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Center for Competitiveness
University of Fribourg
Switzerland

The Economic Performance of Swiss Regions

Indicators of Economic Performance, Composition of Cantonal Economies and Clusters of Traded Industries

Philippe Gugler
Michael Keller

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Introduction

Switzerland is a federal country consisting of 26 states named cantons.[1] Berne is the seat of the federal authorities. The country is located in Western Europe where it is bordered by Germany to the north, France to the west, Italy to the south and Austria and Liechtenstein to the east. Switzerland is a landlocked country of 41'285 km2 and comprises approximately 7.7 million people. Switzerland is one of the richest countries in the world by per capita GDP, 67'384 US$ in 2008 (WEF, 2009). According to the Global Competitiveness Report, Switzerland is the most competitive nation in the world (WEF, 2009). However, there are significant differences in economic performance of Swiss cantons.

Indeed, there are substantial differences in economic performance across regions in virtually every country. This suggests that most of the main determinants of economic performance are to be found at the regional level. In his paper "The Economic Performance of Regions", Michael Porter (2003) proposed a complementary approach to the previous contributions dedicated to regional performances of regions or cities. His paper examines broad indicators of economic performance, the composition of regional economies and the role of clusters in the US economy over the period 1990 to 2000. It offers an interesting framework for the analysis of economic performance of regions in other countries.

In this paper we adopt Michael Porter's framework to examine the economies of the Swiss cantons. First, we present data on the differences in *cantonal economic performances* according to several indicators. Secondly, we use data of industry employment across geography to *decompose cantonal economies* into traded, local, and resource-dependent industries. Thirdly we identify *clusters of traded industries* in Switzerland according to the approach of the U.S. cluster-mapping project and the European Cluster Observatory. In this third section, we then propose a complementary cluster-mapping approach for Switzerland and provide some basic results.

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[1] *Lake Geneva Region*: GE: Geneva, VD: Vaud, VS: Valais,
Espace Mittelland: BE: Berne, FR: Fribourg, JU: Jura, NE: Neuchâtel, SO: Solothurn.
Northwestern Switzerland: AG: Aargau, BL: Basel-Country, BS: Basel-City.
Zurich: ZH: Zurich.
Eastern Switzerland: AI: Appenzell Inner-Rhodes, AR: Appenzell Outer-Rhodes, GL: Glarus,
GR: Graubünden, SG: St. Gallen, SH: Schaffhausen, TG: Thurgau.
Central Switzerland: LU: Lucerne, NW: Nidwalden, OW: Obwalden, SZ: Schwyz, UR: Uri, ZG: Zug.
Ticino: TI: Ticino.

Indicators of Regional Economic Performance

International comparisons of economic performance are commonly drawn with respect to national gross domestic products (GDP). Data of the Federal Statistical Office (FSO) does not allow an analogous analysis at the regional level in Switzerland however. The FSO has never published regionalized GDPs but only *cantonal revenues* (CR) derived from gross national product (GNP). The most recent cantonal revenues (2005) are presented to introduce this section of the paper.

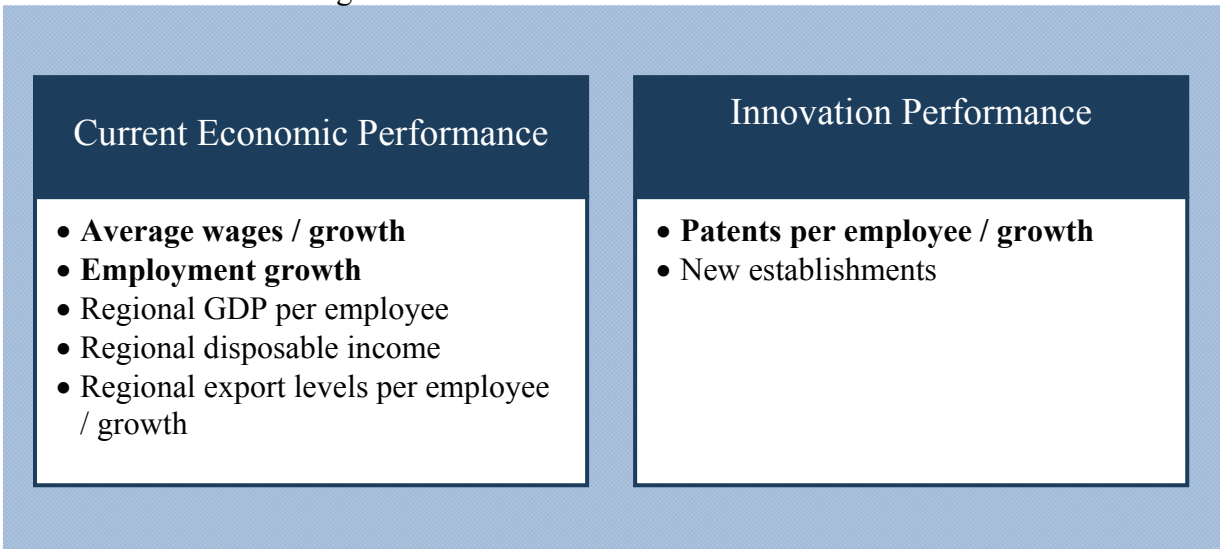
Admittedly, the use of cantonal revenues as an indicator of regional economic performance is questionable both regarding theoretical and methodological issues. GNP reflects the value of all goods and services produced by labor and property supplied by the *residents of a country* (or region), as in opposition to GDP, which reflects the value of goods and services produced *in* a country (or region). To capture the prosperity created in actual fact within the territorial borders of a given region, GNP is thus an imperfect indicator. Moreover, the regionalization of the Swiss GNP has frequently been criticized on methodological grounds. As a result the FSO decided to suspend the publication of cantonal revenues in 2008.

Hence, the presentation of the cantonal revenues is followed by a set of alternative indicators. In his paper "The Economic Performance of Regions", Michael Porter (2003) proposed a complementary approach to measure and to compare the economic performance of regions. According to Porter, the regional standard of living is determined by the productivity of its economy (Porter et al., 2004). Productivity determines the wages that can be sustained and the returns to investment in the region. These two elements are the main components of per capita income. As indicated by Porter "Productivity, contrary to popular usage, is more than just efficiency. It depends on the value of the products or services that a region's firms can produce, as measured by the price they can command, not just their efficiency of producing standard items. The central challenge for a region is to create the conditions that enable companies operating there to achieve high productivity and sustained productivity growth" (Porter et al., 2004).

Michael Porter's analysis of the economic performance of US Economic Areas is based on three core indicators, namely *wages, employment growth and patenting intensity*. In a follow-up study on rural U.S. regions (Porter et al., 2004) he proposed some additional indicators.

Figure 1 shows the indicators of regional economic performance according to Michael Porter's framework. The results of the three core indicators for the Swiss cantons are presented below. Data for the additional indicators is provided in the Appendix (Appendix Figure 1-6).

Figure 1: Indicators of Economic Performance



Source : Adapted on the basis of Porter, M. E., Ketels, C., Miller, K. & Bryden, R. (2004). *Competitiveness in Rural U.S. Regions : Learning and Research Agenda*. Boston. & Porter, M. E. (2003). The Economic Performance of Regions. *Regional Studies*. No 37, 6&7.

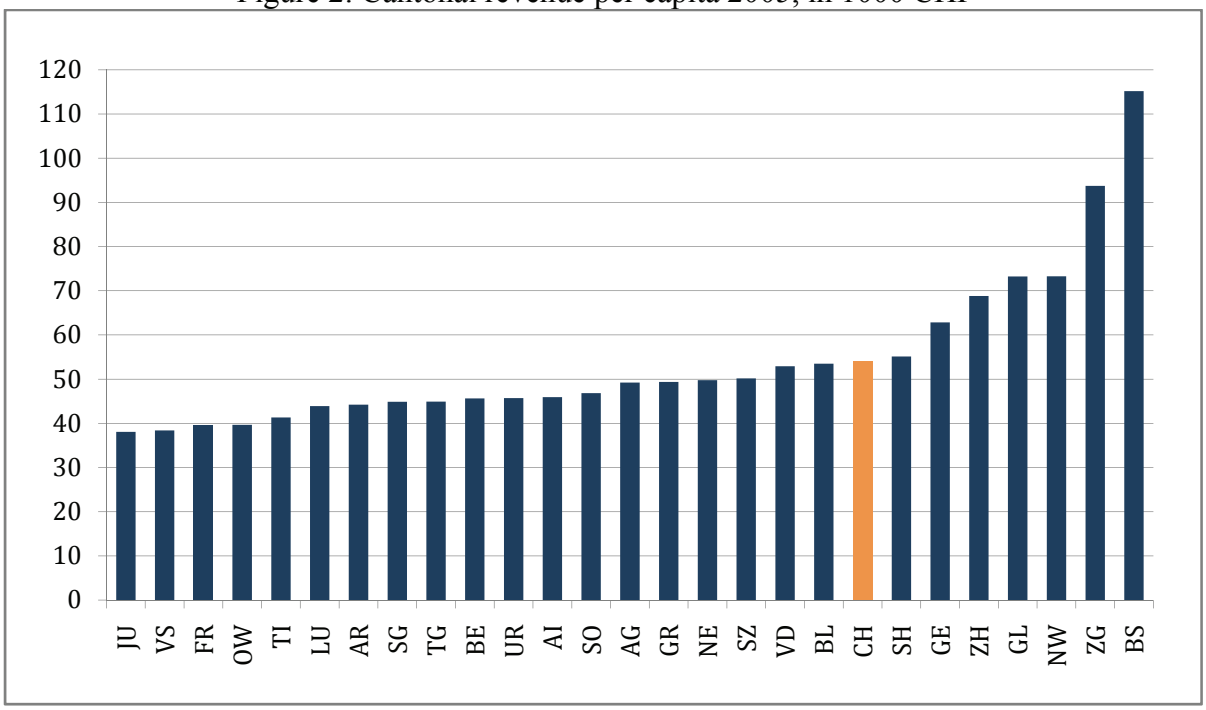
The most recent *cantonal revenues per capita* (2005) are presented in Figure 2. The average per capita revenue in Switzerland was 54'000 CHF in 2005. There is a striking variation in per capita revenues among the 26 cantons, ranging from 115'000 CHF in Basel-City to 38'000 CHF in Jura. Likewise, Basel-City experienced the highest compound annual growth rate (CAGR)[2] in per capita revenue from 2000-2005 (7.29%) whereas the average CAGR was 1.46% and three cantons (AI, SZ, AR) experienced a revenue decrease in the same period (see Figure 3).

[2] The compound annual growth rate (CAGR) is defined as follows:

$$CAGR = \left(\frac{X(t)}{X(t_0)}\right)^{\frac{1}{n}} - 1$$

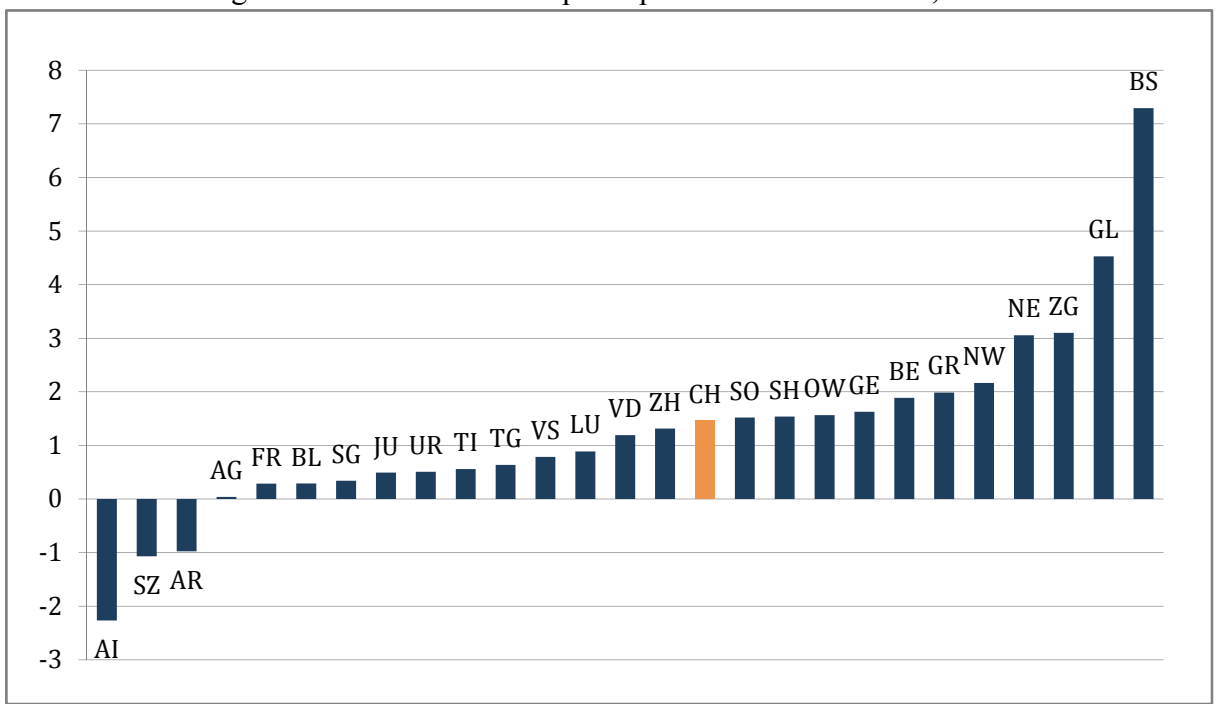
with $X(t)$= final value, $X(t_0)$ = initial value and n = number of years between the vertices.

Figure 2: Cantonal revenue per capita 2005, in 1000 CHF



Source : Personal elaboration on the basis of data from FSO. (2008). *Revenus cantonaux selon les bénéficiaires.*

Figure 3: Cantonal revenue per capita CAGR 2000-2005, in %



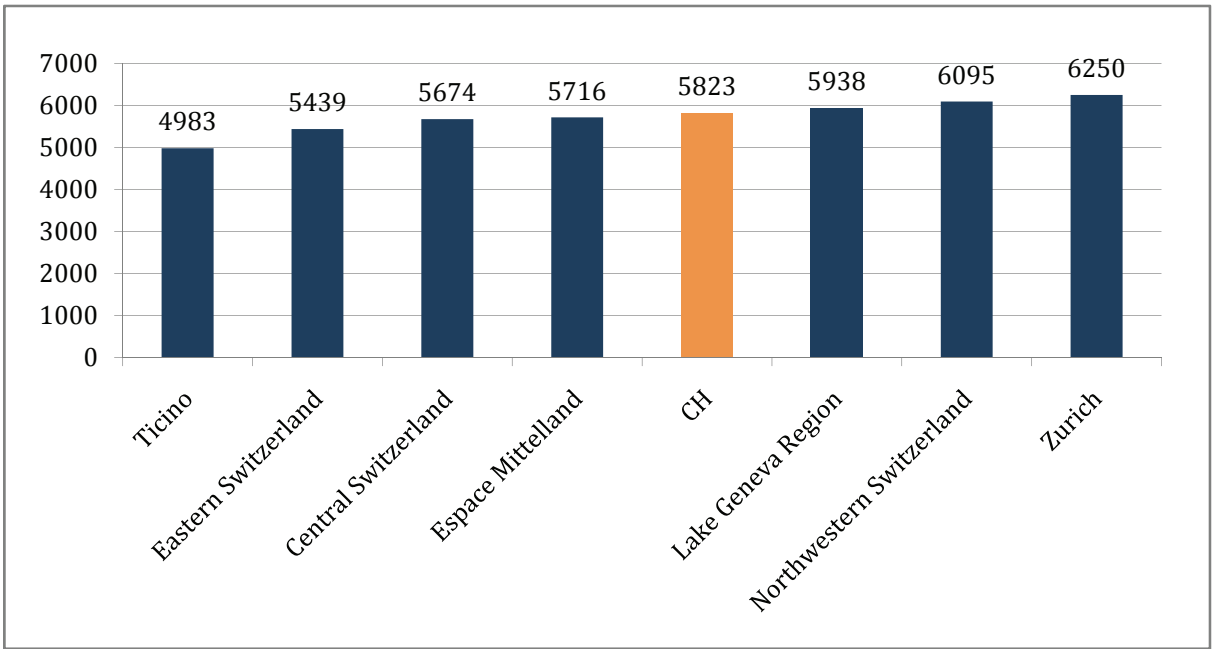
Source : Personal elaboration on the basis of data from FSO. (2008). *Revenus cantonaux selon les bénéficiaires.*

Within Michael Porter's set of indicators *average wages and wage growth* play a major role. They are assumed to be the most basic measures of a region's economic performance and

most associated with its standard of living (Porter, 2003). Due to Switzerland's small geographical size, comprehensive regional data on wages is difficult to obtain. In most cases, data is only available for the seven Swiss NUTS 2 regions.[3] Moreover, wage data comes from sample surveys. Compared to exhaustive census data, the reliability of sample wage data is frequently disputed in Switzerland.

In 2008, the average median gross monthly wage in Switzerland was 5823 CHF. The highest median wage was observed in the Zurich region (6250 CHF) and the lowest in the Ticino region (4983) (see Figure 4). Over the period 1998-2008 the Swiss regions experienced on average a CAGR of 1.32%. Three regions experienced a below average CAGR: Zurich, wage leader in 2008, on the one hand, and Ticino and Eastern Switzerland on the other (see Figure 5). Regional wage inequality was stable over the 1998-2008 period, with a wage GINI coefficient of 0.045 in both 1998 and 2008. However, the GINI coefficient of intermediate years signalizes an intermittent decrease of regional wage inequality, followed by anew increase since 2006 (GINI 2002: 0.031; GINI 2006: 0.028).

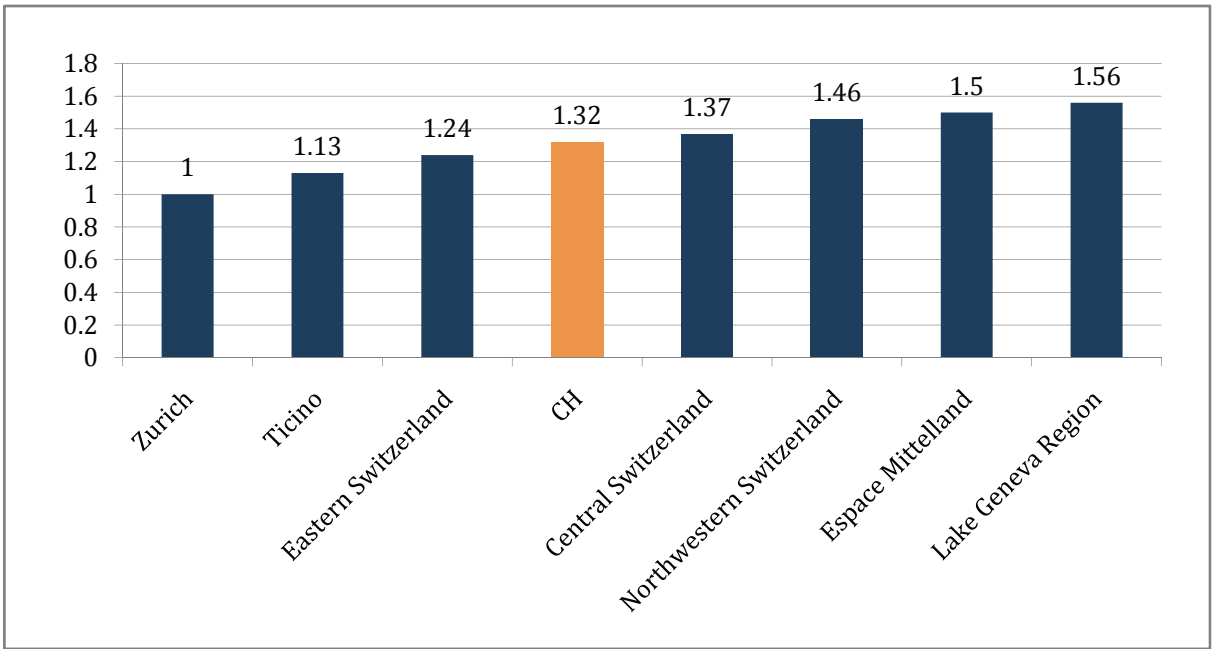
Figure 4: Median gross monthly wage 2008, in CHF



Source: Personal elaboration on the basis of data from FSO. (2008). *Enquête biannuelle sur la structure des salaires 1998, 20000, 2002, 2004, 2006, 2008.*

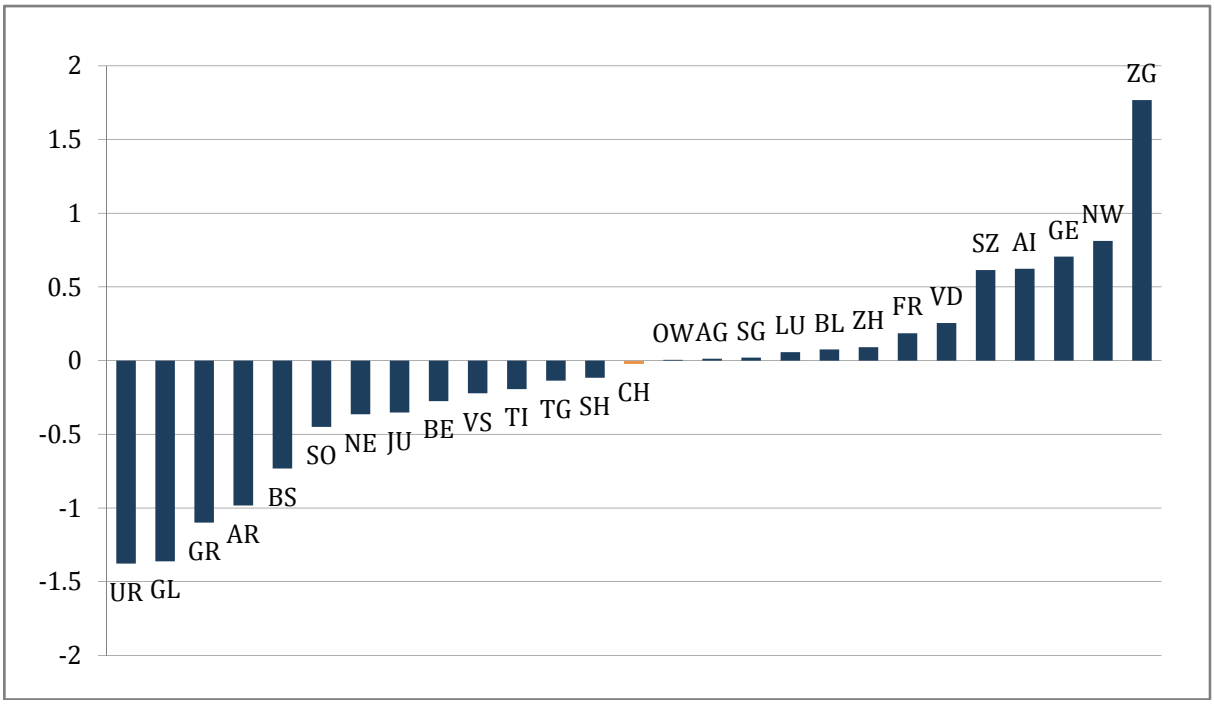
[3] The Swiss cantons correspond to NUTS 3 regions. NUTS 2 regions in Switzerland are composed of 1-7 cantons each: Lake Geneva Region (GE, VD, VS), Espace Mittelland (BE, FR, NE, SO, JU), Northwestern Switzerland (BS, BL, AG), Zurich (ZH), Eastern Switzerland (SH, TG, SG, AI, AR, GL, GR), Central Switzerland (LU, ZG, NW, OW, SZ, UR), Ticino (TI).

Figure 5: Median gross monthly wage CAGR 1998-2008, in %



Source : Personal elaboration on the basis of data from FSO. (2008). *Enquête biannuelle sur la structure des salaires 1998, 20000, 2002, 2004, 2006, 2008.*

Figure 6: Employment CAGR 1995-2005, in %

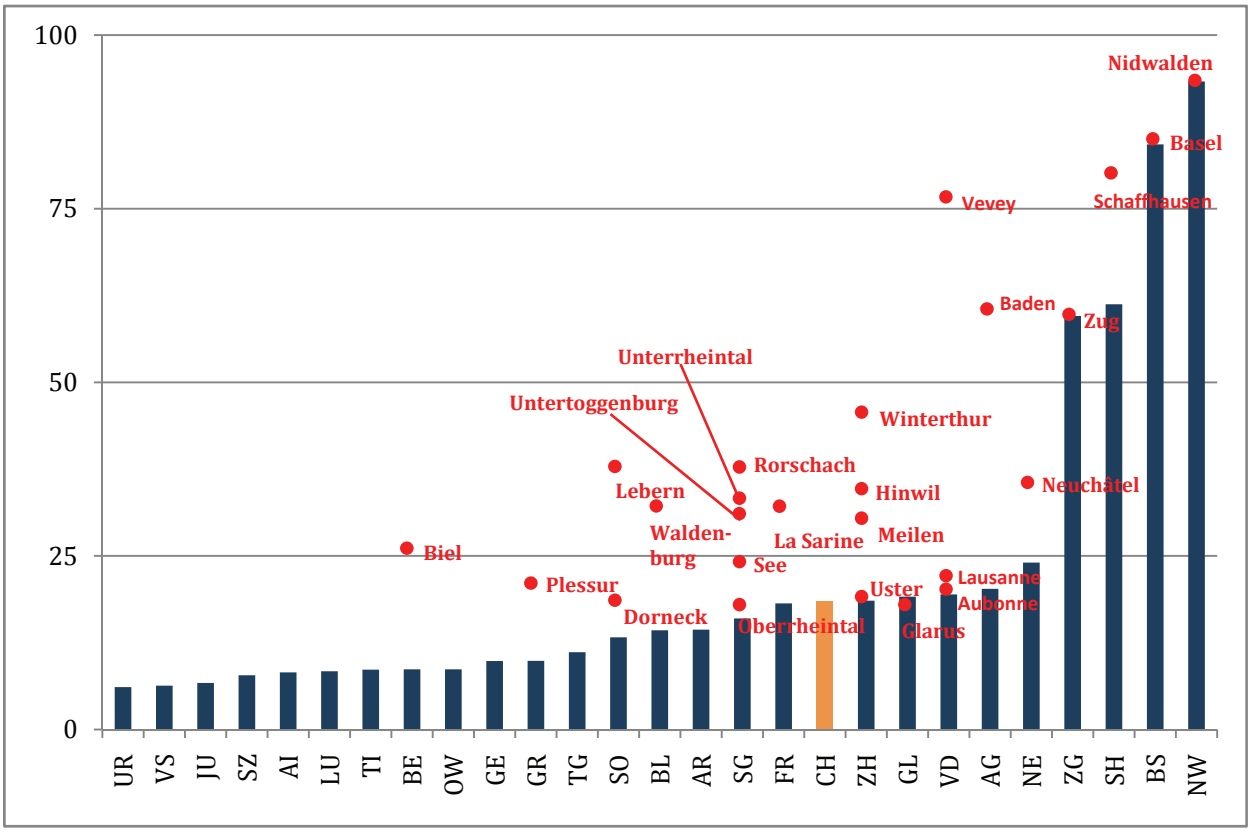


Source : Personal elaboration on the basis of data from FSO. (2008). *Recensement fédéral des entreprises 1995, 2001, 2005.*

Unlike wage data, employment data is available at the cantonal level, stemming from an exhaustive survey. At the national level, *employment growth* over the 1995-2005 period was virtually zero. However, a striking variation across cantons can be observed. Employment CAGR ranged from -1.38% in Uri to +1.77% in Zug.

Patenting intensity, the third core indicator proposed by Michael Porter, is a more forward-looking measure of regional performance and considered to be the best available and comparable measure of innovative activity across regions (Porter, 2003). Since the Federal Statistical Office (FSO) does not publish patent data, we use the OECD REGPAT Database, listing all patent applications to the European Patent Office between 1978-2006. We mapped patents to cantons by assigning each patent to the canton in which the inventor resides. Moreover, we refined the regional division to the level of the 175 Swiss districts in order to get a more precise image of innovation activity in Switzerland (see Figure 7).

Figure 7: Patents per 1000 employees (2005), 1978-2006, cantons and districts

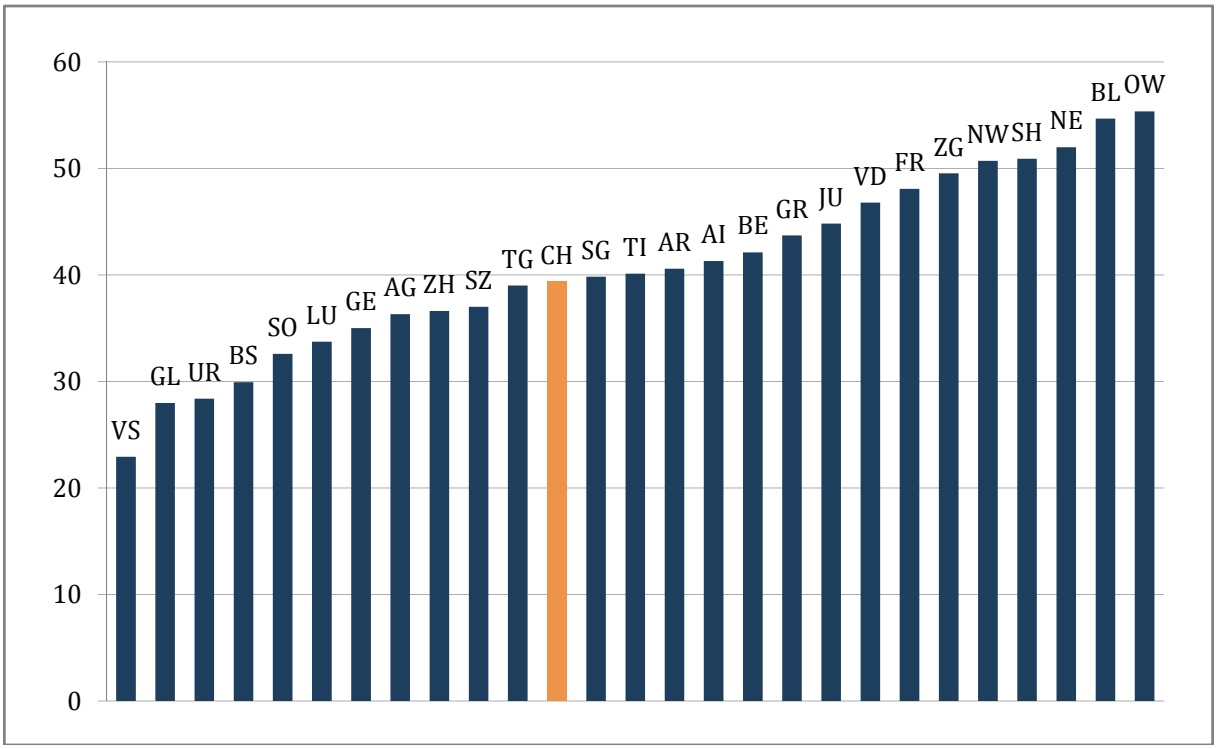


Note: The figure only represents districts with both above-swiss-average and above-cantonal-average patenting intensity.
Source: Personal elaboration on the basis of data from OECD. (2008). *REGPAT Database* et de l'FSO. (2008). *Recensement fédéral des entreprises 1995, 2001, 2005.*

Patenting intensity is measured by patents per 1000 employees over the 1978-2006 period. Again, a striking variation across cantons can be observed. Over the 1978-2006 only 6.11 patents per 1000 employees are assigned to the canton of Uri, whereas the figure for the canton of Nidwalden is 93.31. The same analysis at the level of the 175 Swiss districts reveals some hot spots of patenting intensity. Districts such as Baden (AG), Vevey (VD) or Winterthur (ZH) clearly outperformed their canton's average over the 1978-2006 period.

The 1978-2006 period has finally been fractionned into before and after 2000 in order to examine, for which cantons a good overall result (1978-2006) is driven by recent innovations (patents since 2000) (see Figure 8).

Figure 8: Share of patents since 2000, in %



Source: Personal elaboration on the basis of data from OECD. (2008). *REGPAT Database* et de l'FSO. (2008). *Recensement fédéral des entreprises 1995, 2001, 2005.*

Composition of Cantonal Economies

According to Michael Porter, a part of the variety in economic performance of regions can be explained by the composition of regional economies. He examined the differing types of industries that constitute a regional economy. The concentration patterns of economic activity by industry over regions reveals three different broad categories of industries, with very different patterns of spatial competition and different drivers of locational behaviour (Porter, 2003). These three types of industries are *local industries, resource dependent industries and traded industries*. On the one hand, local industries are those present in most if not all geographical areas, are evenly distributed in space and hence primarily sell locally. Traded or resource dependent industries, on the other hand, are concentrated in a subset of geographical areas and sell to other regions and nations. A further distinction has been made between traded and resource dependent industries. Whereas the latter tend to locate where the needed natural resources are found, traded industries locate in a particular region based on broad competitive considerations (Porter, 2003).

Traded industries are fundamental to prosperity. Michael Porter (2003) provided empirical evidence for the U.S., suggesting that traded industries have higher wages, higher wage growth, higher productivity and higher patenting rates. Moreover, the average level of local wages in a region is strongly associated with the average level of traded wages.

Due to the striking lack of comprehensive regionalized wage data in Switzerland, the paper at hand does not expand in the investigation of such interrelations for the Swiss economy. In the light of the empirical evidence from the U.S. it seems however interesting to separate Swiss industries into local industries, resource dependent industries and traded industries. A particular importance of this decomposition results from the fact that it forms the basis of the detection of clusters (see section “Clusters of Traded Industries”). In fact, traded industries are characterized by an uneven distribution of employment in space and thus likely to be clustered in particular regions.

We abide by the computation strategy proposed by Michael Porter (2003) and utilize the actual distribution of employment by industry to separate Swiss industries into local, traded or resource dependent, using data from 2005.[4] The computation of concentration patterns sets the starting point of the decomposition. The concentration of Swiss industries has been computed in a first step by the means of the locational Gini coefficient, simply defined as the Gini coefficient of the cantonal location quotients (LQ)[5]. The locational Gini coefficient takes on values in [0,1], where a value of zero denotes equal distribution of LQs across cantons and a value of one denotes extreme inequality and thus extreme concentration of the considered industry in a few cantons.

The choice of the locational Gini coefficient as a measure of industry concentration across locations is consistent with international standard and allows for comparability with concentration patterns in other countries (cf. Jayet (1993) in general, Combes et al. (2004) regarding the European Union, Fujita et al. (2004) regarding Japan and China and Holmes et al. (2004) regarding North America). The choice of the cantons as geographical base units has been of practical nature. More detailed geographical divisions would require the use of a concentration measure taking special account of randomness problems, as the Ellison-Glaeser

[4] The computation relies on the most recent exhaustive employment data from the Federal Statistical Office (FSO. (2008). *Recensement fédéral des enterprises 1995, 2001, 2005.*). The used employment data are given in full-time equivalences in each case. They are available for 1995, 2001 and 2005 and in the form of private-only or total-aggregate employment. The provided results in this paper are exclusively based on 2005 total-aggregate employment data with regard to static computations, and based on 1995 and 2005 total-aggregate employment data with regard to dynamic computations. The fundamental computations (industry classification and cantonal key industry computation) have been conducted on the basis of all available data and showed to be robust to changes in the used base year and type of employment.
Data is specified according to the NOGA General Classification of Economic Activities 2002 at a 2-digit level. A more detailed classification could not be implemented for the present report due to the latter's comprehensiveness. However, it could be of great use to conduct further specific research on the basis of a more detailed classification.

[5] The LQ is a ratio of a location's share of industry employment to its share of total employment. Values > 1 indicate that the location has more of its employment in a particular industry than would be predicted based on its total employment share. It can be read as a measure of specialization of a location in a particular industry. The LQ is defined as follows:

$$LQ_{ij} = \frac{Yij}{\sum_{i=1}^{n} Yij} : \frac{\sum_{j=1}^{m} Yij}{\sum_{i=1}^{n}\sum_{j=1}^{m} Yij},$$

Y_{ij} = industry employment in particular geographical area, $\sum_{i=1}^{n} Yij$ = total industry employment (all areas),

$\sum_{j=1}^{m} Yij$ = total employment in particular area, $\sum_{i=1}^{n}\sum_{j=1}^{m} Yij$ =total employment (all areas).

index for example (Holmes et al., 2004). However, such measures rely on employment data at the plant level, which are not available for Switzerland.

Table 1 shows the most and least concentrated Swiss industries according to the locational Gini coefficient.

Table 1: Most and least concentrated Swiss industries

Industry	Locational Gini coefficient 2005	Locational Gini coefficient 1995	Ten year variation
11 Crude petroleum and natural gas	0.92	0.59	+0.33
16 Manufacture of tobacco products	0.88	0.64	+0.25
62 Air transport	0.67	0.61	+0.05
23 Manufacture of coke, refined petroleum	0.62	0.52	+0.10
19 Tanning and dressing of leather;	0.60	0.54	+0.06
17 Manufacture of textiles and textile products	0.53	0.42	+0.11
18 Manufacture of wearing apparel	0.52	0.57	-0.05
61 Water transport	0.51	0.47	+0.04
24 Manufacture of chemicals	0.50	0.60	-0.10
25 Manufacture of rubber and plastic products	0.47	0.40	+0.07
91 Activities of membership organizations n.e.c.	0.15	0.14	+0.01
90 Sewage and refuse disposal, sanitation	0.15	0.19	-0.04
74 Other business activities	0.11	0.11	+0.00
45 Construction	0.11	0.09	+0.02
60 Land transport; transport via pipelines	0.10	0.13	-0.04
50 Sale and repair of motor vehicles	0.09	0.07	+0.02
80 Education	0.08	0.09	0.00
85 Health, veterinary and social work	0.07	0.08	-0.01
52Retail trade	0.06	0.05	+0.01
93 Other service activities	0.05	0.04	+0.01

Source: Personal computation based on data from FSO. (2008). *Recensement fédéral des enterprises 1995, 2001, 2005.*

Two more measures of the variation of industry employment across geography have been added to the locational Gini coefficient: The share of national employment for all cantons with LQ $\geq$ 1 and the mean LQ of the top five cantons ranked by LQ (Porter, 2003). The cutoffs proposed by Porter have been established so as to draw the line between traded or resource dependent industries on the one side, and local industries on the other. The further distinction between traded and resource dependent industries has been made on a purely intuitive basis. The established cutoffs and the results for traded and resource dependent industries are summed up in Table 2.

Table 2: Industry classification

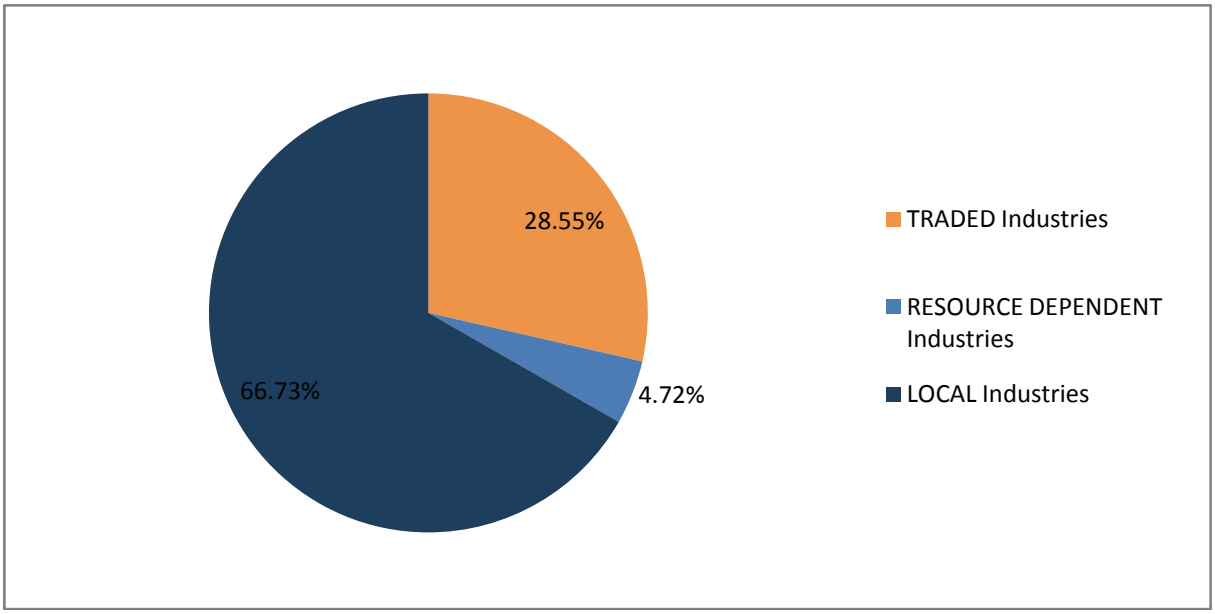
Industry	C1	C2	C3	Classification
01 Agriculture and forestry	☑	☑	☑	RESOURCE DEPENDENT
02 Forestry, logging and related services	☑	☑	☑	RESOURCE DEPENDENT
05 Fishing and fish farming	☑	☑	☑	RESOURCE DEPENDENT
11 Crude petroleum and natural gas	☑	☑	☑	RESOURCE DEPENDENT
14 Other mining and quarrying	☑	☑	☑	RESOURCE DEPENDENT
15 Manufacture of food products and beverages	☑	☑	☑	TRADED
16 Manufacture of tobacco products	☑	☑	☑	TRADED
17 Manufacture of textiles and textile products	☑	☑	☑	TRADED
18 Manufacture of wearing apparel	☑	☑	☑	TRADED
19 Tanning and dressing of leather; manufacture footwear	☑	☑	☑	TRADED
20 Manufacture of wood and of products of wood and cork	☒	☑	☑	TRADED
21 Manufacture of pulp, paper and paper products	☑	☑	☑	TRADED
23 Manufacture of coke and refined petroleum products	☑	☑	☑	TRADED
24 Manufacture of chemicals and chemical products	☑	☑	☑	TRADED
25 Manufacture of rubber and plastic products	☑	☑	☑	TRADED
26 Manufacture of other non-metallic mineral products	☒	☑	☑	TRADED
27 Manufacture of basic metals	☑	☑	☑	TRADED
28 Manufacture of fabricated metal products	☑	☑	☑	TRADED
29 Manufacture of machinery and equipment	☒	☑	☑	TRADED
30 Manufacture of office machinery, data processing devices	☑	☑	☒	TRADED
31 Manufacture of electrical machinery and apparatus	☑	☑	☑	TRADED
32 Manufacture of radio and communication equipment	☑	☑	☑	TRADED
33 Manufacture of precision instruments, watches	☑	☑	☑	TRADED
34 Manufacture of motor vehicles, trailers and semi-trailers	☑	☑	☑	TRADED
35 Manufacture of other transport equipment	☑	☑	☑	TRADED
36 Manufacture of furniture, jewellery and other goods	☒	☑	☑	TRADED
37 Recycling	☑	☑	☑	TRADED
40 Electricity, gas, steam and hot water supply	☒	☑	☑	TRADED
41 Collection, purification and distribution of water	☑	☑	☒	RESOURCE DEPENDENT
55 Hotels and restaurants	☒	☑	☑	TRADED
61 Water transport	☑	☑	☑	RESOURCE DEPENDENT
62 Air transport	☑	☑	☑	RESOURCE DEPENDENT
65 Monetary intermediation	☑	☑	☒	TRADED
67 Activities auxiliary to financial intermediation	☒	☑	☑	TRADED
73 Research and development	☑	☑	☑	TRADED

Note: Criterion 1 (C1): Locational Gini coefficient ≥ 0.3.
Criterion 2 (C2): Industry employment in Cantons with LQ ≥ 1 of ≥ 50% of total industry employment.
Criterion 3 (C3): Mean LQ of the top five Cantons ≥ 2.

Source: Personal computation based on data from FSO. (2008). *Recensement fédéral des enterprises 1995, 2001, 2005.*

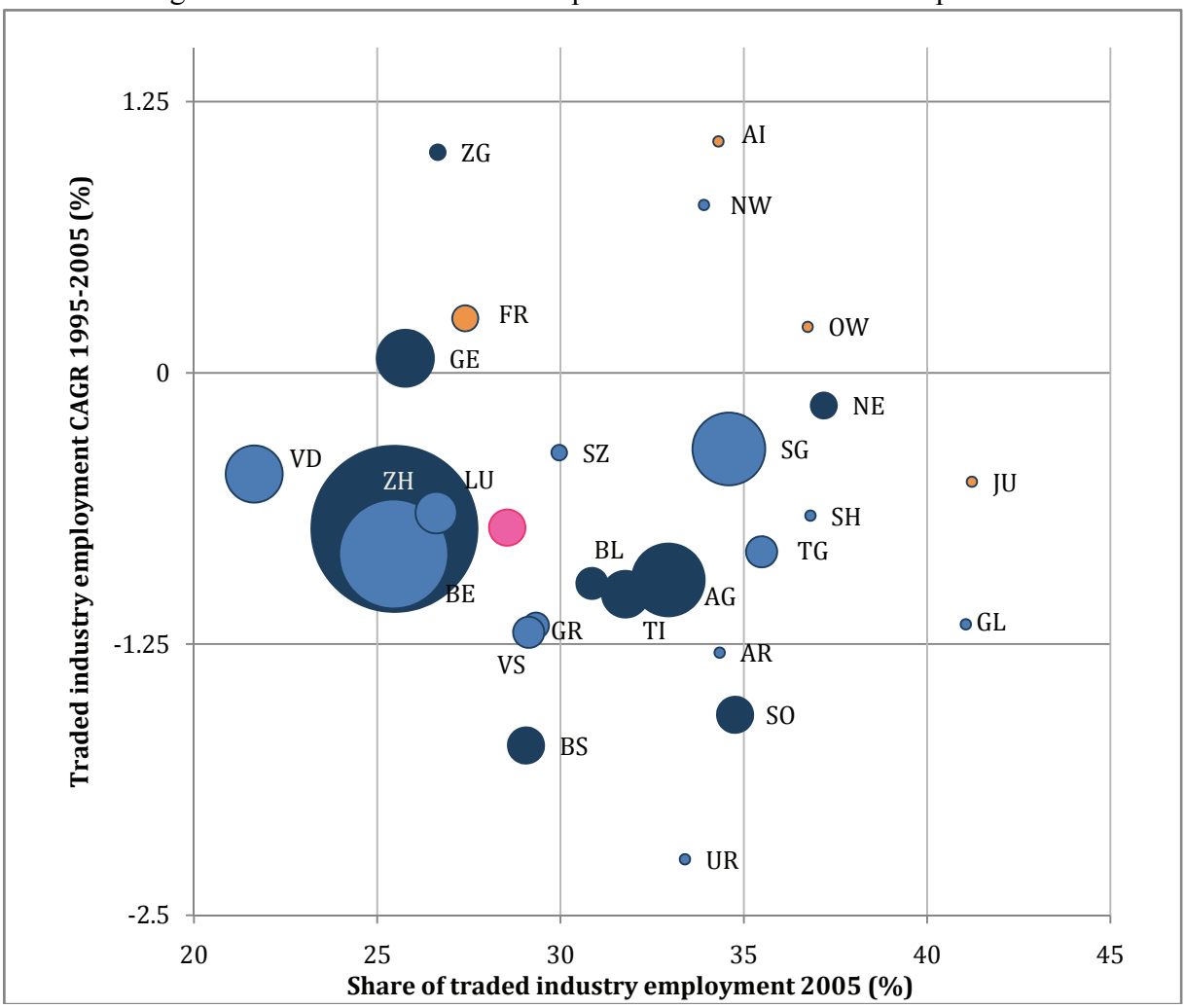
Figure 9 shows the composition of the Swiss economy in terms of traded, resource dependent and local industry employment. With 67 % in local, 28 % in traded and 5 % in resource dependent industries the outcomes for Swiss employment are comparable to the results for U.S. employment (cf. Porter et. al, 2004). However, the composition of the economy varies markedly between cantons. Figure 10 gives a comprehensive picture of the composition of cantonal economies. The figure draws a profile for each canton with respect to total traded employment, share of traded employment, CAGR of traded employment and total resource dependent employment. There is no noticeable relationship between the share of traded industry employment and traded industry employment CAGR. However, some patterns stand out. The top five cantons in terms of traded industry employment CAGR (AI, ZG, NW, FR, OW) are cantons with comparatively low total traded employment and three of them belong to the 1st tercile of cantons ordered by share of resource dependent employment. All the cantons belonging to this 1st tercile have a below-average patenting intensity for the 1978-2006 period. Moreover, it is observable that the two biggest cantons in terms of population (ZH, BE) have fairly similar profiles and are close to the average Swiss profile. The two mountainous cantons in the south of Switzerland (GR, VS) have similar profiles as well.

Figure 9: Composition of the Swiss economy



Source: Personal computation based on data from FSO. (2008). *Recensement fédéral des enterprises 1995, 2001, 2005.*

Figure 10: Traded and resource dependent industries: Cantonal profiles



Notes: The bubble size represents the Canton's total traded industry employment.
: 1st tercile of Cantons ordered by share of resource dependent employment.
: 2nd tercile of Cantons ordered by share of resource dependent employment.
: 3rd tercile of Cantons ordered by share of resource dependent employment.
: CH average

Source: Personal computation based on data from FSO. (2008). *Recensement fédéral des enterprises 1995, 2001, 2005.*

Clusters of Traded Industries

Spatial agglomeration of economic activities has caught the imagination of scholars and policy makers for years. Since the late 1980s spatial issues have experienced a renaissance within economics. Authors such as Allen Scott (1988), Michael Porter (1990) and Paul Krugman (1991) laid the foundations for a comprehensive economic analysis of potential efficiency benefits of industrial clustering. In the course of what is now known as the "New Economic Geography", industrial clusters have become a well-established concept in various fields of economic theory.

According to Michael Porter, the presence of clusters, or geographic concentrations of linked industries (Porter, 2003) is one of the most striking features of regional economies. Porter defines clusters as "a geographically proximate group of interconnected companies, suppliers, service providers and associated institutions in a particular field, linked by externalities of various types" (Porter, 2003). Academic researches and empirical evidences have showed that clusters enhance regional competitiveness as they increase productivity and efficiency, boost innovation and favor the attraction of new firms and start-ups (Porter, 1998). Hence, it is an integral part of the analysis of regional economic performance to detect clusters.

The basic approach of cluster-mapping goes back to Porter's seminal work on economic clusters (1990) and his systematic identification of clusters in the U.S. (Rosenthal, 2004). The U.S. cluster-mapping project is the most comprehensive of its kind and forms at the same time the basis of the European Cluster Observatory's, the second important cluster-mapping project in the world covering also Switzerland.

The elementary strategy of the U.S. cluster-mapping project, its adoption by the European Cluster Observatory and the results for the Swiss regions are briefly described as follows. In a first step of the project, concentration patterns of U.S. industry employment have been computed. On this basis, all industries in the economy have been separated into "traded or resource dependent" and "local" industries, with the aim of identifying a restricted subset of industries characterized by an uneven distribution of employment in space (traded industries) and thus likely to be clustered in particular regions (see section "Composition of Cantonal Economies"). It is among this last class of industries that clusters have been identified, using localization correlation of industries across geographical areas (Porter, 2003). Conjointly

clustering industries have been deduced from generally observed industry-interlinkages to form what is called a "cluster definition". Overall, the U.S. cluster-mapping project has identified 41 of such cluster definitions (http://data.isc.hbs.edu/isc/). Finally specific regions with an over-average employment proportion in a particular cluster have been identified using a measure of regional specialization (location quotients, LQ).

The strategy of the U.S. cluster-mapping project has been adopted by the European Cluster Observatory to establish a cluster-mapping for the European Union, covering also Switzerland (www.clusterobservatory.eu). Two main difficulties have come up during this procedure. First, the methodology used to identify localization correlations in the U.S. has exploited unique characteristics of the U.S. economy, which is by far the largest economy in the world, in which virtually every industry and cluster is present, and which consists of a large number of distinct but interrelated regions. Such a methodology is not feasible in any other country (Porter, 2003). Therefore, the European Cluster Observatory has decided to adopt the pre-defined cluster definitions of the U.S. cluster-mapping project. This has led to the second difficulty, consisting of harmonizing the European employment data to a classification level that can be matched with the U.S. cluster definitions (DG Enterprise and Industry Report, 2007).

Table 3 sums up the *top 15 clusters* as they result from the mapping for Switzerland of the European Cluster Observatory. Although the adopted strategy of the European Cluster Observatory is comprehensible for a cluster-mapping project of such an extent, it offers the possibility to propose complementary approaches for a small country like Switzerland. Two potential problems are closely associated with the approach of the European Cluster Observatory.

On the one hand, adopting pre-defined cluster definitions is problematic in two respects: First, even if pre-defined definitions are well-matched to the conditions in the country where they were developed, they are suspicious to underestimate the possibility of unique clustered industry combinations in any other region. Secondly, pre-defined cluster definitions are based on the computation of concentration patterns in a particular country (U.S. in this case). However, it is perfectly conceivable that an industry tends to cluster in a given economy, but not in another.

Table 3: Swiss cluster-mapping of the European Cluster Observatory

Cluster	Region	Employees	Specialisation
Finance	Zürich	93 572	3.19
Transportation	Espace Mittelland	59 677	2.10
Metal	Espace Mittelland	52 310	2.88
IT	Zürich	23 685	2.80
Biopharma	Nordwestschweiz	21 741	8.88
Production Tech.	Ostschweiz	12 367	2.22
Production Tech.	Zentralschweiz	8 569	2.15
Chemical	Nordwestschweiz	8 549	2.98
Medical	Espace Mittelland	6 317	3.06
Power	Nordwestschweiz	5 952	3.76
Hospitality	Ticino	5 675	2.01
Instruments	Zürich	5 362	2.43
Tobacco	Espace Mittelland	2 151	6.23
Finance	Région lémanique	35 549	1.53
Transportation	Zürich	25 399	1.00

Note: Specialization is measured by the LQ.
Source: DG Enterprise and Industry Report. (2007). *Innovation Clusters In Europe: A Statistical Analysis and Overview of Current Policy Support.*

On the other hand, a need for differentiation from the cluster-mapping of the European Cluster Observatory results from a closer examination of its outcomes for Switzerland. Obviously, the data of the European Cluster Observatory have been processed on a rough regional division level. The whole cluster-mapping is conducted on the basis of NUTS 2 regions. The lines of the border of such regions are to a high degree arbitrary and do rarely correspond to the actual extent of a cluster. The results for Switzerland leave much to be desired with respect to this problem.[6] No information is obtainable to detect whether the indicated cluster is of major importance for the whole covered NUTS 2 region or only for a few municipalities. Spatial connections are not visible; an indicated cluster could be composed of many neighboring locations across, but as well of two isolated locations at the extremities of the region. In addition, clusters of minor extent are likely to be overlooked if they are located in a NUTS 2 region with an aggregate specialization differing heavily from the cluster. Practitioners aiming at detecting the precise location of a cluster to design a cluster initiative are left without advice. The indicated tobacco cluster in the Espace

[6] Presumably, the situation for other countries is not less problematic. In the extreme case of Ireland no regional division is made at all. All the identified clusters appear thus to be located in the country as a whole (DG Enterprise and Industry Report, 2007).

Mittelland region sets a striking example of these shortcomings. What appears as an important cluster in one of the biggest Swiss NUTS 2 regions turns in reality out to be limited to a few highly specialized isolated municipalities.

In response to the aforementioned problems, the Center for Competitiveness of the University of Fribourg, Switzerland, has developed an empirical strategy to compute a complementary, theoretically and practically funded database on Swiss clusters, using employment data from 2005[7] (Keller, 2009). The concepts and some results of the Center for Competitiveness' cluster-mapping project are described below.

The following six objectives for a Swiss cluster-mapping project have been defined:

> ***Objective 1*:** Capture geographical patterns of industry location in Switzerland, in consideration of the actual economic concentration patterns and industry interlinkages.
> ***Objective 2*:** Capture geographical patterns of industry location in Switzerland, in consideration of the potential for future clusters and cluster initiatives.
> ***Objective 3*:** Abide by the elementary strategy of the U.S. cluster-mapping project and the European Cluster Observatory to allow for comparability.
> ***Objectives 4 & 5:*** Provide own cluster definitions based on concentration patterns characteristic of the actual situation in Switzerland to allow for unique industry interlinkages on the one hand, and to avoid considering industries, which do not cluster in actual fact in Switzerland.
> ***Objective 6:*** Geographical precision to capture the actual extent, the spatial connections and the precise localization of Swiss clusters.

In order to achieve these objectives, the adopted computation strategy has been a multi-level one. Beginning with *preliminary computations* to detect concentration patterns and to identify clustering industries (see section "Composition of Cantonal Economies") the strategy has introduced the notion of *cantonal key industries* with a view to finally establishing two complementary and interconnected levels of cluster definitions; *broad cantonal cluster definitions* on the one hand, allowing for unique industry interlinkages, and *narrow cross-border cluster definitions* on the other, focusing on maximal geographical precision.

[7] Cf. Footnote 4

Cantonal key industries are those of pre-eminent importance for a canton in terms of specialization (LQs). In practice, all the traded industries, for which a canton has a LQ ≥ 1.5 have been classified as cantonal key industries under the condition that they account for a minimum of 500 jobs in the canton. In addition, industries have been added, for which a canton has at the same time a LQ ≥ 1 and a CAGR exceeding the Swiss average. The minimum employment condition has been dropped for industries with less than 10000 total jobs in favor of a minimum condition proportional to total industry employment. A list showing all key industries by canton is provided in the Appendix.

Broad cantonal cluster definitions have then been construed for each canton individually around its key industries (note that not only key industries are considered, but also other industries, including local industries). This approach is designed to a major degree to fit the analysis of potential future clusters. The strengths of a canton in terms of its industry structure can form the basis of a well-designed cluster initiative. In practice, the establishment of such broad cantonal cluster definitions requires in-depth case-study knowledge of all the cantonal economies. An example of such a broad cantonal cluster definition analysis is presented in Figure 7. The example stems from a report of the Center for Competitiveness on the competitiveness of Fribourg's economy and has been designed on the basis of different earlier case-studies and reports (Direction de l'économie et de l'emploi, 2008; RIS-WS, 2007; Kleinewefers, 2004; Innosphere GmbH, 2003; Service de Statistique FR, 2000; Gaudard, 1999; Gaudard et al., 1996).

Given the focus on cluster initiatives, the broad cantonal cluster definitions leave much to be desired with respect to the actual detection of existing clusters. Moreover, the arbitrary lines of the cantonal borders contravene the requirement for geographical precision. In order to provide a precise cross-border mapping of actual cluster occurrence, the broad individual cluster definitions have thus to be dropped in favor of countrywide-valid cluster definitions. In order to establish *narrow cross-border cluster definitions* key industry co-location has been studied at the level of the 175 Swiss districts. The impossibility of a systematic correlation analysis (Porter, 2003) has been bypassed by a simple intuitive approach. Frequent pairs of industries at the district level have been shortlisted for countrywide-valid cluster definitions. All of the shortlisted industry pairs have been tested for thematic fit, whereof eight have eventually been proposed as potential cross-border cluster definitions. A further distinction has been made with respect to the industry-scope of the proposed cluster definitions. For five

combinations, it has been assessed that the covered industry-scope of the definition exceeds the desired extent for the cluster mapping. These extended clusters have to be kept in mind for more detailed future research. The remaining industry combinations have been fixed as *narrow cross-border cluster definitions* (Table 4). In addition to the newly formed definitions, all the other traded key industries have been fixed individually as narrow cross-border cluster definitions. Finally, concise cluster denominations have been given to all the narrow cross-border cluster definitions. Table 5 presents the definite narrow cross-border cluster definitions.

Table 4: Potential cross-border cluster definitions

Frequent industry pairs at the district level	Potential cluster definitions
27 Basic metals / 28 Metal Products	Metal clusters
28 Metal products / 29 Machinery	Extended clusters: Metal - Machinery
28 Metal products / 31 Electrical machinery	Extended clusters: Metal – Electrical machinery
27 Basic metals / 32 Communication equipment	Extended clusters: Metal – Electronics
28 Metal products / 32 Communication equipment	Extended clusters: Metal – Electronics
29 Machinery / 32 Communication equipment	Extended clusters: Machinery – Electronics
31 Electrical machinery / 32 Communication equipment	Electronics / Electrical machinery clusters
65 Monetary intermediation / 67 Auxiliary activities	Financial clusters

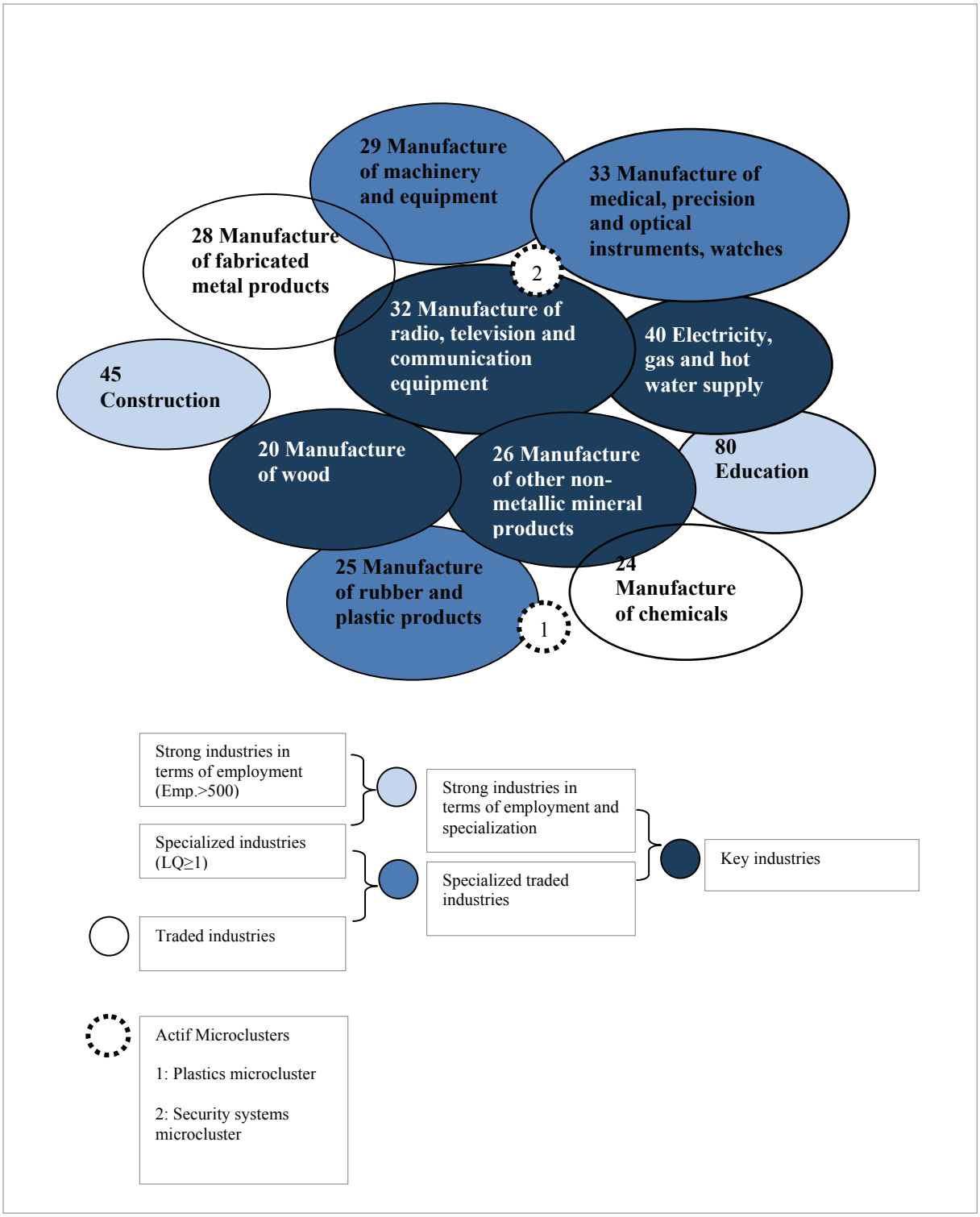
Source: Personal elaboration.

Table 5: Narrow cross-border cluster definitions

Clusters	Industries
Tourism clusters	55 Hotels and restaurants
Financial clusters	65 Monetary intermediation / 67 Auxiliary activities
Machinery clusters	29 Machinery and equipment
Metal clusters	27 Basic metals / 28 Metal Products
Watches / Precision instrument clusters	33 Manufacture of precision instruments, watches
Chemical clusters	24 Manufacture of chemicals and chemical products
Food / Beverage clusters	15 Manufacture of food products and beverages
Electronics / Electrical machinery clusters	31 Electrical machinery / 32 Communication equipment
Wood clusters	20 Manufacture of wood and of products of wood
Plastics / Rubber clusters	25 Manufacture of rubber and plastic products
Electricity / Gas clusters	40 Electricity, gas, steam and hot water supply
Glass / Cement clusters	26 Manufacture of other non-metallic mineral products
Research clusters	73 Research and development
Other vehicle clusters	35 Manufacture of other transport equipment
Paper / Pulp clusters	21 Manufacture of pulp, paper and paper products
Textile clusters	17 Manufacture of textiles and textile products
Apparel clusters	18 Manufacture of wearing apparel
Motor vehicle clusters	34 Manufacture of motor vehicles and trailers
Recycling clusters	37 Recycling
Tobacco clusters	16 Manufacture of tobacco products
Footwear / Leather clusters	19 Tanning and dressing of leather; manufacture footwear
Office machinery and data processing device clusters	30 Manufacture of office machinery, data processing devices
Petroleum and coke clusters	23 Manufacture of coke and refined petroleum products

Source: Personal elaboration.

Figure 11: Example of a broad cluster definition analysis: Cleantech cluster Fribourg



Source: Personal elaboration on the basis of Gugler, P., Keller, M. & Tinguely, X. (2008). *Compétitivité de l'économie fribourgeoise.*

On the basis of the narrow cross-border cluster definitions *cluster-maps* have been elaborated for each cluster. The clusters have been described in three main dimensions: First, they have been assessed with respect to *employment and concentration (measured by locational Gini coefficient) on the basis of data from 2005*. Secondly, *tendencies* for these two criterions have been pointed out *on the basis of data covering the period 1995-2005*. Thirdly, the maps have enabled the *geographic identification of specific cluster regions*.

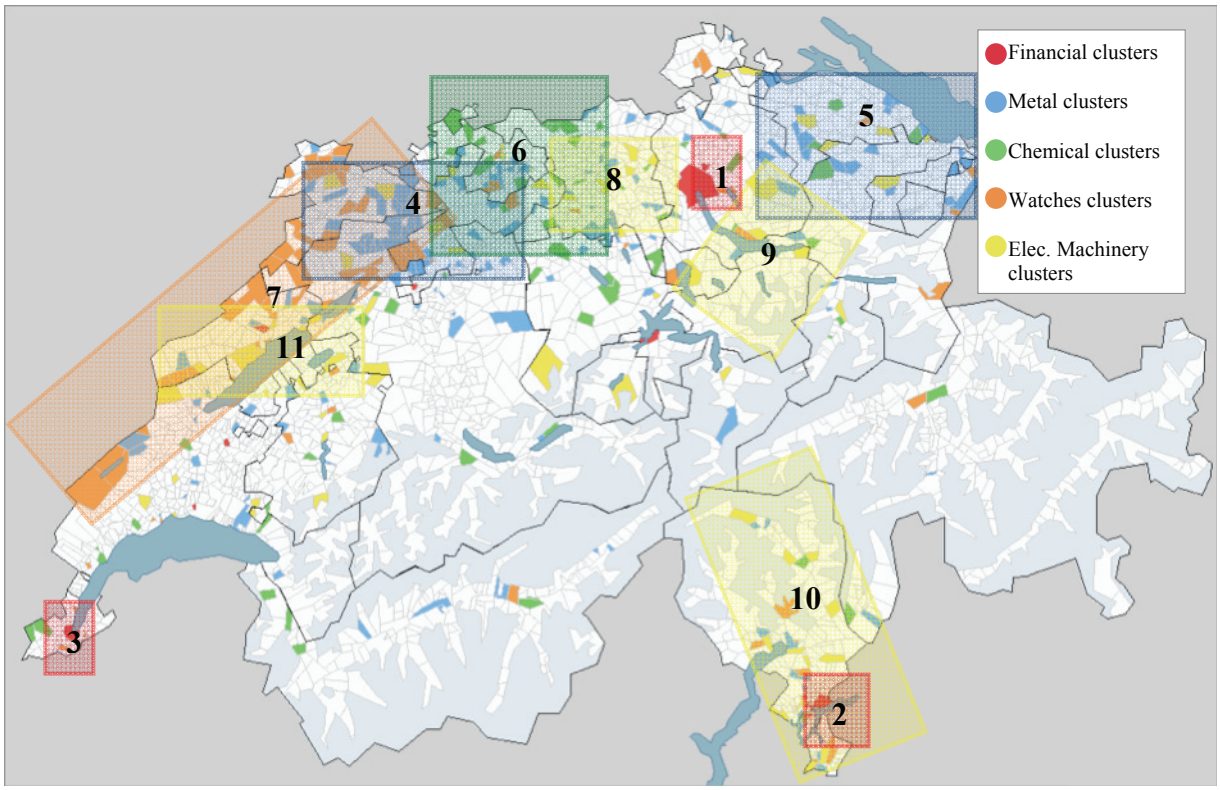
Three categories of outstanding clusters have been derived from the clusters' *characteristics with respect to employment and concentration*. *Main clusters,* ranking high with respect to both employment and concentration, *employment intensive clusters*, accounting for an important share of total Swiss cluster employment but being widely dispersed over the Swiss territory, and *specialized clusters* characterized by restricted employment but strong clustering in uniquely specialized regions:

> ***Main clusters:*** *Financial clusters, metal clusters, watches and precision instrument clusters, chemical clusters, electronics and electrical machinery clusters.*
> ***Employment intensive clusters:*** *Tourism clusters, machinery clusters, food and beverage clusters.*
> ***Specialized clusters:*** *Textile clusters, apparel clusters, footwear and leather clusters, tobacco clusters, petroleum and coke clusters.*

A linear extrapolation of the ten-*year tendency 1995-2005* has allowed looking ahead. Given the linear representativeness of the tendency 1995-2005 for the next 20 years*, Swiss clusters will be of increased importance in 2025, in the sense that more cluster industries will rank among one of the categories of outstanding clusters.*

Finally, the cartographic analysis has enabled the *detection of 24 specific cluster regions*. Figures 12-14 graphically sum up these results.

Figure 12: Main clusters, top LQs



Source: Personal computation.

Financial clusters: *1. Financial cluster Zurich.*

2. Financial cluster Lugano.

3. Financial cluster Geneva.

Metal clusters: *4. Metal cluster Northern Jura.*

5. Metal cluster Rheintal / Bodensee / Wil.

Chemical cluster: *6. Chemical cluster Northwestern Switzerland.*

Watches cluster: *7. Watches /precision instrument cluster Jura.*

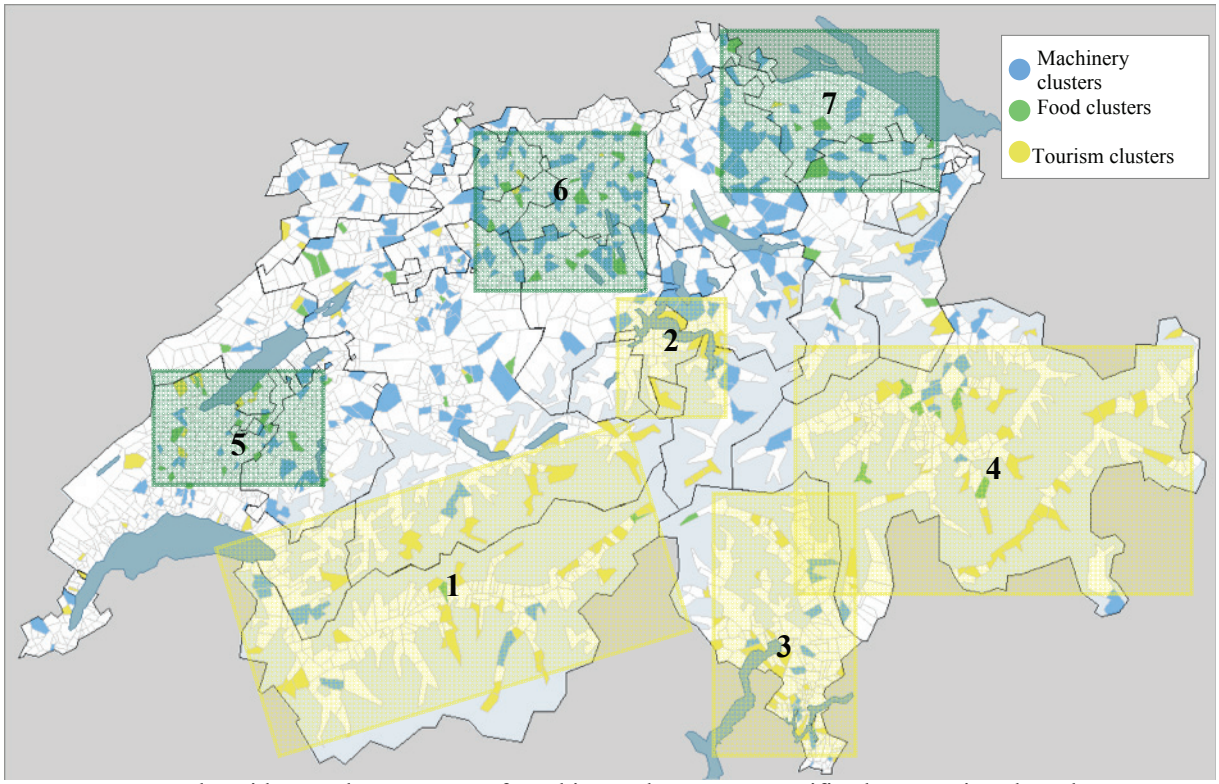
Electronics clusters: *8. Electrical machinery cluster Northern Jura-Südfuss / Central Aargau.*

9. Electrical machinery cluster Zug / Zürichsee / Zürcher Oberland.

10. Electrical machinery cluster Ticino.

11. Electrical machinery cluster Lake Neuchâtel.

Figure 13: Employment intensive clusters, top LQs



Note: Due to the widespread appearance of machinery clusters, no specific cluster regions have been highlighted in this map.
Source: Personal computation.

Tourism clusters:

1. Tourism cluster Valais / Berner Oberland.

2. Tourism cluster Lake Lucerne.

3. Tourism cluster Ticino.

4. Tourism cluster Grisons.

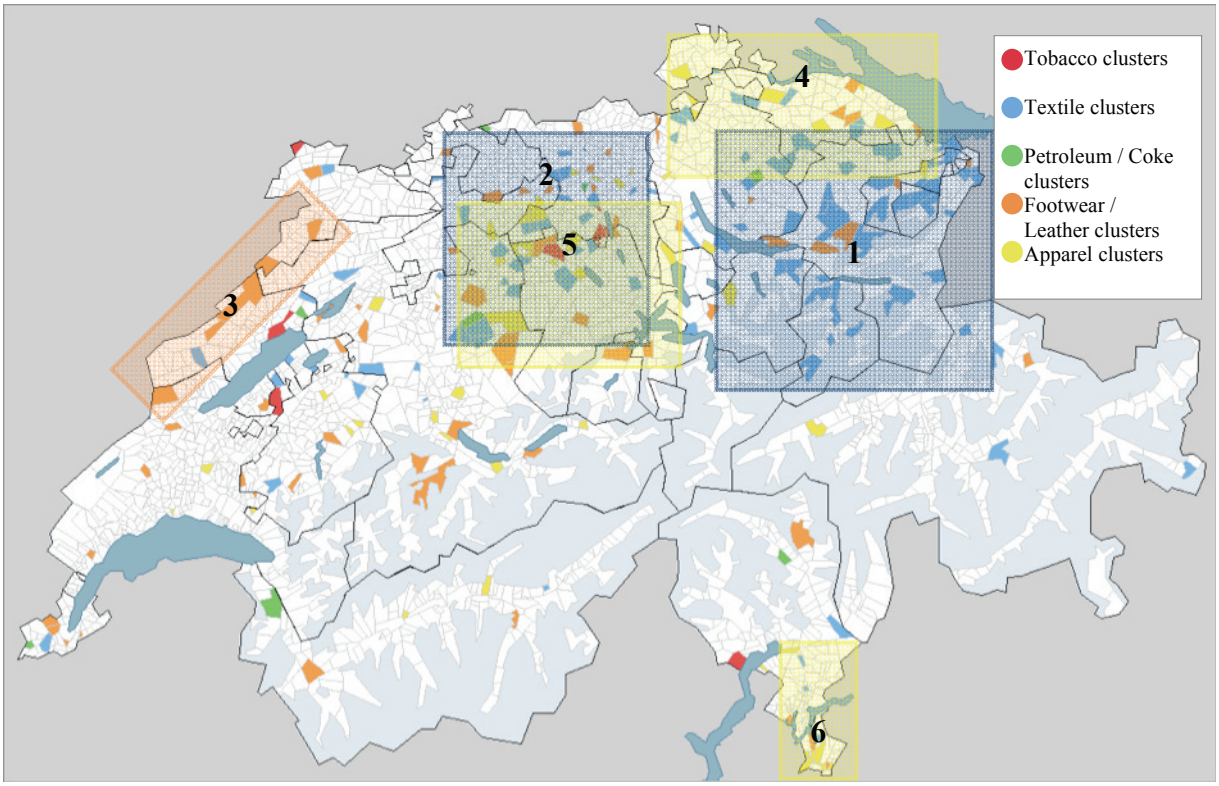
Food clusters:

5. Food cluster Fribourg / Northern Vaud.

6. Food cluster Aargau / Lucerne.

7. Food cluster Notheastern Switzerland.

Figure 14: Specialized clusters, top LQs



Note: Tobacco and petroleum / coke clusters are limited to a few isolated municipalities. Thus, no specific cluster regions are highlighted in this map.
Source: Personal computation.

Textile clusters: *1. Textile cluster Eastern Switzerland.*

2. Textile cluster Aargau / Oberaargau / Lucerne.

Leather cluster: *3. Footwear / Leather cluster Central Jura.*

Apparel clusters: *4. Apparel cluster Northeastern Switzerland.*

5. Apparel cluster Aargau / Oberaargau / Lucerne.

6. Apparel cluster Ticino.

Conclusion

In this paper we have adopted Michael Porter's framework of regional economic performance to examine the regional economies of Switzerland. First, we have presented data on the differences in *cantonal economic performances* according to several indicators. Secondly, we have used data of industry employment across geography to *decompose cantonal economies* into traded, local, and resource-dependent industries. Thirdly we have identified *clusters of traded industries* in Switzerland.

We have found striking variety in the economic performance of Swiss cantons, particularly with respect to *cantonal revenues*, *employment growth* and *patenting intensity*. The composition of the Swiss economy in terms of *traded, resource dependent and local* industry employment is comparable to the results for U.S. employment (cf. Porter et. al, 2004). However, the composition of the economy varies markedly between cantons. In the third section of the paper we have first identified the top 15 clusters of traded industries in Switzerland according to the *cluster-mapping of the European Cluster Observatory*. Secondly, two problems associated with the European Cluster Observatory's approach have been discussed and the Center for Competitiveness' complementary approach has briefly been described. Some results of the *Center for Competitiveness' cluster-mapping project* have been presented, particularly *cantonal key industries, broad cantonal cluster definitions, narrow cross-border cluster definitions* and a list of *specific cluster regions* in Switzerland.

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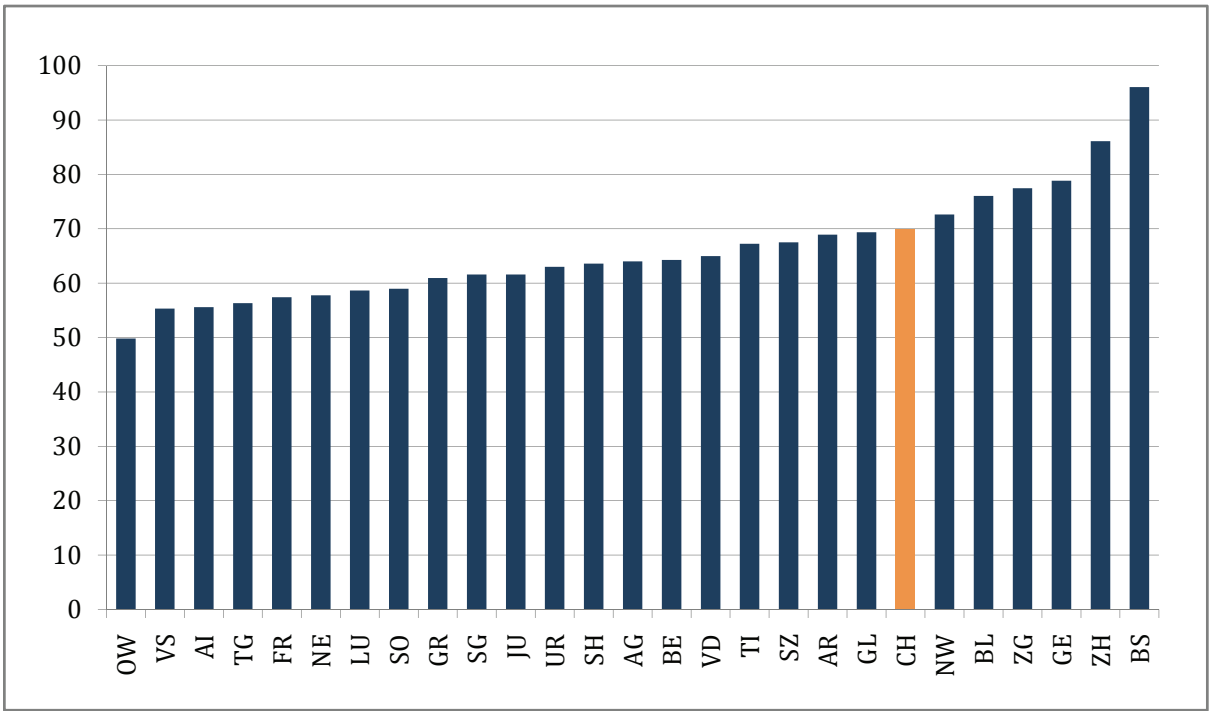
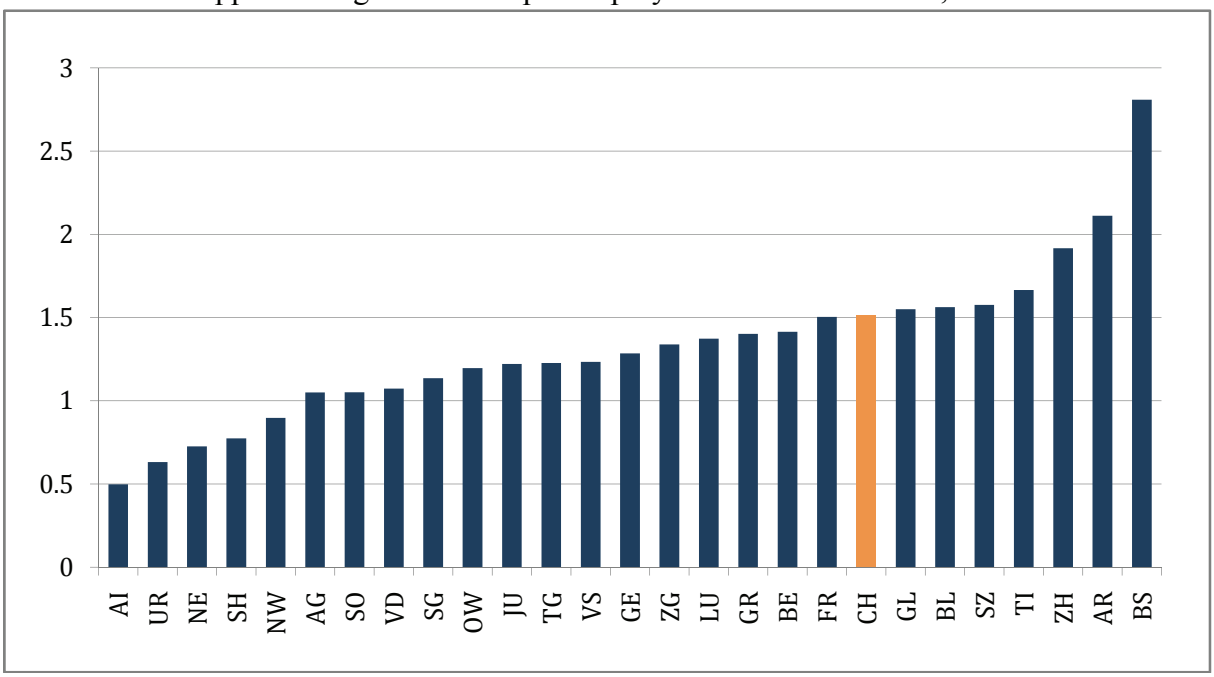
Appendix: Additional Indicators of Regional Economic Performance

Appendix Figure 1: GDP per employee 2005, in1000 USD PPP 1997, 2000 prices



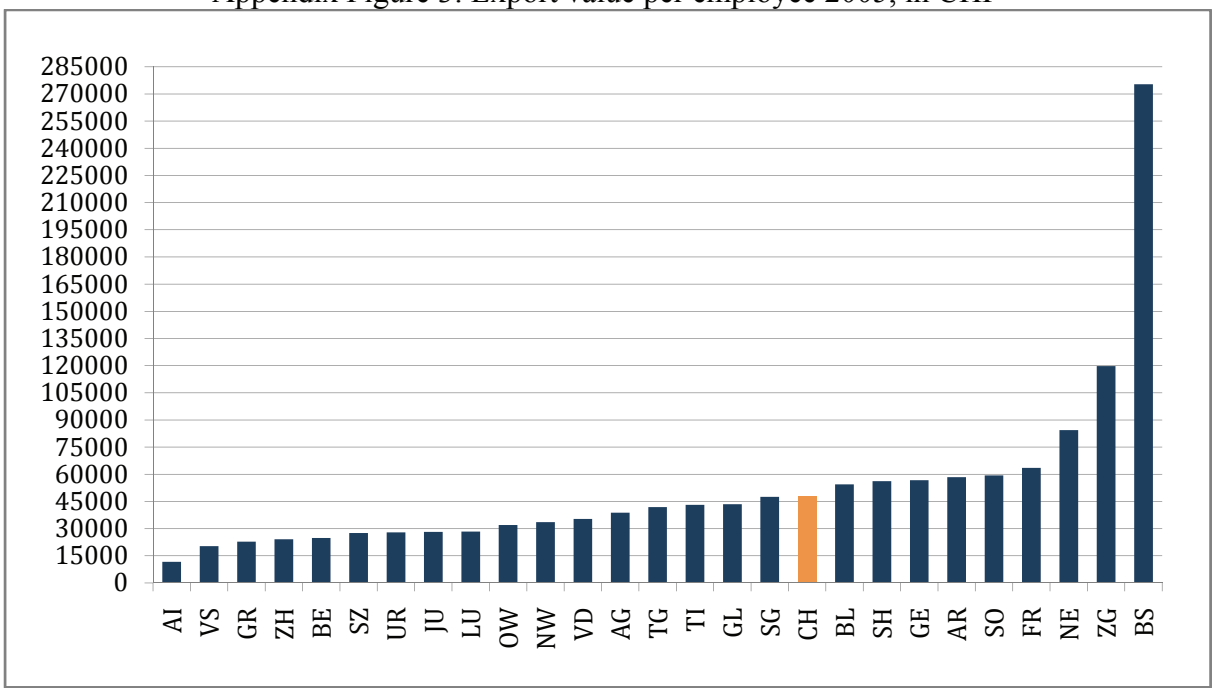
Source : Personal elaboration on the basis of data from BAK. (2009). *International Benchmarking Report 2008.* & FSO. (2008). *Recensement fédéral des entreprises 1995, 2001, 2005.*

Appendix Figure 2: GDP per employee CAGR 1995-2005, in %



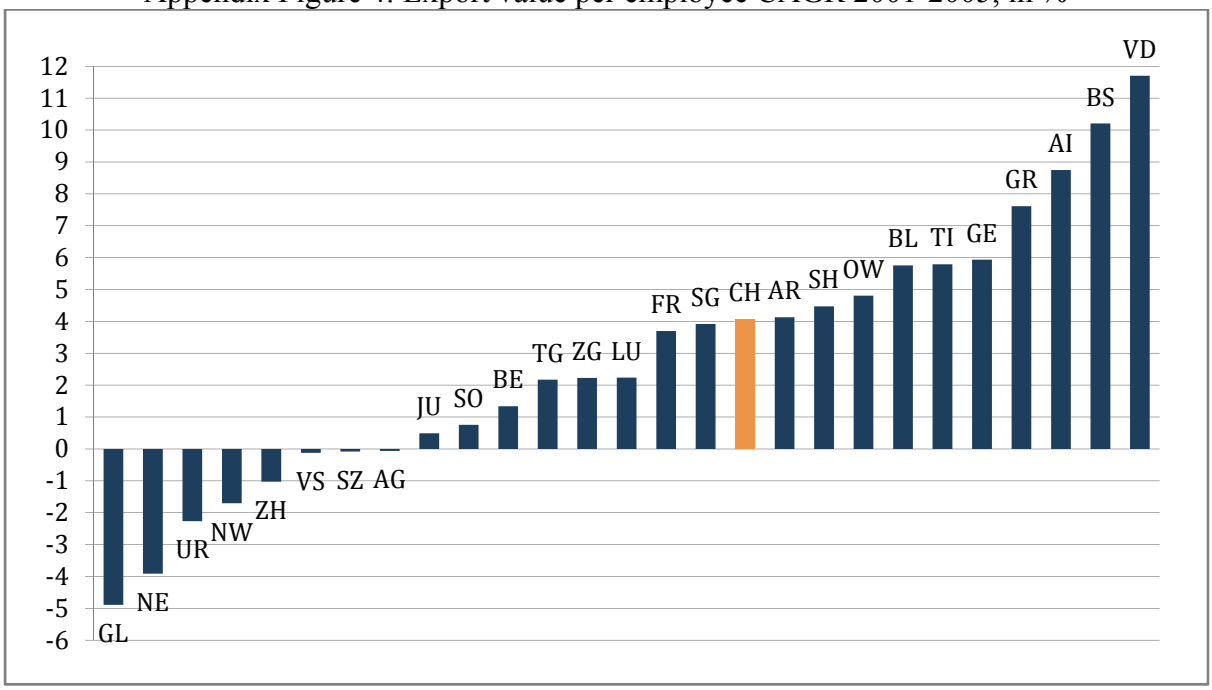
Source : Personal elaboration on the basis of data from BAK. (2009). *International Benchmarking Report 2008.* & FSO. (2008). *Recensement fédéral des entreprises 1995, 2001, 2005.*

Appendix Figure 3: Export value per employee 2005, in CHF



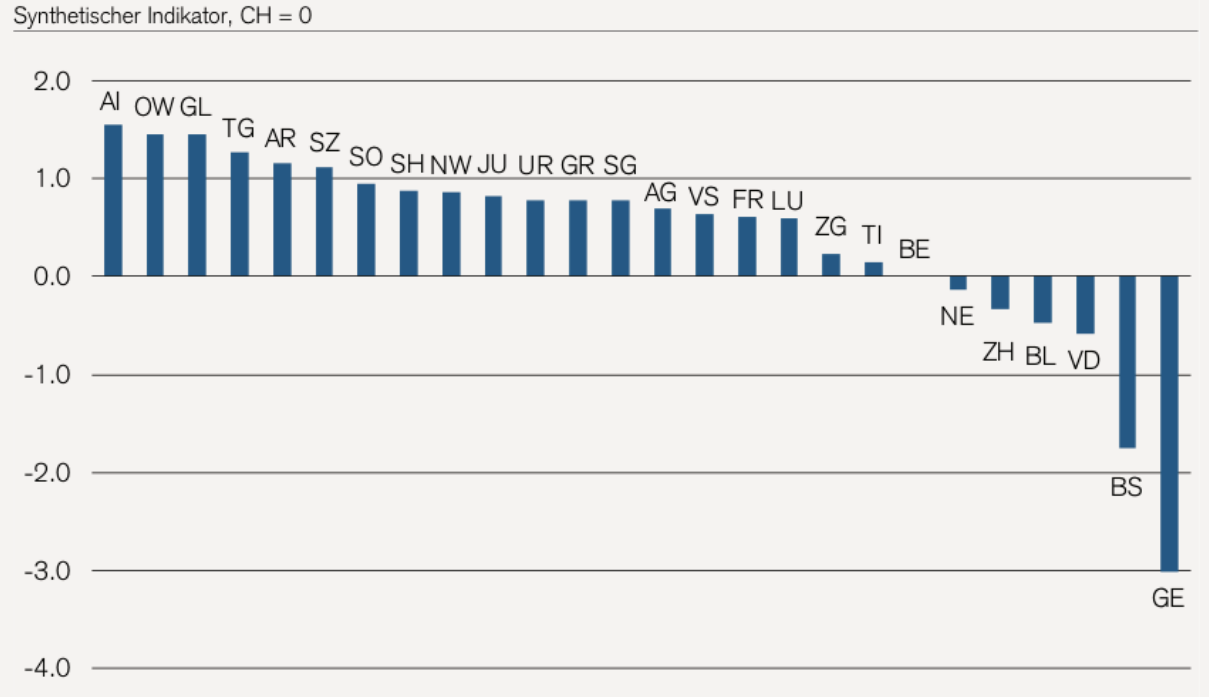
Source : Personal elaboration on the basis of data from FCA. (2008). *Exportations - Groupe de marchandises 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007.* & FSO. (2008). *Recensement fédéral des entreprises 1995, 2001, 2005.*

Appendix Figure 4: Export value per employee CAGR 2001-2005, in %



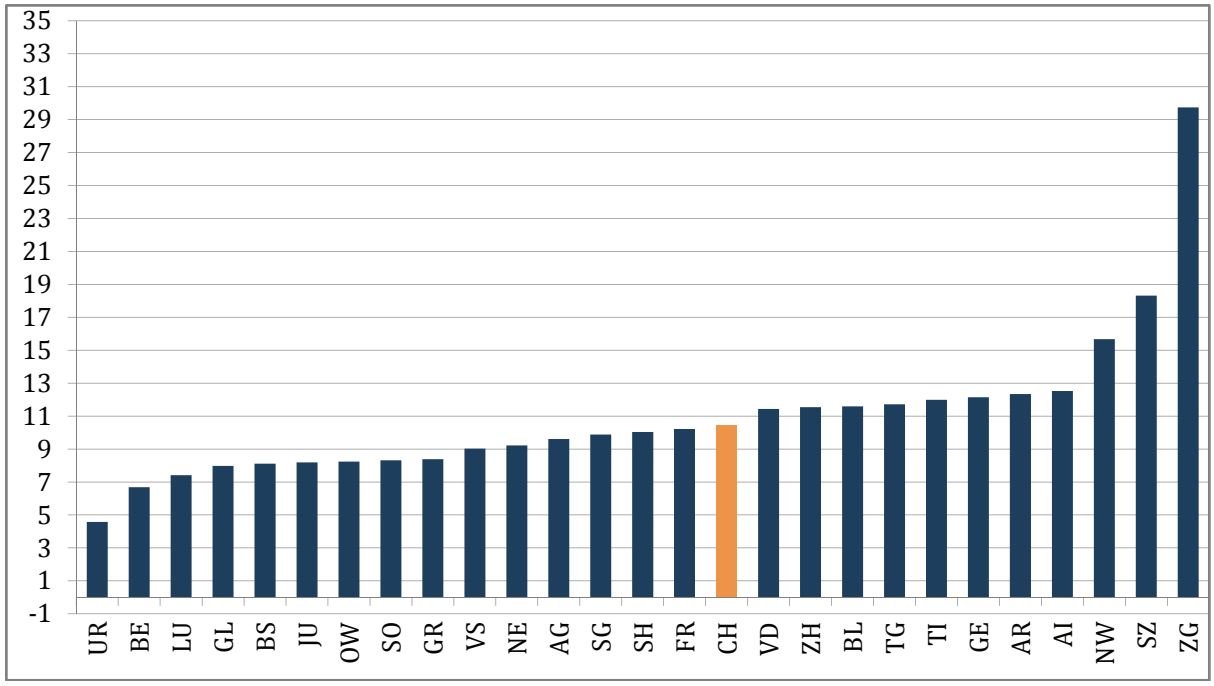
Source : Personal elaboration on the basis of data from FCA. (2008). *Exportations - Groupe de marchandises 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007.* & FSO. (2008). *Recensement fédéral des entreprises 1995, 2001, 2005.*

Appendix Figure 5: Regional disposable income 2008, CH = index 0



Source : Crédit Suisse. (2008). *Das verfügbare Einkommen in der Schweiz.*

Appendix Figure 6: New establishments between 2003 and 2005 per 1000 employees in 2005



Source : Personal elaboration on the basis of data from FSO. (2008). *Démographie des entreprises 2003, 2004, 2005.*

Appendix Table 1: Cantonal key industries

Canton Share of key industry employment	Key Industries (LQ; Employment)
Lake Geneva	+ Ticino
GE 13. 23 %	19 Tanning and dressing of leather; manufacture of footwear (3.20; 392) 65 Monetary intermediation (2.37; 17344) 67 Activities auxiliary to financial intermediation (2.24; 3335) 33 Manufacture of medical and precision instruments, watches (1.54; 7708)
VD 3.17 %	73 Research and development (1.66; 1947) 33 Manufacture of medical and precision instruments, watches (1.06; 6404)
VS 21.18 %	23 Manufacture of coke, refined petroleum products (8.94; 217) 27 Manufacture of basic metals (3.42; 1629) 24 Manufacture of chemicals and chemical products (2.58; 5524) 40 Electricity, gas, steam and hot water supply (2.34; 1687) 55 Hotels and restaurants (2.04; 12141) 20 Manufacture of wood and of products of wood and cork (1.75; 2060)
TI 22.36 %	18 Manufacture of wearing apparel; dressing and dyeing of fur (8.64; 1713) 19 Tanning and dressing of leather; manufacture footwear (4.60; 380) 31 Manufacture of electrical machinery and apparatus n.e.c. (1.82; 2730) 27 Manufacture of basic metals (1.77; 1128) 65 Monetary intermediation (1.55; 7632) 36 Manufacture of furniture, jewellery, musical instruments and other goods (1.53; 1532) 55 Hotels and restaurants (1.50; 11650) 67 Activities auxiliary to financial intermediation (1.42; 1430) 33 Manufacture of medical and precision instruments, watches (1.07; 3604) 40 Electricity, gas, steam and hot water supply (1.04; 999)
Espace Mittelland	
BE 3.8 %	23 Manufacture of coke, refined petroleum products (2.25; 210) 30 Manufacture of office machinery, data processing devices (2.60; 614) 28 Manufacture of fabricated metal products (1.25; 12628) 26 Manufacture of other non-metallic mineral products (1.18; 2583)
FR 8.57 %	32 Manufacture of radio, television and communication equipment (2.33; 1301) 15 Manufacture of food products and beverages (2.27; 3515) 20 Manufacture of wood and of products of wood and cork (1.67; 1640) 26 Manufacture of other non-metallic mineral products (1.58; 753) 40 Electricity, gas, steam and hot water supply (1.06; 640)
JU 27. 02 %	16 Manufacture of tobacco products (23.14; 502) 33 Manufacture of medical and precision, watches (5.97; 3934) 27 Manufacture of basic metals (4.86; 603) 32 Manufacture of radio, television and communication equipment (3.80; 663) 28 Manufacture of fabricated metal products (2.93; 2015)
NE 21.61 %	16 Manufacture of tobacco products (21.73; 1172) 23 Manufacture of coke, refined petroleum products (14.78; 232) 33 Manufacture of medical and precision instruments, watches (5.97; 9774) 32 Manufacture of radio, television and communication equipment (2.34; 1017) 27 Manufacture of basic metals (2.05; 632) 31 Manufacture of electrical machinery and apparatus n.e.c. (1.83; 1328) 28 Manufacture of fabricated metal products (1.61; 2744) 20 Manufacture of wood and of products of wood and cork (1.15; 870)

SO 22.15 %	21 Manufacture of pulp, paper and paper products (5.03; 1796) 27 Manufacture of basic metals (3.40; 1412) 33 Manufacture of medical and precision instruments, watches (2.59; 5699) 28 Manufacture of fabricated metal products (2.10; 4828) 31 Manufacture of electrical machinery and apparatus n.e.c. (1.81; 1772) 40 Electricity, gas, steam and hot water supply (1.74; 1093) 29 Manufacture of machinery and equipment n.e.c. (1.65; 4575)

Nortwestern Switzerland + Zurich

AG 16.84 %	31 Manufacture of electrical machinery and apparatus n.e.c. (3.72; 8297) 32 Manufacture of radio, television and communication equipment (2.73; 3632) 25 Manufacture of rubber and plastic products (2.40; 3740) 73 Research and development (1.97; 1919) 21 Manufacture of pulp, paper and paper products (1.93; 1567) 24 Manufacture of chemicals and chemical products (1.85; 7881) 37 Recycling (1.81; 428) 27 Manufacture of basic metals (1.74; 1648) 40 Electricity, gas, steam and hot water supply (1.72; 2473) 15 Manufacture of food products and beverages (1.39; 5133)
BL 11.09 %	73 Research and development (3.78; 1692) 24 Manufacture of chemicals and chemical products (3.14; 6153) 31 Manufacture of electrical machinery and apparatus n.e.c. (1.59; 1637) 27 Manufacture of basic metals (1.53; 668) 36 Manufacture of furniture, jewellery, musical instruments and other goods (1.43; 981)
BS 14.7 %	24 Manufacture of chemicals and chemical products (6.38; 16050) 73 Research and development (3.80; 2188) 35 Manufacture of other transport equipment (1.47; 731)
ZH 8.79	65 Monetary intermediation (2.07; 43462) 67 Activities auxiliary to financial intermediation (1.71; 7299) 35 Manufacture of other transport equipment (1.66; 4000)

Eastern Switzerland

AI 10.68 %	55 Hotels and restaurants (1.97; 597)
AR 12.35 %	17 Manufacture of textiles and textile products (19.65; 1104) 31 Manufacture of electrical machinery and apparatus n.e.c. (6.07; 1117)
GL 15.34 %	26 Manufacture of other non-metallic mineral products (6.35; 501) 25 Manufacture of rubber and plastic products (5.20; 564) 29 Manufacture of machinery and equipment n.e.c. (2.87; 1263)
GR 16.85 %	55 Hotels and restaurants (2.78; 12664) 40 Electricity, gas, steam and hot water supply (1.71; 944) 35 Manufacture of other transport equipment (1.58; 510)
SG 20.13 %	17 Manufacture of textiles and textile products (4.08; 2551) 25 Manufacture of rubber and plastic products (3.25; 4659) 34 Manufacture of motor vehicles, trailers and semi-trailers (2.91; 767) 30 Manufacture of office machinery, data processing devices (2.16; 242) 28 Manufacture of fabricated metal products (2.06; 9946) 29 Manufacture of machinery and equipment n.e.c. (1.90; 11053) 21 Manufacture of pulp, paper and paper products (1.83; 1371) 27 Manufacture of basic metals (1.75; 1520) 26 Manufacture of other non-metallic mineral products (1.53; 1597) 15 Manufacture of food products and beverages (1.50; 5079) 32 Manufacture of radio, television and communication equipment (1.27; 1550)

SH 21.61 %	25 Manufacture of rubber and plastic products (3.74; 835) 24 Manufacture of chemicals and chemical products (2.79; 1699) 29 Manufacture of machinery and equipment n.e.c. (2.10; 1904) 15 Manufacture of food products and beverages (1.99; 1050) 33 Manufacture of medical and precision instruments, watches (1.76; 1269)
TG 24.09 %	34 Manufacture of motor vehicles, trailers and semi-trailers (6.79; 790) 25 Manufacture of rubber and plastic products (2.82; 1785) 26 Manufacture of other non-metallic mineral products (2.69; 1237) 36 Manufacture of furniture, jewellery, musical instruments and other goods (2.35; 1423) 28 Manufacture of fabricated metal products (2.30; 4895) 35 Manufacture of other transport equipment (2.17; 742) 29 Manufacture of machinery and equipment n.e.c. (1.94; 4988) 15 Manufacture of food products and beverages (1.89; 2826) 17 Manufacture of textiles and textile products (1.82; 503) 20 Manufacture of wood and of products of wood and cork (1.70; 1610) 21 Manufacture of pulp, paper and paper products (1.58; 521)

Central Switzerland

LU 8.16 %	16 Manufacture of tobacco products (4.15; 476) 36 Manufacture of furniture, jewellery, musical instruments and other goods (2.19; 2258) 35 Manufacture of other transport equipment (1.88; 1097) 20 Manufacture of wood and of products of wood and cork (1.83; 2949) 15 Manufacture of food products and beverages (1.47; 3760) 26 Manufacture of other non-metallic mineral products (1.32; 1038) 21 Manufacture of pulp, paper and paper products (1.31; 739)
NW 8.88 %	35 Manufacture of other transport equipment (23.03; 1366)
OW 22.29 %	31 Manufacture of electrical machinery and apparatus n.e.c. (8.79; 1189) 15 Manufacture of food products and beverages (2.30; 514) 55 Hotels and restaurants (1.73; 1244)
SZ 13.25 %	36 Manufacture of furniture, jewellery, musical instruments and other goods (2.06; 689) 28 Manufacture of fabricated metal products (2.03; 2393) 20 Manufacture of wood and of products of wood and cork (2.02; 1062) 25 Manufacture of rubber and plastic products (1.57; 551) 29 Manufacture of machinery and equipment n.e.c. (1.27; 1806)
UR 18.74 %	31 Manufacture of electrical machinery and apparatus n.e.c. (4.13; 535) 29 Manufacture of machinery and equipment n.e.c. (1.91; 702) 55 Hotels and restaurants (1.65; 1138)
ZG 13.90 %	32 Manufacture of radio, television and communication equipment (8.83; 3280) 67 Activities auxiliary to financial intermediation (2.23; 929) 29 Manufacture of machinery and equipment n.e.c. (1.39; 2452) 33 Manufacture of medical and precision instruments, watches (1.28; 1795)