SMALL AND MEDIUM-SIZED TOWNS IN SWITZERLAND: ECONOMIC HETEROGENEITY, SOCIOECONOMIC PERFORMANCE AND LINKAGES

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Summary: Knowledge about economic characteristics and development dynamics of small and medium-sized towns (SMSTs) is scarce. The aim of this article is to present insights into economic characteristics and development dynamics of SMSTs in Switzerland and to conceptualize the linkages of SMSTs with neighboring centers and hinterlands. SMSTs in Switzerland are independent jurisdictions that are in charge of their economic development strategies, tax base, etc, which can shape their socio-economic characteristics independently of the larger urban agglomeration they belong to. This circumstance makes them especially interesting for research particularly regarding the economic heterogeneity, socioeconomic performance and functional linkages these SMSTs have. The article presents seven types of SMSTs that have different economic characteristics and socio-economic dynamics. The types were built using cluster analysis. The typology shows that SMSTs can have different economic characteristics and development dynamics despite being embedded in the same regional context. For analyzing relationships between cluster membership and linkages to neighboring centers, we carried out an analysis of variance. It can be inferred that the intensity of linkages of SMSTs vary according to the type of SMSTs.

Zusammenfassung: Obwohl klein- und mittelgrosse Städte (SMSTs) wichtige Funktionen in nationalen urbanen Systemen haben, ist wenig Wissen über sie vorhanden. Dieser Artikel hat daher das Ziel, einen Einblick in wirtschaftliche Charakteristiken und Entwicklungsdynamiken von SMSTs in der Schweiz zu geben und deren Verbindungen zu den benachbarten Städten und Umland zu konzeptualisieren. SMSTs in der Schweiz können Strategien zur wirtschaftlichen Entwicklung, Steuersätze, etc. selber festlegen und somit ihre sozioökonomische Entwicklung auch unabhängig von grösseren städtischen Agglomerationen beeinflussen. Dieser Umstand macht die Schweizer SMSTs hinsichtlich wirtschaftlicher Heterogenität, sozioökonomischer Charakteristiken und funktionellen Verbindungen spannend für die Forschung. Mit Hilfe einer Cluster Analyse wurden sieben SMST Typen gebildet, welche verschiedene wirtschaftliche Charakteristiken und sozioökonomische Dynamiken aufweisen. Die Analyse zeigt, dass SMSTs trotz Einbettung in derselben Region, unterschiedliche wirtschaftliche Charakteristiken und Entwicklungsdynamiken haben. Um die Beziehung zu benachbarten Städten und dem Umland zu analysieren, wurde eine Varianzanalyse durchgeführt. Die Ergebnisse deuten darauf hin, dass je nach Typ von SMST die Intensität der Verbindungen zu anderen Orten unterschiedlich ist.

Keywords: small and medium-sized towns, urban-rural linkages, Switzerland, urban development, metropolitan area, economic geography

1 Introduction

Over the last decades, economic specialization patterns and dynamics of small and medium-sized towns (SMSTs) have mostly gone unnoticed (Bell and Jayne 2009; Lorentzen and van Heur 2012; Schneidewind et al. 2006). On the one hand, scholars and policy-makers emphasized the role of metropolitan regions as engines of growth (Thierstein et al. 2008; Hall and Pain 2006) and on the other hand, they analyzed peripheral economies (North and Smallbone 1996; Terluin 2003; Anderson 2000). Yet, towns that neither could be identified as metropolitan centers nor as periphery were mostly neglected even though they account for a significant share of population in many countries (Mayer and Knox 2010) and particularly in Europe (Hamdouch et al. 2017). Very recent research has taken up the challenge of examining smaller urban areas more systematically. The ESPON TOWN project, for example, analyzed European small and medium-sized towns (Atkinson 2017; Sýkora and Mulíček 2017; Smith 2017; Servillo and Paolo Russo 2017; Servillo et al. 2017; Hamdouch et al. 2017). Another set of publications focuses on development patterns in smaller urban settlements and on the fact that these cannot be explained focusing solely on agglomeration economies (Burger et al. 2015; Parkinson et al. 2015;

Camagni et al. 2015). Schneidewind et al. (2006, 101) note that "at a time when polycentric development is an issue for Europe, small and medium-sized towns represent an important reserve for urban development". Others state that it is also "important to consider the economic diversity of the local economy in the SMSTs" (Servillo et al. 2014, 32). Different regional contexts and positions of SMSTs within an urban system as well as their endogenous potentials lead to a great diversity of SMSTs. Hence, one of the core conclusions of this recent research on SMSTs is that they are characterized by a diverse pattern of economic specialization (Hamdouch et al. 2017). Furthermore, the cited works show that it is important to consider SMSTs and their relationships within a polycentric urban system. The ways in which SMSTs are able to specialize economically and how they form linkages with other parts of the urban system seem to determine their success. Although economic specialization of SMSTs is acknowledged, it has not been examined systematically in the context of the heterogeneity of SMSTs. We note that the literature presents selective evidence (for example Hamdouch et al. 2017; Hildreth 2006; Gatzweiler et al. 2012), yet it is missing a broader and above all empirically grounded overview of the economic situation and socio-economic dynamics of SMSTs within a polycentric national context. Moreover, the relationships of SMSTs with their regional context and their functional linkages within the polycentric urban system exert major influence on their economic characteristics. The relative distance to a city in particular can influence the flows occurring between SMSTs and their respective neighboring city. However, studies that focus on flows and linkages, manifested through e.g. commuting patterns and transportation linkages, do not try to find a relationship between the economic characteristics of a town and its linkages. Sýkora and Mulíček (2017) for example looked at the relationship between inter-urban networks and performance in terms of population and jobs. Other studies focus on national or international networks and how these can positively influence metropolitan functions in small and medium sized towns within a functional urban area or in second tier cites, especially in regard to top firms, international institutions, cultural activities and science (Camagni et al. 2015; Meijers et al. 2016; Burger et al. 2015).

Based on the research gaps, this article focuses on SMSTs in Switzerland and aims at gaining a broader understanding of the economic heterogeneity and socio-economic performance of SMSTs as well as their geographical links with their surrounding area. As Switzerland is often not included in European-wide analyses, it is important to examine SMSTs in this context, particularly also as the country represents a classic polycentric context similar to Germany or the Netherlands. With the help of a cluster analysis, we develop a typology of small and medium-sized towns in Switzerland that groups towns with similar economic features and socio-economic dynamics. To analyze the relationship between these different types of SMSTs and variables describing linkages of the towns, we carried out a one-way analysis of variance with the help of the Kruska-Wallis-Test. In doing so, we are conducting an exploratory study that is guided by the following research questions:

- How can the Swiss SMSTs be grouped regarding their economic characteristics and their socio-economic dynamics?
- What is the relationship between these different types of SMSTs and linkages with the regional context?

We follow the most recent population threshold for SMSTs by the ESPON TOWN project and define SMSTs as towns having between 5,000 and 50,000 inhabitants. Such a typology is useful for researchers and policy-makers because of the prevalence of spatial development concepts that have emphasized the role of metropolitan regions in a polycentric context while rather neglecting smaller settlements – regardless whether they are located inside metropolitan regions or outside. This is, for example, the case in Switzerland, where the so-called "Raumkonzept Schweiz" defines the strategic framework for polycentric spatial development (BR et al. 2012). The concept identifies networks of small and medium-sized towns but it does not emphasize or even highlight their economic roles, which stands in strong contrast to the well-defined economic functions of Switzerland`s major metropolitan areas Zurich, Basel and Geneva. Switzerland does not stand alone with this oversight as Servillo et al. (2017, 11) suggest when they note that most national and regional levels of governance "failed to consider the role(s) and function(s) of SMSTs". In this article, we advance the argument that a profound understanding of metropolitan regions and a national urban systems requires to see metropolitan regions as more than a single urban entity and consider the strong autonomy of SMSTs.

The article is organized as follows: The next section presents the definition of SMSTs and their embeddedness in the urban context of Switzerland.

This section is followed by the literature review that connects the literature on SMSTs with insights from studies that help us understand contemporary SMST economy. The fourth section discusses the methodology of the study. We then present the SMST typology and the results from our analysis of linkages of the different SMST types with their respective regional context. The last section draws conclusions.

2 Small and medium-sized towns in Switzerland

The literature on small and medium-sized towns is characterized by a great variety of definitions that seem to be employed depending on the national context. German and Dutch authors define small towns as towns having between 5,000 and 20,000 inhabitants and medium-sized towns as towns having between 20,000 and to 100,000 inhabitants (Gatzweiler et al. 2012; van Leeuwen and Rietveld 2011). Studies examining SMSTs in the European Alps define them as "municipalities with at least 10,000 inhabitants or 5,000 jobs" (Perlik et al. 2001, 245). The aforementioned definitions, however, are based merely on population thresholds and do not include morphological, functional and administrative aspects. These aspects were included in the most recent definition developed by the Swiss Federal Statistical Office (BFS) in 2014. It is based on the latest definitions of cities and rural areas developed by the European commission (Dijkstra and Poelman 2014) but has been adapted for the Swiss spatial context[1] (Goebel and Kohler 2014). The BFS identifies a total of 162 towns in Switzerland. The population of these towns ranges from 5,067 to 396,955 (2015). The ten largest towns in Switzerland range from 54,163 to 396,955 population (2015). We call these ten towns cities in this article. As stated above, we follow the most recent population threshold for SMSTs by the ESPON TOWN project and define SMSTs as towns having between 5,000 and 50,000 inhabitants. Hence, we define 152 towns in Switzerland as SMSTs that range from 5,067 to 43,500 inhabitants in 2015.

SMSTs in Switzerland are independent jurisdictions that are in charge of their economic development strategies, tax base, etc, which in turn can shape their socio-economic characteristics independently of the larger urban agglomeration they belong to. That means SMSTs have residual power in the Swiss political system of Switzerland, which consist of three institutional levels (municipalities, cantons, confederation). Besides the cantons that also have strong subsidiary powers, the confederation has a less important role than in other states (Kaufmann et al. 2016). Hence, it is not necessary for a town to be isolated or separated from an urban agglomeration in order to be classified as a SMST, particularly because in a small-scale and polycentric context as is the case of Switzerland, SMSTs both inside and outside metropolitan regions play a crucial role in the urban system.

Nevertheless, the position of SMSTs within the national urban system must be considered to understand functions, characteristics and development dynamics (Schneidewind et al. 2006). Switzerland is a classic example of a polycentric nation, in which metropolitan regions like Zurich, Basel, Geneva and Bern exert strong forces of urban concentration. The BFS bases the definition for metropolitan regions on commuting statistics. If agglomerations fulfill the threshold of minimum of 8.3 % out-commuters to the core agglomeration of the metropolitan region, then it is assigned to a metropolitan region[2] (Schuler et al. 2005). SMSTs that are located within an agglomeration that belongs to a metropolitan region are considered as being inside a metropolitan region. SMSTs can be located inside or outside these metropolitan regions. The BFS defines 49 urban areas as agglomerations. A location belongs to an agglomeration when at least on third of the employed inhabitants commute to the agglomeration center. The agglomeration center has to have a certain density and minimum size of inhabitants, employees and overnight stays (Goebel and Kohler 2014). SMSTs can also be located within these agglomerations. In contrast to the agglomerations, periurban rural areas have moderately good access and the travel time with the motorized private transport to the next agglomeration center is less than 60 minutes (ARE 2013). There

[1] To be defined as *town*, each town in Switzerland has to have a continuous zone of inhabitants, jobs and equivalent for overnight stays (IJO) which sum is higher than 500 per km^2 in a grid cell with an edge length of 300 m. This zone has to combine a total of at least 12,000 IJO. Moreover, the zone has to have a high density core with a IJO of more than 2,500 IJO per km^2. The core zone has to have an absolute size of at least 5,000 IJO. This zone has to have more than half of the IJO of the whole town.

[2] Parts of the canton Schaffhausen belong to the metropolitan region of Zurich due to the number of inhabitants commuting to the core agglomeration of the metropolitan region of Zurich, even though there is a periurban rural area between the metropolitan region of Zurich and Schaffhausen. The high quality of transport infrastructure between Zurich and Schaffhausen could be a reason for that.

are six SMSTs located in the periurban rural areas in Switzerland. Finally, there are peripheral rural regions that are characterized by their rather large distance to agglomerations and metropolitan regions. Only three SMSTs are located in these areas (ARE 2013). Figure S2 (supplement) shows the location of SMSTs in relation to the various urban types we discussed above.

We chose Switzerland as a suitable country to conduct this study for three reasons. First, Switzerland is a country with a polycentric urban system in which – as outlined above – the vast majority of cities are SMSTs that are situated in different contexts and that fulfill different functions. Nearly two thirds of SMSTs are located within larger metropolitan regions such as Zurich, Geneva, Basel and Bern. Yet, SMSTs outside these metropolitan regions (that can be located in smaller agglomerations, periurban rural or peripheral rural areas) also fulfill important functions within the polycentric context. For example, in the western part of Switzerland we can find traditional watchmaking towns in the Jura region. Other towns include well-known tourist destinations in the Alps. Further, there are towns that are located at the intersection of two or more metropolitan regions that serve as important locations for industries. Second, due to the federal system, towns have a great deal of decision-making power and can influence their development dynamics for the most part independent of the cantonal and national administration (e.g. tax base). Third, even though Switzerland is a comparably small country, SMSTs are embedded within very different regional contexts that can also be found in other European countries (e.g. border regions, different language and cultural contexts, etc.).

3 Literature review

Although SMSTs are a crucial part of urban systems, little is known about their economic characteristics or development processes and an empirically grounded typology of SMST economies will be valuable. While the literature discusses the ways how towns can gain functions and improve their performance or which economic structures and geographic location lead to good performance, most studies are case-based and do therefore not discuss the heterogeneity of SMSTs in depth (e.g. Bell and Jayne, 2006; Ofori-Amoah, 2007). Empirical studies of small and medium-sized towns tend to focus on a limited number of cases and sectors. For example, Hamdouch (2017) distinguish three economic profiles of European SMSTs: residential economy (mainly public sector, local retail and personal services), productive economy (roughly equivalent to industrial and agriculture activities) and a mixed type that is influenced by the creative and knowledge economy (professional services and the creative economy). The 31 case study towns are from 10 European countries, not including any towns from Germany or Switzerland. Whereas this typology provides a good overview of different profiles, it is too general and does not explain specialization in more detail. Other studies of SMST specialization differentiate slightly more. Hildreth (2006) groups English small and medium-sized towns into industrial towns, gateway towns, heritage/tourism towns, university towns, towns of a larger city-region and regional service towns. By mixing sectoral specialization and functional embeddedness within a territorial context, Hildreth`s (2006) study does little to advance our understanding of SMST specialization and its relationship to SMST linkages. Other studies provide general overviews of towns in different national or regional contexts (Gatzweiler et al. 2012; Servillo et al. 2014) or present in-depth case studies focusing on socioeconomic characteristics (often biased towards the creative economy) and development strategies SMSTs are pursuing (Knox and Mayer 2013; Lorentzen and van Heur 2012).

There are also a few studies that answer the question how the SMST economy develops and changes over time. A number of those can be found for German SMSTs. Most of these studies, however, deal with towns situated in East Germany and they discuss primarily how SMSTs are affected by processes of shrinkage (Lütke 2004; Gatzweiler et al. 2012; Wirth et al. 2016). None of these studies, however, relates development dynamics to SMSTs` economic specialization. Yet, the economic specialization influences development. Studies show that towns with an economy dominated by industry are less dynamic as towns with a knowledge based economy. According to Hamdouch et al. (2017) the majority of SMSTs with a dominant industrial employment structure had to deal with lower employment growth rates since 2000. The same study found that around a third of the case study towns diversified their economic profile and were thus more successful regarding employment rate and number of businesses per capita. In addition, Erickcek and McKinney (2006) illustrate that US towns with a dominant research, government or business sector have had higher growth rates than expected during the 1990s. In sum, these studies show that economic specialization and dynamics need to be examined in parallel.

3.1 Economic specialization of SMSTs

SMSTs may specialize in different economic sectors or economic functions. Recent developments in the literature encompass greater attention to local consumption and knowledge-based activities besides the traditional production-oriented focus.

An important economic sector for SMSTs is the residential economy (Hamdouch and Banovac 2014). Residential economy includes economic activities that serve local or regional markets. Residents normally consume the products. Grocery stores and educational institutions are two examples of the residential economy. Firms that produce products for extra-regional demand do not belong to this sector. Towns with a high share of employment (SOE) in the residential economy can be expected to be towns with a central place function for their hinterland or towns that function as attractive residential places for people working in another town or city and spending their income where they live (Segessemann and Crevoisier 2015). Hence, a high percentage of out-commuters facilitated by efficient transportation linkages to a nearby city may characterize these towns. The geographic context is especially relevant for such residential economy towns since shops and services in SMSTs inside metropolitan regions might face competition with other towns in the region or cities, whereas SMSTs in more rural locations are able to provide a wider array of services in the absence of strong competition from the hinterland (Fertner et al. 2015).

Research about knowledge intensive business services and knowledge intensive financial services (KIBS/KIFS) in the context of SMSTs is rare. Yet, structural changes in the economy such as those towards a more knowledge-oriented economy also affect SMSTs. Most research on KIBS/KIFS focuses on the industry`s central location within metropolitan regions. The dominant view focuses on internationally recognized (global) cities, such as London, Munich or Zurich that function as nodes in global economic networks and that ensure the exchange of capital, knowledge and talent (Glanzmann et al. 2006). Businesses that provide knowledge intensive business and financial services form these networks (Sassen 2001; Taylor 2004). While the mainstream literature on KIBS/KIFS and global cities has not focused on SMSTs as locations for this type of economy, SMSTs that are located within metropolitan regions can also be attractive locations for KIBS and KIFS. In this case, the image and the functions of the metropolitan center may be "borrowed" (Meijers and Burger 2015) by the SMSTs and close connections and fast transportation linkages to the center are crucial.

Nevertheless, the industrial or productive economy is still an important characteristic of many SMSTs (ARE 2008; Hamdouch et al. 2017). The productive economy, however, is not a homogeneous sector. Rather, it can be distinguished into high tech (for example machine industry) and low tech (for example textile) industry based on the respective innovation performance (Eurostat 2016). Nowadays globalization processes tend to challenge industrial locations. However, Hamdouch et al. (2017) found that most SMSTs hold on to their industrial specialization and consequently orient their development strategies towards those sectors. Evolutionary processes and path dependency may play a key role regarding the industrial specialization of SMSTs. New and technologically related industries are more likely to develop in areas with an already existing industry base (Neffke et al. 2011). Besides historical trajectories, SMSTs also offer specific location factors that differ from larger urban agglomerations: Cheap and available land, suitable workforce, and availability of raw materials were often the reason why towns were chosen as a production location. Yet, often there is a lack of employees with a tertiary degree working and living in these areas (Hamdouch and Banovac 2014; Henderson 1997; Hemesath et al. 2009). Nevertheless, towns with research-intensive industries, so called high tech industries, are important value creators and demand highly educated employees as well as knowledge and sales networks (Friedmann 2002; Hall and Pain 2006; Castells 2010; Krätke 2007).

SMST research has focused to a limited extent on the role of these towns as locations for business headquarters. Small and medium-sized firms and regionally embedded headquarters are seen as crucial factors for economic success and economic stability of SMSTs (Knox and Mayer 2013; Adam 2006). The presence of headquarters increases the share of skilled employees and can positively influence the wage level of a town (Shilton and Stanley 1999). SMSTs hosting business headquarters may have good transportation linkages to the next city or airport and a favorable tax system. Headquarters with a long history in the area are less likely to change location (Strauss-Kahn and Vives 2009; Hemesath et al. 2009).

Finally, particular SMSTs in regions with scenic landscapes base their economy heavily on the tourism sector (Gatzweiler et al. 2012). Towns located in mountain regions seem to be unfavorable to locating industrial or service activities. Yet, particularly in the

context of Switzerland, these towns mostly dispose of efficient train or road connections to urban areas. Hence, these towns can function as recreational areas for national metropolitan regions as well as for international guests. Consequently the tourist sector helps these towns gain importance as regional centers and also integrates them in international networks (Perlik et al. 2001). The dependence on international markets and currency fluctuations however influence the growth paths of these towns (Schmid 2010).

3.2 SMSTs and their linkages

While the aforementioned studies about the SMST economy present valuable insights into diverging specialization patterns, they offer limited insights into the ways in which the linkages between towns and their regional context may or may not influence these economies. Not only geographical proximity is crucial, but also linkages and connectivity to other places play an important role. Towns with different economic characteristics have special connectivity requirements (Cox and Longlands 2016). Sýkora and Mulíček (2017) focus on the functional context towns are embedded in. Depending on the number of in- and out-commuters, SMSTs can either be defined as agglomerated (commuting flows that are significant only for themselves), networked (commuting flows that are significant for the destination center and for themselves) or autonomous (no significant out- or incoming flow of commuters). However, regarding job and population growth, no differences could be found in this study between the different functional types of towns. Yet, Hamdouch et al. (2017) note that the most dynamic SMSTs are rather agglomerated or networked than autonomous. Especially towns with a residential profile show higher population and employment growth rates if they are agglomerated or networked. Hence, the relative distance to the next core city can exert major influence on the flows occurring between SMSTs and their respective core city. Empirical evidence from different countries suggests that towns closer to larger cities grow faster and are also more specialized than towns further away from metropolitan centers (Gatzweiler et al. 2012; Hamdouch et al. 2017; Polèse and Shearmur 2006; Smith 2017; Vaishar et al. 2015). Yet, how a certain type of SMST and its linkages to the next city (e.g. in form of public transport, commuting time, etc.) relate has not been examined so far.

The concept "borrowed size" introduced by Alonso (1973) provides another fruitful way to explain the influence a core city can have on SMSTs. Alonso (1973, 200) notes that a "small city or metropolitan region exhibits some of the characteristics of a larger one if it is near other population concentrations". This concept has recently been refined and empirically tested by Meijers and Burger (2015). They found that the borrowing size process is more likely to happen in polycentric metropolitan regions and between cities of the same size. If smaller cities borrow size, they mostly borrow performance whereas larger cities borrow functions. Cities that did not manage to borrow size can experience a so called "agglomeration shadow". This means that close proximity to a core city can lead to the presence of fewer functions and a lower level of performance than expected regarding the size of the town.

In contrast to borrowing size, network concepts state that physical proximity can also be replaced by network activities and flows between towns (Capello 2000; Camagni 1993; Camagni et al. 2015). Networks can help SMSTs organize their activities with the help of other locations, access functions and borrow benefits from larger urban agglomerations. As a result, they are able to overcome diseconomies of scale (Phelps et al. 2001). Hence, network activities and linkages can determine the function and specific position of an SMST in an urban hierarchy. Meijers et al. (2016) conclude that "network connectivity is crucial and sometimes even more important than local size" (195). McCann and Acs (2011) also confirm that global connectivity, especially through multinational companies, has gained importance and the size of a town has become less important in industrialized countries. In sum, while the borrowed size and network concepts concentrate on the effects larger urban areas can have on SMSTs, they have done little to explain how SMST economic characteristics relate to various forms of linkages.

4 Methodology

To be able to identify the heterogeneity of economic features and socio-economic performance of SMSTs and gain an overview about the relationship between these two attributes we carried out a cluster analysis. The cluster analysis groups SMSTs with similar characteristics in these two attributes. This way we could gain knowledge about the diversity of SMSTs regarding their economic and socio-economic performance. To analyze the relationship between cluster membership and variables describing linkages of the towns, we carried out a one-way analysis of variance with the help of the Kruska-Wallis-Test. In the following, we describe the two methods in detail.

4.1 Cluster Analysis: Grouping SMSTs with similar economic features and socioeconomic performance

Wards' minimum variance clustering method together with the squared Euclidean distance coefficient was chosen as the most suitable method to cluster SMSTs. This method is one of the two most often used statistical clustering methods (Romesburg 2004) and has also been applied in similar research projects (Hedlund 2016; Schmid 2010). The goal of Ward`s method is to build homogenous and realistic clusters. The advantage of this method compared to other clustering methods is that after every merge of clusters a distance coefficient is calculated. The larger the distance coefficient is the more different are the towns that are being merged. Hence, it makes it easier to decide on the number of clusters (Backhaus et al. 2016; Romesburg 2004). With this method, it is possible to build a realistic number of clusters of towns with similar characteristics.

We chose 10 variables[3] to describe both economic characteristics and socio-economic performance of SMSTs. A correlation analysis was carried out to exclude possible correlated variables. The variables have not shown correlations. Hence, no variables had to be excluded (Backhaus et al. 2016).

Five variables give information about the employment structures of the towns: Share of employment (SOE) in the high tech/medium-high tech industry, low tech/medium-low tech industry, knowledge intensive business services (KIBS) & knowledge intensive financial service (KIFS), residential economy, and accommodation & food/beverage service activities. These variables have been chosen because they determine economic specialization. We also expect geographical differences regarding these five variables. The high tech industry as well as the KIBS/KIFS variables play an important role in the metropolization process. Since both of these sectors rely on global networks and well educated people, the towns with a high SOE in these sectors depend strongly on places that function as global nodes or "global gateways" (Glanzmann et al. 2006). Hence, we expect that these towns are located around the metropolitan centers (Friedmann 2002; Hall and Pain 2006; Castells 2010; Krätke 2007). In contrast, the low-tech industry might be more represented in towns located outside metropolitan regions. A high SOE in the accommodation & food and beverage service activities is expected in the alpine tourist towns. The residential economy sells products and services needed for daily life and the products are not exported (Segessemann and Crevoisier 2015). Hence, it can be assumed that towns with a dominant residential economy are either attractive living places or they may function as centers for their hinterlands.

In order to show economic growth or decline, changes in full time equivalent employment (FTE) between 1995 and 2008 were also included in the cluster analysis. Due to a change in the survey methodology[4] in 2008, the numbers regarding FTE after 2008 cannot be compared to the numbers before 2008. The starting year 1995 has been chosen because it is a sufficient time period to detect development dynamics and the data from 1995 onwards has been adapted to the revised NOGA (Nomenclature générale des activités économiques definitions). Hence, 1995 was the earliest year and 2008 was the latest years we could use for a dynamic analysis regarding FTE.

In addition to change in employment, we also wanted to focus on entrepreneurial dynamics, large firms and human capital. Thus, we included on the one hand the cumulative number of new established firms 2009-2013 in our analysis. On the other hand, the number of top 500 industry, trading or service firms in Switzerland shows how attractive a town is for headquarters of large firms. The share of population over 25 years old with a tertiary education degree depicts the human capital available in these towns.

Finally, the percentage change in population development between 1995 and 2013 illustrates positive or negative demographic development. Variables that represent geographical information and relations, such as commuting statistics were deliberately left out. These data would depict the geographical locations and distract the cluster analysis from building types with a distinct economic profile. However, we use such data to find relationships between different SMST types and their linkages to the regional context.

[3] All data could be obtained from the BFS, except the list of the number of top 500 industry, trading or service firms in Switzerland for the year 2013 was obtained from Handelszeitung and Bisnode Schweiz AG.

[4] The BFS changed the survey methodology regarding business statistics in 2008. Hence, data before 2008 and after 2008 cannot be compared. For this reason, we can only analyze development dynamics from a given year until 2008, or from 2008 onwards. The new methodology includes very small businesses with one or two employees that have not been considered in the statistics before 2008.

We are aware that the different time periods of the variables are not optimal. However, the data show development trends over the last 20 years that help to characterize towns and are thus for the nature of a cluster analysis sufficient. Table S1 (supplement) provides a detailed overview of the variables and data used.

Due to the big range of values between the cluster variables, the data was standardized with the z-score standardizing function before starting the cluster analysis. Otherwise the variables with great ranges have more influence in determining the clusters (Romesburg 2004). Nevertheless, outliers can still heavily influence the outcome of a Ward`s minimum variance cluster analysis. Hence, the Single Linkage Method was applied in order to eliminate them (Backhaus et al. 2016). As a result, we identified four outliers.

The number of clusters was determined by the width of range of the resemblance coefficient (Romesburg 2004). A large heterogeneity indicates that the cluster procedure should be stopped. A significant change in the distance coefficient occurred after the seventh cluster solution (see Fig. S1 in supplement). The discriminant analysis confirmed the seven-cluster solution with 91.9 % probability.

4.2 One-way analysis of variance: Analyzing relationships between cluster membership and linkages

For analyzing relationships between cluster membership and linkages, we carried out an analysis of variance. Two linkages were derived from the literature review:

Commuting linkages: percentage of out-commuters as a share of the working population and percentage of commuters to the town from the surrounding area as a share of the working population (BFS 2010–2012).

Public transport linkages: The time it takes to travel to the next center, meaning either to the core cities Basel, Bern, Geneva, Lausanne, Lugano or Zurich or to the next agglomeration center or center without an agglomeration[5] (whichever is closer) by public transport emphasizes the intensity of flows occurring between an SMST and a neighboring center. (ARE and SWISSTOPO 2011).

As the Shapiro-Wilks test confirmed, these variables are not normally distributed among the seven SMST types. Hence, in order to compare means, the Kruska-Wallis Test had to be carried out. Differences among the types could only been found for the out-commuting and public transportation linkages. No differences exist between the types for the number of in-commuters (see Tab. 1). To see which types differ significantly in the two left variables we carried out a post-hoc test (Dunn-Bonferroni-Test) (see Tab. 2).

5 Economic heterogenity, socioeconomic performance and linkages of Swiss SMSTs

The cluster analysis shows that seven distinct types of SMSTs regarding economic characteristics and socioeconomic performance can be built with the 10 used variables. The towns within a cluster are more similar to each other than to other SMSTs but can still have certain characteristics that they do not share with other members of the same cluster. Towns with above average employment and population growth rates have mostly a knowledge intensive economy or a residential economy and are located inside metropolitan regions.

In the following, we present the different types of SMSTs. Each of the types is given a name derived from the dominant characteristic of the cluster. Table A1 (appendix) as well as figure S2 (supplement) show the locations of the different types. Also cluster mean values and standard deviations can be found in table S2 (supplement). The different types of SMSTs will be presented according to the numbering of the hierarchical cluster analysis.

Residential economy towns: A large majority of small and medium-sized towns in Switzerland specializes in the residential economy. With an average of 65 % SOE in the residential economy and a small SOE in the industry, KIBS/KIFS and accommodation/food sector, they classify as typical towns with an economy that primarily serves local, residential needs. Nearly two thirds of these towns are located inside a metropolitan region and another 34.1 % belong to an agglomeration. The towns that belong to an agglomeration outside a metropolitan region are important regional centers, such as Brig-Glis or Thun. The data shows however, that this type experienced below average growth rates in terms of inhabitants, and FTE. The reason for this could be that these towns are to a certain extent saturated due to earlier growth processes not included in this analysis.

[5] Definition for core cities, agglomeration center or center without an agglomeration bases on the definition by Schuler et al. (2005). Agglomeration centers can also be inside a metropolitan region, each agglomeration has a center.

Tab. 1: Result of the Kruska-Wallis Test

	Out-commuters	In-commuters	Travel time by public transport to the next core city
Chi-Quadrat	24.795	8.969	36.250
df	6	6	6
Asymptotic Significance	.000	.175	.000

Level of significance: 0.05

Prospering residential economy towns: The type *prospering residential economy towns* combines sixteen towns with the highest growth rates in either population or FTE among all the 148-clustered towns. However, the cumulative number of new firms is below average compared to all other towns. Hence, we assume that public services have grown and already existing firms have expanded. Noticeably, the one town of this type that is situated in the agglomeration around Bern (Ittigen) experienced high employment growth benefitting from Bern`s capital city function (Kaufmann et al. 2016). All of these SMSTs are located close to a city with 11 of them belonging to a metropolitan region and five to an agglomeration. These towns are located around Zurich, Basel and Geneva.

Business hub towns: The type *business hub towns* includes towns that stand out due to their high number of headquarters of top firms, such as is the case of the airport town Kloten in the Zurich metropolitan region. They also stand out for their high number of new established firms, as shown in the example of Montreux. These towns have high SOE in the residential economy and at the same time an above average SOE in the KIBS/KIFS sector. Top firms located in these *business hub towns* may benefit from the towns` residential economy but also from the presence of a KIBS/KIFS economy. Top firms are often historically embedded in the towns and are able to draw on a specialized labor pool. However, there is evidence that multinational firms located in a SMSTs are more orientated towards Zurich or the whole of Switzerland and that they see the town in which they are physically located as less important (Gallati and Pütz 2010). The *business hub towns* have average population and FTE growth rates. Geographically, the majority of *business hub towns* are inside a metropolitan region with a bias towards Zurich. This might be due to the need of international firms to be close to the airport in Zurich, to benefit from good public transport system and high quality of life (Gallati and Pütz 2010). Additionally, towns outside metropolitan regions group in the Swiss plateau around Zurich. Only a few of the *business hub towns* function as regional centers outside metropolitan regions, namely they are Chur and Neuchâtel. This type seems to indicate that a selected number of Swiss SMSTs fulfill an important role as locations for top 500 firms.

Knowledge intensive towns: This type reveals characteristics that are typical for metropolization processes: the towns within this type have a high SOE in the KIBS/KIFS sector. All towns of this type belong to a metropolitan region and have above average growth rates in new firms, FTE, and inhabitants. Two towns located in the Zurich metropolitan region stand out as good examples of KIBS/KIFS towns: Adliswil and Opfikon are located about nine km from downtown Zurich and both are less than 30 minutes by public transport away from the main train station and the airport. Adliswil is home to two major insurance companies whereas Opfikon is the location of a major Swiss bank. Both towns experienced high population growth and a high increase in total employment. Moreover, the towns of this type stand out due to their high share of inhabitants with a tertiary education degree, such as Küsnacht (Zurich) or Chêne-Bougeries (Geneva) that can be found close to the metropolitan centers in attractive urban areas.

High Tech Towns: As its name suggests, this type is characterized by specialized high tech industries. This type shows a weak residential economy compared to all other SMSTs in Switzerland. Towns of this type have mainly below average population and FTE growth rates. However, high tech industry towns inside the metropolitan region of Zurich have a high increase in the number of inhabitants. Two towns, namely Stans and Baden, experienced a high increase in population and FTE. Le Locle, a specialized watchmaking town, stands out compared to other towns of this type with a SOE of 53.2 % in the high tech industry. The increase of FTE between 1994 and 2008 is also significantly higher than for all other towns, and finally the number of top 500 firms is the highest within this type. 11 of the 18 *high*

tech towns are located in an agglomeration outside a metropolitan region. Seven are located inside a metropolitan region. No *high tech towns* can be found in periurban or peripheral rural regions. Other examples of towns belonging to this type are Uzwil and Stäfa. Uzwil industrialized in the 19th century and was home to firms specialized in the production of mechanical looms and iron foundry at the time. One of these firms still exist today and is world leader in the machinery industry. Stäfa on the other hand is the location of a leading exporter of hearing aids, which was founded in 1947. These two examples illustrate the importance of historically embedded firms (Hemesath et al. 2009).

Low Tech towns: This type is characterized by a high SOE in the low tech industry. 25 towns within this type have a small share of the population with a tertiary education degree as well as below average population growth and a low increase in total employment. These findings support Servillo et al. (2014) who note that industrially dominated towns had to deal with lower employment rates during the last decade than towns with different economic structures. Geographically, these towns are located either in an agglomeration outside a metropolitan region, especially in the eastern part of Switzerland, or inside a metropolitan region. Only three are in periurban rural regions and one in a peripheral rural region. *Low tech towns* may experience the agglomeration shadow (Meijers and Burger 2015) of nearby cities and thus may not be able to profit from urban areas nearby. Most of the towns belonging to this type were industrialized in the early 19th century through the mechanization of the cotton spinnery and belong to the first industrialized towns in Switzerland (Odermatt and Wachter 2004). Glarus is one example of a town belonging to this type as it is located at the outskirts of the metropolitan region of Zurich in a peripheral rural area and has a long tradition in textile production.

Alpine tourism towns: As its name suggests, this type groups well-known tourist towns. Three of the four towns are internationally known ski destinations (St. Moritz, Zermatt, and Davos). The other town (Interlaken) is close to famous mountains and mountain villages in the Bernese Oberland. These towns are not only nationally significant tourism centers but they also fulfil a crucial role for their rural hinterland. Their economy is characterized by a small share of industrial and KIBS/KIFS employment. Due to the strong tourism sector, the residential economy may strongly depend on the number of visitors. Regarding the dynamic variables, these towns have very low values and are for the most part far below the average.

Outliers: Three out of the four outliers, namely Zug, Baar, and Risch, are tax-friendly towns with dominant KIBS/KIFS (Zug and Baar) respectively high tech sectors (Risch). They are located in the canton of Zug, which is known for its fast transportation connections to Zurich and Luzern. These outliers show a high number of newly established firms between 2009 and 2013, many top 500 firms, a high share of inhabitants with a tertiary education degree and high growth rates of FTE and population. These three towns are globally connected through the presence of multinational companies. As a result, they gained functions (such as being a global node) that cannot be explained by their size (McCann and Acs 2011). The second outlier is the town of Plan-les-Ouates, which is located very close to the French border and lies inside the Geneva metropolitan region. Plan-les-Ouates experienced the highest increase in population and total employment compared to all other SMSTs in Switzerland. Land availability, the location near the border to France, the motorway and airport connection as well as the favorable tax conditions for multinational companies are among the reasons for these development dynamics.

The Kruska-Wallis Test shows that SMST types only differ significantly in terms of their commuting and transportation linkages when the economy of SMSTs has completely different characteristics (see Tab. 2). SMSTs that specialize in tourism have significantly lower number of out-commuters compared to *residential economy towns*, *prospering residential economy towns* and *knowledge intensive towns*. *Residential economy towns, high tech towns, low tech towns* and *alpine tourism towns* have significantly longer travel times to the neighboring center compared to the *knowledge intensive towns* and might thus be subject to less intensive commuting linkages and hence different development trajectories. Whereas those towns that specialize in KIBS/KIFS benefit from their proximity to a neighboring center and are characterized by intensive exchange.

Synthesizing the existing literature on SMSTs with our results, different types of SMSTs and different kinds and intensity levels of linkages are illustrated in figure 1. While we only assessed the relationship between SMST types and linkages such as

commuting and transportation empirically, there are other types of linkages that need to be considered such as knowledge spillovers, gateway functions and the provision of basic supplies, education, health services, etc.

All SMST types are connected to the hinterland and neighboring centers. However, the kind and intensity of linkages a town has differ depending on the type of SMST. Figure 1 illustrates how *prospering residential economy towns*, *residential economy towns*, *knowledge intensive towns and business hub towns* depend on the one hand on linkages directed towards neighboring centers, such as out-commuters and fast transportation (arrows on the left directed towards neighboring center). On the other hand, we have functions of neighboring centers that can be accessed by these SMSTs, such as gateway functions and knowledge linkages (arrows with direction toward SMSTs). That indicates that these types of SMSTs are mostly agglomerated with the neighboring center and profit from its functions and economic performance. Hence these towns are able to "borrow size" in form of population and FTE growth in the case of the *prospering residential economy towns* or also functions such as the presence of KIBS and KIFS in the case of the *knowledge intensive towns* (Meijers and Burger 2015). Besides their KIBS/KIFS activities, *knowledge intensive towns* represent residential areas in accessible locations and thus show a high de-

Tab. 2: Comparison of commuting statistics and travel times with public transport to the next center

		M	SD	Types with significant different means*
Residential economy towns N: 44	Out-commuters	60.2%	12.1%	
	In-commuters	55.2%	8.8%	
	Time to the next center	33.7min	23.9min	
Prospering residential economy towns N: 16	Out-commuters	67.1%	9.3%	
	In-commuters	53.6%	11.7%	
	Time to the next center	24.8min	16.4min	Alpine tourism towns
Business hub towns N: 31	Out-commuters	57.0%	13.3%	
	In-commuters	53.9%	10.0%	
	Time to the next center	26min	22.4min	Alpine tourism towns
Knowledge intensive towns N: 10	Out-commuters	67.6%	5.3%	
	In-commuters	55.1%	6.5%	
	Time to the next center	9.3min	8min	Residential economy towns, High tech towns, Low tech towns, Alpine tourism towns
High tech towns N: 18	Out-commuters	55.9%	13.5%	
	In-commuters	55.8%	11.1%	
	Time to the next center	45.9min	28min	
Low tech towns N: 25	Out-commuters	56.3%	12.8%	
	In-commuters	48.7%	11.9%	
	Time to the next center	44min	26.9min	
Alpine tourism towns N: 4	Out-commuters	18.8%	17.7%	Residential economy towns, prospering residential economy towns, knowledge intensive towns
	In-commuters	27.7%	25.4%	
	Time to the next center	139.3min	64.3min	

*All of these differences show medium to high efficiency, according to the classification by Cohen (1992)

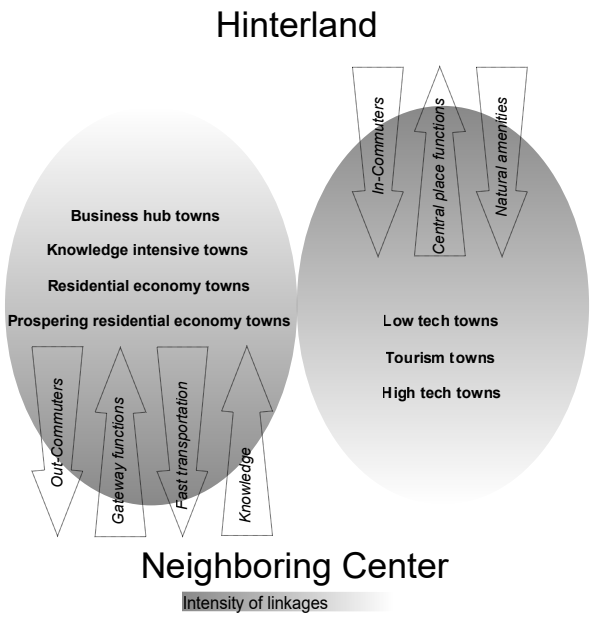

Fig. 1: Conceptualizing SMSTs and their linkages to centers and hinterland

gree of out-commuters, yet they depend on knowledge exchange with institutions and firms and also on the gateway functions of neighboring centers. It takes inhabitants of the *residential economy towns* significantly longer time to reach neighboring centers when compared to the inhabitants of the *knowledge intensive towns*. However, as is the case with *prospering residential towns* and *knowledge intensive towns*, *residential economy towns* also depend on employment possibilities for their inhabitants in neighboring centers. In contrast, the linkages with the hinterland (arrows on the right side), such as in-commuter, natural amenities for recreation, and central place functions, are more intense for *high tech towns*, *low tech towns* and *alpine tourism towns*. These types of towns are therefore more isolated from the neighboring center than the aforementioned and might be too far away from them to be able to "borrow size". *Alpine tourism towns* base their economy on the natural amenities their hinterland has to offer, whereas the natural amenities for *low tech* and *high tech towns* might be valuable for attracting people to live and work in these towns. The longer it takes to reach the neighboring centers, the more important will be the towns` central place functions and the jobs available for their hinterland. It seems that towns with an economic structure that is more similar to cities such as Zurich or Geneva are more closely aligned to core regions, while towns that depend less on center`s characteristics are more closely aligned with the hinterland in terms of their functions.

6 Conclusion

The results show that SMST economies specialize in a wide variety of sectors including industry, knowledge intensive sectors, residential economy, tourism and that they can be important locations of business headquarters. Moreover, geographic patterns as well as different dependence on commuting and public transportation linkages regarding the typology of towns could be found. Our results support on the one hand the observations by Servillo et al. (2014) as well as Erickcek and McKinney (2006) that service-oriented towns have higher growth rates compared to industry dominated towns. Hence, considering the borrowed size concept (Meijers and Burger 2015), these towns may be able to benefit from the economic dynamics in the metropolitan center and borrow performance in terms of population, employment and new firm growth. On the other hand, this result confirms also the finding of Hamdouch et al. (2017) that agglomerated and networked towns are more successful in terms of population and employment growth. However, we also saw that the landscape of SMSTs and their linkages to neighboring centers are more diverse as suggested in other studies before and moreover that different types of SMSTs do not significantly differ in terms of regional context, commuting and transportation linkages. One explanation for the presence of *high tech towns* relatively far away from universities in Switzerland and close to *low tech towns* can be the evolutionary processes of individual firms over many years. The multinational high tech firms in SMSTs in the eastern part of Switzerland, for example, have been in these towns since the early industrial age and they have developed from rather low-tech suppliers for the textile industry to world leading high tech firms. The reason for some towns to be *prospering residential economy towns* might lie in the availability of housing and high levels of quality of life. At this stage, we did not investigate the relationship between low communal tax rate for natural persons and *prospering residential economy towns*. However, this could be another explanation for prospering residential economy towns.

The results of this study point towards two interesting lines of inquiry for future research. First, because there are indeed different types of SMSTs in the same regional context, we need to consider SMSTs as single urban entities also in the context of metropolitan regions. Second, it is necessary to examine the influence of economic development policies and local politics to better understand dif-

ferences in economic specialization, dynamics and linkages. Third, evolutionary processes and temporal changes in the economic structure should be analyzed more deeply. This study has not focused on changes in the economic profiles of SMSTs. Overall, this study showed that SMSTs in the same regional context are heterogeneous in terms of economic characteristics, dynamics and linkages and their different needs must be acknowledged when designing place based economic development policies.

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Appendix

Tab. A1: Swiss SMSTs: Typology, number of inhabitants and location

ID	SMST	Economic Type	Population 2013	Location*
2	Affoltern am Albis	Residential economy towns	11,276	1
52	Bassersdorf	Prospering residential economy towns	11,243	1
53	Bülach	Residential economy towns	17,975	1
62	Kloten	Business hub towns	18,402	1
66	Opfikon	Knowledge intensive towns	16,116	1
69	Wallisellen	Business hub towns	14,188	1
96	Regensdorf	Business hub towns	16,975	1
117	Hinwil	High tech towns	10,615	1
118	Rüti (ZH)	Low tech towns	11,968	1
121	Wetzikon (ZH)	Prospering residential economy towns	23,274	1
131	Adliswil	Knowledge intensive towns	18,037	1
133	Horgen	Business hub towns	19,282	1
138	Richterswil	Low tech towns	12,832	1
141	Thalwil	Business hub towns	17,340	1
142	Wädenswil	Residential economy towns	20,967	1
154	Küsnacht (ZH)	Knowledge intensive towns	13,518	1
155	Männedorf	High Tech towns	10,470	1
156	Meilen	Low tech towns	12,816	1
158	Stäfa	High tech towns	13,876	1
161	Zollikon	Knowledge intensive towns	12,163	1
174	Illnau-Effretikon	Residential economy towns	16,117	1
177	Pfäffikon	High Tech towns	11,027	1
191	Dübendorf	Business hub towns	25,341	1
198	Uster	Business hub towns	32,748	1
199	Volketswil	Prospering residential economy towns	17,768	1
243	Dietikon	Business hub towns	24,843	1
247	Schlieren	Business hub towns	17,199	1
250	Urdorf	Business hub towns	9,471	1
306	Lyss	Low tech towns	14,080	2
329	Langenthal	Residential economy towns	15,184	2

ID	SMST	Economic Type	Population 2013	Location*
355	Köniz	Business hub towns	39,375	1
356	Muri bei Bern	Knowledge intensive towns	12,675	1
361	Zollikofen	Residential economy towns	9,977	1
362	Ittigen	Prospering residential economy towns	10,997	1
363	Ostermundigen	Low tech towns	15,871	1
404	Burgdorf	High tech towns	15,659	2
546	Münchenbuchsee	Low tech towns	9,749	1
581	Interlaken	Alpine tourism towns	5,504	2
616	Münsingen	Residential economy towns	11,566	1
768	Spiez	Low tech towns	12,549	2
861	Belp	Low tech towns	11,108	1
939	Steffisburg	Residential economy towns	15,515	2
942	Thun	Residential economy towns	42,735	2
1024	Emmen	Residential economy towns	28,701	2
1054	Ebikon	High Tech towns	12,571	2
1058	Horw	Residential economy towns	13,618	2
1059	Kriens	Residential economy towns	26,751	2
1103	Sursee	Business hub towns	9,079	3
1201	Altdorf (UR)	Residential economy towns	8,981	4
1301	Einsiedeln	Low tech towns	14,632	1
1322	Freienbach	Knowledge intensive towns	15,758	1
1362	Arth	Low tech towns	10,924	3
1372	Schwyz	Low tech towns	14663	2
1407	Sarnen	Low tech towns	9,959	3
1509	Stans	High tech towns	8,112	2
1630	Glarus Nord	Low tech towns	17,198	3
1632	Glarus	Low tech towns	12,312	4
1701	Baar	Outlier	22,355	1
1702	Cham	Business hub towns	15,020	1
1707	Risch	Outlier	9,779	1
1708	Steinhausen	Residential economy towns	9,213	1
1711	Zug	Outlier	27,537	1

ID	SMST	Economic Type	Population 2013	Location*
2125	Bulle	Prospering residential economy towns	20,177	2
2196	Fribourg	Business hub towns	36,633	2
2228	Villars-sur-Glâne	Prospering residential economy towns	11,975	2
2546	Grenchen	High Tech towns	16,173	2
2581	Olten	Business hub towns	17,133	2
2601	Solothurn	Residential economy towns	16,465	2
2703	Riehen	Residential economy towns	20,699	1
2761	Aesch (BL)	High tech towns	10,220	1
2762	Allschwil	Business hub towns	19,898	1
2763	Arlesheim	Residential economy towns	9,073	1
2765	Binningen	Residential economy towns	14,817	1
2766	Birsfelden	Low tech towns	10,277	1
2769	Münchenstein	Residential economy towns	11,715	1
2770	Muttenz	High Tech towns	17,339	1
2771	Oberwil (BL)	Residential economy towns	10,721	1
2773	Reinach (BL)	Residential economy towns	18,661	1
2829	Liestal	Residential economy towns	13,708	1
2831	Pratteln	Residential economy towns	15,282	1
2937	Neuhausen am Rheinfall	Residential economy towns	10,220	1
2939	Schaffhausen	Business hub towns	35,413	1
3001	Herisau	High tech towns	15,222	2
3215	Rorschach	Low tech towns	8,918	2
3251	Altstätten	Low tech towns	11,075	2
3271	Buchs (SG)	Residential economy towns	11,536	2
3340	Rapperswil-Jona	Business hub towns	26,354	1
3402	Flawil	Low tech towns	10,126	2
3408	Uzwil	High Tech towns	12,726	2
3427	Wil (SG)	Low tech towns	22,985	2
3443	Gossau (SG)	Low tech towns	17,941	2
3787	St. Moritz	Alpine tourism towns	5,147	2
3851	Davos	Alpine tourism towns	11,156	2
3901	Chur	Business hub towns	34,087	2

ID	SMST	Economic Type	Population 2013	Location*
4001	Aarau	Business hub towns	20,103	2
4012	Suhr	Prospering residential economy towns	9,673	2
4021	Baden	High tech towns	18,522	1
4040	Spreitenbach	Prospering residential economy towns	10,930	1
4045	Wettingen	Residential economy towns	20,135	1
4082	Wohlen (AG)	Residential economy towns	14,879	1
4095	Brugg	Residential economy towns	10,611	1
4201	Lenzburg	Residential economy towns	8,626	1
4254	Möhlin	Prospering residential economy towns	10,455	1
4258	Rheinfelden	Residential economy towns	12,174	1
4280	Oftringen	Prospering residential economy towns	12,939	2
4289	Zofingen	High tech towns	10,824	2
4401	Arbon	High tech towns	14,012	2
4436	Romanshorn	Low tech towns	10,353	2
4461	Amriswil	Residential economy towns	12,619	2
4566	Frauenfeld	Business hub towns	24,119	1
4671	Kreuzlingen	Residential economy towns	20,520	2
4946	Weinfelden	Business hub towns	10,699	3
5002	Bellinzona	Residential economy towns	17,744	2
5113	Locarno	Residential economy towns	15,483	2
5250	Chiasso	Business hub towns	7,933	2
5254	Mendrisio	Low tech towns	14,499	2
5401	Aigle	Prospering residential economy towns	9,703	2
5583	Crissier	Prospering residential economy towns	7,402	1
5589	Prilly	Residential economy towns	11,709	1
5590	Pully	Knowledge intensive towns	17,368	1
5591	Renens (VD)	Residential economy towns	20,232	1
5624	Bussigny	Low tech towns	8,122	1
5635	Ecublens (VD)	Residential economy towns	11,427	1
5642	Morges	Residential economy towns	14,994	1
5721	Gland	Prospering residential economy towns	11,693	1
5724	Nyon	Knowledge intensive towns	19,170	1

ID	SMST	Economic Type	Population 2013	Location*
5822	Payerne	Residential economy towns	9,146	3
5886	Montreux	Business hub towns	25,456	1
5889	La Tour-de-Peilz	Residential economy towns	10,828	1
5890	Vevey	Business hub towns	18,594	1
5938	Yverdon-les-Bains	Residential economy towns	28,486	1
6002	Brig-Glis	Residential economy towns	12,728	2
6136	Martigny	Business hub towns	16,897	2
6153	Monthey	Residential economy towns	16,880	2
6248	Sierre	Low tech towns	15,945	2
6266	Sion	Business hub towns	32,167	2
6297	Visp	High tech towns	7,281	2
6300	Zermatt	Alpine tourism towns	5,786	4
6421	La Chaux-de-Fonds	High tech towns	38,267	2
6436	Le Locle	High tech towns	10,208	2
6458	Neuchâtel	Business hub towns	33,474	2
6608	Carouge (GE)	Knowledge intensive towns	20,375	1
6612	Chêne-Bougeries	Knowledge intensive towns	10,530	1
6623	Le Grand-Saconnex	Prospering residential economy towns	11,847	1
6628	Lancy	Business hub towns	28,909	1
6630	Meyrin	Business hub towns	21,718	1
6631	Onex	Prospering residential economy towns	17,851	1
6633	Plan-les-Ouates	Outlier	10,250	1
6640	Thônex	Low tech towns	13,587	1
6643	Vernier	Business hub towns	33,744	1
6644	Versoix	Prospering residential economy towns	12,879	1
6711	Delémont	Residential economy towns	11,809	2

List of Towns: Federal Statistical Office (BFS) (2014). *Statistische Städte 2012 [Statistical Towns 2012]*. Neuchâtel: BFS.

Source of population data: Federal Statistical Office (BFS) (2013). *STATPOP, 31.12.2013*. Neuchâtel: BFS.

*Location:
1: Metropolitan region
2: Agglomeration outside metropolitan region
3: Periurban rural region
4: Peripheral rural region

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Tab. S1: Cluster variables

Variable	Deinition	Data source
Share of Employment (SOE) in the high tech/medium-high tech industry 2013	Nomenclature générale des activités économiques (NOGA) Ref. 2: 20-21, 26-30 (EUROSTAT 2016)	Bundesamt für Statistik *(Federal Statistical O□ce)* (BFS) (2013). *STATENT 2013*. Neuchâtel: BFS.
SOE in the low tech/medium-low tech industry 2013	NOGA Ref. 2: 10-19, 22-25, 31-33 (EUROSTAT 2016)	
SOE in the KIBS & KIFS sector 2013	NOGA Ref. 2: 62-66, 69-73 (EUROSTAT 2016; SCHNABL and ZENKER 2013; SCHRICKE et al. 2012)	
SOE in the Residential Economy 2013	NOGA Ref. 2: 36-39,41-43, 45-47, 49-53 (without 501, 502), 58, 60, 68, 74, 75, 77-82, 842, 843, 85, 86-88, 90-96 (SEGESSEMANN and CREVOISIER 2015)[1)]	
SOE in the accommodation and food & beverage service activities 2013	NOGA Ref. 55, 56	
Number of top 500 industry, trading or service irms in Switzerland 2013	Ranking according to the consolidated revenue	Handelszeitung and Bisnode Schweiz AG (2015). *Die grössten Industrie-, Handels- und Dienstleistungsunternehmen in der Schweiz 2015 [The biggest Industry, Trading or Service Firms in Switzerland 2015].* Urdorf: Handelszeitung & Bisnode.
Share of population over 25 years old with a tertiary education degree 2010-2014 cumulative		Bundesamt für Statistik (BFS) (2016). *SE 2016.* Neuchâtel: BFS.
Change of number of total full time equivalent 1995 - 2008		Bundesamt für Statistik (BFS) (1995 - 2008). *Betriebszählung 1995-2008 [Business census].* Neuchâtel: BFS.
Cumulative number of new established irms 2009-2013		Bundesamt für Statistik (BFS) (2009 - 2013). *UDEMO 2009 - 2013.* Neuchâtel: BFS.
Population Development 1995 - 2013	% Change of number of inhabitants	Bundesamt für Statistik (BFS) (1995 - 2013). *STATPOP 1995-2013.*Neuchâtel: BFS.

[1)] In contrast to SEGESSEMANN and CREVOISIER(2015) the NOGA Ref. 33, 62-66, 69 and 55-56 have not been included, because they have been assigned to the Low tech/medium-low tech industry, KIFS/KIFS or accommodation/food-beverage service activities variables. Also only the codes were taken into account that belong regardless of size of business (number of jobs) to the residential economy (for more information see SEGESSEMANN and CREVOISIER (2015))

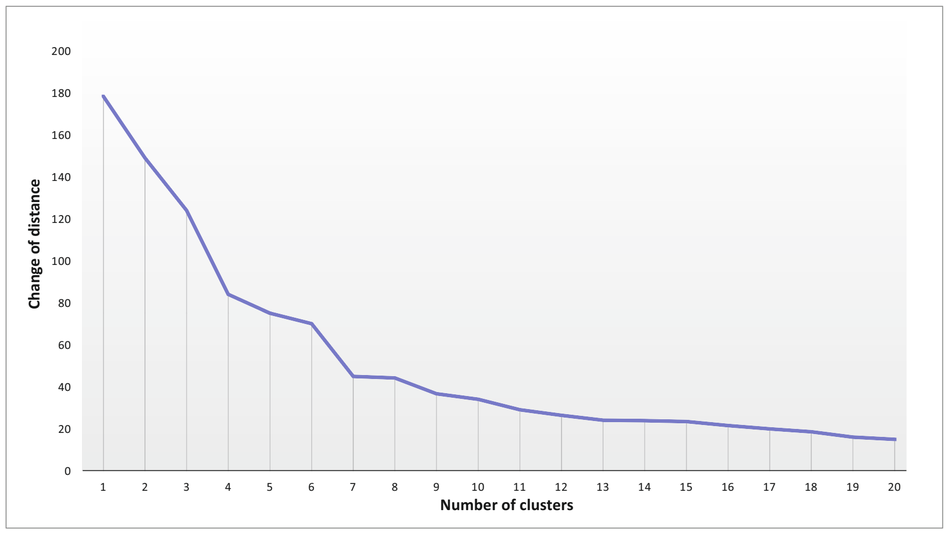

Fig. S1: Change in the distance coefficient between merged clusters

Tab. S2: Cluster mean values, standard deviations and location

Type	N		Change in number of inhabitants 95-13	Change in number of full time equivalent 95-08	SOE High Tech 2013	SOE Low Tech 2013	SOE KIBS/ KIFS 2013	SOE Accom/ Food 2013	SOE Residential Econ. 2013	Cumm. Nr of new firms 2009 - 2013	Number of top500 irms 2013	Share of inhabitants with a tertiary education degree	% of towns in Metro	% of towns in Agglom-eration	% of towns in Peri-urban rural	% of towns in Peripheral rural
1 Residential economy towns	44	M	12.1%	8.7%	8.4%	6.8%	12.9%	3.3%	64.6%	96.6	0.3	20.4%	61.4%	34.1%	2.3%	2.3%
		SD	7.7%	11.3%	5.8%	3.5%	5.8%	1.2%	7.7%	39.0	0.4	5.1%				
2 Prospering residential economy towns	16	M	36.6%	32.0%	6.6%	8.1%	9.6%	4.0%	66.9%	87.2	0.9	20.6%	68.8%	31.3%	-	-
		SD	18.0%	27.3%	5.5%	4.9%	2.7%	2.9%	7.7%	35.2	1.0	6.3%				
3 Business hub towns	31	M	15.5%	15.5%	5.2%	6.0%	17.2%	3.9%	63.6%	196.5	2.1	21.0%	67.7%	25.8%	6.5%	-
		SD	8.3%	14.7%	3.5%	3.2%	5.5%	2.1%	5.5%	88.9	1.4	4.1%				
4 Knowledge intensive towns	10	M	17.8%	28.4%	2.1%	3.3%	31.6%	3.3%	57.0%	201.9	0.4	31.8%	100%	-	-	-
		SD	12.8%	13.1%	1.7%	2.0%	9.9%	1.1%	10.2%	142.8	0.7	9.0%				
5 High tech towns	18	M	12.7%	7.1%	28.0%	8.9%	9.6%	2.7%	47.6%	87.6	1.4	20.7%	38.9%	61.1%	-	-
		SD	12.6%	13.1%	11.6%	4.6%	5.0%	0.6%	8.8%	52.8	1.1	5.5%				
6 Low tech towns	25	M	12.4%	8.3%	6.4%	18.3%	10.0%	3.5%	57.5%	83.7	0.2	18.3%	40%	44%	12%	4%
		SD	9.7%	15.7%	5.1%	4.9%	3.5%	1.4%	7.4%	43.6	0.4	5.1%				
7 Alpine tourism towns	4	M	2.7%	-4.7%	0.2%	3.3%	8.0%	37.7%	48.5%	49.0	0.0	15.0%	-	75%	25%	-
		SD	6.1%	8.1%	0.1%	0.9%	2.9%	13.7%	9.5%	12.0	0.0	2.3%				
Total	148	M	15.7%	13.4%	8.9%	8.6%	13.8%	4.4%	60.1%	119.1	0.8	20.9%	58.1%	35.8%	4.1%	2.0%
		SD	13.0%	17.6%	9.5%	6.0%	7.7%	6.1%	9.8%	80.8	1.2	6.2%				
Outliers	4	M	54.7%	79.1%	23.7%	4.1%	18.8%	2.3%	48.9%	607.5	4.8	27.8%	100%	-	-	-
		SD	31.3%	52.2%	17.3%	2.2%	7.4%	0.8%	8.4%	612.7	5.9	5.8%				

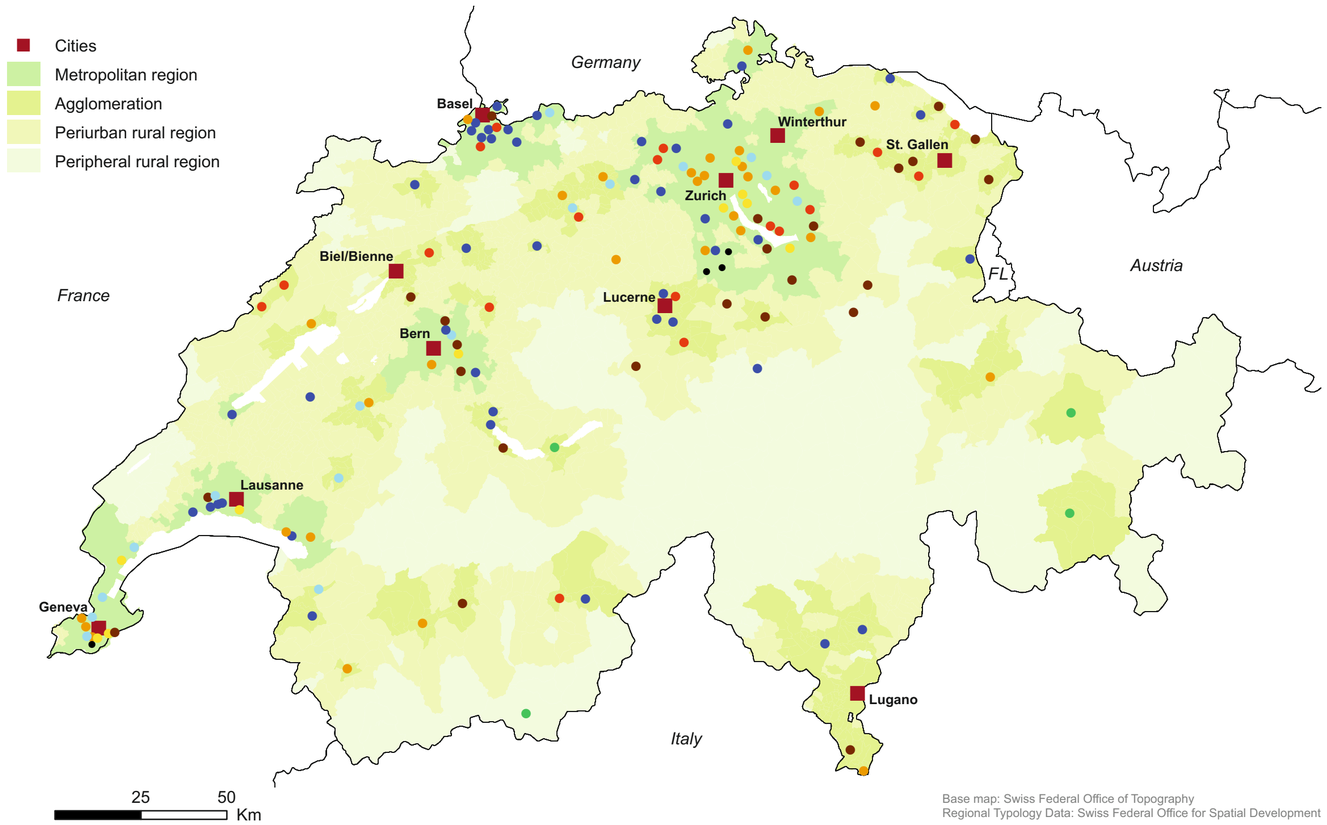

Fig. S2: Geographical distribution of the different types of SMSTs