

**Development of the Transit Transport System  
and its Impact on Spatial Development in Switzerland (COST 340)**

**Accessibility, Spatial Organisation  
and Demography  
in Switzerland through 1920 to 2000:  
First Results**

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## Abstract

We know the problem of population losses in peripheral alpine regions as well as about the urban sprawl in the Mittelland. But the impressions often are not quantified and therefore subjective. The slow, steady process aggravates the difficulties of cognition additionally. About the spatial consequences not a lot is known. Only when we look at historic images of now built landscapes, we understand how tremendously our habits, our living space, the whole environment in which we live has changed through the last decades.

The goal of the paper and presentation is to make in the first part general statements about the population, its development and its spatial distribution. Following questions are of interest: When did the population grow? Where did the population grow and how did the population grow? In a second part we analyse the change of accessibility. This leads us to a conclusion in which we discuss the interaction between accessibility and demographic change.

The population data come from the censuses of 1850 – 1990. In the case of 2000, population data of the Bundesamt für Statistik is employed. The extended time frame leads to some minor problems regarding the analyses and the mapping of the results. In the canton of Thurgau municipalities have been divided or merged; these changes are not considered within this data set.

The work is part of the project „Development of the Transit Transport System and its Impact on Spatial Development in Switzerland“, conducted within the framework of Action 340 of the European Co-operation in Scientific and Technical Research (COST) consortium, entiteled „Towards a European Intermodal Transport Network: Lesson from history“. The focus in this paper is the on demographic aspect, as discussed above.

The presentation will be structured as followed:

- Population – and settlement patterns in Switzerland: General statements
- Population development along transit axes
- Development of Accessibility
- Discussion and Outlook

## **Keywords**

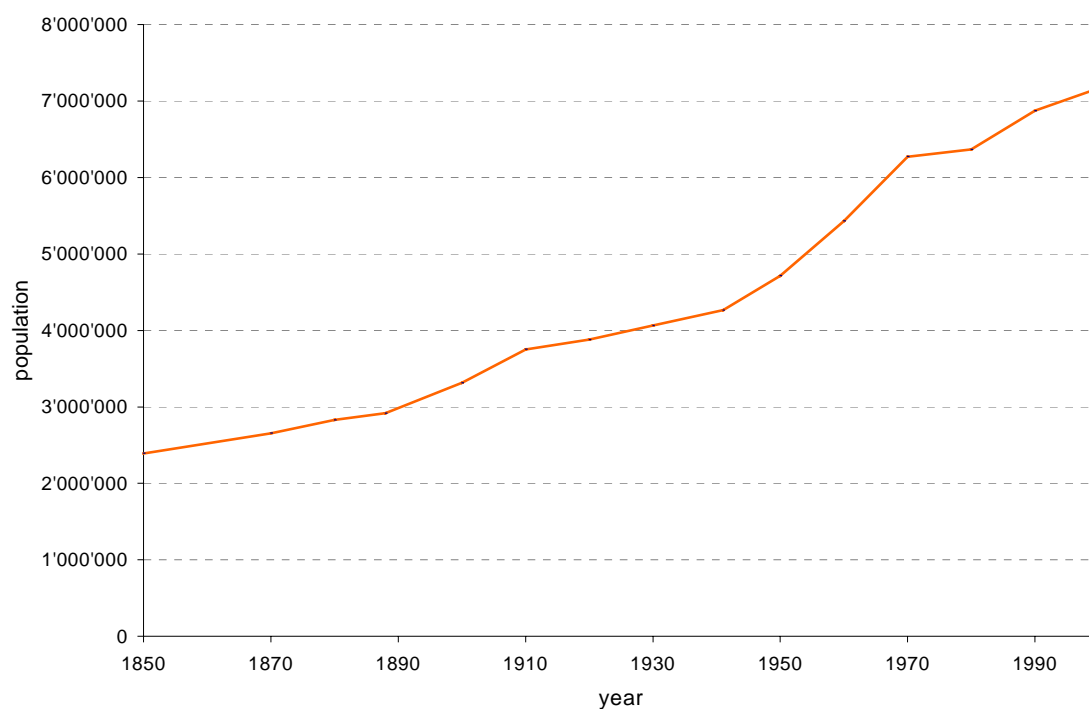
space; demography; accessibility, Switzerland; Swiss Transport Research Conference – STRC 2003 – Monte Verità

# 1. Population – and settlement patterns in Switzerland

## 1.1 Population development

During the last decades Switzerland had one of the largest growth rates in western Europe (see Haug, 2002). The development in the analysed time period is characterised by a continuous population growth but with different intensities. Periods with strong growth can be observed around 1900, the time after WWII until 1970 and the last two decades until 2000. In this time period population almost tripled (see Figure 1).

Figure 1 Population development in Switzerland

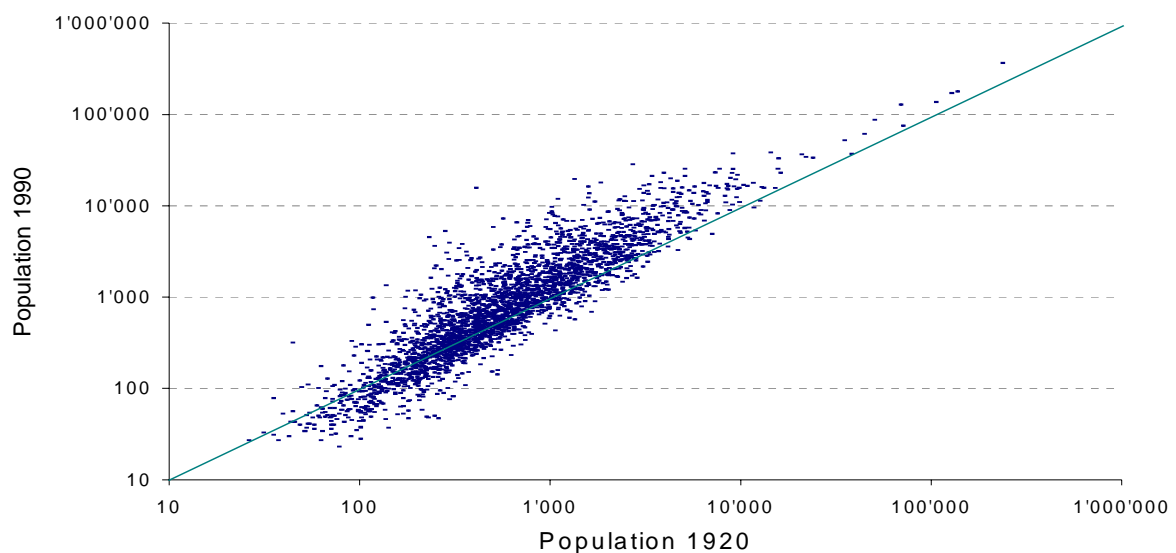


## 1.2 Development of municipalities

After those general statements above we are interested in the different population growth patterns of individual municipalities. How did the growth took place? Which municipalities have changed? Are there interactions between size and growth? The log-log scaled diagram

(Figure 2) shows the number of inhabitants of each Swiss municipality at two points in time: 1920 and 1990. Municipalities above the diagonal have won inhabitants. Municipalities below have lost them. Differences can clearly be seen in the development due to the size of the municipalities. The largest 20 towns grew consistently, while medium sized towns between 5'000 and 30'000 inhabitants grew fast in that time period. Municipalities with less than 500 inhabitants have a heterogeneous growth rate and no trend can be seen. The smaller as the municipalities get, the more they show a tendency for lower growth rates or even a loss of population.

Figure 2 Population grew of Swiss municipalities (1920-1990)

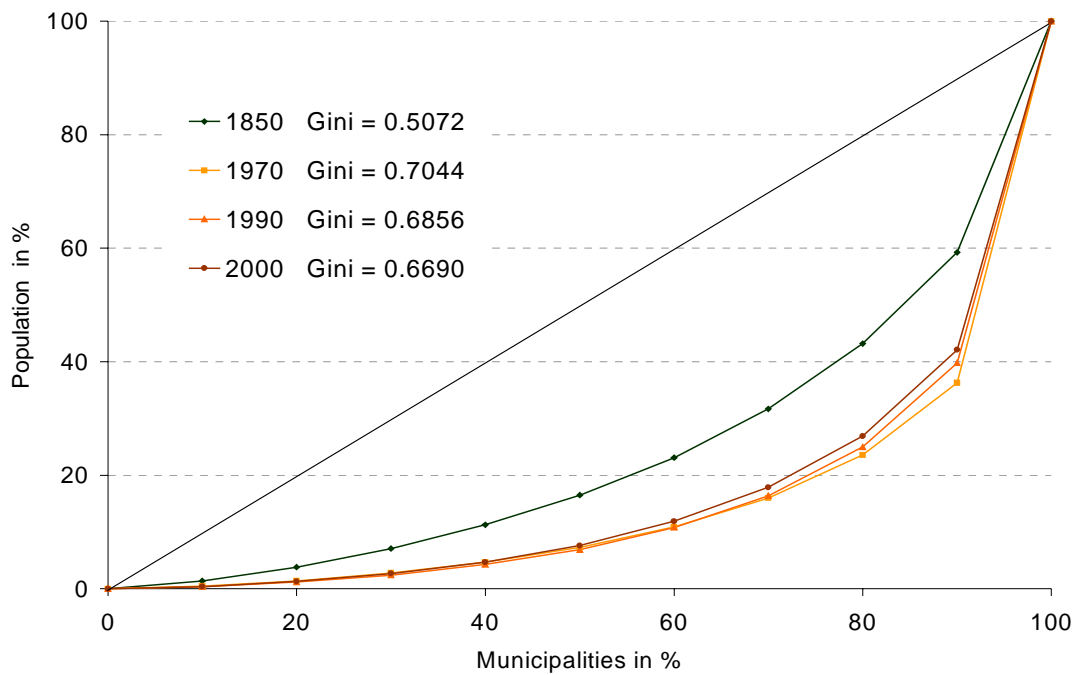


### 1.3 Grade of urbanisation (Lorenz curve)

Another indicator for the distribution of the population is the Lorenz curve (see Figure 3). The Lorenz curve displays the relative concentration of inhabitants, implying the dispersion of population between municipalities. As closer as the curve lies to the diagonal the more consistent is the population spread over the municipalities. Is the curve equal to the diagonal, then all municipalities have the same size. The Gini Index is a measure of concentration (Böckerman, 1982). It measures the ratio of the area between the diagonal and the curve to the total area underneath the diagonal: Gini = 0: Extremely equal dispersion, Gini = 1: extremely con-

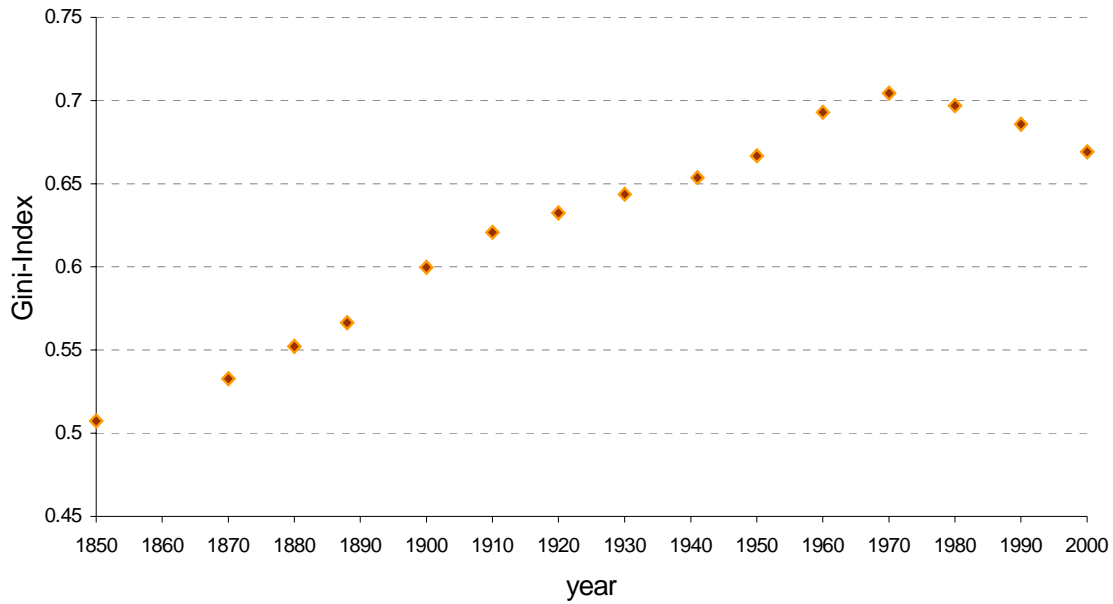
centrated dispersion. The Gini Index can be seen as a measure of the spatial concentration of the population.

Figure 3 Lorenz curves based on municipal population size in Switzerland



The Gini Index is increasing over the decades (Figure 4) and reaches 1970 its highest value. More than 66 % of the population live in the 10 % largest towns. In the last three decades a continuous decline of this value can be understood as a reversal of their trend. As shown in the scatter diagram (Figure 2) medium sized municipalities were the winners, meanwhile the smallest ones tend to lose inhabitants.

Figure 4 Development of the Gini index of the Swiss municipalities



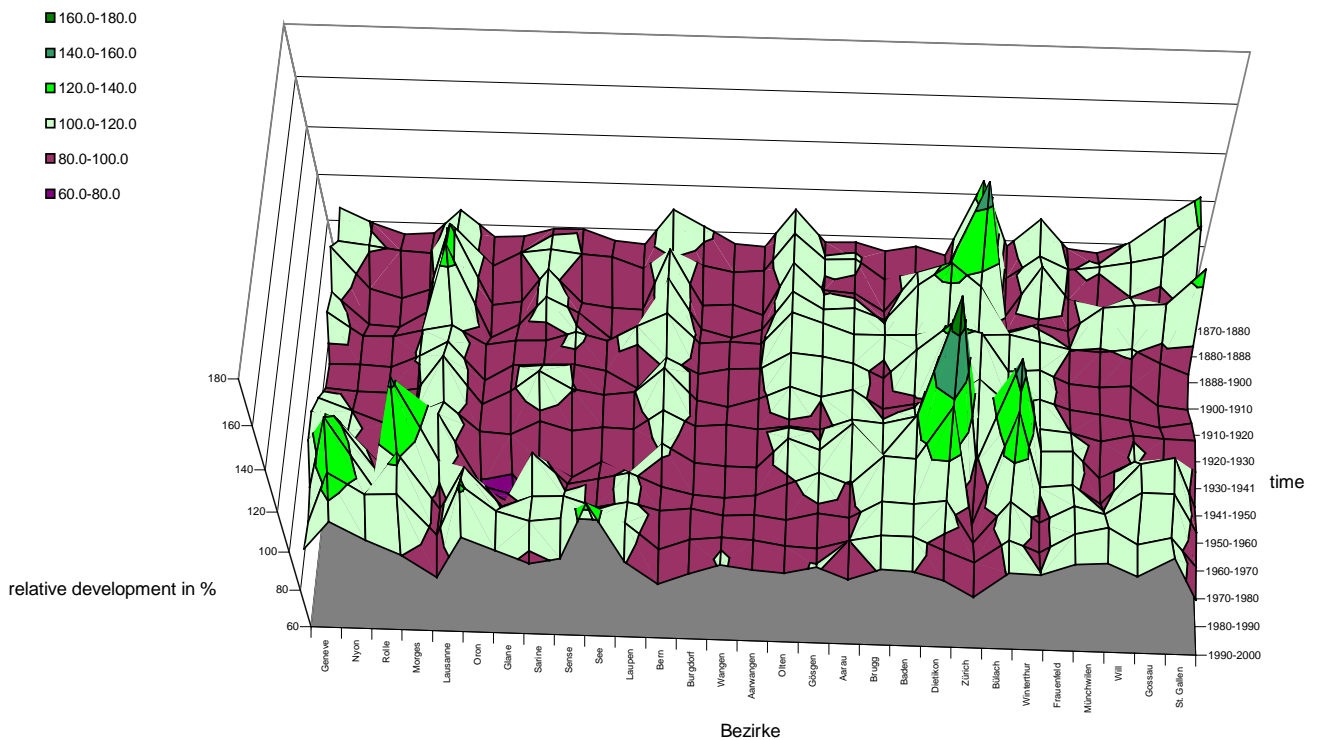
## 2. Population growth along the transit axes

Until now we showed when and how strongly population grew. Now the question where the population growth took place is in the centre of interest. The development over time is shown in the third dimension.

### 2.1 Longitudinal axis Mittelland

Figure 5 shows the Swiss Mittelland from Genève to St. Gallen. The longitudinal axis follows the west-east railway line (Genève-Lausanne-Fribourg-Bern-Olten-Brugg-Zürich-Winterthur-Gossau-St. Gallen).

Figure 5 Development of population of west-east axis (Bezirke)





The Bezirke along the west-east railway axis are shown along the  $x$ -axis. The  $y$ -axis is the time axis. The  $z$ -axis shows the relative population growth. In comparison to the census 10 years earlier, relative to the average growth in Switzerland (red areas: growth less than average or negative, green areas: growth higher than average).

Time after WWII is marked by an enormous suburbanisation in the greater Zürich area. The zones of growth are concentrated to the suburban Bezirke Dietikon and Bülach next to the centre of Zurich. This development is going along with a below average growth in the city centre itself. The same phenomenon can be seen ten years later at the Arc Lémanique with its agglomerations Lausanne and Genève and their fast growing Bezirke Nyon and Morges.

The phenomenon of below average growth can be observed also but less dramatic in Lausanne, Winterthur and St. Gallen; Fribourg and Genève are also in the beginning of that process. The drain of Zürich and Lausanne is now shifting towards the 30 years earlier fast growing suburban Bezirke as Dietikon e. g.. The wave of growth moves further to more peripheral parts of the agglomeration.

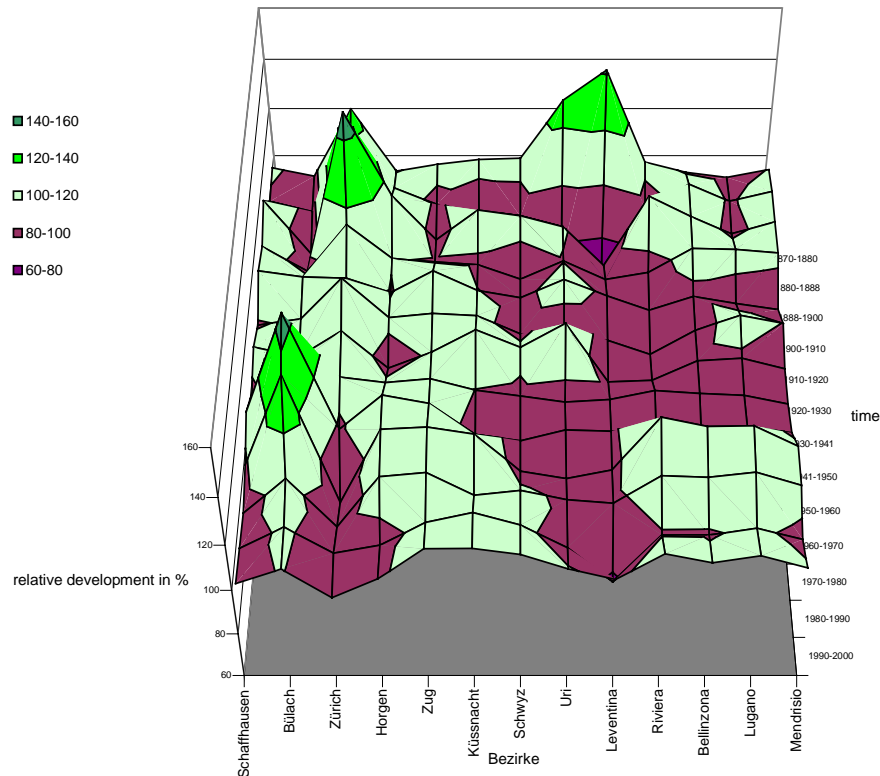
Figure 5 shows the dynamic growth rates around 1960 in Bern and Olten. Those towns were not able to develop in the same way as Zürich and Lausanne. In contrast to this, formerly rural areas of the Mittelland in the cantons Vaud, Fribourg, Aargau, Zürich and St. Gallen are growing. Surprising is the growing belt between Bern and Olten which develops at a below average rate.

## 2.2 Axis Schaffhausen-Chiasso

Figure 6 shows the north-south axis including the alpine range. The axis is similar to the railway line from Schaffhausen to Chiasso via Zürich, Zug, the upper Reuss valley, the Leventina trough to Lugano and Chiasso.

On figure 6, as along the west-east axis, the growth and relative decline of the Zürich area can be recognised. More astonishing is the over proportional development in the Gotthard region around 1870. This occurs on both sides of the Gotthard. It can be explained by the massive demand for manpower which was needed to build the Gotthard railway. Thousands of workers lived for a short time in the region to accomplish this work. The tremendous loss of population in this area after the completion of the railway around 1900 demonstrates this process.

Figure 6 Development of population along the north-south axis (Bezirke)



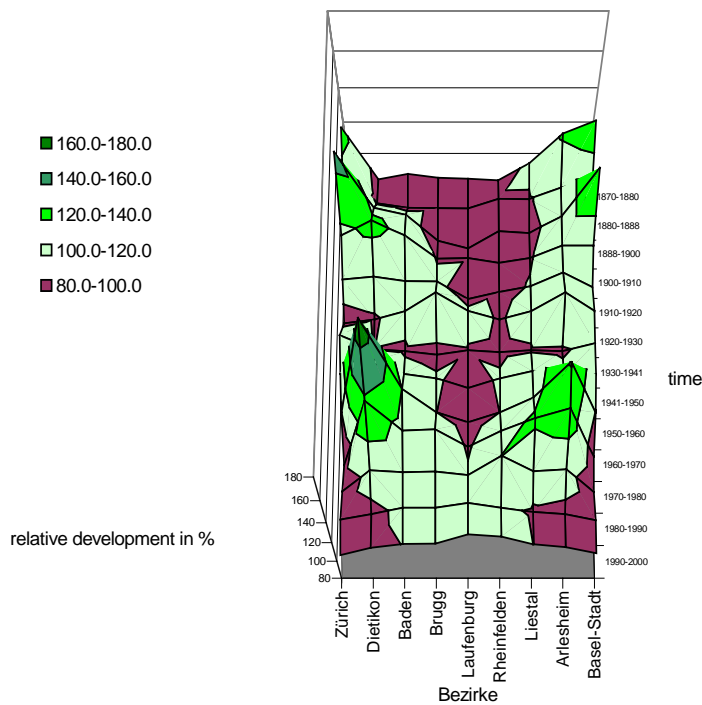
In Figure 7 the direct link between the two big urban areas in north western Switzerland is examined. The longitudinal axis follows the railway and the A3 motorway line through the Bözberg.

The same development as in Figures 5 and 6 can also be seen in Figure 7: A first period of fast growing town centres is followed by a suburban growth (Bezirke Dietikon and Arlesheim, which happened simultaneously in the Zürich and Basel agglomeration). In the following decades the above average growth moves more and more into the peripheral Bezirke meanwhile a drain can be observed in the centres and later in the subcentres. From 1960 a proportionate decline of population in city centres set in, as well in Zürich as in Basel. This is linked with an explosion of the suburban Bezirke Dietikon in Zürich and (less pronounced) Arlesheim in Basel. This situation lasted only for a short term and 20 years later those Bezirke

grow at below average rates. The discussed areas of below average growth are growing – the zones of above average growth are shifting towards more and more peripheral regions until they meet in the middle between Zürich and Basel.

During the last 130 years the fast growing areas moved from the city centres to the suburban areas to meet nowadays between the centres.

Figure 7 Development of population in the agglomerations Zürich and Basel (Bezirke)



### 3. Development of accessibility

During the last chapters settling patterns were of interest. Now populations connection shall be analysed. How can the inhabitants be reached? What accessibility does each municipality has?

In the present work, accessibility is defined as in Geurs and Ritsema van Eck, 2001:

“...the extent to which the land-use transport system enables [groups of] individuals or goods to reach activities or destinations by means of a [combination of] transport mode[s].

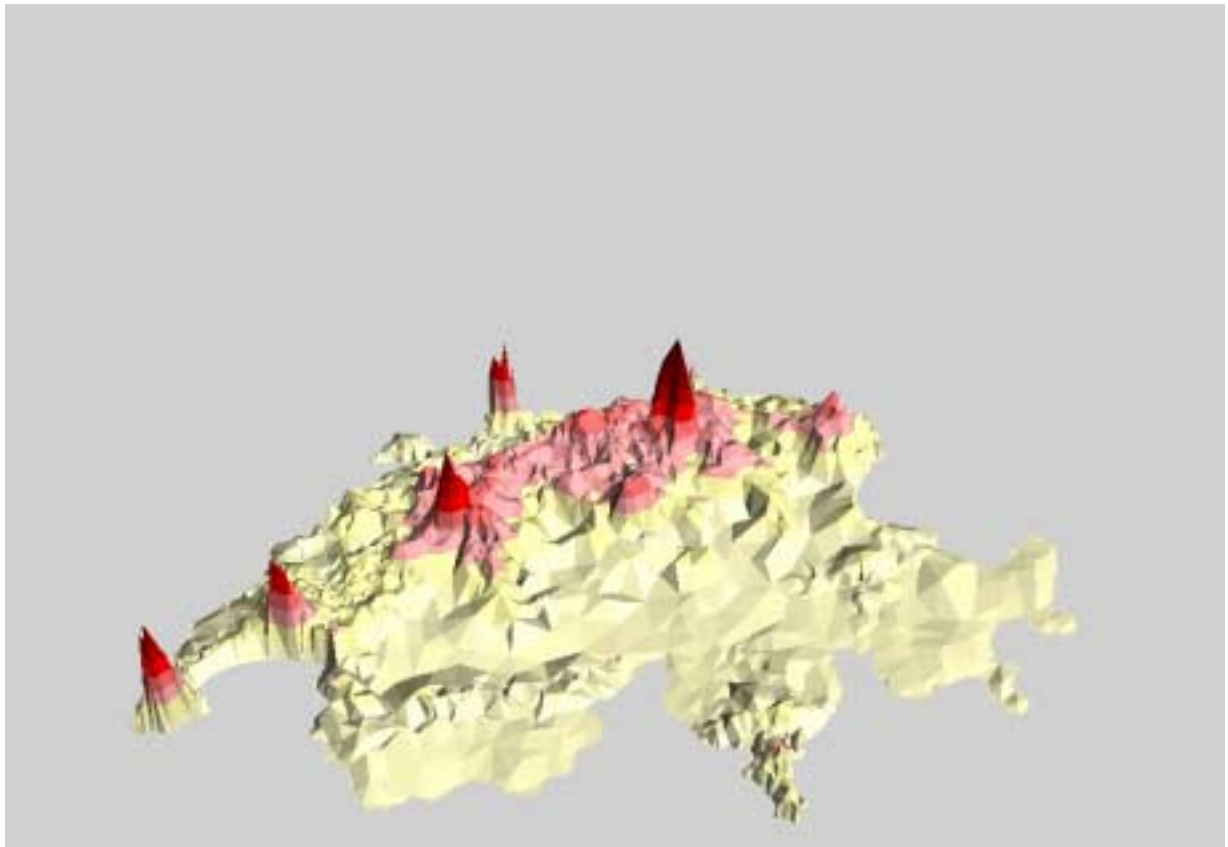
$AccPop_i$	accessibility to people living in municipality, $i$
$A_j$	the number of residents of municipality, $j$
$c_{ij}$	travel time by private vehicle between the municipality $i$ and municipality, $j$
$\beta$	exponent

$$AccPop_i = \sum_{j=1}^{j=2903} A_j * \exp(-\beta * c_{ij})"$$

This “potential approach” weights attractiveness of the activity points with the necessary travel time to these points by mean of a negative potential function.

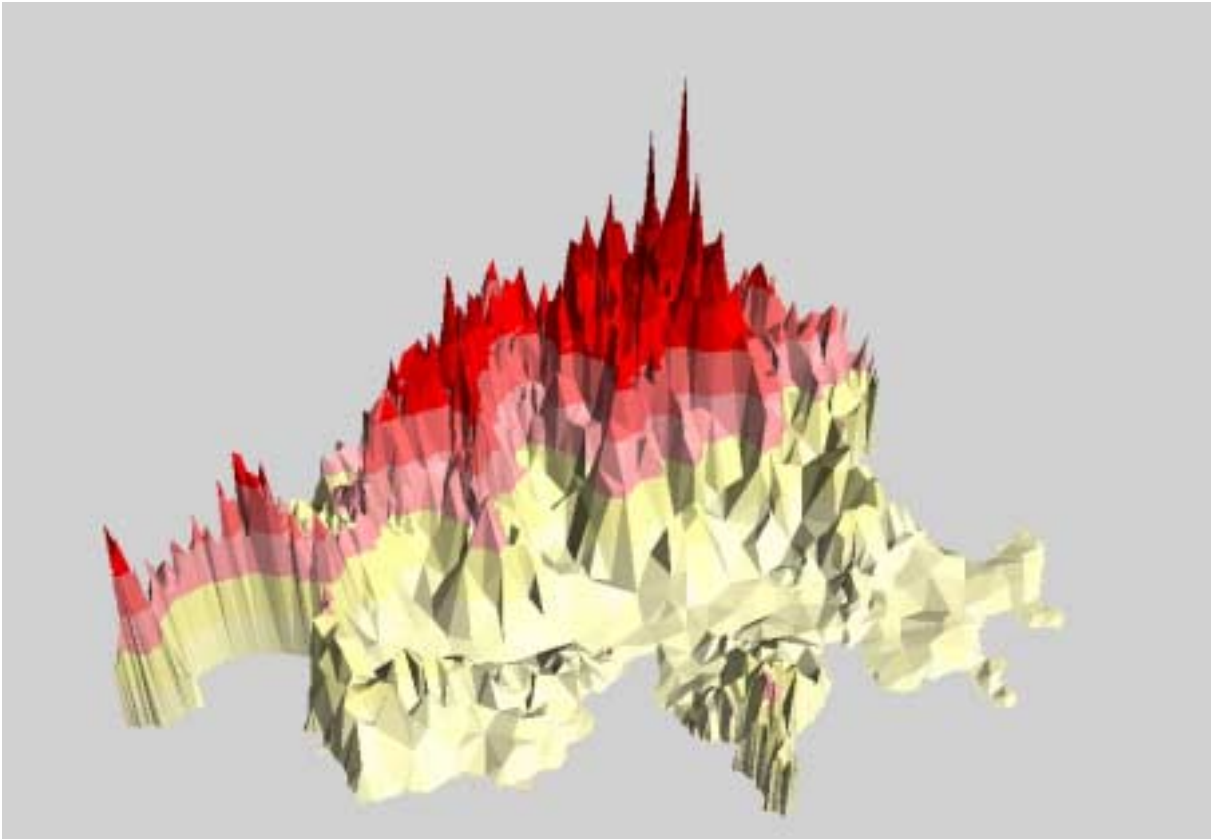
In 1950 the major urban areas Zürich, Bern, Basle and Genève had a clear absolute accessibility advantage over the other parts of Switzerland (see Figure 8). The only band of high accessibility is the Mittelland, spreading between Bern and Zürich. With the exception of the Rhône valley, large parts of the mountain regions have low accessibility values.

Figure 8 Accessibility 1950 in Switzerland (Road network distances)



In 2000 the locations within the highest quintile of accessibility values are concentrated in a circular area around Zurich including Bülach, Olten and the northern part of lake of Lucerne (see figure 9). Around Bern, a cross-shaped area with municipalities of high accessibility can be seen, leading from Biel to Thun and from Solothurn to Fribourg. Around Lake Geneva, the distribution has changed from two main peaks, Genève and Lausanne, to a more homogeneous appearance, with two additional peaks at Vevey and Nyon.

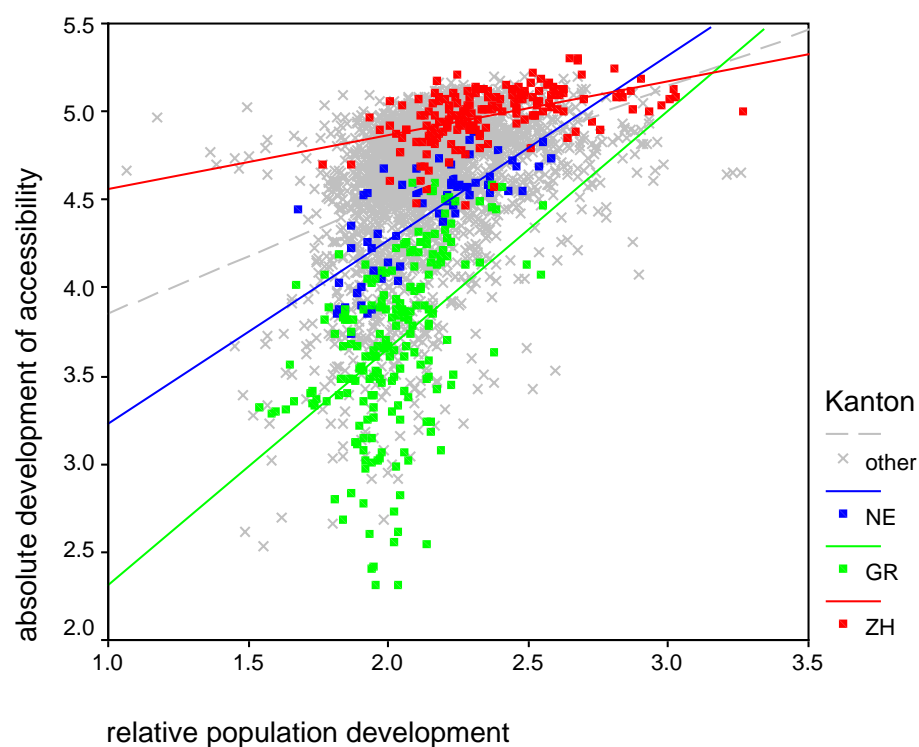
Figure 9 Accessibility 2000 in Switzerland



## 4. Discussion

If we link accessibility directly to population development we can see an obvious relation. We analyse three different Kantone: Zürich, which is urban and highly industrialised; Neuchâtel, a Kanton from the peripheral Mittelland/ Jura and Graubünden, which is rural and alpine. We notice a surprisingly strong coherence between population growth and growth of accessibility. Nevertheless there are big differences what is concerning the different Kantone. In Graubünden e. g. there is not much evidence that a higher accessibility generates a strong population growth (exceptions are tourist resorts). The situation is different in Neuchâtel and Zürich, where there is a link. Surprisingly, the elasticity with aspect to accessibility change is strongest in the already urbanised and densely settled Zürich.

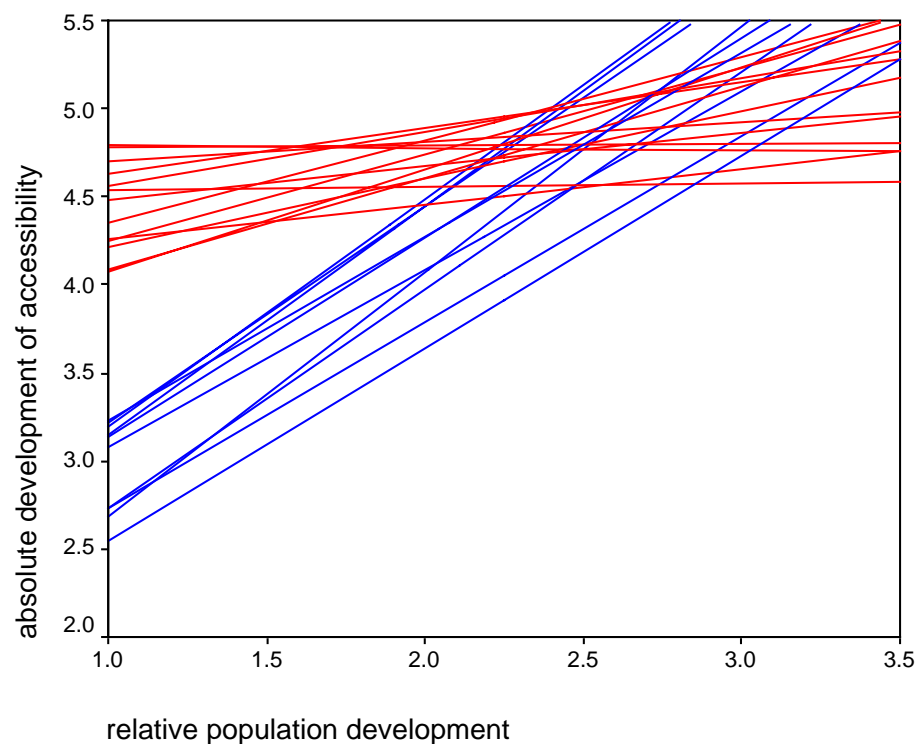
Figure 10 Accessibility and population growth 1950 –2000 (all municipalities)



The total increase in accessibility in Graubünden was too small to have an impact on population growth. But the more the value is increasing (Neuchâtel and especially Zürich) the more we see a connection with the development of municipalities.

Comparing the all regression lines of all Kantone we can roughly divide them into two groups: A first group of urban Kantone in the Mittelland where the elasticity with aspect to accessibility change (red) is strong (Kantone ZH, BE, LU, ZG, FR, SO, BS+BL, AR+AI, SG, AG, TG, VD, GE) and a second group (blue) with rural, more alpine Kantone (UR, SZ, NW+OW, GL, SH, GR, TI, VS, NE, JU), whose regression line is much less steep.

Figure 11 Accessibility and population growth 1950 –2000 (all Kantons)





The population in Switzerland has almost tripled since 1850. In the beginning the growth was limited to the city centres of the large towns in the Mittelland. The industrialisation, the reduction of agricultural employment, the transition to industrial mass production has concentrated the work places and thus the population. This process of concentration ended with the boom phase between 1960 and 1970. The Gini indices (all municipalities) show a striking trend reversal from 1960 onwards.

The income growth after WWII led to an individualisation and mass mobilisation of the society. Suddenly the car was affordable to a wide range of population groups. The building boom was a consequence (single family houses) inside the agglomerations which grew continuously. That social change was followed by a massive extension of traffic infrastructure and accessibility increased enormously in the Swiss Mittelland. Now work- and living place can be further apart than previously. Figure 5 demonstrates this change in society over the decades: A migration into cities and a tremendous augmentation of population in the town centres is followed by a suburbanisation around the cities. This process is followed by a general dispersion of the agglomerations which seem to grow together so e. g. the agglomerations Basel and Zürich or the metropolitan areas Lausanne and Genève.

The decentralisation which began around 1960 is a consequence of the spreading out of the agglomerations in the Mittelland. Peripheral, alpine regions are less or not affected at all from this trend.

The mobility of people, the reduced resistance in space in the Swiss Mittelland lead to more interactions. The short distances in Switzerland, the federal structures expedite those trends and lead to an abolishment of the former typical division of town and countryside.

Beneficiaries of the motorway network are not primarily the urban centres but the areas in between, where accessibility improved tremendously, the growing together of the agglomerations in the Swiss Mittelland are the consequences.

## 5. Literature

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