	Dest	Res	Dest	Res	Des
2001-03								
Total flows	171080	184644	202782	220720	190557	207646	564419	613010
Segregation index	5%	5%	3%	2%	6%	6%		
Imbalance	5%		6%		8%		6%	
1990-94								
Total flows	235245	252751	171076	183799	126997	138041	533318	574592
Segregation index	3%	4%	2%	2%	8%	7%		
Imbalance	5%		6%		7%		5%	

Table 2: Development of selected indicators for specialisation in travel to work between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

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In the following analyses we excluded all trips to and from the Green Heart and outside the Randstad, in order to focus on patterns of specialisation and complementarity between the urban regions of the Randstad. Table 3 shows the percentages of trips categorized into internal, symmetrical and asymmetrical flows at the level of urban regions. Both asymmetrical flows into the region and out of the region are shown. The percentages are over the total number of trips starting in the region, so "Internal", "Symmetrical" and "Asymmetrical out" add to 100%. The tables show some interesting patterns. It's important to note that around 80% of all travel to work trips in the Randstad stay within the residential urban region. The percentage internal trips is larger for the largest urban regions. For most regions, the symmetrical flows form the second largest group. This is not the case for all regions however. For some educational levels, the asymmetric inflows in Utrecht, Amsterdam and Den Haag are of the same order as the symmetric flows; the asymmetric outflows from the smaller urban regions are in many cases larger than the symmetric flows. In most cases, either the asymmetric inflows or the asymmetric outflows are insignificantly small. This shows that generally, the urban regions have a clear function as either a net residential region or a net destination region. Exceptions are Hilversum and Rotterdam.

	Internal	Symmetrical	Asymmetrical in	Asymmetrical out
Amersfoort	70.3%	20.3%	1.0%	9.5%
Utrecht	81.4%	17.4%	5.8%	1.2%
Hilversum	65.6%	32.1%	2.5%	2.4%
Amsterdam	88.3%	11.6%	8.1%	0.0%
Haarlem	64.2%	14.8%	0.7%	21.0%
Leiden	69.4%	16.7%	0.6%	13.9%
Den Haag	86.0%	13.4%	5.4%	0.6%
Rotterdam	85.1%	11.4%	2.5%	3.5%
Dordrecht	69.1%	16.1%	0.0%	14.8%
Total	81.2%	14.3%	4.4%	4.4%

Table 3: Internal, symmetrical and asymmetrical travel to work flows by urban region, 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Table 4 shows the percentages of the same categories of trips summed over all urban regions, for different educational levels as well as for both time periods. The percentage of Internal trips is larger for the Lower Educational group and smaller for the Higher Educational group in comparison with both the medium group and the total average. The percentages of both symmetrical and asymmetrical external trips follow the reverse pattern. Interestingly, since

the early 1990's the percentage Internal trips has diminished somewhat (except for the medium education group) but so has the percentage Asymmetrical trips. Relations between the urban regions have become a little bit stronger in the sense that the travel to work flows between the regions have become more important. But they have clearly become more symmetrical, in the sense that in most cases these flows have become more balanced in both directions. As was argued above, this may or may not indicate a growing complementarity. In any case we can say that the asymmetric flows, which are a much clearer sign of complementarity, have not grown.

	Internal	Symmetrical	Asymmetrical in	Asymmetrical out
2001-03				
Lower Ed.	87.8%	8.3%	3.9%	3.9%
Medium Ed.	83.8%	11.5%	4.7%	4.7%
Higher Ed.	72.4%	21.4%	6.2%	6.2%
Total	81.2%	14.3%	4.4%	4.4%
1990-94				
Lower Ed.	88.9%	7.0%	4.2%	4.2%
Medium Ed.	83.5%	10.8%	5.6%	5.6%
Higher Ed.	75.7%	17.1%	7.1%	7.1%
Total	84.1%	11.0%	4.9%	4.9%

Table 4: Development of different categories of travel to work flows between urban regions, by educational level between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

In order to study the complementarities between individual cities, and get some picture of the resulting spatial structure, we need to look at the individual net flows between cities. We have not analysed these in detail yet; significance tests have not yet been carried out. Purely for illustrative purposes, we show some maps, showing the largest net flow in or out each urban region. Figure 4 shows the most important net travel to work flows for the lower educational level, and figure 5 shoes the same map for the higher educational level. First of all, it must be noted that these maps show that the largest complementarities are between neighbouring regions. This is of course not unexpected. In order to show complementarities over larger distances, for instance between the different "wings" of the Randstad, further analysis is necessary. Still, some interesting features can be pointed out. For instance, there seems to be an strong complementarity between Amersfoort and Hilversum, with highly educated workers living in Amersfoort and working in Hilversum, and workers with lower education living in Hilversum and working in Amersfoort. This can be explained at least in part by the presence
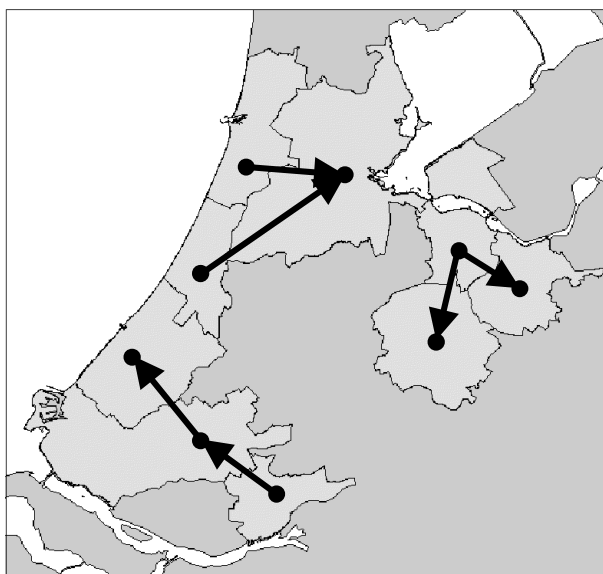
Figure 4: most important net travel to work flows, lower educational level, 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)
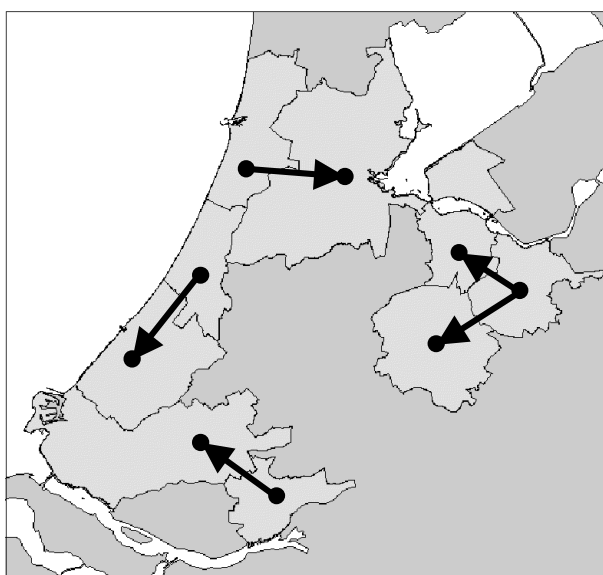

Figure 5: most important net travel to work flows, higher educational level, 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

of the large media-cluster in Hilversum, the seat of Dutch national television, attracting large groups of highly educated people in the creative professions. The explanation is not complete without looking at the housing market too. It seems that Hilversum provides more attractive housing for lower educational (presumedly lower income) groups whereas Amersfoort offers attractive large houses in green surroundings for highly educated (presumedly higher income) groups. Also interesting is the position of Leiden: it supplies a net flow of highly educated workers to the government centre in Den Haag, whereas its most important net flow of the

lower educated workers goes to Amsterdam. This seems to confirm the popular conception that Leiden functions as a "pivot" between the North and South Wings of the Randstad.

Shopping trips

Figure 6 shows the net shopping trips by educational level and urban region. One thing that should be noted is that the numbers are much smaller than in the comparable figure 3, whereas the total number of shopping trips is about 25% larger than the total number of trips to work. We can conclude that net shopping trips are relatively few or to put it differently: that the urban regions are rather well balanced with respect to the number and attractiveness of shopping facilities. Still there are some net imbalances, most notably Den Haag and Utrecht attract more shoppers from other regions than the other way around. Unexpectedly, Amsterdam does not show on this graph: the number of outgoing shopping trips is about equal to the number of incoming shopping trips.
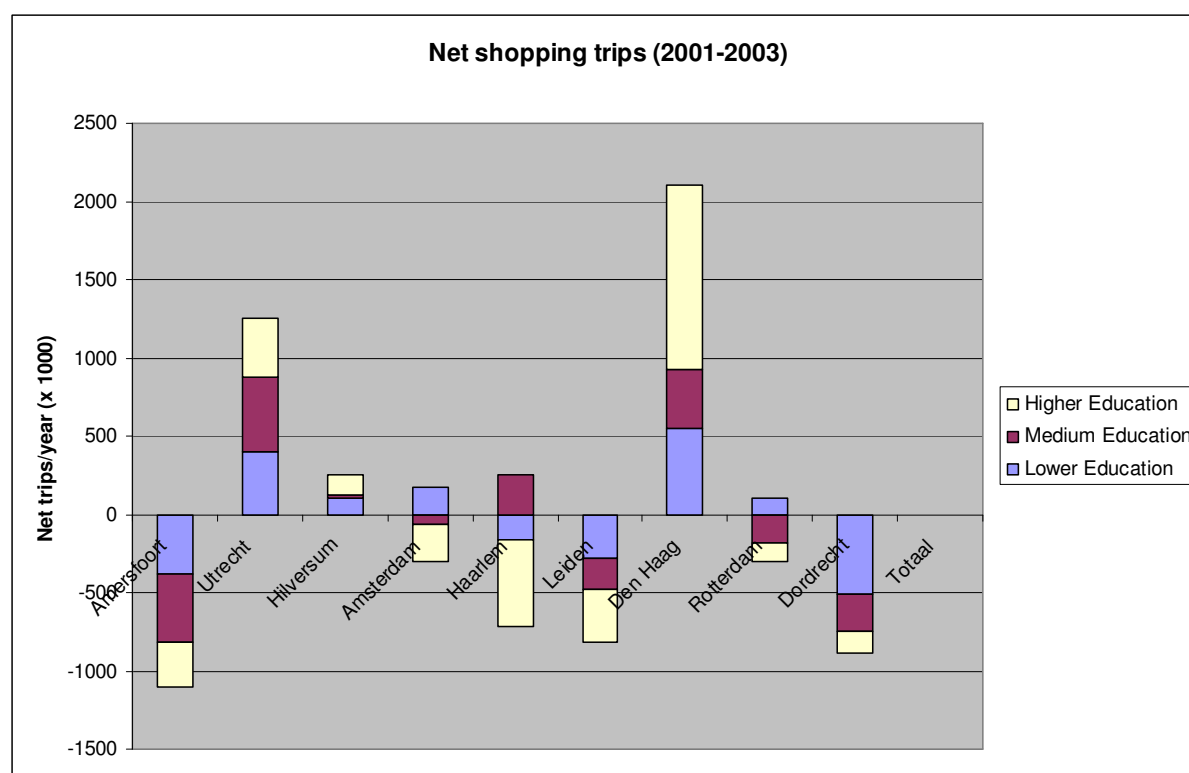

Figure 6: Net shopping trips, by urban region and educational level (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

This general picture is confirmed by table 5, which shows that there are hardly any imbalances in the numbers of shopping trips per region. The segregation indices do show some differences in the composition of the population which are closely reflected on the destination side. Development since the early 1990's does not show any clear development.

	Lower Education		Medium Education		Higher Education		Total	
	Res	Dest	Res	Dest	Res	Dest	Res	Des
2001-03								
Total flows	269459	272639	206919	209388	194692	195424	671070	677450
Segregation index	5%	5%	2%	1%	8%	8%		
Imbalance	1%		1%		1%		1%	
1990-94								
Total flows	376130	381080	211886	213102	142509	142628	730525	736809
Segregation index	4%	4%	2%	2%	8%	9%		
Imbalance	1%		1%		2%		1%	

Table 5: Development of selected indicators for specialisation in shopping trips between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Table 6 shows that the vast majority, about 96%, of shopping trips stays within the region. It must be noted that this includes "run"-shopping for food and other daily necessities; the picture might be different if we were able to distinguish "fun"-shopping and shopping for more durable goods. Interestingly, the table shows that the percentage of internal shopping trips has grown since the early 1990's, and the percentages of both symmetrical and asymmetrical trips have declined. This seems to be a clear refutation of the hypothesis that complementarity between urban regions in the Randstad is growing, at least in the area of shopping. On the contrary, the urban regions are becoming even more self-sufficient in this respect.

	Internal	Symmetrical	Asymmetrical in	Asymmetrical out
2001-03				
Lower Ed.	96.9%	2.1%	0.9%	0.9%
Medium Ed.	96.2%	2.8%	1.0%	1.0%
Higher Ed.	95.3%	2.8%	1.9%	1.9%
Total	96.2%	2.8%	1.0%	1.0%
1990-94				
Lower Ed.	96.6%	2.2%	1.2%	1.2%
Medium Ed.	95.4%	2.9%	1.7%	1.7%
Higher Ed.	94.5%	3.4%	2.1%	2.1%
Total	95.9%	3.1%	1.1%	1.1%

Table 6: Development of different categories of shopping trip flows between urban regions, by educational level between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Trips for education

The net trips for education show a very mixed picture which is not easily interpreted (figure 7). First of all, it should be noted that trips for education by people who have completed one level of education, are apparently made with the purpose of following education at the next higher level. Therefore the category "lower education" in the figure refers to people who are following secondary education, the category "medium education" refers to university students and the category "higher education" to postdoctoral education and various courses. Even so, we cannot yet explain why the university towns of Utrecht and Rotterdam attract large flows of students living outside the region whereas Amsterdam and Leiden, both also possessing important universities, do not (Leiden even having a large net outflow of students). On the other side of the main axis, the position of Dordrecht stands out. Apparently the region of Dordrecht has accessible housing for students in Rotterdam or elsewhere.
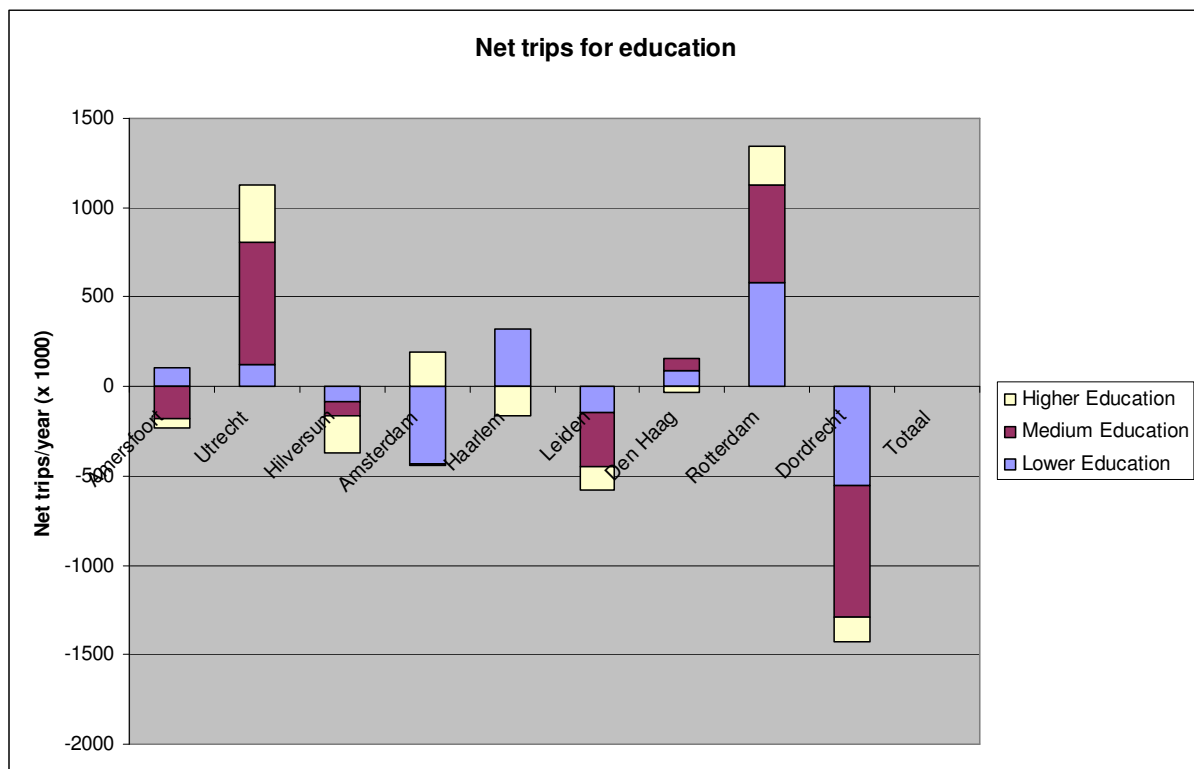

Figure 7: Net trips for education, by urban region and educational level (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Even though our data conceal most of the large variety that exists between educational facilities (not only are there more than a handful of different types of secondary education, but secondary schools also differ with respect to their religious or socio-philosophical denomination, not to speak about the difference between institutes for higher education) table

7 shows that urban regions are much more specialised with respect to education than they are with respect to work or shopping. And whereas the general level of imbalance is approximately stable since the early 1990's, for the group "medium education" (university students) it has clearly declined.

	Lower Education		Medium Education		Higher Education		Total	
	Res	Dest	Res	Dest	Res	Dest	Res	Des
2001-03								
Total flows	77856	81334	33306	38799	13608	15258	124770	135391
Segregation index	4%	6%	5%	7%	14%	16%		
Imbalance	3%		11%		9%		5%	
1990-94								
Total flows	86646	92862	35034	39657	8490	9799	130170	142319
Segregation index	4%	6%	7%	10%	12%	18%		
Imbalance	4%		9%		16%		5%	

Table 7: Development of selected indicators for specialisation in trips for education between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Even though the level of specialisation is larger than in trips to work, this does not mean that flows between urban regions are also larger. People are not as willing to travel to other regions to follow education as they are to go to work (table 8). The asymmetric flows are somewhat larger than those for work, indicating that these are often forced by the absence of a certain type of education in the residential region; the symmetric flows are for all categories relatively small. Interestingly, a decline in the percentage of asymmetrical trips since the early 1990's has been compensated by a larger percentage of symmetric flows. The share of internal flows has remained almost constant.

The spatial pattern of net flows of trips for education is also interesting (figure 8), because it suggests that the traditional view of a North- and a South Wing in the Randstad, supplemented with a third cluster around Utrecht, is not valid for all activities. This map seems to suggest a "West Wing" stretching from Haarlem to Den Haag, an enlarged North-East Cluster including Amsterdam and a diminished South Wing consisting of Rotterdam and Dordrecht.

	Internal	Symmetrical	Asymmetrical in	Asymmetrical out
2001-03				
Lower Ed.	93.8%	3.8%	2.4%	2.4%
Medium Ed.	78.3%	14.4%	7.3%	7.3%
Higher Ed.	75.3%	13.4%	11.3%	11.3%
Total	87.7%	8.9%	3.4%	3.4%
1990-94				
Lower Ed.	92.8%	4.4%	2.8%	2.8%
Medium Ed.	78.1%	10.4%	11.5%	11.5%
Higher Ed.	71.5%	9.9%	18.6%	18.6%
Total	87.7%	7.5%	4.9%	4.9%

Table 8: Development of different categories of educational trip flows between urban regions, by educational level between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)
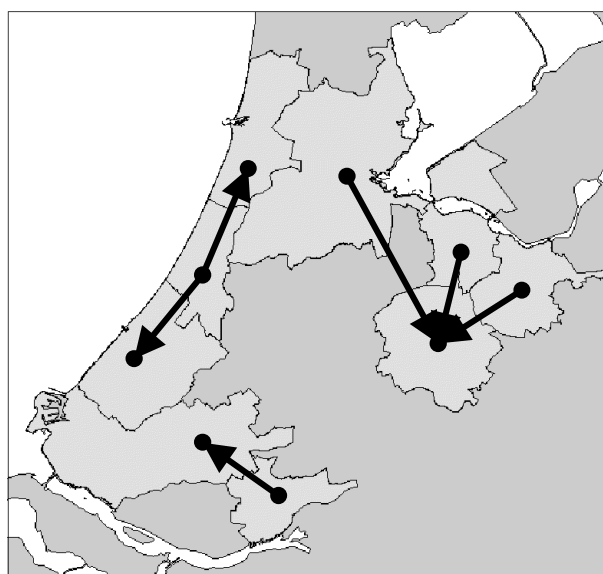

Figure 8: most important net travel to education flows, all educational levels, 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Recreation

The graph of net trips of recreation is not shown here because it shows an even more chaotic picture than the corresponding figure for education. Of course, the label "Recreation" is used for a large number of activities which are very different in nature, ranging from a sports training via watching a movie in the cinema of visiting the zoo to sunbathing on the beach or visiting a café or disco. Clearly, in order to get any grip on the phenomena of specialisation and complementarity in the field of recreation, we need tot analyse other, more detailed datasets than the OVG. Still, tables 9 and 10 do give us some indication about the developments in this respect on a very general level.

The level of imbalance in total trips for recreation is very small, comparable to that for shopping. It has declined since the 1990's, showing that for recreation as well the regions have become more balanced.

	Lower Education		Medium Education		Higher Education		Total	
	Res	Dest	Res	Dest	Res	Dest	Res	Des
2001-03								
Total flows	117922	119438	108344	109820	111915	110906	338181	340164
Segregation index	7%	7%	2%	2%	9%	9%		
Imbalance	1%		2%		1%		1%	
1990-94								
Total flows	158700	155386	96988	94958	70851	69572	326538	319916
Segregation index	5%	5%	3%	3%	9%	10%		
Imbalance	3%		3%		4%		2%	

Table 9: Development of selected indicators for specialisation in trips for recreation between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

The percentage of internal trips has grown since the early 1990's, once more suggesting that the urban regions are getting more and more self-contained in many respects. As was to be expected, the share of asymmetrical trips has declined, but the development of symmetrical trips shows a different picture: in general the share of these has grown, but for the group of highly educated people it has declined. We do not have a hypothesis yet as to why this might be the case.

	Internal	Symmetrical	Asymmetrical in	Asymmetrical out
2001-03				
Lower Ed.	92.2%	6.0%	1.8%	1.8%
Medium Ed.	88.6%	8.5%	2.9%	2.9%
Higher Ed.	87.2%	9.6%	3.2%	3.2%
Total	89.4%	8.5%	2.0%	2.0%
1990-94				
Lower Ed.	91.2%	5.2%	3.6%	3.6%
Medium Ed.	88.4%	7.3%	4.3%	4.3%
Higher Ed.	83.7%	11.1%	5.2%	5.2%
Total	88.8%	7.8%	3.5%	3.5%

Table 10: Development of different categories of recreational trip flows between urban regions, by educational level between 1990-94 and 2001-03 (source: Statistics Netherlands; analysis by Netherlands Institute for Spatial Research)

Conclusions and discussion

From this exploratory study of the travel behaviour survey, some first tentative conclusions may be formulated about specialisation and complementarity between the urban urban regions of the Randstad. We did find evidence for the existence of complementarity in the fields of work and education; less so in the fields of shopping and recreation. This does not mean that there is no complementarity in the fields of shopping and recreation; rather that we would need more detailed datasets to study the question further, just as we need to look further into the workings of complementarity in the fields of work and education.

We found little evidence supporting the hypothesis that complementarity between urban regions in the Randstad is getting stronger. This may be the case in the field of work; at least the interurban flows of trips to work have become more important since the early 1990's. For all other activities, the share of interurban flows of trips has diminished, indicating that urban regions are becoming more and more self-contained. It would be interesting to look at datasets covering a longer period in order to see whether this is a long-term trend or rather a deviation from a trend towards larger interdependence.

We feel that these results show that studying net or asymmetric flows is a fruitful strategy to look at complementarity between urban regions. This study is part of a larger research project carried out by the Netherlands Institute for Spatial Research about functional relations and complementarity between urban regions in the Netherlands. In the context of this project, we will need to look deeper into the patterns of relations between individual pairs of regions. We did present a few maps of these, suggesting that the most important relation are between neighbouring regions but not necessarily confirming the traditional picture of a South- and a North Wing. The statistical significance of these spatial patterns has yet to be tested; also their development in time has not yet been analysed.

Most importantly, in order to gain some insights into the actual working of complementarity, we will look deeper into the backgrounds of the asymmetric flows that we have found. Asymmetric travel to work flows for example can only be explained by a combination of labour market and housing market effects, as was pointed out in the context of the example of Amersfoort and Hilversum. We intend to do further analyses of both markets in order to find out why specific groups of people who find jobs in specialised sectors of the economy in one urban region, decide to live in another region. In the same way, we intend to do analyses of different types of facilities (shops, educational institutes, recreational facilities) in order to

gain insights into the complementarities that may exist in the fields of shopping, education and recreation. These analyses should complement each other. After all, the choice to live in a specific urban region is not only influenced by the place of work or study of oneself and ones partner or by the price and type of dwelling available, but also by the general residential environment which includes among others the shops and recreational facilities in the region.

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