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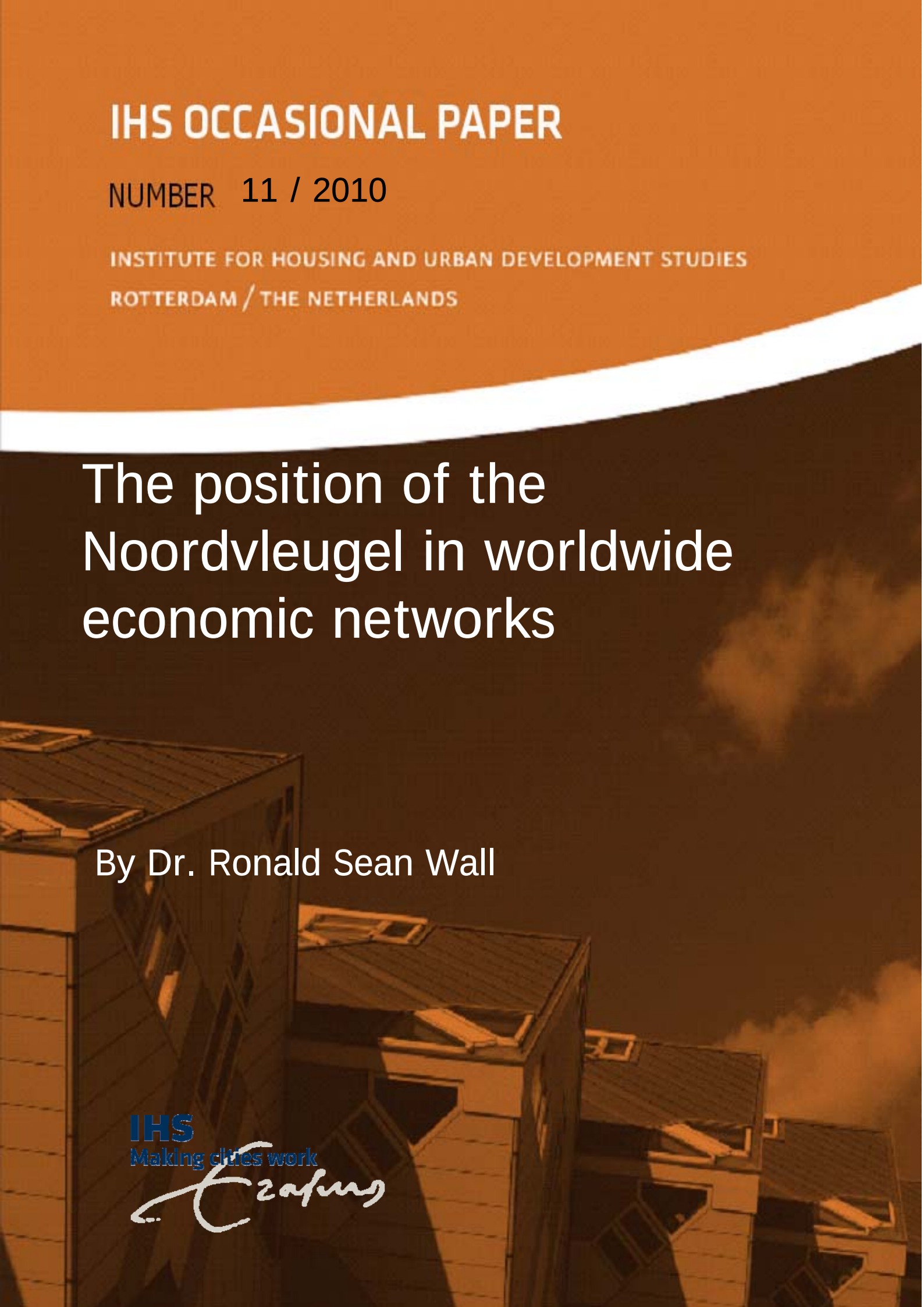
The position of the Noordvleugel in worldwide economic networks

By Dr. Ronald Sean Wall



The Position of the Noordvleugel in Worldwide Economic Networks

Dr. Ir. Ronald Wall

WALL RESEARCH

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1.1. **Introduction to world city networks:**

Over the past decades, there is increasing interest in the economic networks between cities, in which it is argued that the rise of the *network economy* is the result of advances in ongoing globalization, transport and communication technology, common markets, the individualization of production and the growth of multinational firms. It is said that these aspects significantly impact on the spatio-economic structure of cities and regions (e.g. Batten, 1995, Anas et al., 1998), in which the monocentric city is transforming into a polycentric urban network. However, a paradox in this process is the focus of academics and policymakers on sub-national regions as the essential unit of economic activity. In general, most studies and policies fail to conceptualize regional development in an era of globalization (Dicken and Malmberg 2001). Instead, a combined strategy of global production networks and regional assets should be pursued, in which activities are understood across different geographical scales (Coe et al., 2004, Dicken et al., 2001). Today, only a limited number of world city network studies exist (due to scarcity of relational data), e.g. international banking (Meyer 1986), producer service firms (Taylor, 2004), MNC governance (Alderson and Beckfield, 2004), and corporate directorates (Carroll, 2007).

Because economic processes take place at larger spatial scales than that of the traditional city (Kloosterman and Musterd, 2001, Van Oort et al., 2008), administrative boundaries are inadequate (Friedmann, 1986), because competitiveness is primarily determined by what flows cities, rather than what is fixed within them (Castells, 1996). Therefore, competitiveness is a function of a city's network, in which urban development cannot be understood without addressing the networks to which cities belong (Rozenblat and Pumain, 2007). Interest in competitiveness has led to many ranking lists, in which cities are compared e.g. economic performance (Kresl and Singh, 1999), multinational presence (Godfrey and Zhou, 1999) creativity (Florida, 2005), accessibility and services (Kaufman et al., 2005), or sustainability (Dutzik et al., 2001). These studies assume that all cities are in competition with each other, and do not measure competition as a relationship between cities. Furthermore, most national planning policies (e.g., 'Randstad 2040') still consider the spatial proximity of cities as critical to economic performance, ignoring their transnational networks (Van Oort et al., 2006, Taylor et al., 2008). This is odd, considering the many studies (e.g., Camagni and Salome, 1993, Davies, 1998) that stress the need for an 'intellectual transition' in the conceptualization of urban external relations (Meijer's, 2007). In order to validate urban competitiveness it is important to understand the extent to which cities compete and where this competition comes from (Markusen and Schrock, 2006).

This article is primarily based on my PhD work (Wall, 2009a) and several related studies, in which several topics are explored for the Noordvleugel i.e. (1) a historical introduction to world city networks, focusing on Amsterdam, (2) the contemporary connectivity and competition of Amsterdam, Utrecht, Rotterdam and The Hague, to other cities at local, regional and global scales, (3) an elaborate comparison of Noordvleugel city networks to other cities in The Netherlands, (4) revealing important international and national firms of Noordvleugel cities, (5) the network competitivity of Noordvleugel cities, (6) measuring the relationship between city performance and corporate connectivity, (7) a comparison of results to similar studies, (8) expected future trends, and (9) recommendations for improving Noordvleugel networks.

1.2. **A brief examination of city networks over the past centuries and Amsterdam changing position.**

As will be shown later on, Amsterdam is the primary city of The Netherlands, and serves as an important global contender. It is argued that this privileged status is strongly related to its historical development within the evolving world city network. In the book *The Human Web*, J.R and W.H. McNeill (2003) explain that human history is related to the development of worldwide networks. This is related to the increased scale of economic interaction, infrastructural development, technological innovation, and declining transport costs (Bordo, Taylor and Williamson, 2005), and have created new patterns of demand, output, and employment (Maddison, 1995). Another important factor is the development of the nation-state, inaugurated by the Westphalia Treaties in 1648 (Kentor, 2005). Although the importance of nation states grew over the past centuries, in the last few decades of the 20th century, this system has started to fracture - primarily due to the growing importance of multinationals. These firms have dispersed production and labor across the globe (Sassen, 1991). Multinationals have become the foundation of a new dimension of economic power, enabling them to increasingly circumvent regulations formally controlled by the nation-state (Kentor, 2005). Multinationals and subsidiaries are situated in cities, which leads to an extremely complex intercity corporate network. The hierarchy of these networks is determined by the relative power of the corporations residing within these cities, expressed in terms of their control over the economic activity in other cities (Ross, 1994). Based on the above, the four maps (Figure 1) illustrate how economic networks have developed since the start of the Industrial Revolution. This transition is based on four succeeding phases of technological innovation, namely: (1) *steam power, mechanization, and railways*, (2) *electricity, steel, and heavy engineering*, (3) *oil, motorization, and mass production*, and finally, (4) *information and communication technologies*. Each period is illustrated with geographic information system (GIS) maps that represent specific phases of network formation, based on various data (Chandler, 1987, van Susteren, 2007). It is argued that the contemporary global network is the result of an evolutionary process, in which intercity linkages not only diversified and strengthened over time, but more efficient technologies have led to faster and higher volumes of exchange between cities. Furthermore, core, semi-periphery, and periphery relationships have developed over time into an increasingly complex structure. The cores (London in the first two maps and New York in the second two maps) have served as locations of leading technologies and central markets, revealing the diversity and intensity of connections that they have with semi-peripheral and peripheral cities. From this, increased transnational interaction has led to the spread of regional and local sub-centers, consisting of networks of smaller types of firms.

In the 17th century, previously city-centered economies became organized into state-centered ones (through the Westphalia Treaties), in which city interactions flourished more than ever before (Bairoch, 1988). This led to the emergence of large cities and the rise of demand and trade. This era is considered as Amsterdam's Golden Age, in which it became the wealthiest city in the world (Haverkamp-Bergman, 1982) and became one of the most important markets. In this era, the Dutch excelled at international trade, hereby shifting the locus from Venice and Genoa to Amsterdam (Findlay and O'Rourke, 2007). Because Amsterdam was strongly linked to colonial settlements, the Dutch economy is regarded as 'the first modern economy' (De Vries, v.d. Woude, 1997). The Dutch East India Company, headquartered in Amsterdam, was the first multinational corporation in the world, making Amsterdam the primary world center for trade and finance (Ames 2007). Amsterdam's prosperity declined during the 18th and early 19th century, as wars with England and France took their toll. During this period, Amsterdam lost its city primacy, being gradually replaced by London and later New York (Bairoch, 1988). However, Amsterdam's strength has always been its strength in international trade. Compared to other Dutch cities, Amsterdam has fluctuated in global importance over the centuries, reflecting a robustness which arguably contributes to its current economic status.

1.3. **A description of the centrality and structure of Dutch cities within global, European and Dutch corporate networks.**

Data and methodology:

The data used in the analyses concern multinational networks, which are important to the global economy. For instance, the top 200 global corporations (1999) accounted for approximately 30% of world GDP (Anderson and Cavanaugh, 2000), and the top 500 multinationals (2004) accounted for 90% of world FDI and 50% of global trade (Rugman, 2005). Much of this activity consists of transnational transactions which are typically controlled by corporate headquarters that determine the magnitude of foreign investment, the transfer of technology, access to international markets, the repatriation of profits, the number of employees, etc. Similarly, the data used in this research concerns ownership relations (51% or more share) between headquarters to subsidiary firms worldwide (Wall, 2009a). Although multinationals have global reach, they differ by economic size and geographic location, which subsequently determines the total number of corporate connections and strengths of the ties between cities. Furthermore, firms connect networks together at local, supra-regional and global scales. Therefore, three comparative datasets (global, European and Dutch) have been collected, based on *Fortune*, *Lexis-Nexus* and *Reach* sources. Each dataset includes the top 100 headquarters located either in the world, Europe or the Netherlands. It is important to note that the difference between the three datasets lies in the varying economic sizes and geographic locations of their initial top 100 headquarters. However, the subsidiaries for all three networks are worldwide. For instance, the top 100 global headquarters are economically stronger than those of other scales, and are located in cities across the globe. In the case of the top 100 Dutch headquarters, these are less financially powerful and are located only in Dutch cities. However, in both these cases, the headquarter networks to subsidiaries, span the globe. The *global* network holds 9,243 corporate ties, connecting 2,259 unique cities worldwide (Figure 2). The *European* dataset holds 8,307 ties to 2,369 different cities across the globe, while the *Dutch* dataset holds 9,012 connections to cities worldwide. In this way, the data is unique because cities are not preselected (as is usually the case), but instead includes all cities that exhibit headquarters or subsidiary ties. Based on the data, the corporate *centrality* and *structure* of cities is defined for each scale. *Centrality* is a measure of the total corporate ties that a city has with other cities. This can be measured in two ways. *Outdegree* is a measure of a city's headquarter ties to subsidiaries in other cities and represents a city's economic power over other cities (Alderson and Beckfield, 2004). *Indegree* is a measure of a city's subsidiary linkages to headquarters in other cities. It is a measure of how dependent other cities are on a particular city. *Structure* is a measure of the strength of individual linkages between cities. In this way, network measures can define a city's relational positional within the global system.

Cities of the Noordvleugel within the global corporate network:

In the list (Table 1) centrality scores of the global top 100 headquarter networks is shown, in which New York is 1st, both in terms of headquarter (outdegree) and subsidiary (indegree). Düsseldorf is 2nd, Munich 3rd and Zurich 4th, proving to be top global cities, where London at 6th position, Paris 7th and Tokyo 22nd are weaker than expected. The global centrality strengths of moderately populated cities like Düsseldorf, Munich and Zurich, confirm Powell's (1990) conception of network organization, that modestly populated cities can specialize in services, and hereby elevate their status in the urban hierarchy. Concerning the Randstad (G4) cities, it is seen that, in terms of outdegree, Amsterdam claims 9th position and The Hague 11th position in the global economy. However, The Hague's position is mainly related to Shell's presence in this city. Furthermore, it is observed that Rotterdam and Utrecht do not have headquarter functions within the global network. However, considering subsidiary relationships, Rotterdam ranks 21st and Utrecht 31st. In terms of subsidiaries, Furthermore, Amsterdam claims a disproportionately high share of the G4's connections (Wall, 2009b). Hence, the global position of the Randstad is highly dependent on the corporate activities of Amsterdam. Regarding linkage strengths (Table 4), Amsterdam has strong outdegree relations with

subsidiaries in Paris, Brussels and Hong Kong, while, alternatively, Amsterdam has strong indegree relations with headquarters situated in Brussels, Paris, Dusseldorf and London. See also the global network diagram (Figure 3).

Cities of the Noordvleugel within the European corporate network:

The second dataset concerns worldwide networks generated by top European 100 multinationals (Wall, 2009b). It is evident in the list (Table 2) that Paris and London have risen, relative to the ranking in the global network, to 1st and 2nd position, in both headquarter and subsidiary functions, followed by Zurich. The most important non-European subsidiary cities are Singapore 6th, Hong Kong 8th and Buenos Aires 10th. Looking at ranks of Randstad cities, a higher ranking is evident than at the global scale. Amsterdam now ranks 4th as a headquarter city, meaning that it plays a stronger role in the European network than the global one. Furthermore, Utrecht ranks 30th and Rotterdam 38th, while The Hague's headquarter status has become relatively less important, arguably because its petroleum operations (Shell) are less important to the Europe than to the world. In this dataset, Amsterdam, for instance, has strongest outdegree relations with London, Zurich and Tokyo (Table 4) and is alternatively highly controlled by headquarters in Paris and Vevey. See also the Europe network diagram (Figure 4).

Cities of the Noordvleugel within the Dutch corporate network:

The next scale concerns The Netherlands top 100 corporate network (Wall, 2009b), in which it is evident that in terms of outdegree, Amsterdam ranks 1st, Utrecht 2nd, Rotterdam 3rd and The Hague 4th (Table 3). In terms of indegree, Dutch subsidiaries are more important to international cities like London 2nd, and Paris 3rd, than to other Dutch cities. This shows that the main corporate relations of the Randstad are related to cities outside The Netherlands. Amsterdam's strongest linkages are to Paris and London (Table 4). Looking at which cities are most connected to the Randstad top four (Table 5), it is clear that Amsterdam's strongest outdegree linkages are to subsidiaries within Amsterdam, then Paris. Rotterdam, which is primarily connected to London and Walton on Thames, is therefore more related to the UK than to The Netherlands. Utrecht is mostly oriented towards Amsterdam, but also strongly connects to Luxembourg and Brussels. It is also highly connected to Willemstad (Dutch Antilles). The Hague is firstly linked to Wilmington, due to Wilmington's importance in petroleum insurance. Looking at the internal relations between Dutch cities (Figure 5), it is evident that Amsterdam and Utrecht are strongly connected, while Rotterdam and The Hague have moderate ties to each other. Cities in the Noordvleugel are therefore not strongly connected to cities in the Zuidvleugel, verifying that Randstad cities are weakly connected to each other (Van Oort et al., 2006).

1.4. **Comparisons of Noordvleugel city networks to other cities in the Randstad and The Netherlands.**

In the three scales of top 100 networks, only Amsterdam, Utrecht, The Hague and Rotterdam play a role. In the next part, a fourth dataset is developed to obtain deeper insight into the corporate interdependencies of Dutch cities. This data (Wall and Burger, 2008) concerns the top 10 000 corporate headquarters of firms located in The Netherlands, based on the Reach database (2007). Next, the subsidiaries of these headquarters were collected, forming a database of 111 883 corporate connections. The data unfortunately does not specify international cities, but only countries to which Dutch cites are connected. The firms are also specified by industrial codes, by which specific sub-analyses could be carried out. The outdegree and indegree techniques mentioned earlier, were used similarly for this analysis. The first analysis revealed that 42159 (38%) of the corporate connections are found within The Netherlands, while 69724 (62%) connections are international. This clearly shows that the Dutch economy is primarily globally oriented, and in terms of connectivity per capita, is the most corporately connected country in the world.

The international centrality and structure of Dutch cities:

In the ranking list (Table 6) the corporate strengths of Dutch cities are revealed. The first column shows their international importance, where it is clear that Amsterdam (1st) is by far the most internationally connected city. It is roughly three times stronger than Rotterdam (2nd), Utrecht (3rd) and The Hague (4th). Furthermore, it claims 31% of all Dutch international connectivity. The combined G4 cities hold 60% of all Dutch international connectivity. If we look at the connectivity of the Noordvleugel and Zuidvleugel, it is found that the former claims 43% of international linkages, while the later claims 24%. It is clear that the Noordvleugel is approximately twice as globally oriented as the Zuidvleugel. In the table, the boxed cells represent cities of the Noordvleugel, while the grey cells represent Zuidvleugel cities. This is useful to compare the relative strengths of these cities to each other, and to other cities of The Netherlands. The remaining Noordvleugel cities (without Amsterdam) together only claim 12% of international connectivity. Hilversum (17th), Alkmaar (24th) and Almere (30th) hold very modest international connectivity levels. It is interesting that new town Almere claims higher connectivity than the more established cities of Haarlem and Amersfoort. In the network diagram (Figure 6), the corporate connectivity between Dutch cities and different nations is seen. Note, only linkages greater or equal to 30 are shown, hereby representing the most important network. It is evident that Amsterdam has the strongest linkages (thickness), but also the highest diversity of nations to which it connects. This shows that Amsterdam is the most globally 'integrated' Dutch city. Its strongest linkages are to the U.S., the U.K., Germany and Spain. Rotterdam is strongly linked to the U.K., Italy and Germany and the U.S. - but has less diversity of international connections. Similar to Amsterdam, Utrecht is well linked to the U.K., Belgium, France and Germany - while The Hague, similar to Rotterdam, is connected to the U.K., Italy, Germany and the U.S. It is notable that Amsterdam and Utrecht have the same linkage preferences, as do Rotterdam and The Hague. Other Noordvleugel cities like Almere, Hilversum and Alkmaar play a more moderate role in the network. It is also evident that the U.K., the U.S., Germany and France are pivotal to the Dutch economy.

The national centrality and structure of Dutch cities:

Looking at only those connections which take place within The Netherlands (Table 6), we see that Rotterdam heads the list (second column), holding 12% of all national connections. It is one and a half times stronger than Amsterdam (2nd) at this level. The combined G4 cities claim 33% of national connectivity. Utrecht (3rd) and The Hague (4th) maintain the same rank as they do internationally. Interestingly, there is lot of variance between the international and national lists, where cities below the G4 have little overlap. For instance, Amersfoort (40th), is much stronger nationally (18th), while Almere (30th and 33rd) maintains a similar strength within both networks. Or that Westland (23rd) is only significant within the national network. This clearly shows that cities play different roles within the economic system. The combined cities of the Noordvleugel hold 20% of the national network, which is half of that of the international network. Hence, the Noordvleugel is primarily internationally oriented. The Zuidvleugel cities together hold almost 30% of national connections, which is higher than their international share. In this light, the Zuidvleugel is more nationally oriented. If we look at the linkages strengths (Figure 7) between Dutch cities (greater than or equal to 30), it is firstly evident that Rotterdam has the highest diversity of unique connections. Therefore, Rotterdam is the most nationally integrated city, with strong connections to Utrecht, Amsterdam and Rijssen. Amsterdam is evidently less integrated within The Netherlands. Its strongest connection is to Utrecht, followed by The Hague and then Rotterdam. Utrecht is well connected to Amsterdam and Rotterdam, but it is striking that no significant connection is found between Utrecht and The Hague. The Hague is well connected to Amsterdam, followed by Rotterdam. A small regional sub-network is seen between Haarlemmermeer, Hoofddorp and Schiphol. Amersfoort and Hilversum have strong connections with Rotterdam, while Almere has moderate ties to Amsterdam. The arrow direction shows that headquarters in big cities hold shares in subsidiaries in smaller cities. It is also seen that many of the cities that Rotterdam and Amsterdam are connected to, are within their own immediate region, revealing the importance of regional proximity. Hence, smaller cities tend to service their own immediate core cities. However, the strengths of these connections are far less than at national and

international levels. Again, this underlines that cities play different roles within the economic system, and should be developed accordingly.

Sectoral differences of corporate network between Dutch cities:

In this analysis the national network is separated into various levels of industrial sector (Table 6). At the highest level, the network is split into goods and information related firms (column 3 and 4). As expected, Rotterdam holds the majority of goods connections, which is almost three times stronger than Amsterdam. Utrecht holds 5th position in goods, succeeded by Nieuwegein (3rd) and Rijssen (4th). Hilversum (21st) Amersfoort (42nd) and Almere (86th) play a weaker role in goods than in information industries. Amsterdam tops the list of information industries, followed by Utrecht, Rotterdam and The Hague. The differences between the G4 cities are far less than in the goods sectors, indicating that information firms are more evenly spread in the Randstad. Interestingly, Den Bosch is 5th in national and also information industries. Hilversum (10th), Amersfoort (15th) and Almere (23rd) are clearly stronger in information than in good related activities. In the next part, we look at several important sub-sectors of the network (Table 6). Important with these is that the network is split into headquarters and subsidiaries, indicated as (H) and (S) in the columns. Column five shows the business services headquarter relations, in which Rotterdam heads the list (1st), followed by Almelo (2nd), Gouda (3rd), Amsterdam (4th) and Utrecht (5th). In column six we see the business service subsidiary networks. Rotterdam, Amsterdam and Utrecht top the list. This sector proves to be the most important sector of Amersfoort and Almere, both in terms of headquarters and subsidiaries. In the headquarter relations of the insurance sector, Utrecht (1st) and Amsterdam (2nd) top the list, followed by Zeist (3rd), Rotterdam (4th) and The Hague (5th). Insurance also proves to be a strong sector of Amersfoort and Almere. The Hague evidently is strongest in insurance subsidiaries (column eight), followed by Amsterdam, Utrecht, Capelle a.d. Ijssel and Rotterdam. Almere appears much weaker in insurance subsidiaries, than insurance headquarters. In terms of real estate headquarters, column nine shows Rotterdam (1st), Heerlen (2nd), Amsterdam (3rd), The Hague (4th) and Naarden (5th). This sector also proves to be Hilversum's (6th and 7th) strongest sector. Interestingly, Utrecht only ranks 19th in this sector's headquarter relations - however, in terms of real estate subsidiaries (column ten), Utrecht is 5th. This also proves to be a strong sector of Almere (13th). In the last two columns wholesale trade networks are revealed. Utrecht, Rotterdam and Amsterdam top both these lists, but The Hague plays a weak role in wholesale trade. Almere, although weak in wholesale trade headquarters, is quite strong in wholesale trade subsidiaries. From this study it is evident that the centralities and structures of cities are also dependent on the specific industrial sectors observed.

1.5. **Important international and national firms in Noordvleugel cities.**

In the list (Table 7) a selection of top firms in Noordvleugel cities is provided. The importance is determined by the number of connections these corporations have with firms in other cities. The column on the left represents the international connections of firms, while the column on the right shows firms with high national linkages. The first observation is that for both columns, only Amsterdam and Utrecht hold highly connected firms. Furthermore, Amsterdam holds (73%) and Utrecht (25%) of all Noordvleugel international connections, (together 98%). The other Noordvleugel cities hardly contribute to global relations. Amsterdam has three times as many important firms as Utrecht. In the list, the names of the important firms can be seen. Firms are important to these cities, not only because they generate strong revenue and employment for the cities, but especially because they integrate cities into the global economy (e.g. trade and FDI). The top firms of Amsterdam are ING, ABN AMRO, Euronext, Commerz Nederland. Obviously these firms are related to finance, but other sectors are also represented, such as Prada, Gucci, Heineken, Getronics, and Universal Pictures. Utrecht's top firms are related to insurance and finance, e.g. Fortis, Cooperative Centrale Raifeisen, SPF and Reaal. Other sectors, like consumer goods giant Sarah Lee, and energy sector's Nuon are found. In Hilversum, Endemol serves as the most connected firm, followed by the tobacco firm JT Europe Holding. Alkmaar's most connected firm is supply company ERIKs, and for Almere this is car company LeasePlan. Looking at national strengths, it is clear that Amsterdam holds the most connected firms. Also, it is seen

that Amsterdam holds (46%) and Utrecht (37%), of national corporate linkages (together 83% of Noordvleugel's national connections). Interestingly, Amsterdam's national firms are generally of a completely different profile than Amsterdam's international firms. Nationally, Amsterdam's top firms are Kempen and Co (finance), ING, Telegraaf and Nuon (energy). The connectivity of these firms is far weaker than Amsterdam's international firms. Utrecht's top national firms are Fuel Company SHV Holdings, insurance company SNS Reaal and Fortis. Interestingly, the overlap between Utrecht's international and national top firms is approximately 90%. This is higher than any other Noordvleugel city. This means that Utrecht is an intermediator between international and national activities. Alkmaar's most connected national firm is Huisvuilcentrale Noord-Holland, followed by ERIKS. For Almere, this is USG, and for Amersfoort it is curator firm Van Hoogevest and engineering firm ARCADIS. Beukenhoeve Beheer is Haarlem's top national firm, and for Hilversum this is car company Kroymans Corporation.

1.6. **Competition between Noordvleugel cities and other cities based on the market overlap of corporate networks.**

So far, we have explored four levels of networks in which the level of collaboration between cities is evident. In the next section, we will explore competition between cities which is an entirely different measurement. This is based on the 'niche theory' concept (e.g. Popielarz and Neal, 2007), that when individual city networks strongly overlap (e.g. the corporate network of The Hague and Utrecht), that this represents competition between these cities - as they share the same economic habitat. Hence, we speak of competition, if geographical markets of cities show a considerable amount of network overlap. In other words, in an urban system, two cities are in competition to the extent they are functionally linked to the same other cities. This is briefly explained using the following diagram (Figure 8). For more detail on the methodology, please see (Burger, Wall and v.d. Knaap, 2008).

- Cities A and G have linkages to different cities (B/C and E/F respectively). The similarity between their networks is therefore 0%, meaning that there is no competition between cities A and G.
- Cities B and C have exactly the same linkage structure, as both cities are (only) linked to city A and D. Hence, the similarity between their networks is therefore 100%, meaning that the geographical markets of cities B and C maximally overlap.
- Cities A and D have a partly overlapping linkage structure. Although cities A and D are both linked to cities B and C, city D is also linked to cities E and F. Hence, the degree of competition between cities A and D is intermediate as their geographical markets only partly overlap.

Based on the above, the market overlap of the networks of Amsterdam, Rotterdam, Utrecht, The Hague and Almere will be discussed. In the competition list (Table 8) we firstly see that Rotterdam's strongest competitor's are firstly Eindhoven (78.1% overlap), followed by Amsterdam (75.5%), Hilversum (73.6%), Den Bosch (73.3%) and so forth. It is interesting that most of Rotterdam's competitors are from the Noordvleugel. The Hague, the other big city of the Zuidvleugel, proves to be a more moderate competitor of Rotterdam. Amsterdam's competitors are Amersfoort (83.2%), Haarlemmermeer (81.2%), Alkmaar (76.5%) and so forth. Interestingly, Noordvleugel cities - Amersfoort, Alkmaar and Almere, are strong competitors of Amsterdam. Furthermore, Rotterdam is Amsterdam's 5th strongest competitor, while Amsterdam is Rotterdam's 2nd strongest competitor. Utrecht, the other big city of the Noordvleugel, proves to be a more moderate competitor of Amsterdam. In the case of The Hague, the primary competitors are Utrecht (88.8%), Apeldoorn (86.0%) and Haarlemmermeer (85.3%), and so forth. Both Rotterdam and Amsterdam are not strong competitors of The Hague. Utrecht's biggest competitor is The Hague (88.8%), Hilversum (88.0%), Haarlem (83.8%) and Zaanstad (83.2%) and so forth. Interestingly, five competitive cities are from the Noordvleugel. Almere's primary competitors are Amstelveen (80.4%), The Hague (77.0%), Haarlemmermeer (76.6%), Amsterdam (75.4%), and so forth. Six competitors are from the Noordvleugel. Finally, observing the results of the five cities, Rotterdam is seen to face the least urban competition. For further information, see (Wall and Burger, 2008).

1.7. **Explanations on the relationship between corporate network centrality and performance indicators of various cities in The Netherlands.**

National indicators versus connectivity at global and European corporate scales:

In this section, the coherence between developmental indicators on the one hand, and corporate connectivity on the other, is investigated. It is argued that by improving a city's indicators (which have a strong statistical relationship to connectivity), will improve its role in the national and international corporate network. The first part observes how national performance indicators impact on the global and European corporate network (discussed earlier). Because reliable, comparative data on the performance of cities across the world is not available, this analysis required the aggregation of the global and European inter-city networks to the national level. In this way, national performance indicators, such GDP and Business Efficiency Index, are used to measure corporate connectivity between nations. In the list (Table 9), the correlation coefficients are shown. The first column lists different performance indicators. The second column displays the coefficients for the global corporate network, while the last column shows this for European corporate connectivity. Both these columns reveal results for outdegree and indegree. In the case of outdegree, it means how the national indicators contribute to the ability of headquarters in nations to hold strong ownership in subsidiaries of other nations. For indegree, this means how these indicators determine the number of subsidiaries located within nations. Firstly, it is seen that almost all the correlations are high, but that the scores of the global results are higher than that of the European network. Although these results do not give insights into causality, they do show that there is strong coherence between most of these indicators and connectivity. From this it is arguable that a country's economic potential (*GDP per capita*), its level of innovation *(Innovation Index)*, its ability to compete internationally (*Global Competitiveness Index*), the sophistication of its institutions (*Institutional Development*), the novelty of its businesses (*Business Sophistication*), its investments into ICT (*ICT Expenditure*), and the overall development of its roads, rail and cities (*Infrastructure*) – contribute most to its corporate connectedness. For more on this, see MNP Report (Wall et al., 2007). This research is developed further (Wall, Burger and v.d. Knaap, 2008), in which various regression models are executed between sub-variables of the Global Competitiveness Index and the nodal and linkage connectivity of the global corporate network. This work statistically supports the outcomes of most correlations above. It is shown in these models that besides *market size* and *GDP*, that a home country's degree of *openness* to business, *closeness* to other active nations, *level of technology*, and its *stock market capitalization* are statistically significant to the expected corporate connectivity.

Different industries of firms versus connectivity at the Dutch corporate scale:

Unlike the previous part, which explored coherences at the level of nations, this section focuses on the relationship between Dutch corporate connectivity and the performance indicators of cities within The Netherlands. The network data concerns the database of 111 883 corporate connections, explained in paragraph 4. A regression model is carried out to explain how firms in different industrial sectors (independent variables) contribute to the international and national connectivity of Dutch cities (dependent variable). The independent variables concern all registered Dutch firms (2007) located in different Dutch cities, and are classified under standard industrial codes (SIC). In this way it is possible to see how much each industry contributes to corporate connectivity. Urban population is used as a control variable, to control for size effects. In the left-hand column (Table 10), the contribution of firms to the international network is seen. The top part concerns nine industrial sectors, from agriculture to advanced services. It is seen that the strongest significant relationship is with wholesale trade (0.268), followed by advanced services (0.193), finance, insurance and real estate-FIRE (0.193) and manufacturing (0.126). The other scores are either weak or statistically insignificant. In the section below, the advanced services and FIRE are divided into detailed sectors. Here we see that real estate (0.279) contributes most to international connectivity, followed by business services (0.235), financial services (0.217) and engineering, research, accounting and management (ERAM). In the column on the right, the variables are used to explain corporate connectivity within The Netherlands (national). In this case, advanced services (0.423) contribute most to explaining the national network, followed by FIRE (0.385), wholesale

trade (0.143) and manufacturing (0.129). The other scores are weak and insignificant. In the more detailed sectors, we see that finance (0.301), business services (0.276) and real estate (0.175) best explain the national network. Interestingly, urban population is insignificant to corporate connectivity.

Economic, social and spatial environments versus connectivity, at the Dutch corporate scale:

In general, it can be argued that cities that have a better business climate also attract more corporate establishments. From a functional point of view, cities are composed of various place characteristics that shape the business climate (data Nyfer, 2003). In this research, a distinction is made between three broad categories: the *economic environment*, the *socio-economic environment*, and the *spatial environment*. The economic environment of cities is linked to the production structure and economic activities present in a city. The social-economic environment is linked to the labor market and employment climate in a city. Finally, the spatial environment is linked to physical attractiveness of a location, in terms of accessibility and amenities. It should be noted that the causality between the business climate of cities and urban network connectivity remains unclear. On the one hand, a city with a good economic, socio-economic and spatial environment, is more likely to draw firms and workers, which in turn would improve urban network connectivity. On the other hand, being well connected within the urban network is an asset in itself and can boost business climate and urban performance. In other words, business climate can be regarded as both a cause and consequence of urban network connectivity.

The economic environment of cities

The focus here is on three dimensions of the economic environment of cities: *economic density*, *entrepreneurial activity*, and *specialization in producer services*. Concerning *economic density*, it is arguable that densely clustered economic localities are likely to accommodate knowledge-generating institutions (e.g., universities, R&D laboratories, trade associations). Moreover, the presence of a large internal market offers a larger degree of stability and lowers transaction costs of firms. *Economic density* is expressed here as the number of establishment (CBS). *Entrepreneurial activity* is expectedly related to connectivity. Cities with a high proportion of entrepreneurs are considered places of variety. Jacobs (1969) argued that the variety present in a city augments its economic growth. Next, cities specialized in *producer services* tend to be better connected to the urban network (Taylor, 2004). Not only are producer services the largest and fastest growing sector of the Netherlands, but is the sector in which network formation is strongest. In the results, (Figure 9) it is seen that a moderately positive relationship exists between *economic density* and city network connectivity. Cities like Amsterdam, Rotterdam, The Hague, Apeldoorn, Amersfoort and Alkmaar, fit the model well, meaning that the number of establishment is quite proportionate to the connectivity of these cities. Almere's number of establishments does not proportionately generate much connectivity; while Utrecht's high connectivity is less related to its number of establishments. When a city increases its number of establishments by 1%, the corporate network connectivity is predicted to increase by 0.429%. For cities like Almere and Alkmaar to improve their connectivity above average, they will need to increase their number of establishments. In general, there exists a strong positive relationship between *entrepreneurial activity*, measured as the number of starting entrepreneurs as a percentage of the working population (Marlet and Van Woerkens, 2003), and urban network connectivity (Figure 10). The results show that if a city increases its entrepreneurial activity by 1%, this increases its connectivity with 1.204%. Amsterdam and Alkmaar best fit this model. Almere's high level of entrepreneurs does not lead to high connectivity. This is probably because its entrepreneurs are not operational in high-end service industries, as will be shown next. Cities specialized in *producer services*, have higher urban network connectivity than cities specialized in other sectors. Of the three indicators, producer services contribute most to corporate networks. Hence, if a city increases its specialization in producer services with 1%, connectivity rises with 1.295% (Figure 11). Cities like Amsterdam and Amersfoort best fit this model. Considering Noordvleugel cities, Almere and Alkmaar fall below average. To become more integrated into the Dutch economy, it is important that these cities improve their level of producer services.

The social-economic environment of cities

order to examine the relationship between the socio-economic environment and urban network connectivity, the socio-economic index as presented in the *Atlas voor Gemeenten* report of 2003 (Marlet and Van Woerkens, 2003) is used. The socio-economic index consists of labor market and employment factors that are important for the local economy, such as the degree of unemployment, participation of women in the labor market, education, and poverty. Here, it is contended that a good socio-economic environment contributes to the business climate of cities. In the results we see that this relationship is quite moderate (Figure 12). It is seen that cities like Amstelveen, Amersfoort and Alkmaar fit this model well. If a city increases its socio-economic index by a 1%, a 0.286% increase in corporate connectivity is expected. Similarly, a moderate relationship between human capital and connectivity can be seen (Figure 13). On average, if the proportion of the working population that has a low education level (lower than HBO) decreases with 1%, urban network connectivity increases with 0.33%. For other tested relationships within the dimension of social economic environment, including safety and wages, no relationship to network connectivity is found.

The spatial environment of cities

In order to examine the relationship between the spatial environment and urban network connectivity, the attractiveness index is used, as presented in the *Atlas voor Gemeenten* report of 2003 (Marlet and Van Woerkens, 2003). The attractiveness index is a score composed of different variables, such as physical accessibility, cultural amenities, proximity to scenic areas, and the presence of universities. Looking at the relationship between the urban attractiveness index and urban network connectivity (Figure 14), a moderate to strong positive relationship is observed. On average, an increase of 1% on the urban attractiveness score, increases network connectivity with 0.65%. Focusing on two dimensions of the urban attractiveness index, *physical accessibility* and *amenities* (Figure 15 and 16), we observe that there is a strong relationship between connectivity and the amenities present in cities. Cities like Amsterdam, Amersfoort and Apeldoorn fit this model well. If a city improves its amenities by 1%, the corporate connectivity will expectedly increase by 0.597%. In the last model, only a weak relationship between connectivity and physical accessibility exists (Beta=0.18). This means that improving a city's infrastructure does not contribute much to improving its corporate connectivity.

1.8. **A comparison between the results of this study and similar studies.**

Gereffi et al. (1994) defined global commodity chains as interorganizational networks of products that link enterprises and states to each other within the world economy. Earlier, within a more city-related context, Friedmann and Wolff (1982) developed a conceptualization of world cities as 'command centers', regulating the 'new international division of labor.' These approaches have led to various theoretical studies on cities and globalization (e.g., Sassen, 1991, Amin and Thrift, 1992, Castells, 1996, Meijer, 1993, Godfrey and Zhou, 1999), but the number of empirical world city network studies remains limited due to scarcity of 'relational' data (Smith and Timberlake, 1995, Taylor, Walker and Catalano, 2002). To date, only a handful of relational studies exist, e.g., on international banks (Meyer 1986), advanced producer firms (Taylor 2004), MNC governance (Alderson and Beckfield, 2004), and corporate directorates (Carroll, 2007). Nonetheless, even in these studies, conceptual differences are evident (Derudder, 2006). One of these differences is the type of data being analyzed. Alderson and Beckfield (2004) argue that the key relationship linking cities into a world system is the multinational enterprise, regardless of the industrial sector observed. Alternatively, the GaWC research group (2004) focuses on the advanced producer service sector, which they justify as representing 'cutting-edge' global economic activity. This, they argue, is because producer service firms have become multinationals in their own right, creating an essential 'interlocking' global network of offices. However, according to Alderson and Beckfield, although producer services may lead the way in integrating cities into a global network, it is likely that other industrial sectors also create important connections between cities. In the list (Table 11), a comparison of the rankings of these two studies is seen. The Alderson and Beckfield study is

the most similar to the analyses in this article, because it is based on the same type of data and techniques. Therefore they similarly identify both headquarter (outdegree) and subsidiary (indegree) ranking. In their results (based on 2000 data) Tokyo, New York and Paris top the list in headquarter connections, while Amsterdam ranks 6th and Utrecht 17th. This is similar to my global network results (based on 2005 data) presented earlier on (table 1), in which Amsterdam holds 10th position in the world economy. In this list, Utrecht holds no subsidiary role. In the Alderson and Beckfield study, Amsterdam ranks 8th, and is exactly the same as in my study. Rotterdam and The Hague do not play an important role in the Alderson and Beckfield study, while in my study these cities are marginal. In the GaWC study (Table 11), Amsterdam is not considered a true global city, but ranks 8th in the secondary category of cities. Both Alderson and Beckfield and the GaWC studies do not identify other Dutch cities as significant to global corporate networks. Other studies like Friedmann (1995) and Godfrey and Zhou (1999) also identify Amsterdam as a top global city. Therefore it can be concluded that at least Amsterdam is essential to the world economy. In this light, it is important that Noordvleugel cities and other Dutch cities take strategic advantage of Amsterdam's global economic power.

1.9. **Future trends of Noordvleugel cities, concerning centrality and structure at different scales, competitivity and performance.**

The empirical network research discussed so far is based on cross-sectional data. Therefore it is not possible to give statistically supported insights into how these city networks transformed over time. If longitudinal data were used - then the actual evolution of such networks could be studied, in which the growth, shrinkage and future expectations of corporate linkages and nodes would become evident. Hence, to understand the competitive nature of cities, it is essential to know what flows through them (over time) instead of only what is fixed within them (Derudder et al., 2008). Furthermore, because of the unavailability of network data, very little longitudinal research on changing networks can be found. Nonetheless, based on a few recent longitudinal studies, I will attempt to make a tentative account of what the trends might be. In the study, 'The Growth of Transnational Corporate Networks: 1966-1998' (Kentor, 2005), it is shown that multinationals over the period 1966-1998 are increasingly gaining control of capital, and their activities are beyond the regulations and control of any single country. For instance, Kentor shows that in 1962, the world's 100 largest industrial corporations owned 1,288 foreign subsidiaries, and that by 1998, the 100 largest industrial firms owned nearly 10,000 foreign subsidiaries. Furthermore, the ratio of revenues of the 500 largest industrial firms to world GDP grew from 0.15 to 0.28 of world GDP between 1983 and 1998. The total TNC headquarter to foreign subsidiary linkages, for the top 100 industrial TNCs grew from 1,260 in 1962 to nearly 10,000 in 1998 - with the sharpest increase occurring between 1991 and 1998. Kentor also shows that primacy of countries with control in foreign subsidiaries varies over time. He also shows that there is a dramatic increase in producer service industries over time, as has been argued by Sassen (1990).

In the study, on network changes between 2000 and 2008 (Derudder et al., 2009), the shifting position of cities in is assessed, hereby providing a preliminary insight into the changing geographies of globalized producer services. The authors reveal the relative decline of Western European, Australasian and especially North American cities, and the relative rise of South Asian, Chinese and Eastern European cities (Shanghai, Beijing, Seoul and Moscow in particular). Furthermore, they discuss that a higher degree of stability can be identified towards the apex of the world economic system, in which London, New York, and Hong Kong remain the most connected cities, and the strongest linkage remaining that between New York and London. Also, it is stated that cities such as Chicago, Los Angeles and Amsterdam have lost out in favor of cities like Shanghai, Beijing and Seoul, in an 'east-west swap'. More specifically, the dropping of US cities and the associated rise of Chinese cities is a more fundamental feature. This, they say, points to an overarching 'world-regional' trend, as the 20 most connected cities in 2000 included 5 North American cities and 5 Asian cities, whereas in 2008, only 2 North American cities (New York and Toronto) made the top 20, as opposed to 9 Asian cities. In this light, it is suggested that the world-system is in the midst of a major geographical transformation from 'West' to 'East' (e.g. Arrighi, 1994, 2007, Frank, 1998), and that within the

context of the current financial crisis, reveals that this shift is indeed unfolding in terms of urban connectivity. In a study on networks of Gulf cities' (Wall, 2010), an analysis is carried out on mergers and acquisitions (M&As) between 2005 and 2009. M&As represent 78% of global foreign direct investment, hereby serving as a good indicator of transnational control. The networks concern corporate relationships between firms in Gulf cities and other cities of the world. Interesting about this data is that it does not simply represent the number of linkages between firms, but is weighted by the deals made between firms. In the graph (Figure 17), it is seen that the combined M&As taking place in the Gulf region increased between 2005 and 2006, after which it dramatically dropped. This applies to both inward and outward investments, and neatly follows the global trends analyzed by Brakman et al., 2006, and Dealogic, 2009 (Figure 18). Based on these graphs, Dubai's recent bankruptcy is not surprising.

These studies underline that globalization is a process of changing interdependency between cities. In this sense, network analysis is ideal for empirically measuring these changes. Furthermore, although networks change, change is not equal across the network. As discussed by Derudder et al. (2009), the apex of the system has not changed much within eight years. This is because top cities hold a disproportionate share of connectivity. For instance, New York, London, Paris and Tokyo held 25% of global connectivity in 2005. In network analysis literature, this is called a 'power-law' distribution, and according to economist Robert Axtell, the stability of this distribution, makes it the most robust statistical regularity in the social sciences. In power-law networks (Barabási and Bonabeau, 2003), a few nodes act as highly connected hubs with a high degree of connectivity, while the majority of nodes have low degrees (Wall et al., 2007). Furthermore, the more connected a city is, the higher the future probability of new connections, known as 'preferential attachment'. This means that the likelihood that a multinational will make a new business relationship with a firm in New York is far higher than with, for instance, Utrecht. Based on the existing distribution of corporate networks, the probable 'corporate potential' of all cities can be calculated and used as a proxy for future development. This is a natural probability, in what proves to be a self-organizing system, and raises the question if and how a city could artificially increase its corporate or urban potential, so that the probability of new business linkages is increased.

Because it is shown in this article that Amsterdam is the highest ranked Dutch city at local, regional and global scales, it can be equally said that Amsterdam is the most robust city, with the highest preferential attachment, in both the Noordvleugel and The Netherlands. Furthermore, as argued earlier on, Amsterdam has for centuries played a leading role in the world economy. Furthermore, in several other studies, only Amsterdam makes the top ranks. Therefore, there is enough evidence indicating that Amsterdam is the pivotal city of The Dutch economy. However, this does not mean that other Dutch cities are unimportant. As is shown in the various scales of network, the other cities play different roles within the system. For instance, it is shown that within the national network, Rotterdam is most important. Furthermore, as shown earlier on, cities can be strong in different industrial sectors. As shown by the studies above, networks change with the cycles of the economy, creating increasing uncertainty as globalization proceeds. Therefore, it is essential that nations and cities start to understand their changing roles within the world economy. This is important, considering that the role of Europe and cities like Amsterdam are apparently declining (Derudder et al., 2009). Because it is shown in various studies (Rozenblat and Pumain, 2006, Wall and Burger, 2008) that a strong relationship exists between corporate connectivity and national and urban development, a declining Amsterdam will expectedly have serious repercussions on other Noordvleugel cities, due to their generally strong dependency on Amsterdam. In turn, because it is shown in the various networks that Amsterdam is highly connected to cities like London and New York, it is equally important that Amsterdam improves these existing corporate relationships, and also initiates new connections to emerging economies.

1.10. **Perspectives on how Noordvleugel cities can improve their positions, competitivity and performance.**

It is shown in this article that the cities of The Netherlands are primarily connected to international cities (62%). Hence, Dutch cities are highly dependent on the wealth generated through transnational relations. It is therefore paramount that these relations are better understood and developed. Furthermore, it is shown that 82% of corporate connectivity occurs between cities, and only 18% within municipal boundaries (Wall, 2009a). This means that municipalities are highly dependent on their relations with cities, near and far. In this context, the age old monocentric city has clearly been overtaken by a polycentric urban network. Therefore, it is hopeful that future policy will develop towards an integral understanding of how Dutch cities compete and collaborate with each other and other cities of the world. This will depend on richer datasets and especially longitudinal studies. From this, changing economic ties and their impact on cities can be observed and utilized for future developmental policy.

Because Amsterdam is highly significant at all three scales (articulator city), it is imaginable that future policy for Amsterdam is devised according to the three geographic scales (Wall and v.d. Knaap, 2008). This approach is important, because various studies show that corporate power is increasingly directed to a limited number of powerful cities (Taylor, 2004, Alderson and Beckfield, 2004). Therefore, a strong recommendation is to particularly reinforce Amsterdam within the global economic system. At the global and European scale, Amsterdam is primarily connected to London, Paris, Brussels and Zurich. The profile of its partner cities and types of firms, are far more global than any other Dutch city. Therefore, it is interesting to see how Amsterdam can start strengthening these international ties. For instance, because London is strongly connected to powerful Asian cities, like Hong Kong and Singapore, Amsterdam can in future take strategic advantage of this for developments with emerging Asian economies. In this way, for instance, ING can reinforce its existing strong ties with New York, Toronto, London and Atlanta. Basell, for example, which already has strong linkages with Hong Kong, could strengthen these either directly or indirectly via London. Amsterdam is also the strongest Dutch city in terms of subsidiary ties. Reinforcements can be made, by investigating which headquarters in other cities, these firms are connected to. Because Utrecht proves to be a moderate subsidiary city at the global and European level, and a strong subsidiary city at the Dutch level, it is advised that Utrecht's subsidiary status be reinforced in future. Because it is already exceptionally connected to Amsterdam, its strong subsidiary link with Amsterdam should be emphasized in future. Utrecht can also improve its existing relationships, especially with Willemstad (Curacao), Brussels and Luxembourg. Other Noordvleugel cities do not play a significant role in any of the three top 100 networks. Therefore, it is advisable that these cities start playing a more regional, supportive role to Amsterdam and Utrecht.

In the fourth dataset, it is shown that the Noordvleugel is twice as internationally connected as the Zuidvleugel. It is therefore arguable to invest in developing the Noordvleugel as a more powerful and competitive global region. This does not only mean investing in Amsterdam and Utrecht, but also developing the smaller Noordvleugel cities in a way that they become a supportive, reinforcing unit of Amsterdam and Utrecht. Hence, development should be polycentric - but not evenly distributed across these cities. Within this context, the international and knowledge rich Noordvleugel should consider how to improve relationships with the more national and goods oriented Zuidvleugel - especially Rotterdam, which is the strongest city within the national network (complimentarity). Because Utrecht is weakly connected to The Hague, it is important to see how these cities can improve their economic activities. Almere is weakly connected to Amsterdam, and its overall share of corporate connections is quite modest. This is odd, considering the close proximity of these cities. It is advisable that Almere starts to improve its connections to other cities, especially Amsterdam. It is imaginable that it competes with other Noordvleugel cities to become the best partner city of Amsterdam. Almere's strength in business services, real estate and wholesale trade form can be reinforced. For Amersfoort, this reinforcement concerns insurance and real estate, and for Utrecht this is insurance and wholesale trade. For Amsterdam this is business services, insurance and wholesale trade. Furthermore it is shown that Amsterdam has the vast majority of international firms, and that these firms are also disproportionately

highly connected to other cities. Firms like ING, ABN AMRO, Wolters Kluwer, Vedior, Gucci, Prada and Getronics tie The Netherlands to the global economy, and are essential to the generation of its wealth. These top firms should be well maintained, and new ones attracted to Amsterdam. Hence, when a city loses a multinational, it not only loses the headquarter, but also its entire global network. In future, it is suggested that the networks of these headquarters are studied in depth, from which development strategies can be derived. Because Amersfoort, Haarlemmermeer, Alkmaar, Eindhoven and Rotterdam prove to be Amsterdam's strongest competitors, it is arguable that future research specifically explores which industries and firms this concerns. By knowing to which other cities Amsterdam's competitors are connected, and the exchange between them (supply and demand), future economic programs and strategies can be developed, so as to improve Amsterdam attractivity, and gain more of its competitors market.

In the performance chapter it is demonstrated that a strong relationship exists between national-urban indicators and transnational corporate connectivity. It is shown that a nation's level of global competitivity, business sophistication, openness, technological level, GDP, ICT expenditure, and infrastructure, are essential to its success in the world. It is therefore important to develop these qualities in Dutch cities – but mostly in the Noordvleugel, due to its already powerful international character. Because The Netherlands is continuously being challenged by nations and cities, near and far (as discussed in the trends chapter), it is essential that it creates a strong, polycentric, but complimentary system of cities, which can take on these international challenges. In the study on sectoral determinants of Dutch connectivity, it is shown that wholesale trade, advanced services, finance, FIRE, and manufacturing are critical to the strengths of Dutch international corporate networks. Therefore, improving these equalities, will lead to an increase of corporate connectivity.

Lastly, in the study on the impact of economic, social and spatial indicators on Dutch cities, it is shown that specialization in producer services, entrepreneurial activity, urban attractiveness, cultural amenities, and economic density; contribute most to national corporate connectivity. Although Amsterdam, Utrecht and Amersfoort score well on these indicators, Almere and Alkmaar are below average on all indicators. It means that these cities need to improve these qualities, which will enable them to compete better within the corporate network.

To conclude, this study has explored historical, structural, scalar, competitive and performance aspects of networks. In this way an initial, relative understanding of the Noordvleugel and other Dutch cities, within local, regional and global networks, is provided. Several recommendations and perspectives have been posited on how to improve these cities. This knowledge is based on cross-sectional data and therefore gives insight into the contemporary context. Nonetheless, the weakness of this is that it does not provide knowledge on the past and likely future of networks. Therefore, it is recommended that future research explores time-series data, in which the evolution of Noordvleugel cities can be studied.

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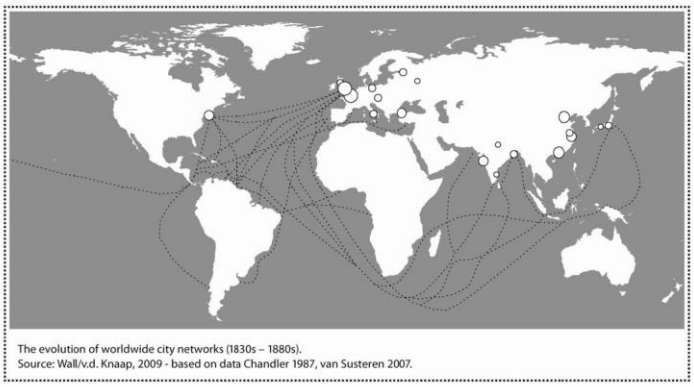
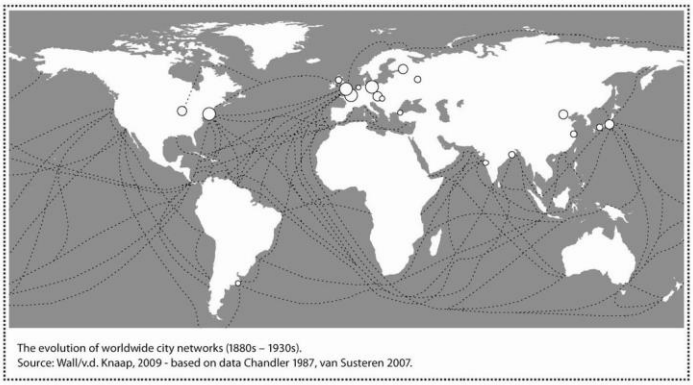
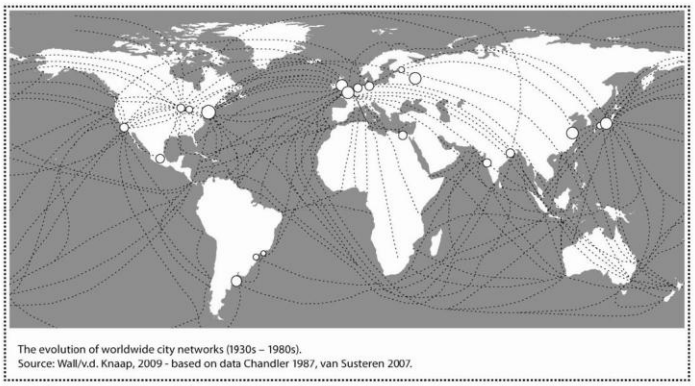


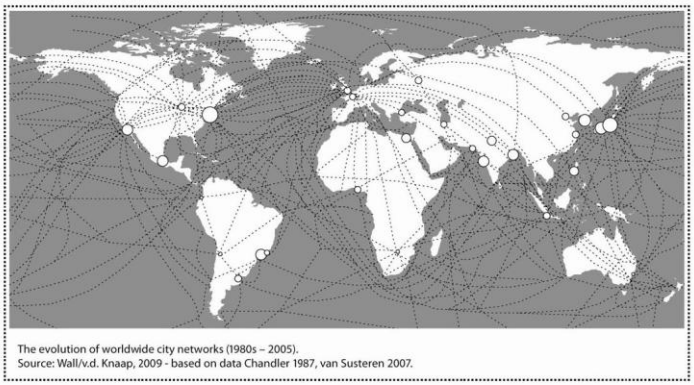
The evolution of worldwide city networks (1830s – 1880s).
Source: Wall/v.d. Knaap, 2009 - based on data Chandler 1987, van Susteren 2007.



The evolution of worldwide city networks (1880s – 1930s).
Source: Wall/v.d. Knaap, 2009 - based on data Chandler 1987, van Susteren 2007.



The evolution of worldwide city networks (1930s – 1980s).
Source: Wall/v.d. Knaap, 2009 - based on data Chandler 1987, van Susteren 2007.



The evolution of worldwide city networks (1980s – 2005).
Source: Wall/v.d. Knaap, 2009 - based on data Chandler 1987, van Susteren 2007.

Figure 1: The evolution of world city networks (1830 – 2005).

Source Wall, 2009a – based on Chandler 1987, van Susteren 2007

Figure 2: GIS map of 9,243 multinational linkages (share ownership), between 2,259 unique cities

Source Wall, 2009a – based on Fortune and Lexis-Nexus data, 2005

Outdegree and indegree of global, European and Dutch corporate networks (data 2005/2006).

Global headquarter city	Outdegree	Outdegree rank	Global subsidiary city	Indegree	Indegree rank
New York	473	1	New York	135	1
Dusseldorf	234	2	London	82	2
Munich	206	3	Dusseldorf	80	3
Zurich	192	4	Brussels	66	4
PaloAlto	162	5	Paris	65	5
London	147	6	Houston	59	6
Irving	110	7	Frankfurt	54	7
Paris	110	7	**Amsterdam**	49	8
New Brunswick	109	8	Milan	47	9
Amsterdam	102	9	Zurich	47	9
Brussels	88	10	Madrid	40	10
The Hague	68	11	Vienna	40	10
Frankfurt	67	12	Tokyo	39	11
Chicago	63	13	Singapore	38	12
Houston	60	14	Atlanta	37	13
Atlanta	55	15	Toronto	36	14
Wolfsburg	54	16	Mexico City	34	15
Detroit	52	17	Munich	30	16
Calgary	49	18	Bangkok	28	17
Gerlingen	48	19	Hamburg	28	17
Lausanne	43	20	Dublin	27	18
Stuttgart	43	20	Hong Kong	27	18
Toyota	40	21	Barcelona	26	19
Tokyo	37	22	Buenos Aires	26	19
Cincinnati	36	22	Luxembourg	24	20
Schaumburg	35	23	**Rotterdam**	23	21
Stavanger	34	24	Berlin	22	22
Philadelphia	32	24	Taipei	22	22
Chesterbrook	31	25	Montreal	20	23
Trieste	28	26	Turin	20	23
Rotterdam	n/a	n/a	**Utrecht**	12	31
Utrecht	n/a	n/a	**The Hague**	11	32
199 cities	N = 3,618				

Table 1: Global top 100 headquarter (outdegree) linkages with subsidiaries (indegree)

Source Wall, 2009b – based on Fortune and Lexis-Nexus data, 2005

Continued

European headquarter city	Outdegree	Outdegree rank	European subsidiary city	Indegree	Indegree rank
Paris	376	1	Paris	154	1
London	302	2	London	117	2
Zurich	232	3	Madrid	70	3
Amsterdam	87	4	New York	67	4
Basel	83	5	Brussels	55	5
Oslo	77	6	Singapore	47	6
Frankfurt	71	7	Munich	45	7
Vevey	71	8	Hong Kong	42	8
Espoo	62	9	Milan	42	8
Munich	59	10	Vienna	41	9
Dusseldorf	53	11	Buenos Aires	40	10
Chicago	47	12	Zurich	39	11
Berlin	45	13	Dublin	37	12
Brussels	42	14	Frankfurt	36	13
Edinburgh	38	15	**Amsterdam**	33	14
Tampere	38	15	Tokyo	33	14
Santa Monica	36	16	Barcelona	23	15
The Hague	31	17	Mexico City	23	15
Wolfsburg	31	17	Bangkok	22	16
Gothenburg	30	18	Dusseldorf	22	16
Leverkusen	29	19	Johannesburg	22	16
La Courneuve	27	20	Luxembourg	22	16
Saint Paul	27	20	Prague	22	16
Rome	22	21	Budapest	21	17
Trieste	21	22	Jakarta	21	17
Stuttgart	20	23	Lisbon	21	17
Bochum	19	24	Oslo	21	17
Gerlingen	19	24	Toronto	21	17
Voorhees	18	25	Hamburg	20	18
Utrecht	12	30	Athens	19	19
Rotterdam	3	38	**The Hague**	10	27
			Rotterdam	9	28
			Utrecht	9	28
199 cities	N = 2,820				

Table 2: European top 100 headquarter (outdegree) linkages with subsidiaries (indegree)

Source Wall, 2009b – based on Fortune and Lexis-Nexus data, 2005

Continued

Dutch headquarter city	Outdegree	Outdegree rank	Dutch subsidiary city	Indegree	Indegree rank
Amsterdam	2,787	1	**Amsterdam**	884	1
Utrecht	2,087	2	London	452	2
Rotterdam	1,223	3	Paris	258	3
The Hague	1,155	4	**Utrecht**	238	4
Arnhem	734	5	Wilmington	213	5
Eindhoven	484	6	Brussels	192	6
Heerlen	294	7	Dublin	190	7
Ritthem	90	8	**The Hague**	188	8
Rijen	61	9	**Rotterdam**	178	9
Nijkerk	26	10	Luxembourg	172	10
Meppel	14	11	Hong Kong	161	11
Den Bosch	12	12	Delaware	107	12
Breda	12	12	Singapore	105	13
Best	11	13	Walton	87	14
Bergen op Zoom	10	14	Milan	85	15
Sittard	5	15	Madrid	83	16
Tilburg	4	16	Hamburg	73	17
Rijssen	1	17	Zurich	68	18
Veenendaal	1	17	Stockholm	66	19
Zwolle	1	17	Dover	63	20
New York	n/a	n/a	Shanghai	63	20
Paris	n/a	n/a	Eindhoven	62	21
London	n/a	n/a	New York	62	21
			Lisbon	59	22
			Melbourne	58	23
			Houston	55	24
			Vienna	55	24
			Buenos Aires	54	25
			Bunnik	54	25
			Warsaw	54	25
			Mexico City	50	26
			Arnhem	49	27
			Budapest	49	27
199 cities	N = 9,012				

Table 3: Dutch top 100 headquarter (outdegree) linkages with subsidiaries (indegree)

Source Wall, 2009b – based on Reach and Lexis-Nexus data, 2005

Amsterdam's linkage strengths with other cities at global, European and Dutch network scales.

To city	Outdegree	From city	Indegree
Global corporate network			
Paris	12	Brussels	7
Brussels	8	Paris	6
Hong Kong	7	Dusseldorf	3
London	7	London	3
Atlanta	6	Dearborn	2
Madrid	5	Frankfurt	2
Toronto	5	Munich	2
Velizy	5	New York	2
European corporate network			
London	13	Paris	16
Zurich	8	Vevey	7
Tokyo	8	Munich	5
Madrid	8	Brussels	3
Paris	7	London	3
Frankfurt	6	Aachen	2
Dublin	6	Auburn Hills	2
Toronto	5	New York	2
Dutch corporate network			
Paris	130	Utrecht	357
London	99	The Hague	18
Dublin	66	Rotterdam	13
Singapore	49	Heerlen	7
Brussels	42	Arnhem	5
Milan	42	Eindhoven	4
Redfern	41	Breda	3
Hong Kong	35	Nijkerk	1

Table 4: Amsterdam's top outdegree and indegree linkages to cities, at three spatial scales

Source Wall, 2009b – based on Fortune, Reach and Lexis-Nexus data, 2005

Outdegree strengths of Randstad cities, within the top 100 Dutch corporate network (data 2005/2006).

Rank	Amsterdam		Rotterdam		Utrecht		The Hague	
1	Amsterdam	474	London	120	Amsterdam	357	Wilmington	167
2	Paris	130	Walton	87	Utrecht	211	London	105
3	London	99	The Hague	68	Willemstad	118	Dover	51
4	Dublin	66	Rotterdam	62	Brussels	116	The Hague	51
5	Singapore	49	Dublin	58	Luxembourg	110	Houston	48
6	Brussels	42	Paris	51	London	86	Melbourne	32
7	Milan	42	Hamburg	22	Rotterdam	83	Cedar Rapids	22
8	Redfern	41	Epping	21	Hong Kong	80	Delaware	21
9	Hong Kong	35	Jerusalem	20	Tortola	49	Amsterdam	18
10	Sydney	35	Mexico City	19	Paris	45	Edinburgh	18

Table 5: The strongest linkages of G4 cities to other cities within the top 100 Dutch headquarter network

Source Wall, 2009b – based on Reach data, 2005

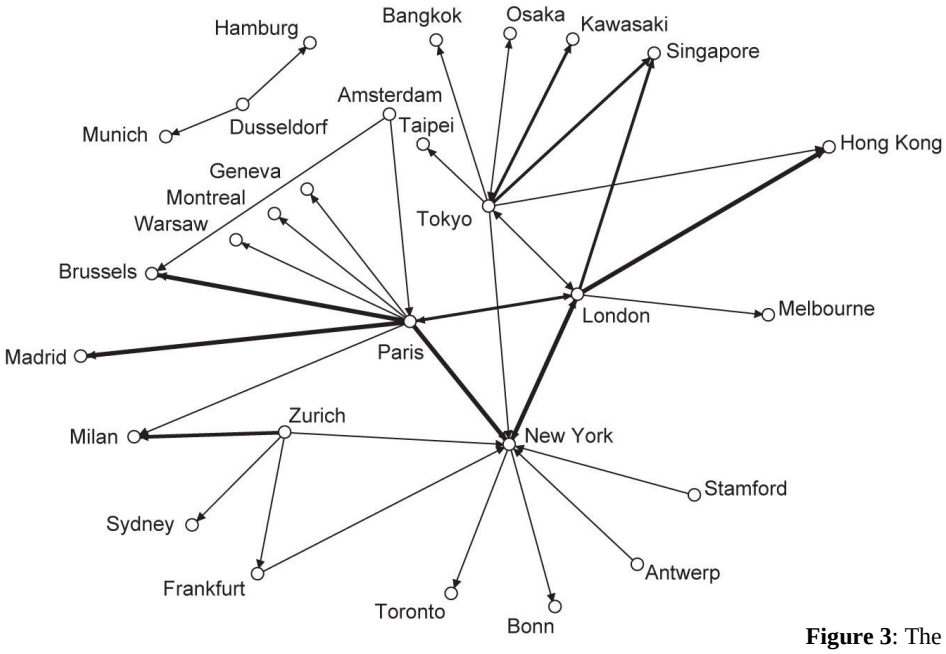


Figure 3: The most important linkages within the Global top 100 headquarter network

Source Wall, 2009a – based on Fortune and Lexis-Nexus data, 2005

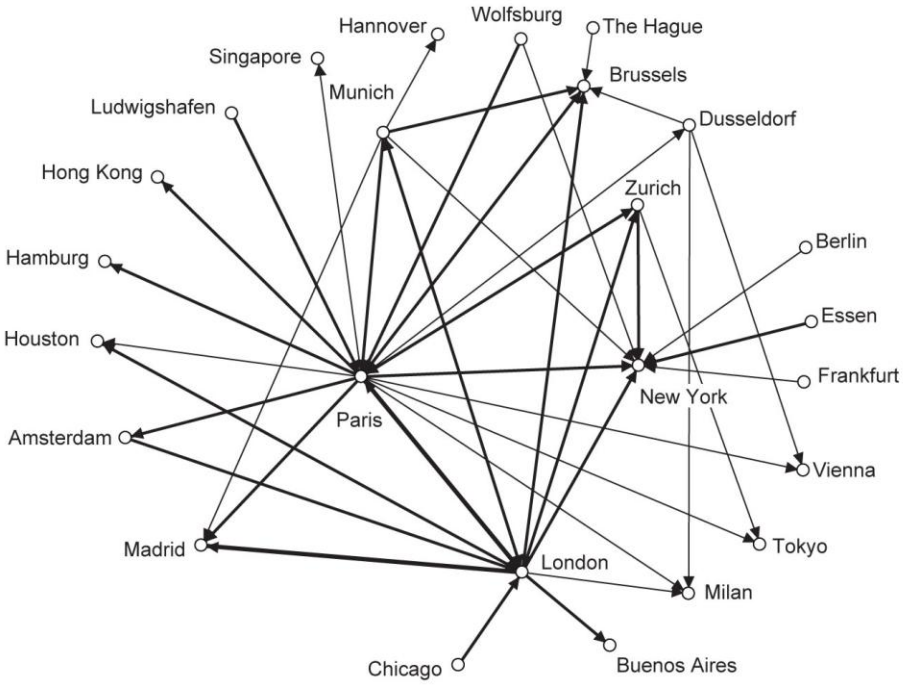


Figure 4: The most important linkages within the European top 100 headquarter network

Source Wall, 2009a – based on Fortune and Lexis-Nexus data, 2005

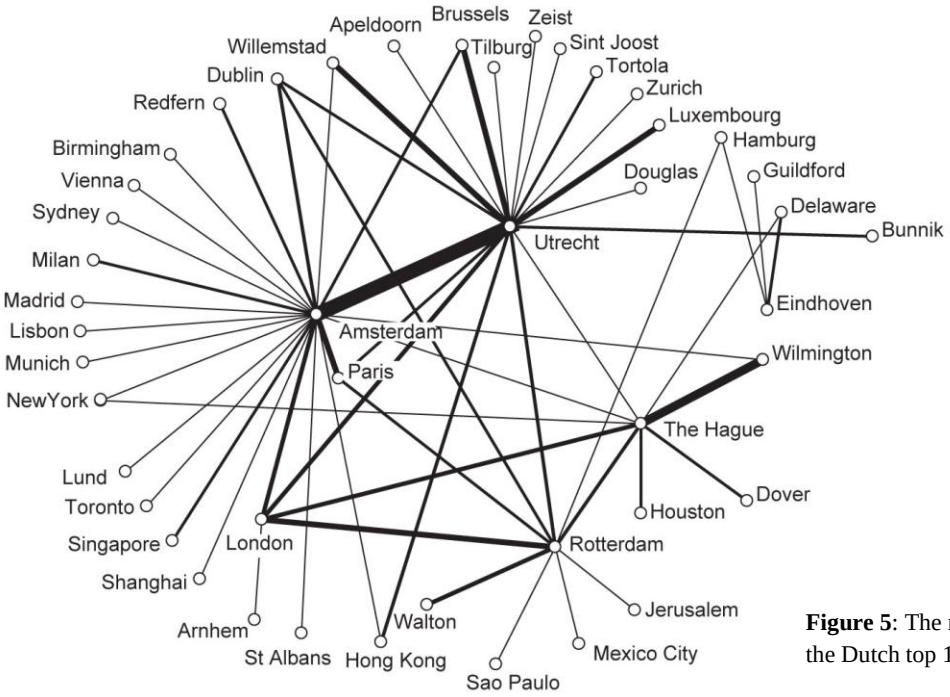


Figure 5: The most important linkages within the Dutch top 100 headquarter network

Source Wall, 2009a – based on Reach data, 2005

Rank	City	International links	City	National links	City	Goods	City	Information	City	(H) Business services	City	(S) Business services	City	(H) Insurance	City	(S) Insurance	City	(H) Real estate	City	(S) Real estate	City	(H) Wholesale trade	City	(S) Wholesale trade
1	Amsterdam	21388	Rotterdam	4906	Rotterdam	2485	Amsterdam	2703	Rotterdam	433	Rotterdam	330	Utrecht	835	Den Haag	362	Rotterdam	288	Rotterdam	259	Utrecht	576	Rotterdam	382
2	Rotterdam	8288	Amsterdam	3634	Amsterdam	930	Utrecht	2531	Almelo	325	Amsterdam	298	Amsterdam	321	Amsterdam	324	Utrecht	222	Amsterdam	172	Heerlen	161	Rotterdam	301	Amsterdam	231
3	Utrecht	7045	Utrecht	2599	Nieuwegein	555	Rotterdam	2421	Gouda	320	Utrecht	165	Zeist	278	Utrecht	222	Amsterdam	172	Amsterdam	83	Amsterdam	185	Utrecht	100
4	Den Haag	5138	Den Haag	2282	Rijssen-Ho	542	Den Haag	2006	Amsterdam	310	Haarlemmi	116	Rotterdam	261	Capelle aa	201	Den Haag	80	Den Haag	75	Neder-Beti	115	Westland	94
5	Nieuwegein	2027	Den Bosch	846	Utrecht	468	Den Bosch	624	Utrecht	156	Almelo	108	Den Haag	254	Rotterdam	155	Naarden	50	Utrecht	54	Rijswijk	112	Harderwijk	76
6	Best	1922	Arnhem	799	Eindhoven	424	Arnhem	549	Diemen	128	Diemen	107	Ede	236	Maastricht	93	Hilversum	44	Naarden	50	Bladel	97	Arnhem	71
7	Zeist	1907	Haarlemmi	723	Den Haag	286	Haarlemmi	526	Amstelvee	126	Arnhem	98	Hoogeveen	74	Den Bosch	67	Zwolle	38	Westland	95	Dordrecht	71
8	Arnhem	1804	Eindhoven	705	Bunnik	255	Nijkerk	470	Arnhem	102	Den Haag	91	Tilburg	59	DeBilt	62	Nieuwegein	30	Deventer	26	Deltzijl	88	Huissel	71
9	Eindhoven	1642	Nieuwegein	701	Arnhem	250	Groningen	448	Haarlemmi	102	Den Bosch	85	Eindhoven	32	Zeist	59	Gouda	30	Maastricht	26	Reimerswa	66	Neder-Beti	69
10	Heerlen	1351	Gouda	624	Den Bosch	222	Hilversum	418	Nijmegen	97	Gouda	30	Haarlemmi	57	Deventer	28	Eindhoven	22	Ede	61	Gorinchem	69
11	Amstelveer	1188	Groningen	600	Velsen	212	Gouda	417	Amersfoord	84	Amstelveer	77	Zwolle	21	Tilburg	43	Apeldoorn	55	Maastricht	25	Zwolle	18	DenHelder	59	Bladel	62
12	Venlo	1148	Bussen-Ho	589	Hardinxvel	210	Almelo	377	Almere	71	Zwolle	20	Tilburg	43	Eindhoven	37	Andijk	25	Andijk	18	Veghel	58	Capelle aa	56
13	Boxtel	984	Hilversum	568	Gouda	207	Zeist	340	DeBilt	60	Gouda	69	Apeldoorn	20	Amersfoord	35	Groningen	22	Almere	18	Meppel	57	Ridderkerk	54
14	Gouda	927	Almelo	511	Haarlemmi	187	Ede	338	Almere	75	Leidschend	69	Nijmegen	18	Amersfoord	34	Leiden	24	Groningen	16	Uithoorn	56	Almelo	54
15	Breda	747	Almelo	387	Meppel	184	Amersfoord	304	Leidschend	66	Amersfoord	68	Leiden	17	Leiden	33	Eindhoven	17	Arnhem	15	Hellevoet	48	Helmond	48
16	Den Bosch	650	Nijkerk	486	Apeldoorn	162	Den Haag	283	Amersfoord	65	Capelle aa	58	Groningen	17	Hoogeveen	33	Heerlen	15	Breda	15	Dordrecht	53	Enschede	46
17	Hilversum	572	Heerlen	394	Bussen-Ho	162	Leeuwarde	273	Barendrecl	61	Capelle aa	51	Capelle aa	51	Amstelveer	32	Bussen-Ho	15	Edam-Vole	15	Harderwijk	51	Uithoorn	44
18	Diemen	547	Amersfoord	371	Groningen	152	Eindhoven	262	Leiden	51	Leiden	51	Uitgeest	15	Amstelveer	32	Bunnik	30	Zoetermee	13	Terneuzen	49	Nijmegen	42
19	Naarden	489	Zoetermee	359	Zeist	359	Heerlen	259	Groningen	49	Nieuwegein	50	Almere	14	Almere	30	Almere	12	Zoetermee	12	Barendrecl	49	Haarlemmi	41
20	Groningen	443	Amstelveer	337	Ede	150	Maastricht	240	Den Bosch	47	Eindhoven	48	Baarn	12	Leeuwarde	26	Utrecht	11	LoonopZan	12	Capelle aa	12	Groningen	39
21	Bergen op	417	Breda	305	Hilversum	140	Rijswijk	240	Vlissingen	44	Houten	48	Heerlen	10	Nieuwegein	24	Utrecht	11	LoonopZan	10	Capelle aa	47	Den Bosch	38
22	Boxmeer	378	Maastricht	302	Heerlen	135	Delfzijl	202	Capelle aa	38	Nijmegen	42	Voorst	7	Hilversum	23	Vlist	11	Westland	10	Leusden	47	Den Haag	38
23	Vlaardinge	354	Westland	300	Almelo	134	Almere	199	Hilversum	33	Delft	41	Capelle aa	6	Heerlen	22	Dordrecht	9	Den Bosch	10	Den Bosch	45	Breda	38
24	Alkmaar	320	Leeuwarde	286	Oldenzaal	131	Breda	197	Beverwijk	33	Dordrecht	40	Diemen	5	Zoetermee	20	Dirksland	9	Hardenber	10	Eindhoven	44	Amersfoord	37
25	Leiden	299	Velsen	268	Neder-Beti	131	Tilburg	192	Breda	30	Papendrec	39	Leeuwarde	3	Overbetuw	20	Westland	8	Arnhem	9	Helmond	44	Barendrecl	35
26	Capelle aa	288	Bunnik	266	Papendrec	128	Capelle aa	189	Zwolle	30	Zaanstad	39	Houten	3	Nijmegen	17	Roermond	8	Rijswijk	9	Ridderkerk	44	Delfzijl	34
27	Helmond	288	Tilburg	263	Hoorn	127	Westland	188	Delft	30	Assen	38	Amstelveer	3	Delft	17	Enschede	7	Gouda	8	Hunsel	39	Nijkerk	34
28	Zwolle	287	Apeldoorn	261	Best	125	Nijmegen	186	Veldhoven	30	Zwolle	37	Meppel	3	Gouda	15	Harderwijk	7	Vlist	8	Schiedam	38	Deventer	34
29	Bunnik	281	Rijswijk	251	Zwartewat	122	Terneuzen	175	Naarden	28	Ijsselstein	36	Arnhem	2	Arnhem	15	DenHelder	7	Apeldoorn	8	Den Haag	35	Venlo	33
30	Almere	259	Zoetermee	248	Gorinchem	114	Diemen	154	Eindhoven	27	Zaltbomme	35	Hilversum	2	Rijswijk	15	Montferlan	7	Zaanstad	8	Almere	35	Tilburg	32
31	Delft	249	Neder-Beti	248	Westland	112	Nieuwegein	146	Deventer	27	Heerenvee	32	Leusden	2	Zwijndrech	15	Amstelvee	6	Ijsselstein	8	Nijkerk	35	Zwijndrech	31
32	Dordrecht	241	Tilburg	213	Breda	108	Hoogeveen	144	Sliedrecht	24	Naarden	31	Stadskana	2	Venray	15	Apeldoorn	5	Zundert	8	Maastricht	34	Zwartewat	30
33	Tilburg	213	Maarssen	108	Hardinxvel	244	Almere	239	Delft	143	Uden	24	Vianen	31	Maasbracl	2	Groningen	14	Delft	5	Dirksland	7	Texel	34	Amstelvee	30
34	Maastricht	189	Capelle aa	233	SonenBrel	101	Middelburg	143	Zaltbomme	23	DeBilt	30	Breda	1	Baarn	14	Arnhem	5	Harderwijk	7	Tilburg	33	Zaanstad	30
35	Schiedam	182	Nijmegen	232	Zwolle	99	Veghel	141	Pijnacker-H	22	Hilversum	30	Sliedrecht	1	Bunschote	14	Epe	5	DenHelder	7	Naarden	32	Hoogeveen	29
36	Nijmegen	164	Zwolle	230	Naarden	97	Harderwijk	135	Purmerend	21	Ede	30	Nijkerk	1	Noordwijk	13	Binnenmai	5	Someren	7	Montferlan	32	Leusden	25
37	Meppel	152	Meppel	229	OudeIJsse	92	Dordrecht	134	Zeist	21	Beverwijk	27	Heerenvee	0	Zwolle	12	Someren	5	Hoorn	7	Zwartewat	32	Naarden	25
38	Haarlem	144	Naarden	224	Bergen op	90	Zwolle	131	Apeldoorn	19	Haarlem	26	Sittard	0	Assen	12	Bergen2	5	Dordrecht	6	Alkmaar	31	Leiden	25
39	Papendrec	143	Terneuzen	224	Helmond	90	Barendrecl	130	Vianen	18	Barendrecl	25	Haarlemmi	0	Naarden	12	Bergen op	4	Roermond	6	Haarlemmi	29	Terneuzen	24
40	Amersfoord	139	Baarn	218	Schiedam	90	Alkmaar	128	Hengelo	16	Deventer	23	Helmond	0	Breda	11	Spijkenisse	4	Montferlan	6	Haarlemmi	29	Alphen aar	24
41	Rheden	136	Delfzijl	213	DeRondeV	88	Schiedam	15	Purmerend	21	Laren	0	Almere	10	Haarlemmi	3	Haarlemmi	6	Haarlemmi	6	Alphen aar	29	Alkmaar	24
42	Weesp	128	Delft	203	Amersfoord	87	Leiden	127	Westland	14	Hengelo	21	Dordrecht	0	Hengelo	3	Amersfoord	6	Amersfoord	6	Krimpen ai	27	Aalsmeer	24
43	Houten	123	Gorinchem	192	Oss	84	Venlo	124	Rijswijk	14	Breda	19	Kerkrade	0	Waalwijk	10	Hoorn	3	Spijkenisse	5	Amstelvee	27	Best	24
44	Goes	119	Schiedam	190	Enschede	73	Neder-Beti	117	Leeuwarde	19	Zaanstad	0	Putten	3	Best	10	Bergen2	4	Bergen op	4	Aalsmeer	27	Rijswijk	23
45	Apeldoorn	113	Enschede	189	Groenlo	72	Enschede	116	Papendrec	13	Schiedam	18	Woerden	0	Diemen	9	Roosendaa	3	Bergen op	4	Sliedrecht	25	Reimerswa	22
46	Barendrecl	112	Dordrecht	185	Tilburg	71	Bladel	114	Aalsmeer	11	Waalwijk	18	Alkmaar	0	Smallinger	9	Oirschot	3	Hengelo	4	Hoogeveen	25	Zwolle	22
47	Deventer	108	Veghel	184	Liesveld	70	DeBilt	108	Sittard	11	Maastricht	18	DenHelder	0	Alkmaar	8	Krimpen ai	3	Tilburg	4	Groningen	24	Teylingen	21
48	Leeuwarde	106	Hoogeveen	183	Rheden	68	Schiedam	100	Geldermal	11	Bladel	18	Vlissingen	0	Houten	7	Oss	4	Zwijndrech	24	Purmerend	21
49	Sliedrecht	105	Harderwijk	176	Maasdonk	65	Apeldoorn	99	Rucphen	11	Weert	17	Emmen	0	Meppel	7	Horstaandi	3	Landgraaf	4	Bodegrave	24	Meppel	20
50	Almelo	103	Best	171	Hoogezand	63	Zoetermee	98	Waalwijk	10	Emmen	16	Bergen op	0	Zaanstad	7	Tilburg	2	Nijmegen	4	Hardinxvel	24	Alphen aar	20
Totals		69724		42159		16077		26082		3705		3698		2605		2594		1308		1302		4202		4160

Zuidvleugel cities

Noordvleugel cities

Table 6: The most important international and national linkages of Dutch cities (by sector), within a database of 111 883 Dutch corporate connections. H = headquarter relations, S = subsidiary relations

Source Wall, 2010 – based on Reach data, 2007

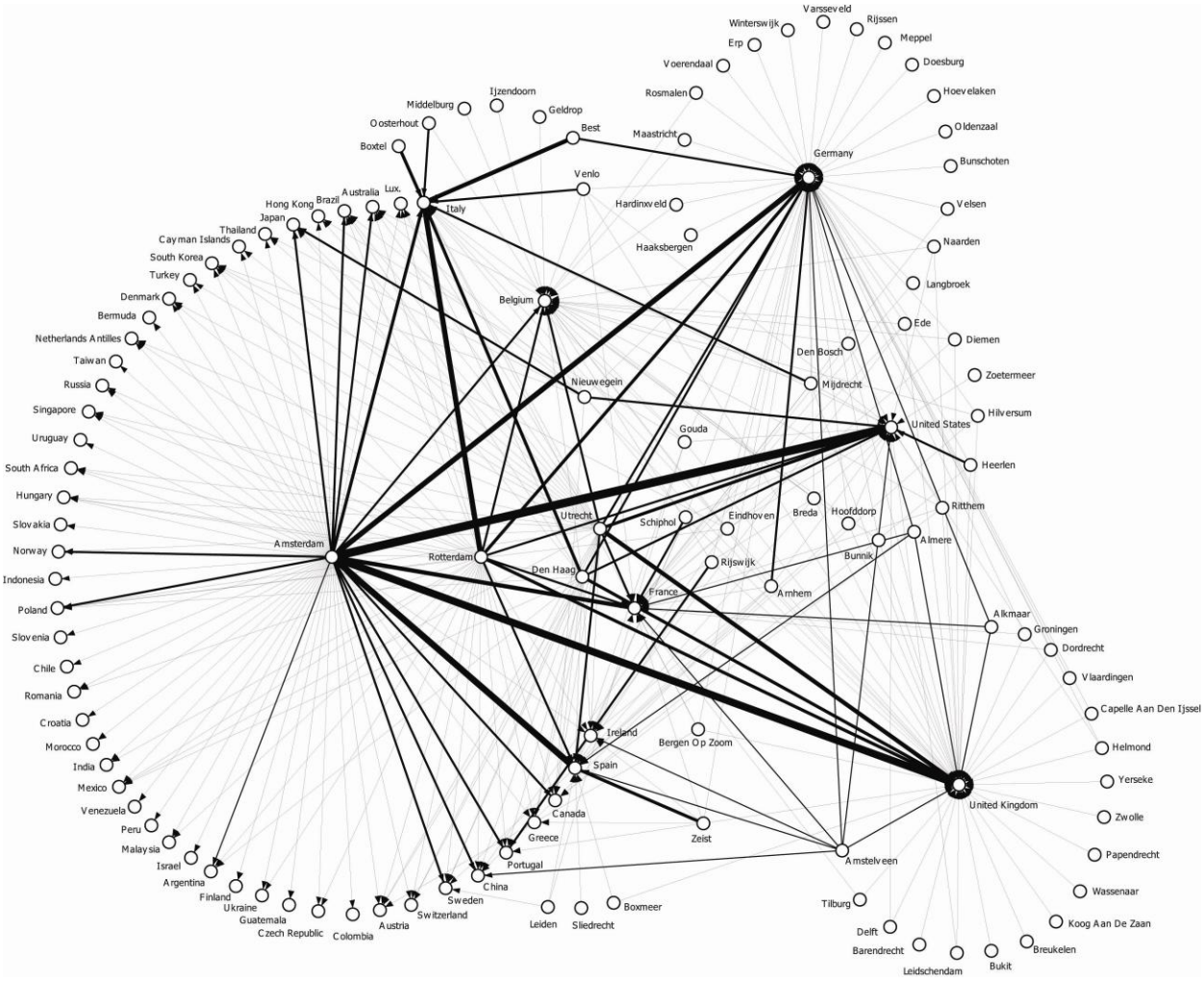


Figure 6: The most important international linkages of Dutch cities to nations, based on 69724 corporate linkages

Source Wall, 2010 – based on Reach data, 2007

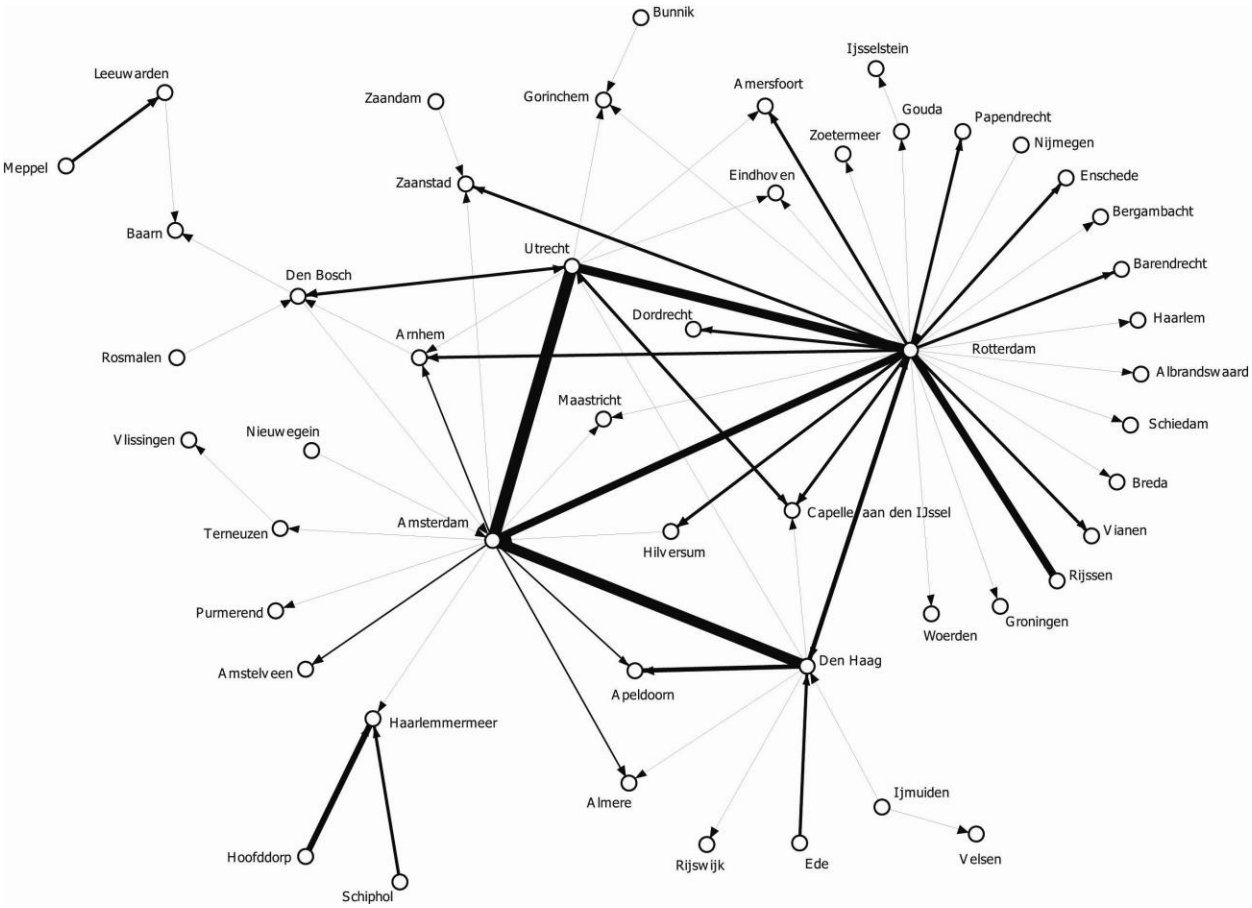


Figure 7: The most important linkages between Dutch cities, based on 42159 corporate linkages

Source Wall, 2010 – based on Reach data, 2007

Important firms with international linkages (2007)

Firm	City	Linkages
ERIKS group nv	Alkmaar	259
SMA International B.V.	Alkmaar	20
De Boer Investment B.V.	Alkmaar	12
Oilily Holding B.V.	Alkmaar	9
LeasePlan Corporation N.V.	Almere	102
USG People N.V.	Almere	71
Samlerhuset Group B.V.	Almere	23
Cascade N.V.	Almere	7
Brokking's Beheer B.V.	Almere	6
Combinatie Teijsen v.d. Hengel	Almere	6
Bell Microproducts B.V.	Almere	5
DHV Holding BV	Amersfoort	45
Mercuri Urval International B.V.	Amersfoort	29
Yokogawa Europe B.V.	Amersfoort	21
Tulip Computers N.V.	Amersfoort	11
Laurus N.V.	Amersfoort	6
Sun Microsystems International B.V.	Amersfoort	6
ING N.V.	Amsterdam	4956
ABN AMRO Holding N.V.	Amsterdam	2433
Euronext N.V.	Amsterdam	1947
Commerz Nederland N.V.	Amsterdam	995
Oranje-Nassau Groep B.V.	Amsterdam	956
Delta Lloyd Bankengroep NV	Amsterdam	932
Wolters Kluwer nv	Amsterdam	878
Aktiva Holdings B.V.	Amsterdam	790
Kempen & Co. N.V.	Amsterdam	678
Eurospecialities Foods B.V.	Amsterdam	635
Heineken N.V.	Amsterdam	505
Koolmees Holdings B.V.	Amsterdam	402
Vedior N.V.	Amsterdam	374
Gucci Group N.V.	Amsterdam	364
Koninklijke Ahold N.V.	Amsterdam	345
Eurobrom B.V.	Amsterdam	329
Eurocil Holding B.V.	Amsterdam	329
Draka Holding N.V.	Amsterdam	161
Postbank Levensverzekering N.V.	Amsterdam	157
Tetra Laval Holdings BV	Amsterdam	150
Corporate Express N.V.	Amsterdam	146
Prada Holding B.V.	Amsterdam	144
n.v. Nuon	Amsterdam	141
Clear Channel International B.V.	Amsterdam	138
Universal Pictures International B.V.	Amsterdam	135
Cartier International B.V.	Amsterdam	130
Getronics NV	Amsterdam	128
SAICA International B.V.	Amsterdam	118
AlpInvest Partners N.V.	Amsterdam	113
Core Laboratories N.V.	Amsterdam	113
Postbank Schadeverzekering N.V.	Amsterdam	107
InterGen N.V.	Amsterdam	106
Mediaproduction Properties B.V.	Amsterdam	101
Merck Sharp & Dohme B.V.	Haarlem	59
Lycos Europe N.V.	Haarlem	46
Beukenhoeve Beheer B.V.	Haarlem	13
Fluor Europe B.V.	Haarlem	8
Imbema Holland B.V.	Haarlem	7
Endemol N.V.	Hilversum	216
JT Europe Holding B.V.	Hilversum	112
Kroymans Corporation B.V.	Hilversum	70
Citadel Enterprises B.V.	Hilversum	17
Krasnapolsky Hotels & Restaurants N.V.	Hilversum	17
RSDB N.V.	Hilversum	16
Jetix Europe N.V.	Hilversum	15
UBF N.V.	Hilversum	13
Roto Smeets De Boer Holding B.V.	Hilversum	10
International Flavors & Fragrances I.F.	Hilversum	8
Intomart GfK Group B.V.	Hilversum	8
Fortis	Utrecht	3088
Coöperatieve Centrale Raiffeisen-Boe	Utrecht	877
SPF Beheer B.V.	Utrecht	756
SNS REAAL N.V.	Utrecht	557
Doctors Pension Funds Services B.V.	Utrecht	444
SHV Holdings N.V.	Utrecht	398
Sara Lee International B.V.	Utrecht	201
AXA Nederland B.V.	Utrecht	160
NV Nederlandse Spoorwegen	Utrecht	71
NS Groep N.V.	Utrecht	70
Koninklijke Wessanen nv	Utrecht	69
Strukton Groep nv	Utrecht	55
OPG Groep N.V.	Utrecht	52
DaimlerChrysler Nederland Holding B	Utrecht	34
Nuon Power Generation B.V.	Utrecht	24
Varta B.V.	Utrecht	21
WE International B.V.	Utrecht	21
Equens Nederland B.V.	Utrecht	20
Baxter B.V.	Utrecht	17
Farinia B.V.	Utrecht	17
Econcern B.V.	Utrecht	16
Railion Nederland N.V.	Utrecht	16
Nedrailways B.V.	Utrecht	11

Important firms with national linkages (2007)

Firm	City	Linkages
Huisvuilcentrale Noord-Holland	Alkmaar	24
ERIKS group nv	Alkmaar	22
Martin Schilder Holding B.V.	Alkmaar	20
Middelbeek Beheer B.V.	Alkmaar	20
Bot Bouwgroep B.V.	Alkmaar	15
USG People N.V.	Almere	72
LeasePlan Corporation N.V.	Almere	29
R.J. van Seenus B.V.	Almere	18
Brokking's Beheer B.V.	Almere	14
Yarden Holding bv	Almere	14
Combinatie Teijsen v.d. Hengel	Almere	13
WZG Group B.V.	Almere	10
Van Hoogevest Groep B.V.	Amersfoort	48
ARCADIS Nederland BV	Amersfoort	33
Bakker's Houdstermaatschappij B.V.	Amersfoort	24
Laurus N.V.	Amersfoort	21
AFAB Financiële Diensten Holding N.V.	Amersfoort	20
A.H. de Vries BV	Amersfoort	18
Stichting Agis	Amersfoort	18
AHM Holding B.V.	Amersfoort	17
DHV Holding BV	Amersfoort	16
Pentascope Groep B.V.	Amersfoort	15
Schuitema n.v.	Amersfoort	13
Amfors Holding BV	Amersfoort	11
Van Hoogevest Bouw B.V.	Amersfoort	10
Kempen & Co. N.V.	Amsterdam	297
ING Bank N.V.	Amsterdam	216
Telegraaf Media Groep N.V.	Amsterdam	185
n.v. Nuon	Amsterdam	161
Aktiva Holdings B.V.	Amsterdam	123
Postbank Levensverzekering N.V.	Amsterdam	118
Box-Shipping BV	Amsterdam	115
Fortis Intertrust (Netherlands) B.V.	Amsterdam	82
Vedior N.V.	Amsterdam	74
Koninklijke Ahold N.V.	Amsterdam	70
Stern Groep N.V.	Amsterdam	62
ING Groep N.V.	Amsterdam	55
Delta Lloyd Bankengroep NV	Amsterdam	54
Postbank Schadeverzekering N.V.	Amsterdam	54
Maxeda B.V.	Amsterdam	53
KAS BANK N.V.	Amsterdam	50
Heineken N.V.	Amsterdam	48
Getronics NV	Amsterdam	44
Wolters Kluwer nv	Amsterdam	41
Spliethoff's Bevrachtingskantoor B.V.	Amsterdam	40
Oranje-Nassau Groep B.V.	Amsterdam	39
Corporate Express N.V.	Amsterdam	36
Draka Holding N.V.	Amsterdam	35
ING Verzekeringen N.V.	Amsterdam	35
Cargill B.V.	Amsterdam	31
VCK Holding B.V.	Amsterdam	20
Beukenhoeve Beheer B.V.	Haarlem	18
Imbema Holland B.V.	Haarlem	14
Airtrade Holding B.V.	Haarlem	13
Fluor Europe B.V.	Haarlem	13
Take Good Care Holding B.V.	Haarlem	9
Merck Sharp & Dohme B.V.	Haarlem	7
Kroymans Corporation B.V.	Hilversum	87
Citadel Enterprises B.V.	Hilversum	55
RSDB N.V.	Hilversum	52
Connexxion Holding NV	Hilversum	50
Johan Matser Projectontwikkeling B.V.	Hilversum	44
Krasnapolsky Hotels & Restaurants N.V.	Hilversum	44
Endemol N.V.	Hilversum	38
Citechma B.V.	Hilversum	26
Roto Smeets De Boer Holding B.V.	Hilversum	26
NOB Holding N.V.	Hilversum	16
Kroymans Lease Holding B.V.	Hilversum	14
UBF N.V.	Hilversum	14
Residence Beheer Hilversum BV	Hilversum	13
Indivers B.V.	Hilversum	11
SHV Holdings N.V.	Utrecht	556
SNS REAAL N.V.	Utrecht	383
Fortis	Utrecht	355
NV Nederlandse Spoorwegen	Utrecht	221
NS Groep N.V.	Utrecht	162
Fortis Bank Nederland (Holding) N.V.	Utrecht	139
Strukton Groep nv	Utrecht	130
OPG Groep N.V.	Utrecht	109
Coöperatieve Centrale Raiffeisen-Boeren	Utrecht	108
Bastion Hotelgroep B.V.	Utrecht	62
Jaarbeurs Holding B.V.	Utrecht	38
AXA Nederland B.V.	Utrecht	37
Sara Lee International B.V.	Utrecht	37
Gebr. Nefkens nv	Utrecht	35
Koninklijke Wessanen nv	Utrecht	35
ISS Holding Nederland B.V.	Utrecht	33
Econcern B.V.	Utrecht	32
VVAA groep bv	Utrecht	32

Table 7: The Noordvleugel's most important international and national firms, based on 111 883 corporate linkages

Source Wall, 2010 – based on Reach data, 2007

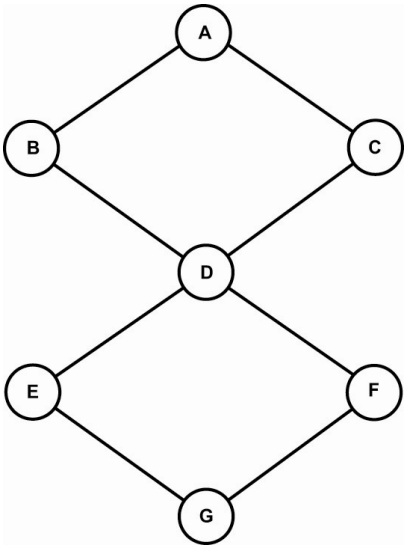


Figure 8: Functional linkages in a hypothetical urban system, to explain intercity corporate competition

Source Burger, Wall, v.d. Knaap 2008

Market share of 4 Dutch cities. Data based on Reach (2007)

Competition - Rotterdam

Rank	City	Market overlap
1	Eindhoven	78.1%
2	Amsterdam	75.5%
3	Hilversum	73.6%
4	Den Bosch	73.3%
5	Utrecht	73.1%
6	Tilburg	72.8%
7	Almere	71.6%
8	Haarlemmermeer	71.1%
9	Amersfoort	70.4%
10	Alkmaar	70.1%
18	Den Haag	65.6%

Competition - Amsterdam

Rank	City	Market overlap
1	Amersfoort	83.2%
2	Haarlemmermeer	81.2%
3	Alkmaar	76.5%
4	Eindhoven	76.1%
5	Rotterdam	75.7%
6	Nijmegen	75.5%
7	Almere	75.4%
8	Den Haag	73.3%
9	Apeldoorn	73.3%
10	Utrecht	73.1%

Competition - Den Haag

Rank	City	Market overlap
1	Utrecht	88.8%
2	Apeldoorn	86.0%
3	Haarlemmermeer	85.3%
4	Leiden	82.8%
5	Amstelveen	79.0%
6	Hilversum	77.8%
7	Almere	77.0%
8	Alphen a.d. Rijn	75.5%
9	Delft	74.7%
10	Amsterdam	73.3%
19	Rotterdam	65.6%

Competition - Utrecht

Rank	City	Market overlap
1	Den Haag	88.8%
2	Hilversum	88.0%
3	Haarlem	83.8%
4	Zaanstad	83.2%
5	Vlaardingen	82.4%
6	Eindhoven	81.6%
7	Tilburg	79.3%
8	Amersfoort	79.1%
9	Alphen a.d. Rijn	78.7%
10	Haarlemmermeer	77.5%
16	Rotterdam	73.2%
17	Amsterdam	73.1%

Competition - Almere

Rank	City	Market overlap
1	Amstelveen	80.4%
2	Den Haag	77.0%
3	Haarlemmermeer	76.6%
4	Amsterdam	75.4%
5	Apeldoorn	74.9%
6	Rotterdam	71.6%
7	Alkmaar	71.1%
8	Amersfoort	70.4%
9	Lelystad	69.9%
10	Delft	69.7%
12	Utrecht	68.9%
25	Hilversum	61.6%
30	Zaamstad	52.8%

Table 8: The market overlap (competition) of 5 Randstad cities with other Dutch cities

Source Wall and Burger 2008

Correlations between National Performance Indicators and Corporate Connectivity

National performance indicators *various sources*	Global corporate connectivity		European corporate connectivity	
	Outdegree	Indegree	Outdegree	Indegree
GDP per capita	0.885	0.905	0.727	0.855
R&D personal	0.651	0.611	0.476	0.501
Business Efficiency Index	0.742	0.786	0.602	0.658
Innovation Index	0.837	0.826	0.718	0.746
Technical Achievement Index	0.746	0.691	0.416	0.548
Patents Granted	0.681	0.531	0.419	0.467
Global Competitiveness Index	0.824	0.741	0.619	0.660
Institutional Development	0.767	0.815	0,716	0.785
Market Efficiency	0.681	0.708	0.546	0.607
Technological Readiness	0.782	0.792	0.624	0.722
Business Sophistication	0.845	0.635	0.620	0.581
Internet Services	0.817	0.881	0.693	0.811
Internet Bandwidth	0.841	0.803	0.716	0.786
ICT Expenditure	0.901	0.902	0,727	0.835
Infrastructure	0.841	0.741	0.675	0.650

All significant at the 0.001 level

Table 9: Correlations between corporate connectivity and national performance indicators

Source Wall, Sleegers and v.d. Knaap 2008

Model - Coefficients International Linkages

Model (all variables log)	Standardized Coefficients Beta	Sig.
AG	,081	,08
MIN	,051	,28
CON	-,109	,19
MAN	,126	,04
TCE	-,044	,61
WT	,268	,00
RT	,042	,64
FIRE	,193	,03
ADSRV	,242	,04
POP	,089	,11
Dependent variable: INTCON		

Model (all variables log)	Standardized Coefficients Beta	Sig.
FIN	,217	,02
INS	,011	,89
RLST	,279	,00
PERS	-,006	,93
BUS	,235	,02
HLTH	-,117	,16
LEGL	,059	,45
EDU	-,047	,59
SOC	-,021	,80
ERAM	,147	,05
POP	,088	,122

Dependent variable: INTCON

Model - Coefficients National Linkages

Model (all variables log)	Standardized Coefficients Beta	Sig.
AG	,010	,82
MIN	,035	,43
CON	,029	,71
MAN	-,129	,05
TCE	,060	,45
WT	,143	,01
RT	-,151	,07
FIRE	,385	,00
ADSRV	,423	,00
POP	,068	,19
Dependent variable: NATCON		

Model (all variables log)	Standardized Coefficients Beta	Sig.
FIN	,301	,00
INS	,098	,19
RLST	,175	,04
PERS	,027	,67
BUS	,276	,00
HLTH	-,130	,10
LEGL	,024	,75
EDU	-,017	,84
SOC	,023	,77
ERAM	,038	,70
POP	,072	,18

Dependent variable: NATCON

AG	*agriculture*	*FIN*	*finance*
MIN	*mining*	*INS*	*insurance*
CON	*construction*	*RLST*	*real estate*
MAN	*manufacturing*	*PERS*	*personal services*
TCE	*transport, communication and energy*	*BUS*	*business services*
		HLTH	*health services*
WT	*wholesale trade*	*LEGL*	*legal services*
RT	*retail trade*	*EDU*	*educational services*
FIRE	*finance, insurance and real estate*	*SOC*	*social services*
		ERAM	*engineering, research, accounting and management*
ADSRV	*advanced services*		

POP	*city population*
INTCON	*international connectivity*
NATCON	*national connectivity*

Table 10: Estimates of Dutch international and national connectivity using different sectoral clusters in cities

Source Wall 2007

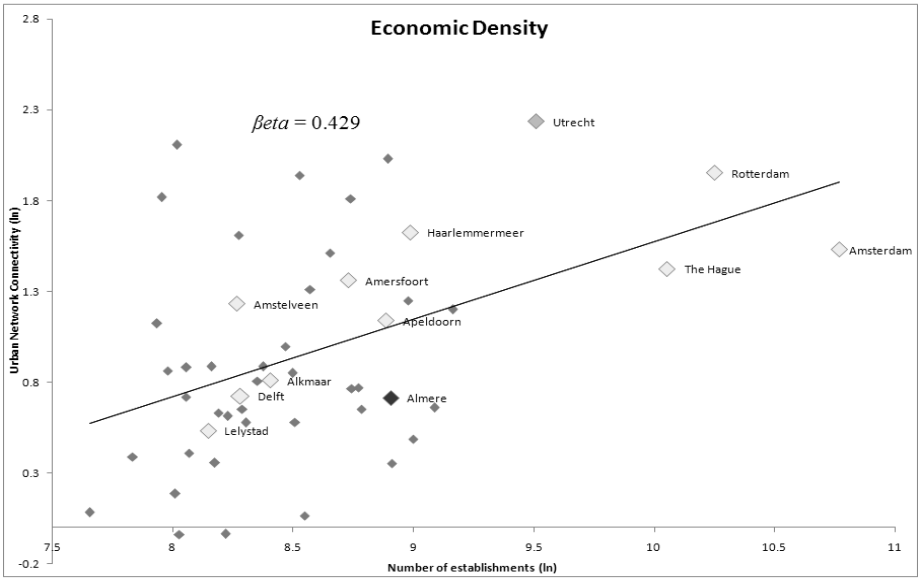


Figure 9: Estimating Dutch city connectivity on the basis of economic density (number of establishments located in cities)

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

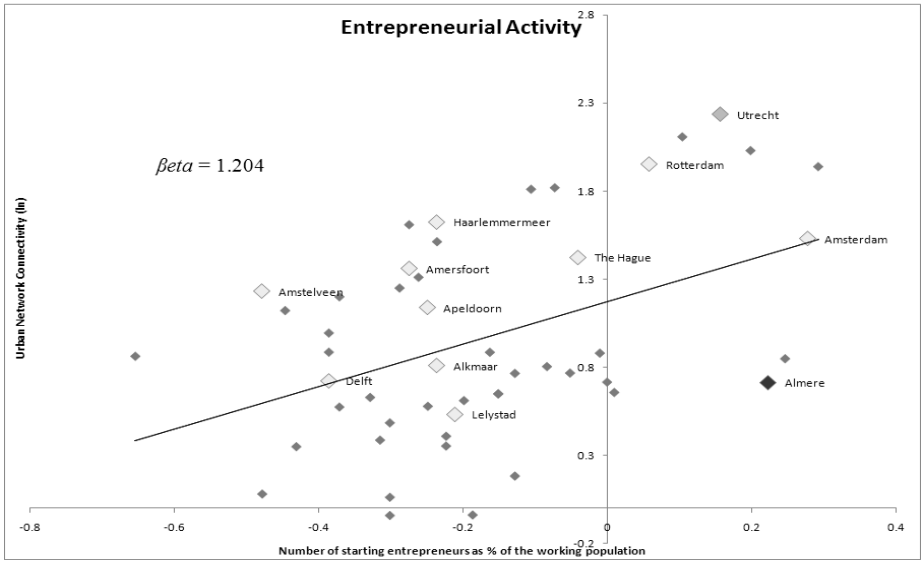


Figure 10: Estimating Dutch city connectivity on the basis of entrepreneurial activity

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

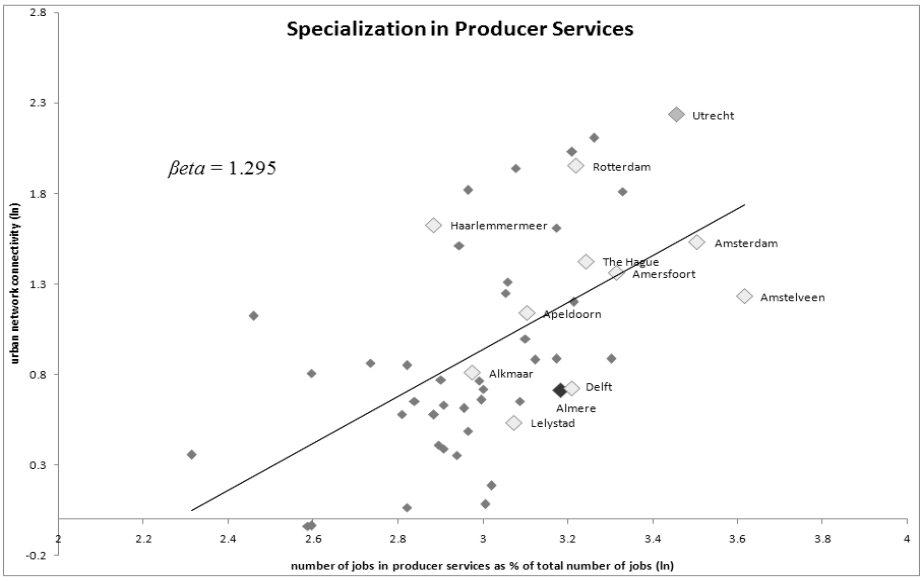


Figure 11: Estimating Dutch city connectivity on the basis of specialization in producer services

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

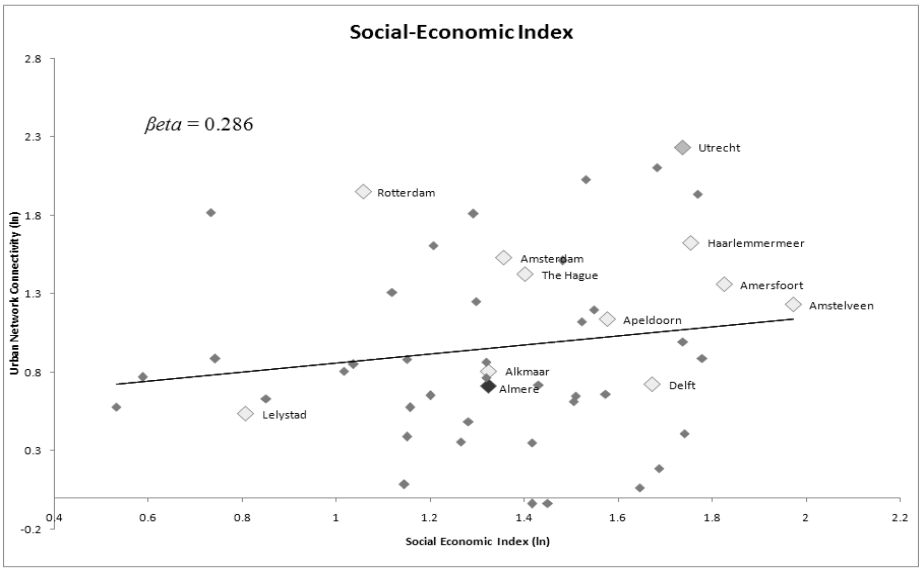


Figure 12: Estimating Dutch city connectivity on the basis of the socio-economic index

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

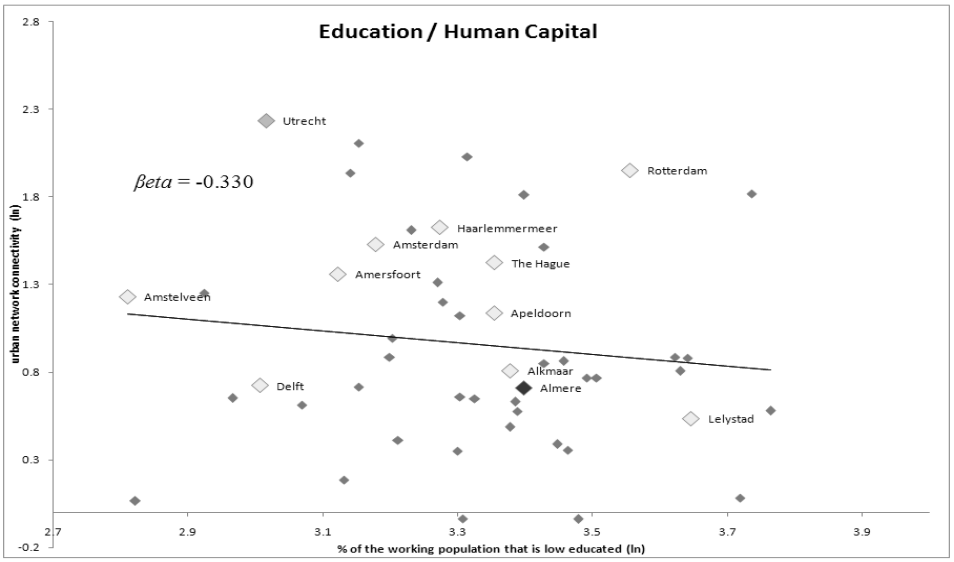


Figure 13: Estimating Dutch city connectivity on the basis of education/human capital

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

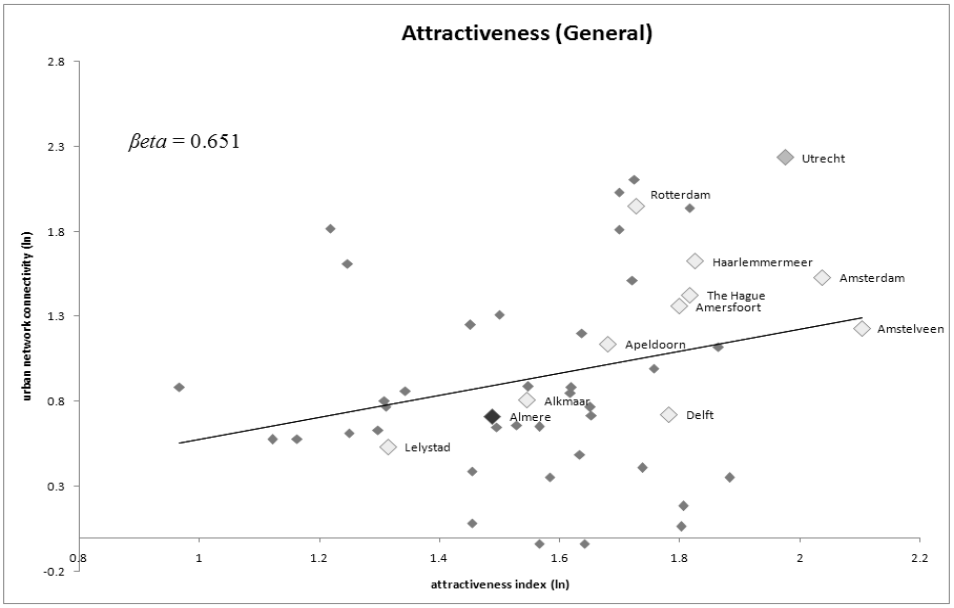


Figure 14: Estimating Dutch city connectivity on the basis of attractiveness

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

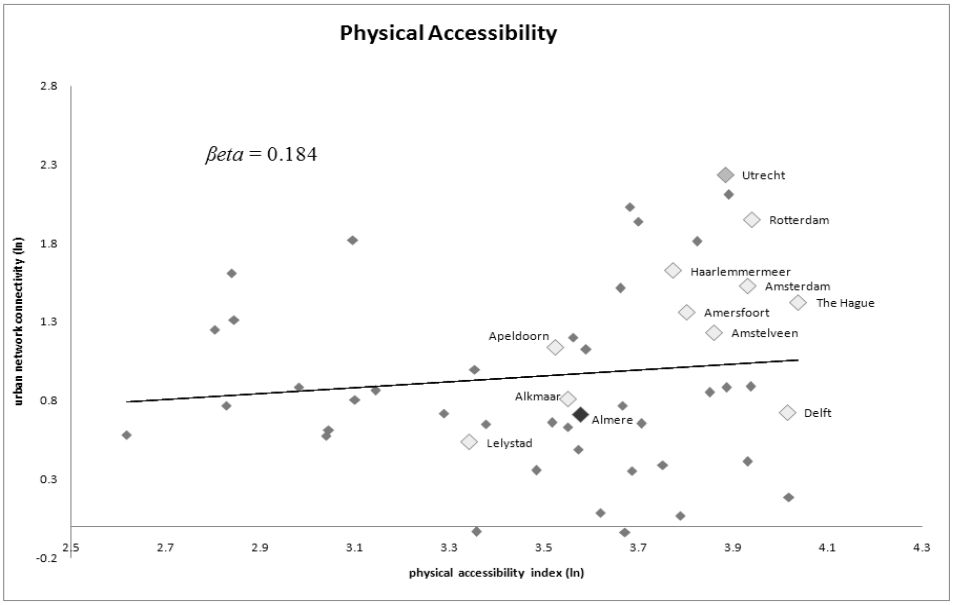


Figure 15: Estimating Dutch city connectivity on the basis of physical accessibility

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

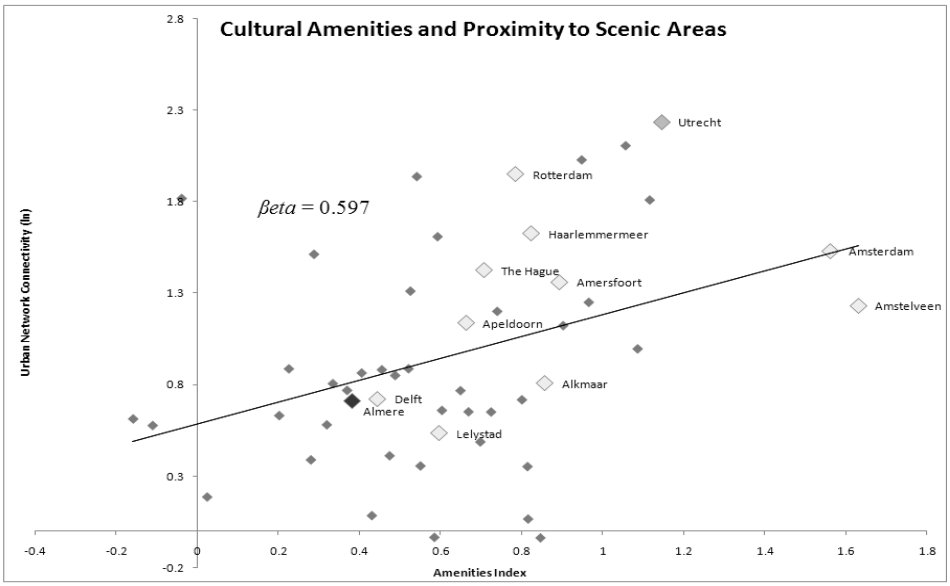


Figure 16: Estimating Dutch city connectivity on the basis of cultural amenities and proximity to scenic areas

Source Wall and Burger 2008 – based on data Reach 2007 and Nyfer 2003

	Social Network Analysis		Interlocking Network Model		
City Rank	Outdegree Centrality	Indegree Centrality	Global Network Connectivity	Dominant Network Connectivity	Subordinate Network Connectivity
1	Tokyo	New York	London	London	Beijing
2	New York	London	New York	New York	Moscow
3	Paris	Paris	Hong Kong	Hong Kong	Zurich
4	London	Tokyo	Paris	Paris	Caracas
5	Dusseldorf	Los Angeles	Tokyo	Tokyo	Sao Paulo
6	Amsterdam	Chicago	Singapore	Frankfurt	Seoul
7	Zurich	Brussels	Chicago	Chicago	Prague
8	Munich	Amsterdam	Milan	Amsterdam	Shanghai
9	Osaka	Singapore	Los Angeles	Los Angeles	Brussels
10	San Francisco	Hong Kong	Madrid	Singapore	Beunos Aries

Sources - Alderson and Beckfield (2004), table 3; Taylor, Walker et al. (2002)

Table 11: Centrality comparison between Alderson and Beckfield (2004) and Taylor et al. (2002)

Source Wall 2008

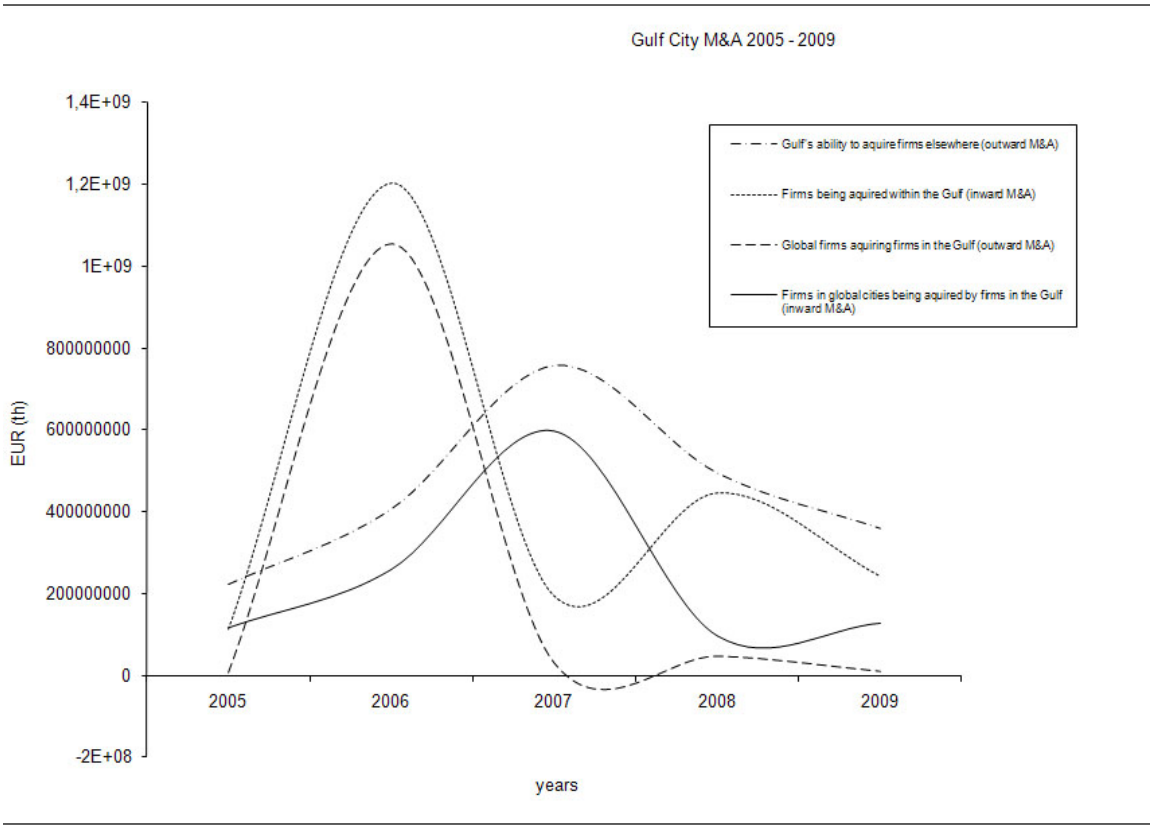


Figure 17: Merger and acquisition cycles (2005 – 2009) of Gulf city networks (global and national linkages)

Source Wall 2010

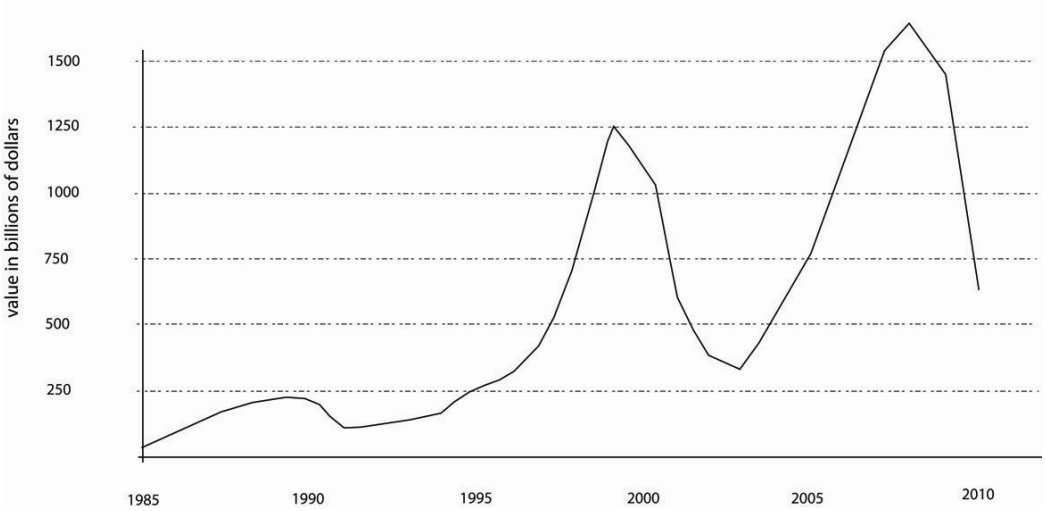


Figure 18: International merger and acquisition cycles (1985 – 2009)

Source Wall 2010, based on Brakman, Garretsen and van Marrewijk (2006) and Dealogic (2009)