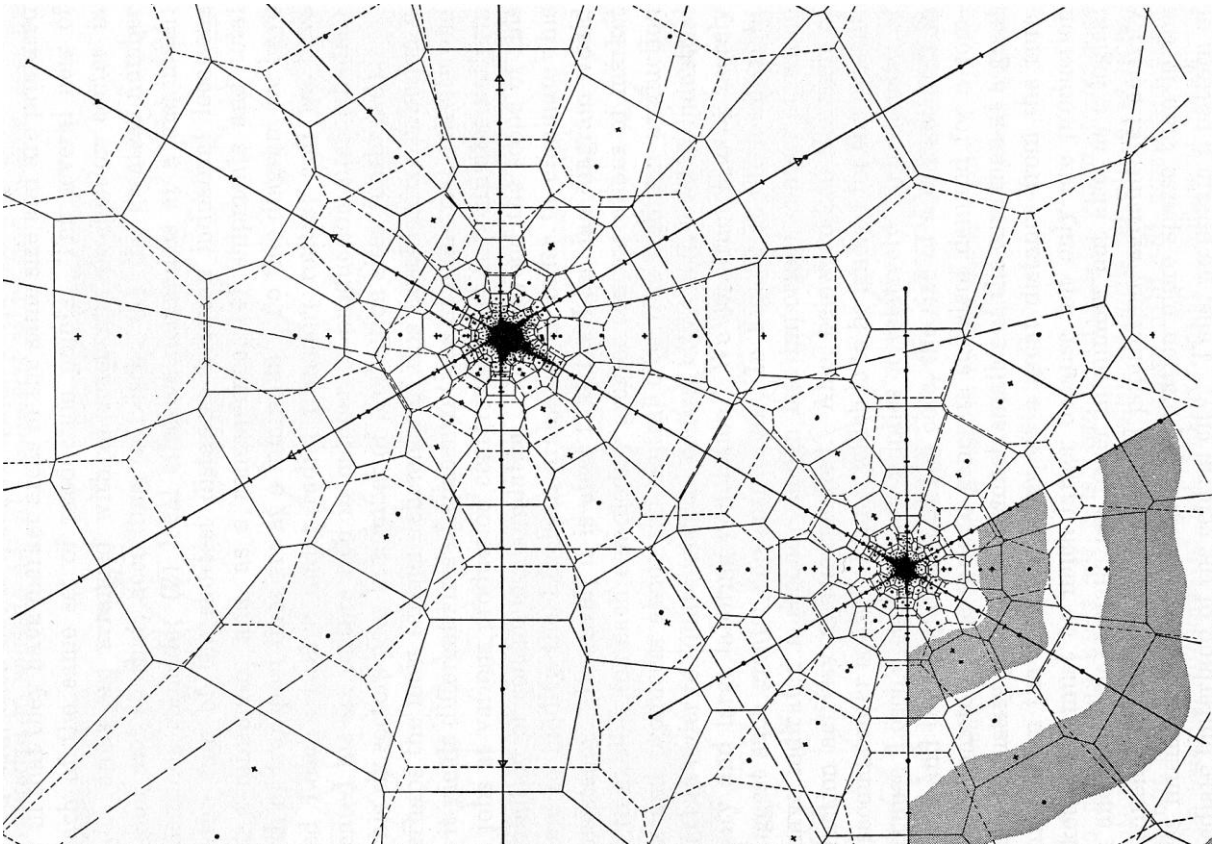

Working Paper 2.3

Synthesis report on the state of the art on firmographics

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Institute for Transport Planning and Systems (IVT), ETH Zurich Revision: 3
FP7-244557 07/05/2010

SustainCity

EUROPEAN COMMISSION
European Research Area
SEVENTH FRAMEWORK PROGRAMME
Funded under Socio-economic Sciences & Humanities

Contents

Synthesis report on the state of the art on firmographics

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07/05/2010

Abstract

The objectives of this working paper are on the one hand to understand and describe the state of the art in firmographics (e.g. life cycle of firms) and on the other hand to make a synthesis of the various strands of literature which are developed in various disciplines (regional science, economic geography, economic theory and econometrics).

Keywords

SustainCity, firmographics, IVT

Preferred citation style

Bodenmann, B.R. and K.W. Axhausen (2010) Synthesis report on the state of the art on firmographics, *SustainCity Working Paper* **2.3**, Institute for Transport Planning and Systems (IVT), ETH Zurich.

1 Introduction

In the context of the project Sustaincity: *Microsimulation, land use and transportation models for more sustainable cities in Europe*[1], several improvements will be implemented in the land use modelling platform UrbanSim (Waddell, 2002). One of these improvements will be the explicit modelling of the dynamics of firms, including birth, growth and relocation in the urban context. This paper addresses the modelling approaches that can be implemented in a new urban modelling platform, UrbanSim-E, adapted for the context of European cities.

The study of the life cycle of firms (firmographics) and of their associated moving and growing behaviour has been comparatively rare in regional science, although it had received some attention in economic geography (gravity model) and in spatial economics (models of competing firms located on a line, a circle or in the space; positive/negative attraction between firms in complementary/substitutable sectors).

One prominent reason was the lack of suitable geo-coded panel data. Recently this has changed and new empirical work has revealed the interactions between the dynamics of firm growth and the associated locations by industry type. These interactions suggest an agent-based approach to model firms and their location decisions, as their history strongly influences their choices. It is not appropriate to treat their choices in each time-interval as independent. New information technologies can be used to improve the estimates of birth and survival rates of firm by size class and industry type.

Birth and survival of firms are not the only sources of evolution in local employment. The other sources are firms' growth or decline, and moves (relocation). Chahuc und Zylberberg (2006) summarize recent labour market economics research, which has demonstrated that two jobs are lost for every three generated in growing industries and the reverse in shrinking industries. This high amount of churn is important for landuse transport modelling. Relocation of large firms is a highly sensitive topic since it has very important indirect effects on local employment and on other firms in linked sectors. This is why it generates an intensive fiscal competition between countries and between cities. Special local fiscal arrangements are common practice for attracting firms, and have received large attention by economists (e.g. Bondonio and Greenbaum, 2007).

[1] www.sustaincity.eu

In Chapter 2 an overview of theoretical approaches is given. The focus lies in particular on the explanatory variables proposed in the models since von Thünen (1842) up to Porter (1990, 1999) and Krugman (1995). The following chapters treat results of relevant research work. Chapter 3 gives an overview to different survey of location preferences of business enterprises, whereas Chapter 4 recapitulates analytical studies on a micro level. Finally in Chapter 5, based on the previous chapters and additional research work on a macro-level, possible variables and indicators for further models are proposed (Chapter 5.

This working paper is a revised and extended version of Bodenmann (2007) about models of site selection by business enterprises.

2 Overview of theoretical approaches

Table 1 gives a general overview of the most important concepts and models used for site selection by business enterprises. While Thünen (1842) and Launhardt (1882) in the 19th century mainly focused on the explanation of site selection by economic sector, approaches since Burgess (1925) have essentially tried to approach site selection behavior more comprehensively. In a first step, the resident population was considered, followed later by several economic sectors. In contrast, the agricultural sector was intentionally not modeled, because of its dependency on soil conditions and its dwindling economic importance.

Since the beginnings of site selection theory, research has indicated different areas of influence on site selection:

i) Production factors (including conditions and ground rent charges, land price, human capital, production costs and, therefore, the price of the end product).
ii) Economic environment (centrality, accessibility, internal and external agglomerations effects).
iii) Municipal interventions.
iv) Environment and quality of life.

Since the beginning of the 20th century, various variables from this areas play an essential role – with the exception of municipal interventions and the inclusion of quality of life. These were first considered in the 1950s, and revived in the 1970s.

While the areas under investigation have changed little over the course of time, the level of the individual variables indicates a very heterogeneous picture (see Table 2). A comparison of individual factors is practically impossible, particularly because of the variety of definitions. For example, accessibility and centrality are measured quite differently in the various models – although the individual variables in the respective models have similar meanings.

Table 1 Influence variables of site selection of business enterprises

Model / Concept	Model variables													
	Site factors										Utilization			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	Economic rent	Price end product	Production costs	Transport costs	Centrality	Major advantages	Branch structure	Municipal intervention	Site characteristics	Additional factors	Resident population	1st economic sector	2nd economic sector	3rd economic sector
von Thünen (1842)	D	E	E	E								(u)		
Launhardt (1882)		D	E	E									(u)	
Weber (1909)	E	D[1]		E[2]		E	E			E	E[4]			
Burgess (1925)	D	E	E	E							E		E	E
Christaller (1933)					D									E
Lösch (1940)	E				D	E	E[3]						E	E
Zipf (1949)					D						E		(u)	(u)
Isard (1956)		B		B		B	B	B			B		(u)	(u)
von Böventer (1962)		B		B		B	B				B[4]		B	B
Perroux (1964)										E				
Smith (1971)	D[5]	E	E	E		E	E			E	E		E	
Geiger (1973)	D			E				E	E		E[6]		E[6]	E[6]
Porter (1990)			E			E	E	E		E			E	E
Krugman (1995)		B	B	B		B	B			B		B	B	
van d. Bergh et al.(1996)		B	B	B		B	B	B		B	B	B	B	B

D Dependent variable
E Explanatory variable
B Balance
(u) Utilization, to be explained

Explanation of the variables

1 Economic and ground rent charges as well as land prices and rents
2 Price of end product, including work expenditure
3 Production costs in general
4 Generalized transport costs, including accessibility
5 Centrality in the sense of central facilities (see model from Christaller)
6 Internal scale effects, *economies of scale*
7 External scale effects, *localization economies* and *urbanization economies*
8 Municipal activities, e.g., taxes, laws, subsidies, infrastructure
9 Site characteristics, e.g., gradient, exposition, view, living quality
10 Additional agglomeration factors, see Table 2

[1] Labor costs explicitly included
[2] Transport costs explicitly included
[3] External savings in the derivation mentioned, however, not considered in the model
[4] Population density
[5] Profit zone
[6] Included in the calculation of accessibility

The variety of the definitions is mostly a result of different data and possibilities for information processing. The study area and the timeframe are the main distinguishing characteristics of the data – especially because study specific surveys were often used. Likewise, the influence of the various technical possibilities showed in the variables centrality and accessibility. While von Thünen, Launhardt and Weber still had to work with a relatively simple mathematical accessibility variable, since the 1970s it is possible to calculate more complex accessibility variables (e.g., Geiger, 1973).

Thus, the effective selection of variables in the individual models does not necessarily correspond to the initial influence variables as foreseen by the author(s). From today's perspective, Table 1 gives information on the areas of influence under consideration – while the model variables in Table 2 show the empirical implementation. Based on the study area, the desired detail of analyses, and considering today's availability of data and the possibilities for data processing, other model variables can and must be considered.

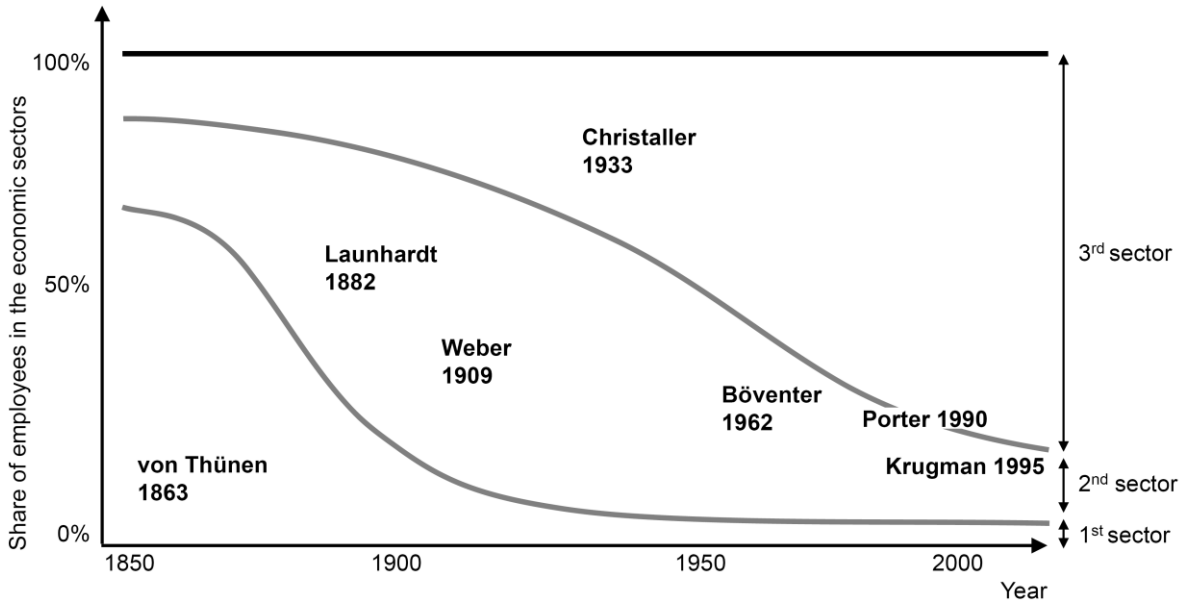
Table 2 Site factors of selected modules and concepts

Model / Concept	Model variables
Weber (1909)	Population density Transport costs "Form coefficient"[1] of the goods produced.
Lösch (1940)	Internal/external scale effects[2]
Isard (1956)	Internal and external scale effect Municipal activities
von Böventer (1962)	Population density Employed, employment by sector Distance and accessibility, traffic carriers
Perroux (1964)	Dominance over other economic units High degree of internationals with other economic units Major growth rates of production Internal scale effects Investments Innovations
Smith (1971)	Cost of (electrical) energy Cost of land Cost of distribution
Porter (1990)[3]	Competition between local rivals Local environment allows appropriate forms of investment Amount and cost of production factors Critical mass of capable local suppliers Existence of clusters
Krugman (1995)	Transport costs Net earnings, purchasing power Internal/external scaling effects (*urbanization*) Number of goods produced[4] Investments in growing sectors[4]
van den Bergh *et al.* (1996) [5]	Investments in transport infrastructure Externalities such as environmental pollution, traffic jams Municipal interventions (duties, taxes) Job market

[1] Added value of the goods based on handling or manufacturing
[2] External savings in the derivation mentioned, but not considered in the model
[3] Compare Porter (1999)
[4] External scale effects
[5] Additional factors to Krugman

The various models were based not only on observations made at a specific time and in a specific spatial environment, they were also developed with regard to specific problems in this environment. Thus, the first models of the 19th century were predominantly concerned with the agricultural sector, while later the focus was more on the industrial sector. And today, the third sector stands in the foreground.

Figure 1 Models in the context of economic change



Source: Bodenmann (2007)

The importance of the individual site factors for the selection of location of company headquarters is meanwhile strongly branch-dependent (see Hilber, 1999 and LaFountain, 2005). Therefore, from today's perspective, a subdivision into three economic sectors may hardly be sufficient. The services sector at least must be divided into individual branches. In addition to a division into general branches (e.g., NOGA sectors in Switzerland) a distinction between growth and non-growth branches (e.g., in the sense of Krugman, 1995) is also likewise conceivable. However, a distinction between site-bound and non-site-bound branches has become less relevant, according to Marx (1966).

3 Survey of Business Enterprises

In addition to mathematical modelling, relevant site factors were collected from various surveys performed by companies and experts. However, often only special areas or branches take the centre of interest. Table 3 presents the ten most important location factors taken from various surveys carried on in Switzerland and Europe[2]. However, there is further work from elsewhere. See Hu *et al.* (2008), Elgar and Miller (2007, 2010), Knoben and Oerlemans (2008) for a good overview of further surveys and results.

Bieger (1987), Muggli and Schulz (1992), Hilber (1999) as well as Ecoplan and Büro Widmer (2004)[3] all conducted surveys about the diverse branches. At first glance, the weighting of the individual factors appears different. However, when the factors of the different factor groups (production factors, economic environment, municipal interventions environment/living quality) are assigned, it is clear that the ten most important location factors for all branches are all basically found in the location factor groups. Around 1990, the most important factors appeared to be human capital, agglomeration effects and accessibility[4]. About 15 years later, the economically friendly behaviour of the cities and direct cost factors, such as earnings levels, tax burdens and incidental wage costs, are now foremost. The importance of accessibility was, in contrast, quite variably evaluated (see Hilber and Ecoplan and Büro Widmer). The results from Ecoplan and Büro Widmer (2004) show that companies in the vicinity of good freeway connections consider these to be relatively important. This could also be the reason why the traffic infrastructures are very highly valued in Basel.

These results coincide in part with the results of the BAK survey conducted in 1994 and 1997 (BAK 1998). According to this study, the importance of location factors was getting in general larger. In 1994, 12 factors were judged to be "important to very important" by the companies surveyed, while in 1997 it rose significantly to 18 location factors.

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2 Another survey on the theme of the city by the IHK St.Gallen Appenzell (see Eisenhut, 2005) will be discussed in chapter 5.4.

3 The survey conducted by Ecoplan and Büro Widmer (2004) took place in 2001.

4 Schönebeck (1996) mentions similar results.

Table 3 The most important location factors, derived from various surveys

Rank	**Hanser** (1986)	**Bieger** (1987)	**Hanser and Meier** (1992)	**Muggli / Schulz** (1992)	**Healey and Baker** (1996)	**BAK** (1998)	**Hilber** (1999)	**Ecoplan / Büro Widmer** (2004)
	Industry	Diverse industies	Services	Diverse industies	Large corporation	exporting comp.	Diverse industries	Diverse industries
1	existing facilities and infrastructure	Skilled work force	Contact Business owners	Job market	Proximity to market	Highly qualified workforce	Traffic connections	Economic friendly climate
2	Traffic situation, freeway access	Traffic connections to center	Customer potential, customer nearness	Contact advantage	Traffic situation, close to cities	Costs of highly skilled workforce	Efficiency of the authorities	General salary level
3	Unskilled work force	Infrastructure for private traffic	Rents and land prices	Traffic situation	Quality tele-communications	Work permits for foreign workers	Economic friendly climate	Tax burden for companies
4	Available industrial sites	Public transportation	Transport connections	Job market	Work force, salary levels	Telecommunicatio n services	Quality of life in the local area	Level of labor costs
5	Industry-friendly atmosphere	Tax rates for legal entities	Image factors, prestige	Property market	Economically friendly climate	Quality of uni-versity graduates	Availability of work places	Tax rates for high-quality MA
6	Financial support from public authorities	Tax regulations, fees	Parking places, vehicle access	Infrastructure	Rents, land prices	Legal, political predictability	Proximity of demanding customers	Costs for energy, water
7	Skilled work force	Cultural services	Proximity to other business locations	Taxes	Availability of work spaces	Cost of skilled work force	Real estate and land prices	Proximity to highway connection
8	Reasonable land prices	Cooperativeness of administration	Contact opportunities	Mentality	Inner city accessibility	Tax rates for companies	Tax rates for companies	Quality of life in the local area
9	Environment and quality of life	Educational opportunities, salary levels	Economically friendly political climate, taxes	Labor costs	Spoken language	Skilled work force	Proximity to sales markets	Rent price levels, real estate
10	Low salary levels	Customer proximity	Location with passersby, *visibility*	Residence factors	Quality of the environment	Social partnerships	Economic promotion	Building land prices

Source: Vettiger (1994), Rietveld and Bruinsma (1998), BAK (1998), Hilber (1999), Ecoplan and Büro Widmer (2004)

As expected, the comparison of the various rankings shows that the weighting is strongly dependent on the industry of the company surveyed. In the production-oriented survey of Hanser (1986) it was clear, e.g., that corresponding companies were primarily dependent on municipally financed infrastructures (construction, road connections, etc.) as well as an unskilled work force. In contrast, location factors for service companies (Hanser and Meier, 1992) are almost exclusively oriented toward networking with customers and suppliers. Healey and Baker (1996) delivered similar results in their survey of European corporations. In the evaluation of location factors for export-oriented corporations (BAK, 1998), in contrast, the costs and availability of a highly skilled workforce usually play a major role.

Hilber (1999) also comes to the conclusion that the evaluation of the importance of location characteristics for a company headquarters, turn out quite differently depending on the sector. Only three location characteristics were seen as essential by nearly all firms: a) transport, b) efficiency of the public authorities and c) the economic friendliness of the population and public authorities. Healey and Baker (1996) discovered this, at least partially, from the results of the survey of large enterprises in various sectors. In addition, the importance of the attitude of the public authorities was supported by the investigations of Eisenhut (2005).

In relation to surveys of the resident population, the criticism was often expressed that the persons surveyed tended to speak too positively of their residence location, which was of course selected by them. This criticism can probably also be attributed to the company surveys. Hilber (1999) pursued this problem with the help of a control question. He compared the expressed evaluation (importance of the proximity of the work place) with actual behaviour (travel time in minutes from home to workplace). Graphically, as well as statistically, a significant correlation between the evaluation of the location characteristics and the actual location selection behaviour could be proven. Admittedly, only about one-third of the variance of the effective distance could be explained by the expressed behaviour.

Surveys of experts or companies are a relatively quick way to obtain an impression about the influence of various location factors. However, it must be considered that the weighting can change considerably based on the timing and sector of the survey.

4 Analyses at Microlevel

Comprehensive business demographic investigations on a micro level are relatively scarce, as corresponding databases often are not available. Many research projects are therefore based on their own surveys or are occupied with sectoral business demographics. Especially formation or closing of businesses is often subject of research studies, as economic and political decision-makers are first of all interested in the gain or loss of workplaces. From an economic viewpoint, Gibrat's Law[5] in particular, is controversially discussed. On-going work devoted to this topic is in progress.

Mainly concerned with business formations and closings, are, among others, Fritsch et al. (2006) as well as Fritsch and Mueller (2007) in Germany, Benson (2006), Hutter (2005), Grossi (2005) and Matti et al. (2003) in Switzerland. Most of these authors examine the formation of new companies and their survival rates and unanimously agree that new businesses are mostly small companies and the survival rate climbs with increasing age. In addition, they show that employment change is fundamentally influenced by new business. In Switzerland, around 40 percent of the increases in the number of jobs between 1998 and 2001 can be traced to new companies. Wagner (2005) presents a good overview of further similar investigations carried out in Germany.

In the Netherlands, in particular, various studies into the migration of businesses have been conducted. Van Wissen and Schutjens (2005) and Pellenbarg (2005) examined databases from the Netherlands Chamber of Commerce in relation to this topic (among others). Brouwer (2004), as well as van Dijk and Pellenbarg (2000) are working with data from questionnaires. These show unanimously that size and branch affiliation of the companies have an essential influence on the migration behaviour of businesses. Especially firms that serve larger markets tend to relocate more often. De Bok (2004) estimated discrete choice models on the highest level of spatial detail (address-level) and tested different accessibility variables as well as the influence of the rental fee. De Bok shows that accessibility has a positive effect to offices business services. The (negative) influence of the level of rental fees turned out to be significant for firms in business services only. Pellenbarg (2005) gives a comprehensive overview of further investigation of business demographics in the Netherlands.

Based on a dataset from the Statistics Canada Business Register Maoh and Kanaroglou (2005, 2007) explored the behaviour of business establishment mobility in the City of Hamilton.

[5] Gibrat (1931) put forth the hypothesis that the growth of a company has no connection with its size.

They show in their comprehensive analyses that age, size and growth influence the behaviour of the companies. As in Hamilton floor space is scarce, growth increases the probability of relocation for manufacturing companies. They also demonstrate decentralisation and suburbanisation effects for all observed industries. Indeed, agglomeration effects tend to be more significant in the case of retail and service establishments.

Devereux *et al.* (2007) investigated the determinants of where multi-plant firms choose to set up greenfield plants in Great Britain. The research focused on governmental subsidies and show that companies are less responsive to governmental subsidies in regions with only few other plants in their industry. The importance of governmental subsidies becomes more important as the number of already established plants increases.

Buenstorf and Guenther (2007) investigated a dataset covering the German firms in the machine tool industry from 1936 to 2002. Their results show that agglomeration effects have a strong effect to the location choice of relocating companies. Both localization and urbanisation effects increase the probability that moving firms relocate in a given region. Almus and Nerlinger (1999) researched Gibrat's Law using 20,000 companies from the second sector that were founded between 1989 and 1996 in West Germany. These rather young companies reveal a clear dependence between the company's size and growth. Sutton (1997) provides a good overview of this subject.

In Switzerland Bodenmann and Axhausen (2008) analysed a dataset of the Business Register of the three cantons of St.Gallen and both Appenzell between 1991 and 2006. On this basis the development of about 55,000 firms was examined, whereby the number of registered firms increased from 21,000 at the beginning of the year 1991 to 32,000 by the end of 2006. Using a logit-loglinear model, they demonstrate four basic influences on the migration behaviour of companies: age, size, branch and location (community type) of the business. Young companies relocate frequently, especially across longer distances. They also are relatively often affected by business deaths. Newly arrived companies also relocate more often - and they also often change communities at the same time. Small companies clearly relocate more often and at further distances than larger ones. Surprisingly, the likelihood that businesses with 10 employees or more will leave their location is no longer dependent on their size. Businesses in growth branches relocate more often, usually into another community. Businesses dependent on their location basically avoid moving. Especially across larger distances, the likelihood of relocation considerably decreases. Clearly more enterprises leave their location in cities than in agricultural areas. A majority of these migrations are between larger cities.

Baranzini *et al* (2006) analyzed a large set of variables to explain firm's location choice in the Swiss cantons. They show that agglomeration effects (measured in the number of employees of the same industry) have a positive effect to the attractiveness of a canton. Also cantonal business development has a significant attractive influence to new as well as migrating companies.

Based on a census database in China of 2001, Hong (2007) studied the influence of firm-specific characteristics on the location behavior of foreign logistic firms across Chinese cities. He shows that especially market demand, labour factors and governmental policies differ significantly among different groups of firms. For instance, small firms are more responsive to labour cost than large companies. In comparison to independent companies, branch companies are less sensitive to local market demand and labour demand. The results of Hong (2007) imply that logistic firms are quite consistent to those of the manufacturing sector.

Additional comprehensive models of the behaviour of companies were developed in Dortmund (Moeckel, 2006) and Zurich (Löchl et al., 2007). In particular, the model introduced by Moeckel depicts the behaviour of businesses fully. Moeckel also offers a current summary of other models. Indeed, the focus of these studies lies on (micro) simulation of companies' behaviour.

5 Possible Variables and Indicators

The location factors discussed in the previous chapters can be divided into four groups:

- Production factors (production costs, wage levels, human capital)
- Economic environment (agglomeration effects, accessibility)
- Municipal interventions (infrastructure, attitude of the administrative authorities)
- Residence location factors (surroundings, quality of life)

In the following section, possible variables and the corresponding indicators for the individual groups will be discussed in brief. Pellenbarg *et al.* (2002), Maoh (2005), Moeckel (2006) and others have also reviewed and summarised the variables needed for land use transport models. The residence location factor occurs in various purely theoretical factor sets. However, it plays a rather subordinate role in the research field of firmographics. One of the major problems is to find an adequate indicator for an analytical research. The corresponding indicators will therefore not be discussed further.

5.1 Production factors

First and foremost the production factors are generally routine production costs, e.g., wages, energy, infrastructure, human capital and the required workspace. In relation to infrastructure and taxes, there is naturally an overlap with municipal interventions, these will be discussed in section 5.4. Based on the above-mentioned models and surveys, the following production factors appear to be important: availability and cost of the workforce (by educational level and training), availability and cost of workspace, infrastructure and taxes.

Concerning the availability of human capital, there is today's resident population on one side and the growth trend of the population on the other. In addition, a survey can ascertain the highest level of education achieved by the residents and the qualifications of the work force. Various models also work with the unemployment rate in order to represent the employment market better.

Human capital plays a central role in most models. For various kinds of work, it can be assumed that the relocation of private households has an influence on the company's site selection. For example, in a long-term study in the USA, Kim (2005) demonstrated a connection between population density and the density of workplaces.

Based on simulations, Dohse (1996) comes to a different conclusion: the relocation of companies entails external effects that are not to be underestimated. These influence the municipal budget, the allocation of public goods, the location choices of other companies as well as the location choices of human capital. Relocation of the company may therefore clearly have a larger influence on private economic site selection than the relocation of human capital. However, because workers, just like company management, build up a network around their work and residence, companies can only change their location within certain limits. Otherwise, they take the risk that the employees will seek a new job in their current surroundings (Stam, 2003).

Statistics on the taxable income of natural persons serves as the basis for estimating wage levels. On the supra-regional level it is, in contrast, derived from GDP (gross domestic product).

From today's perspective, the availability of workspaces is a relatively important factor. In a survey by Sedlacek (1994) 88% of all companies surveyed said they were looking for a new location because development opportunities were missing at their current location. Based on various surveys, Pellenbarg (2005) showed that this has been the most important reason for relocating for many decades. Large companies seek surface areas large enough to satisfy foreseeable future business expansion. In addition, it has been shown (ARE SG, 2003) that precisely in the best locations, land will be in short supply and the company will then have to move into surrounding communities. In order to be able to indicate the corresponding mechanisms in a model, the availability of building land must be included as a factor.

Most of the various results show that the cost of land, real estate or rentals plays a deciding role in the selection of a location by a company as well as for residential locations of the population. Based on a comparison of various models, however, Richardson et al. (1974) mentioned (in relation to land prices) that price composition is in reality considerably more complex than assumed in the models.

Table 4 illustrates that land prices can be observed in two fundamentally different ways: 1) as an exogenous location factor that is predetermined by the land and real estate market (cf. Vettiger 1994) and 2) as an endogenous variable based on the location preferences of the various space users (in the sense of von Thünen). The circumstance, that the price of land can be modeled using other location factors, makes the variable redundant, at the same time, it can be used as an instrument to adjust the model.

Table 4 Land prices: endogenous and exogenous factors

Land prices have an effect on:	Land prices are determined by:
Distribution of uses and users	Situation, location, quality
Intensity of building/construction	Connections, steady utilization
Social segregation	Reliable construction intensity
	Produced qualities (investments)
	Social evaluation
	Number of possible uses
	Supply and demand

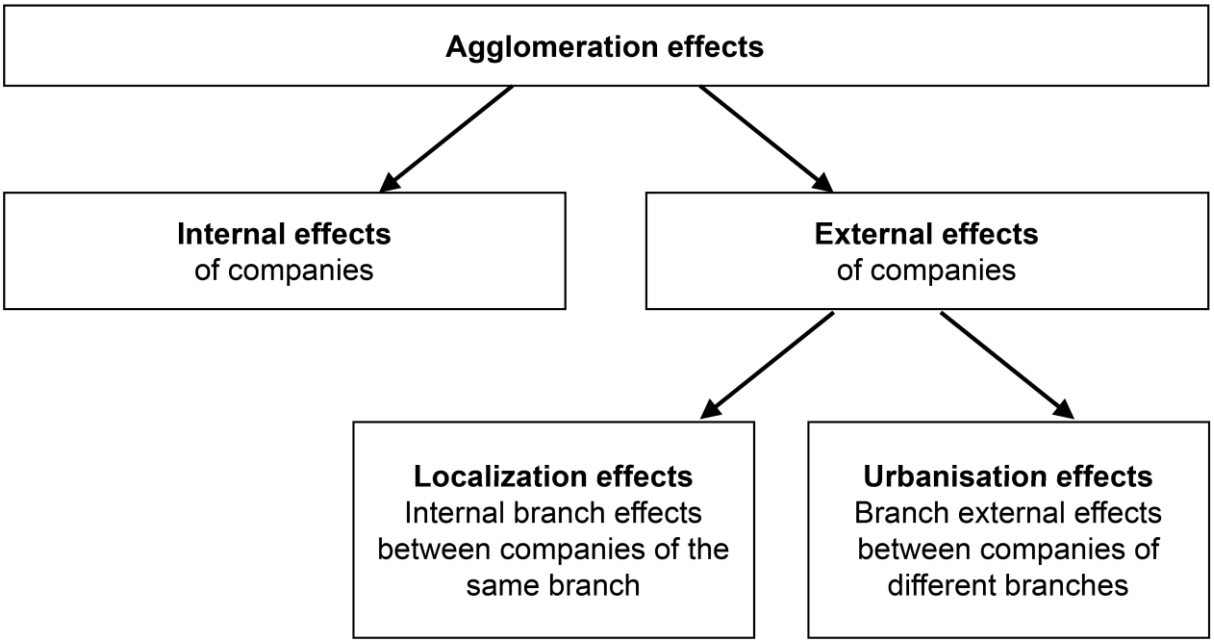
Source: after Häusermann and Siebel (2004)

5.2 Economic environment – without considering distances

In current research on regional micro-economies and location, the approach to agglomeration advantages, spatial clusters and milieu approach plays an increasing role (Frey and Schaltegger, 2002; Fujita and Thisse, 1996; Gaigné *et al.*, 2000). In particular, the diamond concept from Porter (1990) is built on as an enhancement of the milieu approach. The idea is that, because of internal and external scale effects and opportunities for saving money, companies of the same or different branches concentrate on certain locations (Wagner, 1994). Internal savings arise from increasing production amounts. Because operational fixed costs for machine workspace or infrastructure are divided over a large number of produced units, the effect lowers the price per unit and creates a competitive advantage for the company. The external savings are subdivided into localization and urbanization savings.

Localization savings come about through inter-company supply interdependence and a production specialization of several businesses of the same sector in the immediate vicinity. This allows the costs for procurement, distribution, and research and development, among others, to be minimized. Environments with offices from various sectors can, in contrast, lead to urbanization savings. A broad mixture of various sectors produces above-average technical and social infrastructures, maintenance, supply, education and training, traffic and communications systems as well as comprehensive services. In an appropriate environment, good growth conditions dominate, especially for young, small companies (cf. Thompson‘s breeding theory, 1975).

Figure 2 Agglomeration effects



Adapted from: Näf-Clasen (2004)

Agglomeration effects can have positive or negative consequences and thus lead to concentration or dispersion (Wagner, 1994). These saturation effects, among others, lead to time and friction losses that are the result of increasing use and traffic density. The surface and usage competition results in increasing land prices and rents, as well as increasing wage costs for qualified work forces. Based on research on the long-term development of land-use density in Chicago, Sen *et al.* (1998) have shown that increasing wages, in particular, lead to verifiable decentralization, i.e., a broader population layer can manage to buy land, and thus their own home, which causes building land to increase disproportionally.

The concrete representation of the agglomeration effect in a model is difficult. Models including agglomeration effects use therefore very different indicators. These are mainly: residential population, population density, wage earners, employment in different sectors, employees in growth branches or in agriculture, innovative firms, as well as several others. For example, Böventer (1975) combined the agglomeration factor[6] with city size (resident population). He measured the difference between sectors, with the help of the employment structures of the

[6] Böventer divided the agglomeration factors into three levels: intra-urban, intra-regional and inter-regional.

individual industries, of the growth effect in the individual sectors as well as the shift of the employees from less productive industries to highly productive industries. For this, Böventer applied the changes in the share of employees in the agricultural sector to the total number of employees of all economic sectors.

Another way to represent external (and partially internal) agglomeration effects is economic structure analyses. The shift-share analysis (cf. Frey and Schaltegger, 2002) makes it possible to break down the agglomeration effects into a branch structure factor and a location structure factor. Therefore he manages to base the analysis on predominantly available data. For example, Tschopp *et al.* (2005) used the shift analysis to investigate the development of workspaces in Switzerland from 1950 to 2001.

In Table 5 Tank (1987) shows the different effects from the agglomeration effects on different services. He comes to the strongly simplified conclusion that the influence of the agglomeration factors on site selection by companies is essentially determined by the distance to customers and suppliers. Internationally oriented companies are comparatively free in their location choice, while regionally oriented companies are dependent on connections to the city. In addition, the need of the companies for agglomeration, along with the significance of the corresponding location factors, depends strongly on the size, production and degree of specialization of the company. Growth industries and pioneer companies, in particular, require (at least in the early phases of the company cycle) the advantages of an urban agglomeration[7]. After a certain maturation and achieving a certain size, a company can do without many of these advantages, at least partially, and relocation to a less central situation is possible[8].

Companies of the "new market" also tend to form clusters. Dohse *et al.* (2005) come to the conclusion that the corresponding companies seek out rich regions with high work productivity and high concentrations of economic activities. Henderson (2003), as well as Rosenthal and Strange (2003), also demonstrates a tendency to form agglomerations in specific industries (e.g., high-tech) because of localization effects. In addition, Rosenthal and Strange (2003) come to the conclusion that the positive externalities based on the localization effect rapidly subsides with increasing geographical distance. Their analysis requires an evaluation on the community level or a more detailed analysis[9] when possible.

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7 See Thompson's breeding theory (1975).

8 This corresponds to Thompson's filter process (1975).

9 LaFountain (2005) investigated the economic development in the industrial sector of various counties in the USA. At this aggregation level, he could not demonstrate any localization effects, which he traced back to an aggregation that was too general.

Table 5 Agglomeration advantages in the service sector

Branch	size of the labour market	diversity of the labour market	Industry-specific workforce	Cost savings on acquisitions	Information and communication	Cost savings on distribution	Optimization of transport and time costs of customers	Purchasing power	Prestige	Totals
Wholesale	1	2	1	4	4	4	2	1	1	20
Trade negotiation	0	0	0	2	4	2	1	1	1	11
Retail business	0	0	0	2	1	1	8	4	1	17
Credit institute	4	4	1	2	4	1	8	4	2	30
Private insurance	4	2	1	2	2	4	2	4	1	22
Social insurances	2	1	1	2	4	1	1	0	0	12
Accommodations	1	2	0	2	1	0	4	4	4	18
Board, meals, catering	1	0	0	2	1	1	4	4	1	14
Doctor/dentist offices	1	0	2	2	1	2	4	4	2	18
Hospitals	4	4	4	2	1	1	4	4	2	26
Consulting and Advertising	1	2	4	4	4	4	4	0	4	27
Architect/Engineering offices	1	2	2	2	4	2	2	1	2	18
Schools	1	0	2	1	1	1	2	2	1	11
Theater, Orchestras, etc.	4	4	4	2	1	1	8	4	4	32

Evaluation of the factors: 0 = none to very limited importance; 1 = limited importance; 2 = not so important; 4 = large importance; 8 = critical importance

Adapted from Tank (1987)

Güssefeldt and Streit (2000) investigated the general influence of agglomeration effects (without considering different industries) in the NUTS II regions of the European Union. The gross national product per capita is modelled with ten variables, which in turn makes it possible to represent various areas. The labour conditions are characterised by the ratio of farming

population to total work force, the share of the population with higher education and the unemployment rate. Urbanisation is represented by number of residents, population development and population density. Railroad and highway density should indicate the traffic connections and offer information about municipal investment. Investments in research and development as well as the number of the reported patent applications cover the aspect of the innovative milieu. This model shows that the largest part of the variation of the economic development in a region can be explained by the labour conditions (42%). Much less significant is the influence of urbanisation (15%), infrastructure (11%) and innovation (11%).

5.3 Economic environment – considering distances

Interactions are a central theme in social and economic life. In most of the models including agglomeration effects, however, distance was abstracted to a minimum: Instead of distance or travel time, the only distinction made was between „Available on site" and „Not available on site". However, for the transport of goods especially, transport costs must be factored differentially. Earlier location models with a focus on agriculture and industry therefore considered transport costs explicitly. After Zipf (1949), among others, had proved that the total of interactions between cities decreased continuously with growing distance, this information was operationalized. Thereafter, various models had been developed that showed the interaction between the actors spatially.

Today there are three main approaches in use for weighting distance: the central location approach, the isochronic approach and the potential approach.

The **central location approach**, built on the model from Christaller, measures the generalized travel costs from a given location to a selected location that has central location functions. This approach is simple to calculate and understand. The results are not, however, comprehensive and travel behaviour is not considered. In addition, as part of a spatial investigation made by the Canton St. Gallen, ARE SG (2001) shows the difficulty of defining the central location – and the definition, of course, this influences the results.

The **isochronic approach** measures the number of activity points within a specific travel time for an observed starting place. This approach is often applied in connection with the construction of shopping centers or workplace sites. The number of potential customers or employees (residents) in a radius of 30 to 60 minutes is calculated and the possible sites are appropriately evaluated (see Aliesch et al. 2000). This approach is likewise simple to calculate and easy to understand. However, it treats all activity points within the observed travel time the same.

Therefore, no differentiation is made, whether an activity point is in a neighbor‘s house or 25 minutes drive away. Conversely, all activity points outside the observed perimeters are not considered at all.

In the **potential approach,** the activity points are weighted according to their attractiveness (number and generalized travel costs). The weighting of attractiveness is performed according to the model of „homo economicus“, the classical economic theory (Axhausen and Abay, 2000; Ben-Akiva and Lerman, 1985). This model assumes that people behave rationally and regularly seek to maximize their advantage. The corresponding weighting takes place with a negative exponential function. Activities in the immediate vicinity of the observed point are therefore more strongly weighted than points at a larger distance (calculated in generalized travel costs).

Various studies have shown good results using the potential approach. Thus, various quantifiable phenomena such as land prices, rental rates or construction activity can be correlated with the calculated accessibility (Geiger, 2000; Tschopp, 2007; Löchl, 2010). In contrast to the other approaches, the results are difficult to communicate to a broad public. While the results for the isochronic approach were measured in persons and in the central location approach in minutes, in the potential approach, the result is only one number, which is calculated with a fairly complex formula.

For imaging distances and generalized travel costs in a model, it may be (as far as the data permits) that the potential approach is the most suitable. One reason is that a weighting of interaction possibilities that is dependent on the distance seems intuitively correct. In this regard, it should be verified whether a shift-share analysis with an appropriate weighting could be performed.

With the success of the internet, the question arises whether the location factor accessibility will play an equally important role in future. Dohse et al. (2005) conducted an empirical investigation in Germany and established that a marginalization of spatial distance is hardly to be expected. Sinking spatial transaction costs could, however, lead to spatial relocations:

- Production processes that are mainly based on digital data have lost their connection to a specific location through the introduction of the Internet. They are increasingly relocating to the periphery on cost grounds. In today’s globalization process, the sites are often in Eastern Europe, India and China.
- In contrast, production processes that have a high share of localized knowledge and personal contacts tend to spatial concentration.

The results of Dohse *et al.* (2005) show that, in fact, the existing disparities between center and periphery in recent years have grown stronger rather than weaker. The influence of spatial proximity may well have changed, but it is hardly meaningless. The influence of the spatial situation of existing networks in relation to suppliers, customers, and employees will be visible in site selection behavior of already existing firms: new locations are, as a rule, not all that far away from the existing location (Sedlacek, 1994; Pellenbarg, 2005). Otherwise, they risk the loss of economic networks and qualified employees.

5.4 Significance of municipal interventions

In recent years, various researchers have been concerned with the influence of municipal interventions on location choice. Especially Porter (1990, 1999) delivers a comprehensive contribution to the competition between regions and countries. Siebert (2000) names three central areas of influence: a) taxes, b) infrastructure and c) the legal environment. Further, the infrastructures can be divided into physical-capital-oriented and human-capital-oriented infrastructures. Gatzweiler *et al.* (1991) and Grabow et al. (1994) unanimously come to the conclusion that the physical-capital-oriented infrastructures, e.g., transport networks, communication services as well as maintenance and disposal facilities have an essentially larger influence on site selection than does human-capital oriented infrastructures, e.g., educational levels and knowledge transfer industries.

Bondonio and Greenbaum (2007) studied the impact of tax incentives on a number of dimensions of local economic growth in enterprise zone (EZ) programs in different US states. Their results provide evidence, that EZ incentives do have significant impacts. In particular, EZ programs positively affect new firm establishment. Existing companies are also positively affected, but to a smaller extent. Bondonio and Greenbaum recommend paying a greater attention to existing business as they show, that EZ policies are also found to accelerate business closures.

In general, human capital has always been an important production factor. In this regard, the household related public goods should not be allowed to escape attention. Gatzweiler *et al*. (1991) come to the conclusion that in particular, leisure and school quality play an important role for children.

Dohse (1996) designed a model to simulate private economic site selection based on local public goods. The strongly simplified model considers natural spatial circumstances and soft location factors: work as a mobile factor, wage levels, agglomeration advantages and disad-

vantages, public goods, tax rates and realised profits. For the model, a Tiebout balance[10] was calculated in relation to the work force (based on wage) and the company (in relation to realised profits) in a system comprised of three regions[11]. With his model, Dohse simulated three different allocation mechanisms of public goods:

a) a regionally differentiated allocation that arises in the competition between communities,
b) a regionally differentiated allocation with balance-oriented interventions by a central government much like those often organized at the present time, and
c) a consistent allocation.

It is interesting that all three scenarios show a divergence between the optimum and the Tiebout-balance. Therefore, Dohse comes to the conclusion that balancing mechanisms are only efficient when a large difference in relation to financial resources prevails between the regions. For small differences, in contrast, much speaks for a regionally differentiated allocation.

Assuming that land prices and rents are directly dependent on the attractiveness of the location (e.g., Geiger, 2000), we can indirectly estimate their influence from the degree of capitalization of the investments involved. Hilber (1999) has investigated the capitalization of public investments in land prices and rentals and makes comparisons with various other researchers[12]. According to them, tax rates and traffic infrastructure improvement have a verifiable influence on the attractiveness of a location, in contrast, the evidence is very weak concerning the influence from location-dependent figures.

The Chamber of Commerce and Industry of St. Gallen-Appenzell conducted a survey on the conduct of the city in relation to small and medium-sized businesses (SMB) (Eisenhut, 2005). The analyses of the 1025 replies concludes that, for SMBs in eastern Switzerland, the influence of the general legal framework, the administrative process and fiscal burden were considered to be the most important. Assuming these are also important factors for site selection, then these influences must also be considered in a corresponding model. An interesting aspect of the survey regards the negligible factors. Thus, preferential treatment for public projects and positive financial incentives were rated as unimportant.

[10] Dohse (1996) used the Tiebout Balance in the following definition: "A Tiebout balance is achieved when the supply of local public goods is perceived as fulfilling its preferences best, so that no single household has the urge to relocate."

[11] The model is still very far from falsifiability, but already offers information on a variety of questions.

[12] Depending on the assumptions (e.g., the life expectancy of a house), however, the individual results differ considerably.

In the models, the municipal influences were predominantly represented by tax rates for natural persons and legal entities and investment for infrastructures. The significance of investments is without doubt interesting from a political viewpoint, because the benefits/advantages of the investments can be made visible (cf. the above-mentioned work on capitalization of public investments by Hilber, 1999). In order to model site selection of companies, it may be simpler and more precise to directly depict the resulting infrastructure (changes): smaller generalized transport costs, in other words a better accessibility and improved school and college opportunities (measured in number of teachers and professors). However, indicators for economic friendliness of authorities and for handling of permit processes would have to be raised specifically in a questionnaire.

6 Conclusions

The literature review shows that location decision of a company is influenced by various **company-specific factors**: the industry in which it operates, the stage of the life cycle of manufactured goods as well as of company itself (e.g. new established company, age), the organization and structure, and last but not least the size of the company. Moreover, the existing location is the foundation of an (existing) local and regional network that should not be lost due to relocation.

The comparison between the qualitative concepts such as the diamond concept of Porter (1990) and the empirically verifiable models shows that the **characteristic variables for the location** partially strongly differ. Unfortunately, an analytical model using measurable indicators leads typically to an adjustment of the variables to derivable indicators from available data. This causes also often a (unintentional) simplification of the model. Although in this time much more and better data are available, this will certainly remain one of the problems of modeling. Nevertheless, the overview of different analyses shows that at least at the aggregate level of municipalities nowadays a large part of the suspected and proven influencing factors can be obtained and included in the models.

Four groups of variables representing the environment of a given site influence the relocation decision: i) **Production factors** can be represented e.g. by the cost and availability of labor and work surfaces. ii) The **economic environment** comprehends the physical proximity to other companies (same or different industry) and to the resident population (as customers or workers). In particular, these are the agglomeration effects and the accessibility of relevant activity opportunities. iii) The **governmental environment** is divided into three areas: taxes, infrastructure and legislation. iv) The **location factors** are only indirectly related to the location choice of companies and should therefore have a correspondingly smaller impact.

In principle, also other firmographics events as **establishment** and **failure** depend on these factors. Especially age and size of a company have strong influence on the survival rates of companies.

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