Firm Relocation and the Accessibility of Locations: Empirical Results from The Netherlands

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ABSTRACT

This paper describes the empirical results of the estimation of discrete choice models for the location decision of moving firms in a spatial disaggregated environment. Systematic choice sets are applied to account for the choice context of each relocated firm. Each location alternative is described by a set of spatial attributes, including accessibility variables and the migration distance between the origin of the moving firm and the alternative. Firms are analyzed categorized to their mobility profile. These mobility profiles are homogeneous groups of firms with similar mobility characteristics. The models are estimated on an extensive revealed preference dataset with firm migration observations between 1988 and 1997 in the province South Holland, in The Netherlands.

The results first of all show that it is essential for modeling the spatial behavior of relocating firms to account for the original location. The accessibility of locations appears to be of a modest importance in the location preference of firms and measures describing the distance to transport infrastructure appear to have the most significant influence. Finally distinctive taste preferences are observed between firms from different mobility profiles and from different size.

INTRODUCTION

Integrated land use and transport models (LUTI-models) explicitly model the effects of transport policies on the development of urban land use while reversely this land use development influences travel behavior. State of the art overviews of LUTI-models are numerous, for instance see (*1*), (*2*) or (*3*). Although much progress has been made in the development of LUTI models, the behavioral and theoretical aspects in these models are still considered as weak (*3*). With respect to modeling the location of economic activities a few research challenges exist to improve the theoretical foundation.

To improve the behavioral foundation, the first research challenge lies in the decision making unit. Most existing LUTI-models allocate jobs to zones: (*4*), (*5*) and (*6*). In other words: a job decides to relocate whereas the true cause of the spatial development is the entity of the firm. Modeling concepts that have been developed in other disciplines, such as the demography of firms, might be useful for improving the behavioral foundation of LUTI-models. From this it seems necessary to account for the firm as the decision making unit.

The second challenge lies in the level of spatial detail that is used. Most empirical examples of research into the location of economic activities describe location choices using spatial aggregated zones (*4*), (*5*), (*7*) and (*8*) and aggregated accessibility measures (*9*). This level of detail is not sufficient if one aims to analyze a phenomenon like the suburbanization of employment, which concerns the relocation of economic activities from the city centre to peripheral locations: to a large degree this takes place within a municipality (*10*), (*11*) and (*12*). Another spatial phenomenon which stresses the need to model the relocation of individual firms in a highly disaggregated environment is the formation of employment clusters due to economies of scale (*6*), (*13*), (*14*).

This approach tries to overcome these shortcomings by developing a location choice model that first of all represents the firm as the decision making unit and secondly applies a high level of spatial detail. To accurately describe the behavioral context of the location decision, an approach has been applied in which an individual firm makes a decision to relocate and chooses a location from a limited set of feasible alternatives. Furthermore it is acknowledged that firms have a large variety in mobility characteristics and hence a large variety in location preferences regarding infrastructure related location characteristics (*15*). To account for this heterogeneity in preference, the concept of mobility profiles will be used to address the mobility characteristics of firms.

BACKGROUND

Firm migration

The event which is discussed in this research is the firm migration event. Firm migration is a particular form of location adjustment which can be defined as a firm’s change of address from location A to location B. In research history, firm migration has witnessed a broad spectrum of theories and approaches, but one generally accepted theory does not exist. In a contemporary overview (*16*) three approaches are distinguished: the neoclassical, behavioral and institutional approach, each with its own strengths and weaknesses.

All approaches have in common that they represent the firm as an active decision-making agent: a firm chooses a location from a number of alternatives. In doing so, it takes economic and/or non-economic factors into account. The neoclassical approach is based on the homo economicus and is derived from standard classic economic theories, tracing back to the work of Von Thünen (*17*). The neoclassical approach strives for cost-minimizing and has been applied in various LUTI models (*5*). The behavioral approach, founded by Simon (*18*), assumes satisfying behavior and is based on the idea of decision making in a context with limited information and bounded rationality. Pred (*19*) was one of the first to introduce the behavioral approach in location theory. An important argument to apply a behavioral approach is that it can account for non-economic factors and firm internal processes. The fact is that accessibility is often described with non-economic measures, such as a distance to transport infrastructure or as the employment potential in the region. Furthermore the firm migration literature proves that it is necessary to account for firm internal processes. The third approach (institutional) assumes that the environment in which the choice behavior takes place is non-static: the government and real estate market are modeled as an institute influencing the environment. Studies that describe a full LUTI-framework account explicitly for institutional factors.

This research applies a behavioral approach in which the decision to relocate is modeled as a complicated decision making process consisting of multiple stages in which different aspects play a determining role in firm behavior (*10*). The environment in which a firm relocation occurs is taken into account with a great spatial detail. Institutional factors, such as the government or real estate developers, are assumed static and are not considered explicitly.

Mobility profiles

Individual firms have a large variety in size, nature of its activity, region of origin and spatial relations. To account for these relations the mobility characteristics of firms can be used as dimensions for categorizing all firms in groups with similar mobility characteristics (mobility profiles). In the presented research it is assumed that these mobility profiles influence the location preferences of a firm at least to some extent. In other words: if a firm has a high car dependency for its activities, it is likely that this firm has a preference for a location well accessible by car. If these spatial interdependencies are accounted for explicitly, it might improve the insight into the relative importance of accessibility as a location factor.

The mobility profile concept has been defined earlier by Verroen et. al. (*20*) to support the formation of the ABC location policy. This policy aimed to match the mobility needs of businesses with the accessibility of locations (*21*). Although a considerable modal shift can be gained by locating a businesses at the 'right' location (*22*), the successfulness of the policy was limited as a result of the fact that a large amount of business areas remained unaffected by the policy (*23*). The mobility profile concept however seems very usefull for this analysis. The mobility profiles presented in Table 1 are a result of a cluster analyses on a number of mobility characteristics (*20*). These mobility characteristics were derived from extensive datasets such as the Dutch National Travel Survey (NTS) and the Labor Force Counts.

Because it is assumed that the mobility characteristics of a firm influence its preference regarding the accessibility of locations, some expectations regarding the location preference can be formulated. Take for instance the firms that are regarded as office activities with a high car dependency (profile 5). These firms mainly come from business services and include lawyers, accountants, ICT-services, advertising agencies or economic consultants. These firms have a large car share for visitors as well as commuters. Hence a strong focus on road transport is expected. A similar preference structure can be expected for firms in profile 3, the offices trade and industry. Profile 7 consists of the other firms in business services, such as financial services, insurance companies, real estate agents, notaries, news agencies or employment agencies. These firms have a high visiting and labor intensity and a large car share for commuting so consequently a preference for a locations well accessible by car is expected. Firms in profile 8 (government firms) also have a high visiting and labor intensity but they appear to be less dependent on car use. Therefore a more evenly spread preference for road as well as public transport is expected.

THEORETICAL MODEL

This paper presents the empirical results of a location choice model for moving firms. This location choice model is part of a broader firm migration framework that will be described first. This conceptual model for firm migration is based on a behavioral approach describing the spatial decision making of an individual firm in a disaggregated physical environment. At a certain point in time this firm has various characteristics that determine its preference, such as its size, the firm's growth or its mobility profile. The firm is located at its current location in the physical environment in which multiple alternative locations exist. The choice alternatives in this physical environment are unique real estate objects, characterized by real estate attributes such as the size of the real estate object and location attributes, such as location type and accessibility. The firm migration behavior of an individual firm within this physical environment is regarded as a choice process that consists of a sequence of considerations and decisions as visualized in Figure 1.

First of all the decision to move is a result of the relative satisfaction at the current location. The factors influencing this satisfaction are referred to as push factors. These push factors influence the propensity of a firm to move. Research has shown that on a yearly basis seven to eight percent of all firms in The Netherlands move (*24*). Furthermore firms appear to move over relatively short distances, plausibly because firms are dependent on existing spatial relations with employees and customers or suppliers, also referred to as keep factors. The decision to relocate is mainly determined by firm internal factors relating to the life-cycle of firms and to a lesser extent by site related factors (*10*), (*25*). Especially the growth of firms and the demand for more space appears to be an important push factor for firms to move. Other determining factors are the size and age of the firm (*26*). The tendency to migrate furthermore shows large differences between sectors: firms in business services show the highest share of movers.

Once the decision to move is made, the firm will search for alternative locations. This search process will lead to a choice set with limited suitable alternatives. First of all the search process is limited to a set of available locations. Furthermore the set of available alternatives can be reduced to known alternatives by assuming an awareness space of this firm, similar to residential migration (*27*). This space includes locations that the firm has knowledge about through direct contact, through the media or specialized agencies. Finally the search process can be limited to alternatives that are feasible, or in other words that are compatible with the preference of a firm (for instance a minimum size of a location). Once a limited set with feasible alternatives is created the firm will determine its expected utility based on the attributes of each alternative (pull factors) and the preference structure of the firm. Finally the firm will choose the alternative with the highest expected utility.

The influence of accessibility can be both important for the decision to relocate (push factor) as well as for the decision for a new location alternative (pull factor). From literature it seems that accessibility mainly expresses itself as a pull factor rather than a push factor. The objective of this paper is to determine the importance of accessibility in the preference structure of moving firms. The theoretical location choice model, as well as the formation of the choice set will be addressed subsequently.

Location choice

The presented conceptual model distinguishes a separate relocation decision and a conditional decision for an alternative new location. This is similar to approaches applied in firm demography (*28*). The joint decision of firm *i* to move and to relocate to location *j* is the product of the probability firm *i* will move and the conditional probability that firm *i* chooses location *j* from a subset of alternatives:

$$P_{ij} = P_i^{(1)} \cdot P_{j|C_i}^{(2)} \qquad (1)$$

with:

P_{ij}	:	probability firm *i* will relocate and chooses location *j*
$P_i^{(1)}$	:	probability firm *i* will move
$P_{j\|C_i}^{(2)}$	:	probability that firm *i* chooses location *j* from a unique subset C_i

The actual decision for an alternative location from a choice set is a conditional decision which will be modeled using a spatial preference model in the form of a multinomial logit (MNL) model, based on random utility theory (*29*). This implies we assume that a firm attaches a utility to each alternative in a subset of alternative locations that are considered. Furthermore, the firm will choose the alternative that yields the highest utility. The utility of location *j* consists of an observed component and a random, unobserved component:

$$U_j = V_j + \varepsilon_j \qquad (2)$$

with:

U_j	:	the utility of location *j*
V_j	:	the observed utility of location *j*
ε_j	:	the unobserved utility of location *j*

If the random, unobserved component of utility is assumed Gumbel distributed, it drops from the probability function (*29*). The resulting multinomial logit model describes the probability that firm *i* chooses location *j* from a unique subset C_i with *K* alternative locations:

$$P_{j|C_i}^{(2)} = \frac{e^{V_j}}{\sum_{k \in C_i} e^{V_k}} \qquad (3)$$

The observed utility that has been applied in the presented model has the form of a linear additive utility function. Separate choice models have been estimated for each mobility profile so no firm specific attributes were added to the utility function. The observed utility is therefore specified as a function of *M* attributes multiplied by *M* estimable coefficients, describing the preference structure of the mobility profile.

$$V_j = \sum_{m=1}^{M} \beta_m \cdot x_{mj} \qquad (4)$$

with:

x_{mj}	:	generic attribute *m* for location *j*
β_m	:	utility coefficient of attribute *m*

The set of attributes in the utility function first of all consists of a variety of accessibility related attributes. These attributes include distances to physical infrastructure, the accessibility to labor and accessibility to customers or suppliers. Furthermore a set of agglomeration variables are used to explore concentration or deconcentration patterns. Another attribute that is regarded to be an important explaining variable in the utility function is the distance from the original location to the alternative. Furthermore a variable has been added describing the urban environment. Finally, the average rental level in a district has been added to the utility function as a proxy for the real estate quality.

Choice set definition

Systematic choice sets are generated for each observed firm relocation to account for the context in which the location decision was made. This choice set is a representative set of alternative firm locations, out of all possible available firm locations, that have been evaluated in the location decision. The presented location choice model describes the location decision at the level of real estate objects, the lowest level of detail possible. This implies that a large number of alternatives are available. McFadden (*30*) has proven that the full choice set can be replaced with a subset containing the observed choice and a random sample from the possible alternative choices and still yielding consistent estimates.

The choice situation in route choice modeling and location choice shows large similarities concerning the large number of alternatives. Despite these similarities, the methodology of constructing individual choice sets seems much more developed in route choice modeling (*31*). Unfortunately few empirical examples exist in which revealed preference data of firm relocation is combined with the formation of systematic choice sets. The only contemporary example of an analysis on revealed preference data in which systematic choice sets are applied is given by Waddell and Ulfarsson (*6*). They estimated a multinomial logit model for employment location based on revealed preference data. Within their approach the choice set consisted of the chosen alternative and nine randomly selected location alternatives, although no further details are given about the choice set algorithm.

To construct a choice set for each firm relocation observation, a choice set generator has been developed. This choice set generator determines for each firm migration observation stepwise subsets of alternatives, using concepts similar to route choice modeling (*32*). To generate an appropriate choice set the following subsets are determined subsequently, where each next set is a subset of the previous set:

- set of existing alternatives: all chosen firm locations in the dataset;
- set of available alternatives: alternatives that were available in the corresponding period;
- set of feasible alternatives: alternatives that are of corresponding property type (office, retail property or industrial property), corresponding region and of corresponding size;
- choice set: consists of chosen location and nine random alternatives from the feasible alternatives.

DATASET

The research has been conducted on a revealed preference dataset containing individual firm relocations within three LISA registration areas in the Netherlands. LISA stands for “National Information System of Employment”. The three LISA registration areas nearly cover the province of South Holland (see Figure 2), a highly urbanized area with a population of 3,4 million inhabitants in the year 2001. From the LISA datasets all intra-regional firm relocations are derived from the period of 1988 to 1997.

For each firm move in the dataset the 6-digit postal zone of the original location and the new location is known. This is nearly the address level: each 6-digit postal zone contains 10 addresses on average. Multiple firm characteristics are available for each observation. These include firm size (number of jobs) and business sector (5-digit sector code). Based on this sector code the mobility profile has been derived. To avoid any irregularities from small (not existing) firms, the observations will be limited to firms with more than five employees. Some observations had to be excluded from the analysis because address information of the new location or the original location was incomplete. This yielded a dataset containing nearly 6000 relocated firms. The information about each observed firm migration is extended by adding a variety of location attributes including the accessibility of locations.

The first set of accessibility attributes describes the distance to the physical infrastructure: the nearest highway onramp and nearest train station. These attributes are calculated in GIS, using coordinate information. It appeared that the distance attributes were highly correlated. This was solved by recoding the distance measures into a categorical variable describing the position of a location in relation with the physical infrastructure. First of all α-locations are typical train stations locations: within 800 m. of a train station and not too close to a highway onramp. Locations nearby highway onramps (within 2000 m.) are labeled as γ-locations. If a locations is close to a train station as well as a highway onramp (within 800 m and 2000 m respectively) it is labeled as a β-location. If a location has a considerate distance to both the nearest train station and highway onramp it is labeled as a ρ-location.

The second set of accessibility attributes describe the accessibility to labor and the accessibility to customers or suppliers. Accessibility is measured using a regular gravity type accessibility measure in which the opportunities at each possible destination is weighed with a distance decay function. The travel times that were used for the computation stem from the LMS, the National Modeling System. The opportunities come from the WMD-dataset, the Living Environment Database. This dataset contains an extensive variety of socio economic variables of 4 digit postal zones in the Netherlands. The accessibility to labor is computed with the number of inhabitants at each destination. The accessibility to customers or suppliers is computed with the number of employees at each destination. Both variables were highly correlated so during the estimation of the choice models, only one of these two variables is entered at a time.

Furthermore a set of agglomeration variables are used to explore concentration or deconcentration patterns. These agglomeration variables are defined by the number of jobs in specific industry sectors within 800 meters. Agglomeration variables are computed for the number of jobs in commercial services, non-commercial services and industry. These variables turned out to be highly correlated, so to avoid invalid coefficients only one agglomeration variable could be entered in each model. Based on our own judgment we chose the agglomeration variable that was expected to be the most important for each choice model.

To add information about the urban environment of a location alternative, a categorical variable has been used describing the business environment. This typology has been derived from an environment typology from the WMD-dataset. The original 15 categories were reduced to five business environments each accounting for a representative share of business locations. First of all City Centre environments have been distinguished with a high land use density and a mixed land use. The second category is the Urban Business districts with a mono functional land use. Then a Mixed Urban location type has been distinguished with heterogeneous land use and a moderate density. The fourth urban category relates to Residential districts. The last category represents the Non Urban locations.

The firm migration dataset did not contain rental levels for each firm location but from a theoretical perspective it seems reasonable to include the rent level into the utility function. For the firm relocations on the office market a rent level proxy variable has been used derived from the Strabo/VTIS dataset. This rental level index of a 4-digit postal zone is computed as the average rental level (€/m^2) of all observations within this postal zone. For the industrial real estate market, and retail and public facilities market the number of observations was insufficient to compute average rental levels for enough 4-digit postal zones. To force a value range comparable to the other variables the rental levels have been rescaled to 100€/m^2.

RESULTS

The results of the estimated location choice models for each mobility profile are presented in Table 2 and Table 3. These tables show the estimated coefficients and the associated robust t-statistic. The preference structure of each mobility profile can be derived from the estimated coefficients. To explore the influence of firm size on the preference structure of firms different choice models are estimated for small firms (less than 20 employees) and larger firms (20 or more employees). The freeware program BIOGEME (*33*) is used for the model estimations. An effect coding scheme has been applied for the αβγ-location types and business environment attributes in order to derive coefficient values for every attribute level.

In general the estimated models have a modest explanatory value. Important result is the strong influence of the original location of an observed firm relocation. In all models the estimated coefficient for the distance to the original location proved to be significant. The migration distance therefore has a strong influence on the utility function. Furthermore significant differences are found between the preferences structure of each mobility profile and additionally for some mobility profiles significant differences are found between small and larger firms.

Table 2 describes the estimation results for the mobility profiles on the office market. The offices in Trade and Industry show a strong preference for Urban Business districts and appear to dislike Residential locations. Although no significant coefficients are found for the αβγ dummy's, positive coefficients are found for γ and β-locations. This suggests a preference for highway locations. Furthermore offices trade and industry appear to be the only mobility profile with a positive coefficient for locations with a higher concentration of industrial activity. The size of the office firms with a high car dependency appears to have a significant influence on the preference structure. Especially the bigger firms show a preference for γ locations (near highway onramps), as might be expected. The preference for smaller firms tends more to β or α locations (near a train station). The agglomeration variable shows a negative preference for locations with a high concentration of commercial services. Furthermore a preference can be observed for Urban Business districts. Finally a positive rental level index coefficient is found for bigger firms which might indicate a preference for representative locations. Firms in business services show a preference for Urban Business districts and appear to dislike Mixed Urban and City Centre locations. Although not significant, firms in business services show a preference for γ-locations (near highway onramps). Furthermore they also show a negative coefficient for locations with a higher concentration of commercial services. The offices in the government sector show a positive coefficient for β-locations and to a lesser extend for α-locations which might indicate a preference for locations with a train station nearby. Again a preference for deconcentration is measured. Small and larger firms in social services show significant differences in location preference. Small firms prefer β-locations and locations in the City Centre. Bigger firms in social services seem to prefer α-locations and locations in Urban Business districts or Mixed Urban locations.

Table 3 describes the estimation results for the mobility profiles on the industrial real estate market. Firms in space extensive industry show a preference for β- (significant) and γ-locations (nearly significant). Typical train station locations (α-locations) and locations in the City Centre have a negative coefficient. Furthermore a preference is measured for locations in Urban Business District or Residential locations. The estimations for firms in agriculture and mineral extracting did not yield any significant accessibility coefficients. The only significant variable is the migration distance. Transport firms are expected to be dependent on transport infrastructure but the estimates for the utility and transport firms show few significant coefficients. The only significant accessibility coefficient is the negative coefficient for business accessibility. If these firms are separated by its size, a different preference structure can be observed, although not significant. Small firms prefer γ-locations while the bigger firms prefer α-locations. This might be explained by a misspecification of some bigger firms: perhaps some should have been categorized in Mobility profile 3: offices trade and industry. There were too few observations of relocated firms in the space intensive industry with high public transport share (profile 6) so this profile is omitted from Table 4.

The public services mainly consist of retail, catering or educational firms and institutes. For the public services we observed a clear difference between small and bigger firms. Smaller firms prefer the Urban Business District and Non-urban locations. Larger firms in public service prefer locations in the Urban Business District or Mixed Urban locations and attach a considerable positive utility to α-locations (near train stations). Firms and institutes in the medical & sports facilities appear to prefer remote locations, with a poor accessibility. At the same time a negative coefficient is found for locations with a high concentration of non-commercial services. One can assume that it is desirable that these facilities are well accessible by public transport to secure accessibility for everyone, especially medical facilities. In that respect it is remarkable that an opposite pattern is observed. Furthermore these firms appear to prefer Mixed Urban or Residential locations.

CONCLUSIONS AND FURTHER RESEARCH

Based on the presented estimation results some preliminary conclusions and observations can be made about the spatial behavior and location preference of firms in different mobility profiles. Most important finding is the dominant influence of the migration distance when firms evaluate alternative locations. This result can be interpreted as evidence that firms depend heavily on relations with existing inputs, an assumption also found in firm migration literature (*24*). Consequently, it seems essential to account for the original location of a firm if the location behavior of firms is analyzed in a spatial disaggregated environment. With respect to the accessibility of locations, economies of scale and the urban environment the following conclusions can be drawn.

The accessibility of locations is first of all evaluated in terms of the distance to physical infrastructure and secondly in terms of potential accessibility measures. In general accessibility appears to be of a modest importance in the location preference of firms. The estimated coefficients for accessibility measures that describe the distance to highway onramps or train stations are sometimes significant and show a plausible pattern. The importance of these distance measures stresses the need to apply a sufficient level of spatial detail when modeling the spatial behavior of firms. The estimation results for potential accessibility measures, such as the accessibility of employment or labor, are in contrast with the general assumption that firms try to maximize their accessibility to the labor market and customers. The first explanation for this unexpected result is perhaps the limited variation in potential accessibility within a region. Secondly, the actual potential accessibility that is computed can not be observed directly by the decision makers so it is very plausible that this type of accessibility is often misinterpreted. As a result, the estimation results for these types of measures can be expected to be distorted. In general it can be said that some firms prefer to be located near highway onramps but this does not imply that they maximize their accessibility by this relocation. It is also necessary to emphasize that these results count for intra-regional migration. The variation in potential accessibility between regions can be more substantial, so for interregional migration accessibility maximization might still be a motive.

No convincing evidence is found for a large scale pattern of concentrating economic activities: most firms even show a preference for deconcentration. However the results not necessarily prove that economies of scale are unimportant for all firms. It can be assumed that they are important for specific economic activities, mainly activities of the innovative kind. The categories used in this analysis are defined too roughly to isolate these types of firms.

Furthermore the results clearly show that, besides the original location, it is important to account for other individual firm characteristics as well. First of all significant taste differences are observed between different types of firms (mobility profiles). Secondly, in some mobility profiles significant taste differences are observed between small and larger firms. When developing location choice models it also proved to be beneficial to introduce additional aspects about the urban environment into the utility function: the business environment and rental level index of locations prove to be significant for some types of firms.

The estimations are based on a population size sample, covering a period from 1988 to 1997 and are consistent with results found on revealed preference data in the United States (*6*) and (*15*). Therefore, the presented results seem valuable for the further development of a simulation module for the location decision of firms in an integrated land use and transport modeling environment. Future activities will focus on the estimation of other firm demographic model components, such as the propensity to move, and finally the dynamic simulation of the location of economic activities in an integrated land use and transport modeling environment. In the near future, model estimations will be made for the traditional industry sectors. These estimations can reveal the extent to which the usage of mobility profiles indeed lead to more homogeneous firm categories. Furthermore it is acknowledged that it is important to determine the effect of the spatial planning policy on firm location. Estimation of choice models for the period 1998 to 2003, with a distinct spatial planning policy, might yield insight into the influence of the ABC location policy on firm location.

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LIST OF TABLES AND FIGURES

TABLE 1 Mobility profiles (adapted from (*20*))

	Mobility variables								Transport of goods		
Mobility profile	Labor intensity	Car dependency	Car share	Public transport share	Slow traffic share	Distance commuting	Visiting intensity	Visiting car share	Road	Rail	Water
Office market											
3. Offices trade and industry	+	-	++	-	-	+	0	++	var	var	var
5. Offices with high car-dependency	+	++	++	0	-	+	0	++	var	-	-
7. Offices business services	+	-	+	+	-	+	+	++	-	-	-
8. Offices government	+	--	+	0	-	+	+	+	var	var	-
9. Social services	+	--	--	+	++	--	0	++	var	-	-
Industrial real estate market											
1. Space extensive industry	-	-	++	-	-	+	-	++	+	0	0
2. Agriculture and Mineral extracting	--	-	+	-	-	0	--	++	+	0	0
4. Utility and transport companies	-	++	+	-	+	+	-	--	0	0	0
6. Space intensive ind. with high share PT	+	-	0	+	0	0	-	++	+	-	-
Retail real estate market											
10. Public services	0	--	0	+	0	-	++	0	var	-	-
11. Medical and sports facilities	0	-	-	++	+	-	+	+	-	-	-

++ = very high resp. very large
+ = high resp. large
0 = average
- = low resp. small
-- = very low resp. very small
var = variety among firms within profile

TABLE 2 Estimation results for firms on the office market (significant coefficients in bold)

	Office Market																	
	Offices Trade & Industry		**Offices high car dependency**						**Offices business services**		**Offices government**		**Social services**					
	All firms		**All firms**		**Firms<20 emp**		**Firms>20 emp**		**All firms**		**All firms**		**All firms**		**Firms<20 emp**		**Firms>20 emp**	
Variable	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.
Migration attribute																		
Distance to original loc. [km1/2]	**-1.83**	-12.02	**-1.63**	-24.16	**-1.78**	-20.09	**-1.59**	-10.56	**-1.70**	-34.32	**-1.97**	-12.80	**-1.90**	-14.21	**-2.20**	-9.91	**-1.83**	-9.85
Accessibility attributes																		
α-location [-]	-0.33		-0.15		0.06		-0.63		-0.14		0.03		0.15		-0.61		0.62	
β-location [-]	0.11	0.44	0.13	1.11	0.19	1.35	0.04	0.17	0.09	0.95	**0.80**	3.69	0.27	1.63	**0.69**	2.81	-0.04	-0.18
γ-location [-]	0.23	0.99	0.13	1.13	-0.05	-0.31	**0.56**	2.33	0.10	1.16	-0.47	-1.90	-0.19	-1.05	0.25	0.93	-0.54	-1.92
ρ-location [-]	-0.01	-0.03	-0.12	-1.09	-0.20	-1.49	0.03	0.15	-0.05	-0.61	-0.35	-1.64	-0.23	-1.37	-0.34	-1.35	-0.04	-0.17
Accessibility to labor [-]			-4.35E-07	-0.54	6.12E-08	0.06	**-3.07E-06**	-2.10	-1.30E-06	-1.55	-3.38E-06	-1.41	-6.47E-08	-0.04	-3.72E-06	-1.44	4.68E-06	1.79
Business accessibility [-]	-1.02E-05	-1.59																
Aglomeration attributes																		
Concentration Commercial Services [jobs]			**-3.29E-05**	-2.32	**-4.02E-05**	-2.24	-2.30E-05	-0.87	**-3.57E-05**	-3.19								
Concentration Non-Commercial Services [jobs]											**-1.33E-04**	-3.17	-7.74E-05	-1.91	-8.33E-05	-1.45	-5.70E-05	-1.03
Concentration Industry [jobs]	2.24E-04	1.31																
Urban Environment attributes																		
City Centre [-]	-0.29	-1.13	-0.23	-1.65	**-0.41**	-2.36	0.00	0.00	-0.19	-1.68	0.18	0.68	-0.21	-0.84	**0.74**	2.35	**-0.94**	-2.56
Urban Business District [-]	**0.90**	4.65	**0.48**	3.76	**0.65**	3.86	0.26	1.13	**0.36**	3.60	0.25	0.98	0.15	0.67	-0.02	-0.05	0.59	1.83
Mixed Urban [-]	-0.02	-0.06	-0.02	-0.14	-0.03	-0.19	-0.08	-0.31	**-0.23**	-2.21	0.05	0.17	0.15	0.84	0.33	1.34	0.39	1.44
Residential [-]	-0.57	-1.92	-0.33	-1.62	-0.35	-1.37	-0.30	-0.75	0.03	0.25	-0.36	-0.95	-0.10	-0.31	0.63	1.49	**-1.01**	-2.03
Non-urban [-]	-0.02		0.09		0.15		0.12		0.02		-0.11		0.00		-1.69		0.98	
Rent level index [100€/m^2]	-0.47	-0.67	0.03	0.07	0.00	0.00	1.40	1.87	-0.02	-0.07	0.75	1.03	-0.28	-0.51	-0.37	-0.45	-0.25	-0.32
N	212		642		455		187		1049		235		314		171		143	
Init log-likelihood:	-480.7		-1463.7		-1047.7		-416.0		-2368.9		-525.7		-709.1		-391.4		-317.6	
Final log-likelihood:	-184.1		-686.8		-467.9		-210.0		-1051.9		-252.2		-336.5		-160.9		-162.7	
Rho-square:	0.617		0.531		0.553		0.495		0.556		0.520		0.525		0.589		0.488	

TABLE 3 Estimation results for firms on the industrial real estate market and retail real estate market (significant coefficients in bold)

	Industrial Real Estate Market										Retail Real Estate Market							
	Space ext. industry		**Agriculture & mineral extr.**		**Utility & Transport**						**Pulic services**						**Medical & sport facilities**	
	All firms		**All firms**		**All firms**		**Firms<20 emp**		**Firms>20 emp**		**All firms**		**Firms<20 emp**		**Firms>20 emp**		**All firms**	
Variable	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.	coeff.	t-stat.
Migration attribute																		
Distance to original loc. [km1/2]	**-1.62**	-49.46	**-2.93**	-8.86	**-1.54**	-23.98	**-1.52**	-19.65	**-1.57**	-14.34	**-2.43**	-22.08	**-2.86**	-14.29	**-2.37**	-11.32	**-2.42**	-12.19
Accessibility attributes																		
α-location [-]	-0.19		-1.10		0.07		-0.09		0.53		-0.12		-0.41		0.76		-0.26	
β-location [-]	**0.18**	2.19	1.42	1.77	-0.07	-0.43	0.03	0.14	-0.32	-1.07	0.16	1.03	0.37	1.71	-0.03	-0.10	-0.16	-0.64
γ-location [-]	0.11	1.76	-0.28	-0.67	0.10	0.94	0.20	1.59	-0.16	-0.84	0.13	0.99	0.16	1.01	-0.03	-0.10	0.03	0.10
ρ-location [-]	-0.09	-1.40	-0.03	-0.07	-0.10	-0.86	-0.13	-0.96	-0.05	-0.20	-0.16	-1.20	-0.11	-0.61	**-0.69**	-2.11	**0.39**	1.97
Accessibility to labor [-]											-2.61E-06	-1.56	-4.04E-06	-1.58	**-4.79E-06**	-2.22	5.04E-07	0.22
Business accessibility [-]	-6.60E-07	-0.41	2.54E-06	0.19	**-1.68E-05**	-5.94	**-1.73E-05**	-5.35	**-1.68E-05**	-2.95								
Aglomeration attributes																		
Concentration Commercial Services [jobs]																		
Concentration Non-Commercial Services [jobs]											-5.13E-05	-1.41	-1.68E-05	-0.36	-1.58E-04	-1.82	**-2.70E-04**	-2.99
Concentration Industry [jobs]	-1.18E-05	-0.28	-8.14E-04	-1.10	-5.81E-05	-0.68	-6.28E-05	-0.60	-3.75E-05	-0.24								
Urban Environment attributes																		
City Centre [-]	**-0.40**	-4.18	-1.33	-1.27	0.00	-0.02	0.11	0.62	-0.15	-0.44	**-0.51**	-2.82	**-0.68**	-2.76	-0.29	-0.76	-0.02	-0.08
Urban Business District [-]	**0.20**	3.13	0.17	0.27	0.19	1.65	0.18	1.34	0.24	0.99	**0.80**	3.59	**1.24**	3.64	0.45	1.34	**-0.88**	-2.37
Mixed Urban [-]	0.10	1.33	0.26	0.51	-0.05	-0.37	0.00	0.00	-0.24	-0.75	-0.21	-1.44	**-0.50**	-2.45	0.21	0.79	**0.58**	2.39
Residential [-]	**0.19**	2.07	0.29	0.67	0.03	0.15	0.07	0.34	-0.10	-0.24	**-0.42**	-2.66	**-0.61**	-2.70	-0.35	-1.21	0.40	1.32
Non-urban [-]	-0.09		0.61		-0.17		-0.35		0.25		0.34		0.55		-0.02		-0.07	
Rent level index [100€/m^2]																		
N	2405		251		686		455		231		1042		734		308		314	
Init log-likelihood:	-5451.0		-571.7		-1542.5		-1046.7		-495.8		-2300.7		-1679.7		-621.0		-663.0	
Final log-likelihood:	-2154.2		-105.1		-760.4		-514.1		-242.8		-639.3		-409.5		-220.6		-188.7	
Rho-square:	0.605		0.816		0.507		0.509		0.510		0.722		0.756		0.645		0.715	

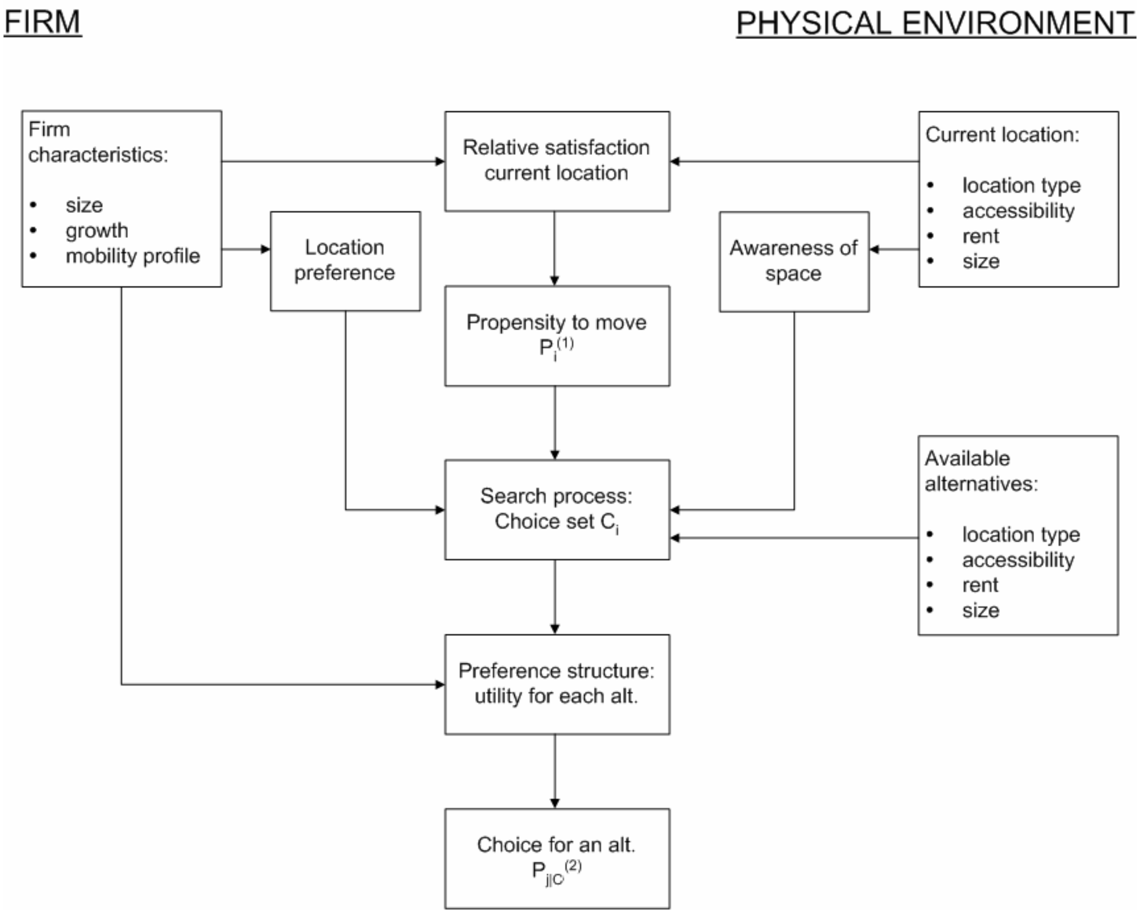

FIGURE 1 Conceptual model of individual firm in a physical environment.

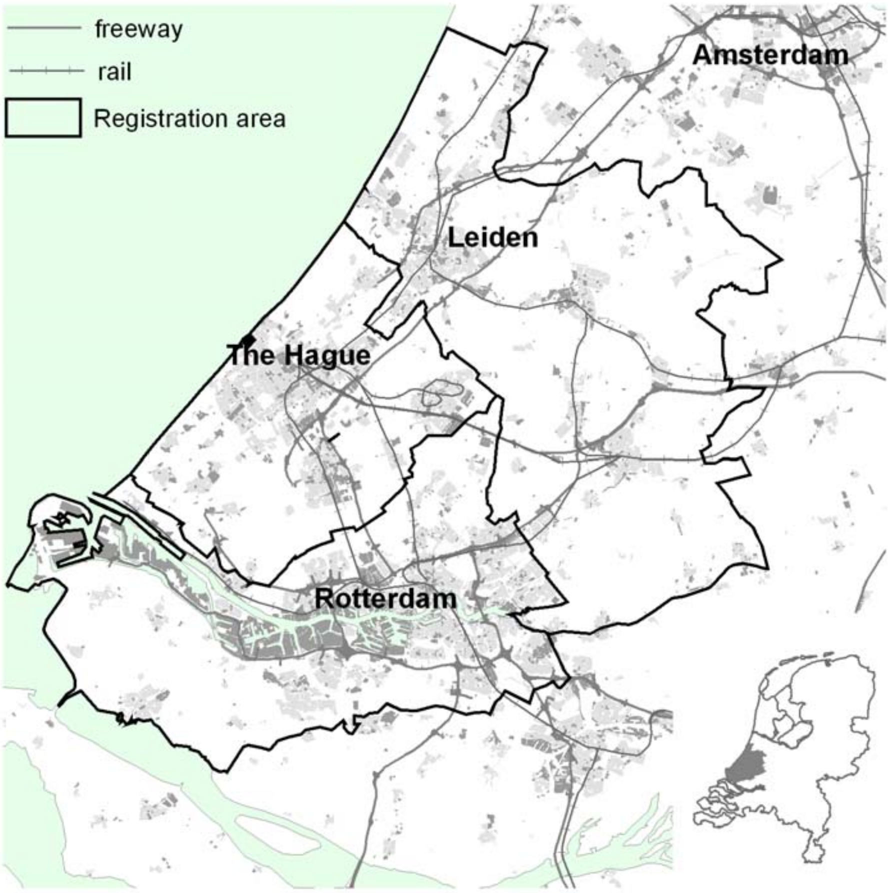

FIGURE 2 Research area.