



Logistics Sprawl in the Region Zurich

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Conference paper STRC 2016

STRC

16th Swiss Transport Research Conference

Monte Verità / Ascona, May 18-20, 2016

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May 2016

Abstract

Logistics sprawl is a land use phenomenon, which has been detected in many urban areas around the world (e. g. Paris, Atlanta, Toronto, Los Angeles, and others). It consists in the displacement of logistics sites from urban areas to suburban areas. Logistics sprawl can negatively affect the reliability of deliveries, increase delivery costs and have undesirable environmental effects (emissions, land consumption). Over the last 20 years, Zurich experienced a significant densification of its urban fabric, which potentially fostered the sprawl of the land-intensive logistic sector. Therefore, we analysed the locations of four types of logistic firms (road transportation, storage, courier service, postal service) in the Zurich area in the period of 1995 – 2012 to determine to what degree logistic sprawl occurred in said area and how this affected the distance of the mean delivery route. The analysis shows that the mean distance of the storage and the courier services firms from the Zurich city centre increased significantly. The logistic sprawl did not occur for the road transportation firms and for post offices. To avoid the displacement of logistics firms in suboptimal sites, it is important to proactively locate the best potential logistics sites and secure them by land use regulation.

Keywords

Logistics Sprawl – Densification – Sprawl – Freight Traffic – Logistics

1 Introduction

In March 2013 with the vote in favour of the new spatial planning law, the Swiss population decided that a new era in the land use planning had to start. In the new era the settlement development has to be oriented toward a concentration.

As settlement development and mobility are indissolubly linked, this change of paradigm will have heavy consequences on the future of the Swiss transport system. A densification of the settlements will affect both passenger and freight transport. Passenger transportation could partially be positively influenced as people living on urban cores cover statistically 30% less kilometers per day than people living in periurban and rural areas (Bundesamt für Statistik und Bundesamt für Raumentwicklung, 2012). Higher concentration of both habitants and work places will however create great pressure on the infrastructure for both passenger and freight transport. The attention of this study is addressed to the link between settlement concentration and freight transport. In particular the relocation of logistics uses when concentration of a settlement occurs will be analysed.

The densification process can affect in different ways the supply of good of an urban area. On the one side it could simplify the distribution as the densification of urban areas could lead to a greater aggregation of the flow of goods. On the other side it complicates the process of distribution. The supply of goods needs indeed surfaces near urban centres, to be carried out efficiently and sustainably. However, the availability of logistics spaces into urban areas is made difficult by the densification process. A more intensive use of the urban areas (more resident and more place of employment on the same area) raises the land prices and puts pressure on the urban areas. As a result, the low value added activities (like logistics) can be bound to be displaced towards suburban areas. This phenomenon is known as logistics sprawl and is described by Dablanc et al. (2010) as the relocation of logistics firms from the urban cores to the outer suburban ones.

An efficient logistic infrastructure, capable to guarantee reliable and cost-effective supply of goods, is an indispensable prerequisite for the competitiveness and attractiveness of cities. Land use planner should be made aware of the possible risks associated with the logistics sprawl, in order to cope and furnish answer to this.

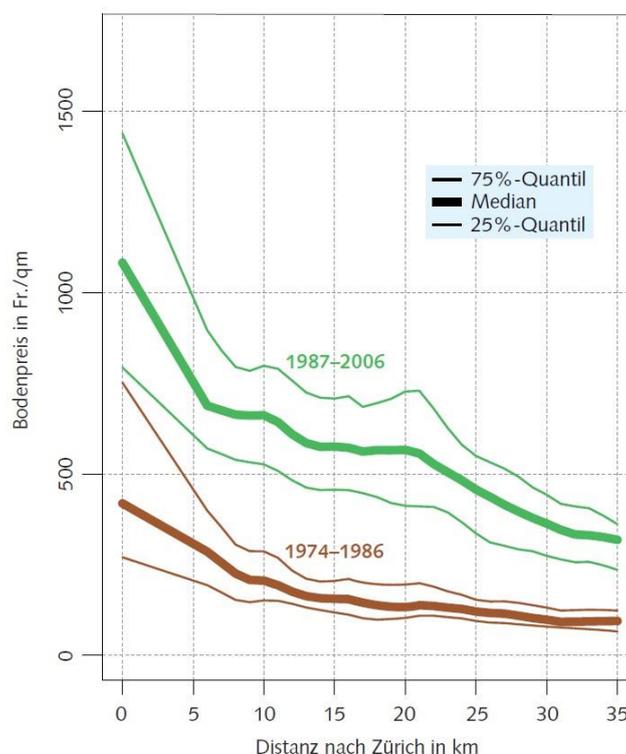
During the last 20 years, the city of Zurich experienced a substantial process of densification, with an increase of both number of inhabitants and workers. In order to understand if and to what extent logistics sprawl affected the city of Zürich during this process of densification, we compared the position of the logistics firms in the region during this period (1995, 2005 and 2012). Compare the mean distance of the firms – and as a direct consequence thereof their delivery route – from the city centre before and after the process of densification experienced by Zurich allows us to understand if logistics sprawl took place over this period.

1.1 Land price as possible explanation

Land prices in the city of Zurich grew considerably in the past decades. We found data to the historical evolution of the land prices only for the residential land. According to the model value of the statistical office of the Canton Zurich (Statistisches Amt des Kantons Zürich, 2014), the value raised from 554 CHF/m² to about 1'700 CHF/m². To understand where this increase took place, in the figure 1 the evolution of the land price in function of the distance to the city of Zurich is represented. The land price near and in the city increased above average.

figure 1

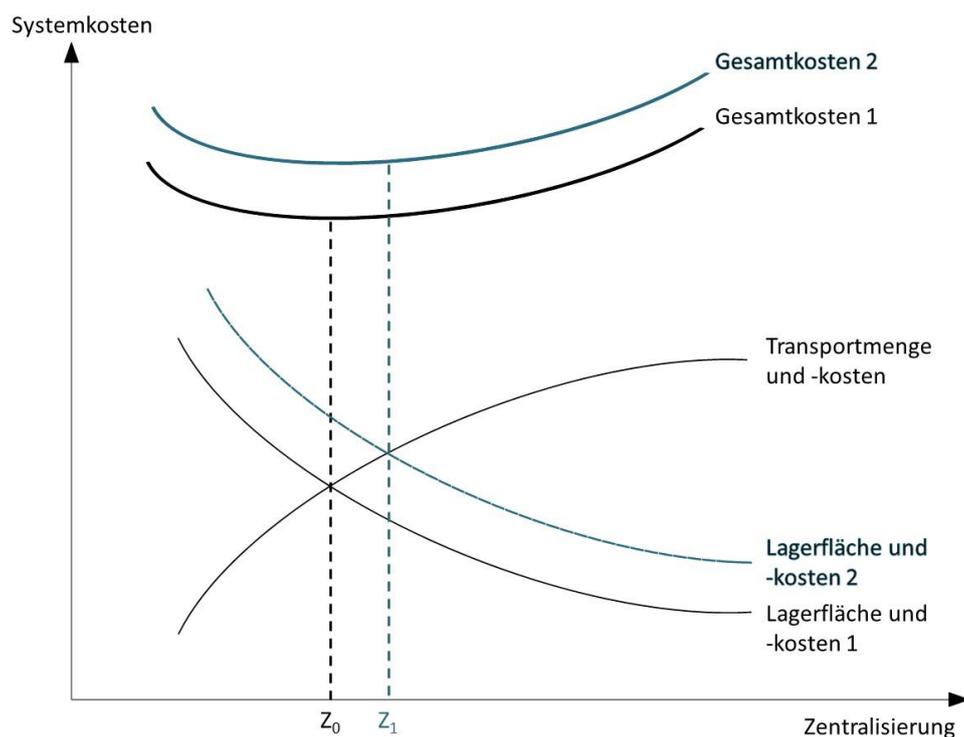
Land price in function of the distance to the City of Zurich.



Source: Moser (2008).

As shown in the figure 1, there is a trade-off between storage area and transport volume: the more centralized the storage areas the bigger is the transport volume. Higher land prices affect the warehousing costs of firms. The firms try to minimize the used storage area by centralizing it (shift from Z_0 to Z_1 in the figure 2) and replace it with more driven kilometres.

figure 2 Trade-off between warehousing and transport costs.



Source: Own diagram based on Bretzke et al. (2010).

As a reaction, the logistics firms leave the urban areas and relocate their activities in suburban areas. If we compare the number of employees by economic activity of the third sector in Zurich for the years 2005 and 2012 as in the XXX we can observe a substantial decrease of the postal and courier activities of about -60% and an increase of more than 60% in the IT, financial and management consultancy activities (IVZ, 2014).

1.2 Effects of the logistics sprawl

The effects of logistics sprawl are various and concern more sustainability dimensions. Dablanc et al. (2010) pointed out as logistics sprawl increases the CO₂ emissions due to longer delivery routes. Longer delivery routes do not imply only more CO₂ emissions but also decreases of the reliability of the goods transports and other local negative consequences as noise and particulate

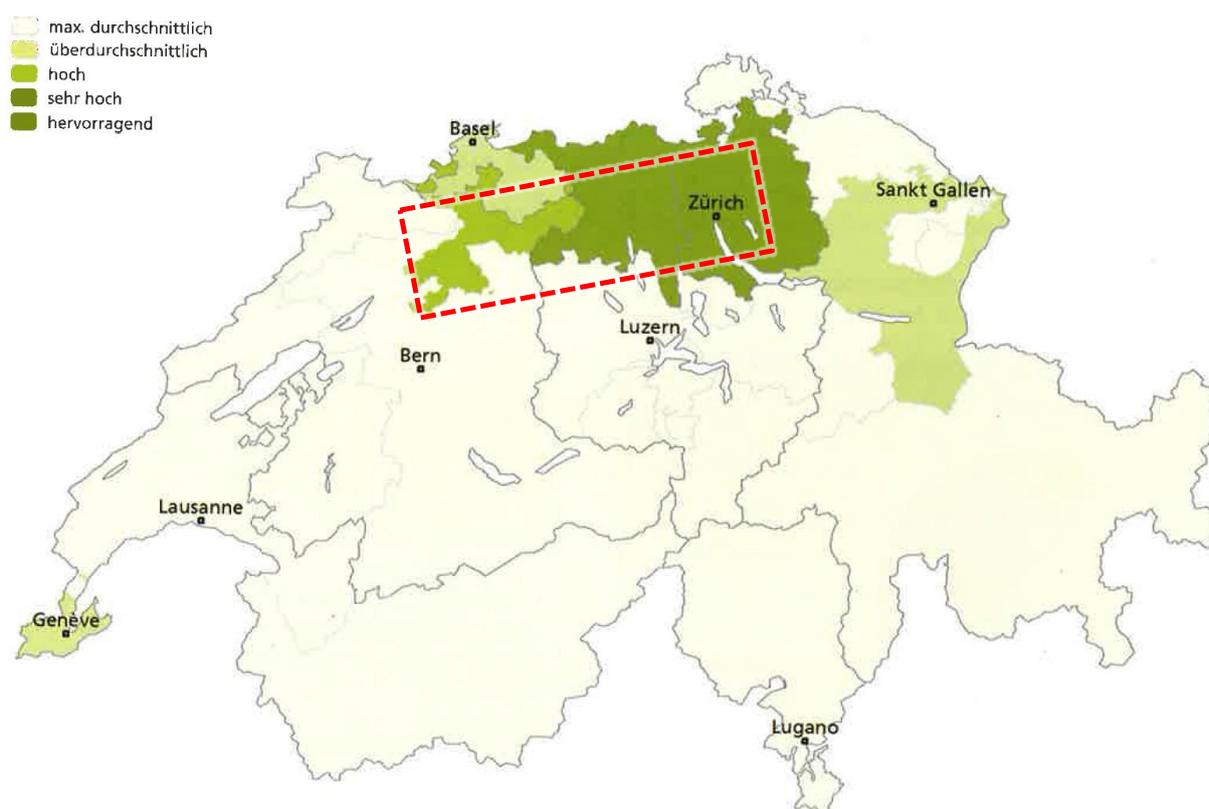
emissions and traffic congestions. The deconcentration of the logistics activities also implies better access to highways (Woudsma et al., 2015) and this may discourage the use of rail in favour of more truck transports.

2 Methodology

2.1 Study area's boundaries

As shown in the figure 3, the most attractive regions for the settlement of logistics activities are the cantons of Zurich, Aargau and Solothurn. This is the best-connected area in Switzerland, as both railway and motorway infrastructure on the North-South and on the East-West axes are available here. At the same time, the most important flow of goods from/to the city of Zurich is in relation with this region (Bundesamt für Statistik, 2013). For these reasons, we focused our analysis on these three cantons.

figure 3 Attractiveness for the settlement of logistics activities.



Source: Own diagram based on Nehm et al. 2013.

2.2 Investigation period

After a decrease since the 60's, the number of inhabitants of the city of Zurich has been growing since mid-90s. In the period 1998-2012 the population grew of +14%, which means an increase of about 46'000 inhabitants (Statistik Stadt Zürich, 2015). Due to changes of the statistical methodologies the number of employees cannot be compared between 1998 and 2012. However, a very strong growth on this period can be imaged. According to the statistical department of the city of Zurich (Statistik Stadt Zürich, 2015) between 2008 and 2012 the number of employees increased from 362'000 to about 450'500 (+24%).

To investigate the effect of the densification, which took place in the city of Zurich, in this analysis the period 1995-2012 will be considered.

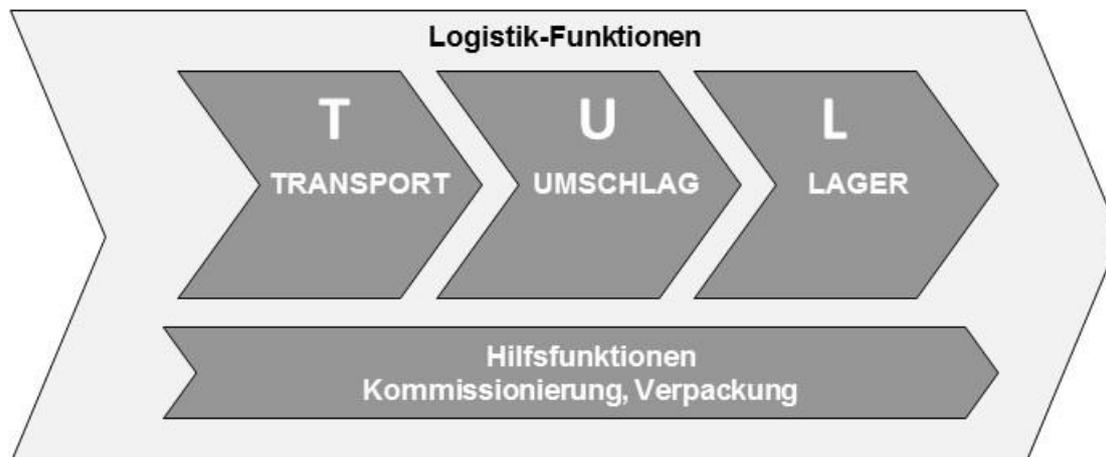
2.3 Delimitation of the research subject: logistics activities and flows of goods

Logistics sprawl can affect all kind of logistics activities. In the literature the authors considered different type of logistics facilities and activities. Cidell (2010) – for example – considered warehousing and cargo trucking. Dablanc et al. (2010) focused their research on parcel transport terminals.

Logistics consists basically of the activities represented in the figure 4: transport, handling and storage as well as the support function, commissioning and packaging.

In order to investigate the various facets of logistics sprawl, in the present study the widest possible range of activities permitted from the data availability was considered (see chapter 2.4).

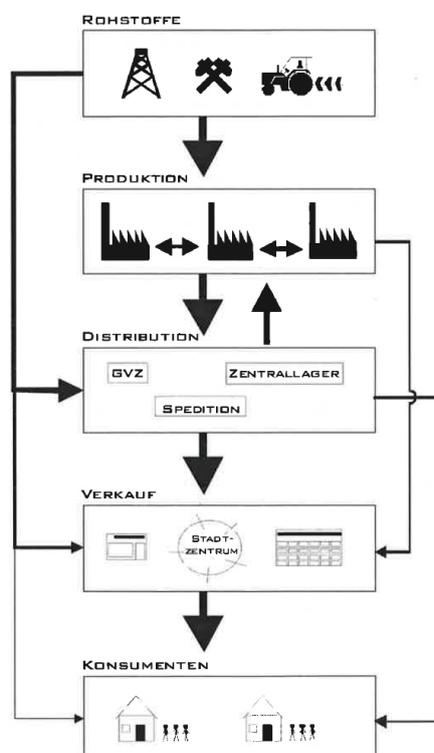
figure 4 Logistics activities.



Source: Ruesch et al. (2014).

In the figure 5 the main flows of goods are represented. The present study deals with the supply of goods of the city of Zurich. For this topic only the flows from the distribution to the consumer are of relevance.

figure 5 Main flows of goods.



Source: Bundesamt für Strassen (2008).

2.4 Data situation and considered logistics activities

To understand if the logistics activities have been dislocated from the urban areas towards suburban and exurban areas, the aerial distance between the logistics firms and the city centre has been calculated for the years 1995, 2005 and 2012.

For this purpose we used data of the Swiss Federal Statistical Office (FSO). In particular the Business Census (BC) for the years 1995 and 2005 and the Structural Business Statistics (STATENT) which during the investigation period took the place of the BC. Both BC and STATENT are complete surveys. For every censused firm the coordinates and the number of employees and full time equivalents (FTE).

BC and STATENT are based on (slightly) different definitions of the economic activities (called NOGA 02 and NOGA08). After an in-depth analysis of the definitions of NOGA02 and NOGA08 we could ascertain that the definitions related to the logistics activities are perfectly comparable. The only restriction is related to the number of employees, which cannot be compared. Although for our research aim only the position of the firms is relevant, order to guarantee a better comparability of the data from BC and STATENT, we only considered firms having more than 3 FTE. Beside a better comparability, this constraint help us to select only the firms with a certain transport volume.

Four activities defined in BC and STATENT are relevant and available: freight transport by road, storage, postal services and parcel services (without postal service). In the figure 6 the number of firms in each activity and the mean number of FTE employees per firm and activity are reported.

figure 6 Number of firms per activity and mean number of FTE employees.

Year	1995	2005	2012
Number of firms			
Freight transport by road	490	501	503
Storage	76	55	57
Postal service	489	564	395
Parcel service	33	44	67
Total	1'090	1'169	1'026
Mean FTE per firm			
Freight transport by road	12	16	20
Storage	35	48	54
Postal service	25	16	17
Parcel service	41	37	41
Total	20	18	22

Source: Own table based on BFS, STATENT 2012 and BZ 1995/2005.

3 Results

We report here the results of two analysis carried out to ascertain if logistics sprawl has took place in Zurich and if it is the case, which logistics activities are concerned by this phenomenon. The first analysis is the analysis of the mean distance of the firms from the city centre. Using the „Degree of Urbanisation“ (DEGURBA) of the communities we analyse then the distribution of the logistics firms on the different spatial typologies.

3.1 Mean distance to the centre of Zurich

As centre of the city of Zurich, the central station has been chosen. In the figure 7 the results of the analysis are summarized.

figure 7 Mean distance to the city centre and displacement (in km and as percentage) for the period 1995-2012.

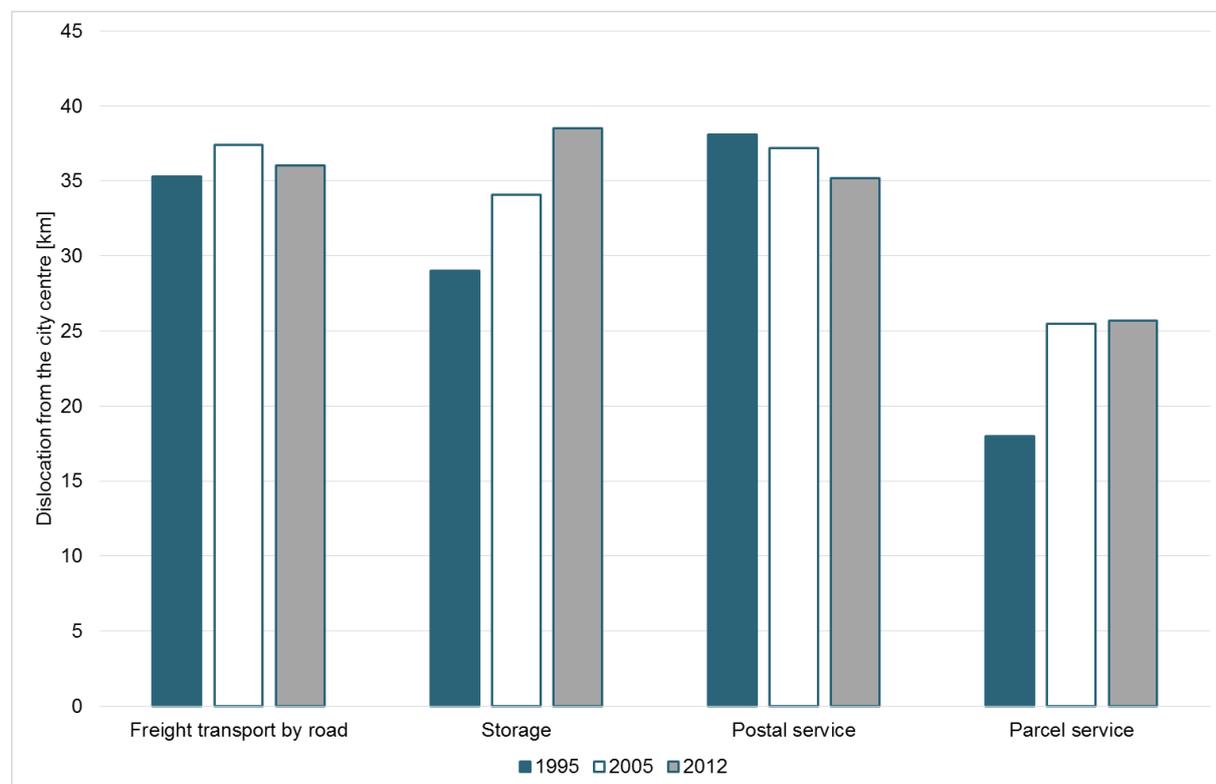
Year	Activity	Distance to the	Displacement	Displacement
		centre		
		[km]	[km]	[%]
1995	Freight transport by road	35.3	-	-
2005		37.4	2.1	6%
2012		36.0	0.7	2%
1995	Storage	29.0	-	-
2005		34.1	5.1	18%
2012		38.5	9.5	33%
1995	Postal service	38.1	-	-
2005		37.2	-0.9	-2%
2012		35.2	-2.9	-8%
1995	Parcel service	18.0	-	-
2005		25.5	7.5	42%
2012		25.7	7.7	43%

Source: Own calculations based on BFS, STATENT 2012 and BZ 1995/2005.

With the exception of the postal service, for all the analysed logistics activities the distance to the city centre increased up to 9.5 km between 1995 and 2012. In the figure 8 the distance to the city centre for the four considered activities is represented graphically.

The location freight transport by road firms remained basically stable on the period 1995-2012. Over this period the mean distance only increased by 2%. Between 1995 and 2005 there has been a slightly trend toward an increase of the distance.

figure 8 Graphical representation of the mean distance to the city centre (in km) for the period 1995-2012.



The most evident increase of mean distance occurred by the storage activities. Over the first decade of the investigation period the distance grew by 18% from 29 up to 34 km. From 2005 to 2012 the distance increased up to 9.5 km (+33%).

The exception is constituted by the postal services. An explanation for this evolution can be found in the liberalisation of the market of the postal services. In the transition from the PTT monopoly to the free market an important process of reorganisation took place. The project “Optima” aimed to eliminate up to 50% of the post offices (Berger, 2000). The elimination of a considerable number of offices (mostly in remote regions) can be the motive for the observed trend toward a reduction in the mean distance to the city centre (-3.3 km).

The biggest percentage growth rate (+43%) took place by the parcel service firms. Over the 12 years investigation period, the distance increased by 7.7 km.

3.2 Distribution of the logistics firms on the different spatial typologies

According to Burchell et al. (1998), density is one of the cardinal defining characteristics of sprawl. In this sense, sprawl is a development outward from the solidly build-up core of a metropolitan area (Burchell et al., 1998). A peripheral growth from urban areas toward more suburban ones. By examining the distribution of the firms on the spatial typologies by degree of urbanisation (DEGURBA). This division of the territory by typology is used by the Swiss Federal Statistical office as well as by EUROSTAT.¹

In each graph of the **Fehler! Verweisquelle konnte nicht gefunden werden.** one can find out two pieces of information: the actual distribution of the firms on the three spatial typologies (densely populated area, intermediate density area, thinly populated area) and the evolution of the distribution over the period 1995-2012. Each bar of the graph represent the share of the firms that are located on a given spatial typology in a particular year (1995, 2005, 2012).

The most part of freight transport by roads, storage and postal service firms are located on areas with intermediate density. Despite a substantial evolution, in 2012 about 50% of the firms in the parcel service are situated on densely populated areas (70% in 1995). For far all types of logistics activity the share of firms on thinly populated areas is very low (less than 20%).

In general the evolution of all types of logistics activities follow closely the evolution observed analysing of the distances to the city centre (section 3.1). Excepted the postal services, all type of activities show a given tendency towards a relocation of the terminals from the urban cores (densely populated areas) to the outer suburban ones (intermediate density areas, thinly populated areas).

The freight transport by roads activities have been going through a process of concentration on intermediate density area. The share of firms located on this typology of cores increased from 60% to 65%.

The storage activities experienced a strong decrease in the presence on urban areas (approximately from 40% to 25%) and – at the same time – a strong increase in the share of the

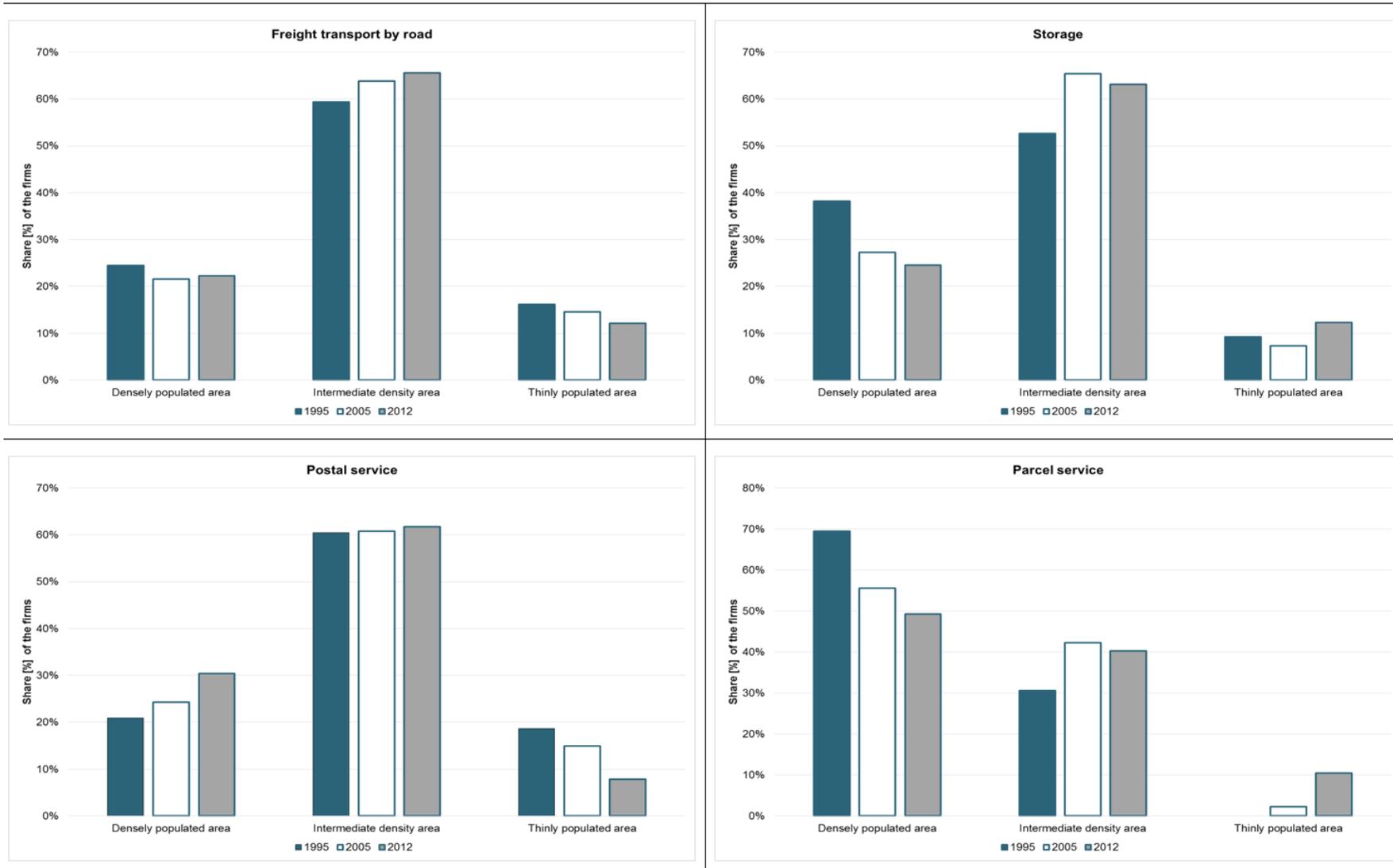
¹ More information about the calculation of the degree of urbanisation can be found here, on the EUROSTAT internet site: http://ec.europa.eu/eurostat/ramon/miscellaneous/index.cfm?TargetUrl=DSP_DEGURBA.

firms being located on periurban (about +10%) and exurban areas (about +5%). For this type of activity a strong sprawl can be ascertained.

As observed in the section 3.1, the postal service experienced a strong process of concentration in the centres: the share of postal service activities decreased on thinly populated areas (around -10%) and increased on densely populated ones (around +10%).

In 1995 resided around 70% of the parcel service firms on urban cores. This share fell by 20% between 1995 and 2012 and at the same time increased the share of the firms on suburban (+10%) and exurban cores (from 0 to 10%). As for the storage activities, a tendency toward a relocation of the firms outside of densely populated areas is clearly observable.

figure 9 Graphical representation of the distribution of the logistics activities by degree of urbanisation over the period 1995-2012.



4 Analysis of the results

The mean distance to the city of Zurich increased for the storage (+9.5 km, +33%) and parcel service (+7.7 km, +43%) significantly. The freight transport by roads firms experienced a very moderate increase (+0.7 km, +2%). Over the same period (1995-2012), the postal service offices underwent a period of concentration: the mean distance from the city centre diminished. This may be due to the liberalisation of the postal market, which occurred during the investigation period.

From the study of Dablanc et al. (2010) resulted a shift of 10 km away from barycentre of all parcel transport terminals over a period of investigation of 34 years. The ascertained delocalisation in the present study – over a period of only 17 years – has to be considered as relevant.

The methodological choice of analysing separately the different logistics activities resulted to be appropriate as it allows to highlight different patterns of evolution. This turned out to be very helpful especially because not all types of activity followed the same path. To present no other study which considers separately more different logistics activities has been carried out.

Another strength of the present study is the quality of the data used. The used data is the result of a complete survey, this guarantee comprehensiveness and a certain reliability. As the survey methodology of the used data changed during the investigation period, these were initially connected with a certain uncertainty. After an in-depth analysis we could ascertain that the categories of logistics activities remained comparable beyond the change of methodology.

Supported by the analysis of the transport connections and of the flow of goods in the region Zurich, this study assumed, that the relocation of logistics terminals would occur toward the western cantons (Aargau and Solothurn). Further research could investigate whether the sprawl took place in other directions. This evolution would however be quite surprisingly.

The analysis of spatial typologies of the areas where the firms are located furnished a similar overall picture of the 4 considered logistics activities. Storage and parcel service are the most concerned activities: their location have been relocated from urban (densely populated) cores toward more suburban ones. Also by this analysis an exception is constituted by the postal service. For this activities the relocation followed the inverse path, i.e. from exurban cores toward urban ones.

In the figure 10 the results of the analysis carried out in the present work are summarized. By storage and parcel service activities not only the distance from the city centre increased significantly, also a relocation process toward less urban areas took place. For these two

activities – therefore – a certain tendency towards logistics sprawl can be ascertained. The opposite is true for the postal service: this activity went through a process of concentration over the period 1995-2012. On this period no relevant relocation can be ascertained for the freight transport by road activities.

figure 10 Summary of the results from the analysis.

Activity	Distance to the city centre	Share of firms on urban (densely populated) areas	Share of firms on suburban (intermediate densely populated)/exurban (thinly densely populated areas)	Tendency
Freight transport by road	+ 0.7 km	Stable	Stable	Stable
Storage	+ 9.5 km	Decrease	Increase	Sprawl
Postal service	- 2.9 km	Increase	Decrease	Concentration
Parcel service	+ 7.7 km	Decrease	Increase	Sprawl

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