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Sources of structural change: Industrial Evolution of Swedish Municipalities 1994-2010

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Abstract

Regional economies are subject to a never-ending process of creative destruction, which was identified by Joseph Schumpeter as the driving force behind economic development. This paper investigates the drivers of structural change of local economies. We analyze changes in the industrial composition of 287 Swedish municipalities between 1994 and 2010. We find that the industrial portfolios of municipalities are organized around skill-related activities, and that the rise and fall of local industries between 1994 and 2010 does not really alter the skill cohesion of the local economies. On the one hand, the skill cohesion of municipalities is reinforced by the decline and exit of existing plants and product-switching behavior of plants. Employment lost in plant decline and exits is concentrated in industries that are underembedded skill-wise in local economies. Product-switching plants tend to switch to industries that are much better

skill embedded in local economies. Decreasing local skill cohesion, in the short as well as in the long run, is induced mainly by non-local entrepreneurs from outside municipalities. Much of the employment they generate is concentrated in industries that are under-embedded in local economies. Hence, they infuse local economies with new skills and hence induce structural change.

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Sources of Diversification and Structural Change: Industrial Evolution of Swedish Municipalities 1994-2010

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1. Introduction

How new regional growth paths emerge is an important question. Regional economies are subject to a never-ending process of creative destruction that Schumpeter (1939) identified as the driving force behind economic development. In the long run, regions depend on their ability to create new activities in order to offset decline and destruction in other parts of their economies. This was underlined by the recent economic crisis, which especially hit specialized regions such as the automobile center Detroit in the United States, highlighting the importance of the entry and development of new industries in regions.

Systematic evidence on how new regional growth paths emerge has been found in recent research on the diversification of economies. Hidalgo et al. (2007) found that countries are more likely to expand and diversify into industries that are closely related to pre-existing industries. Similar evidence at the regional level has been found by Neffke et al. (2011), Colombelli et al. (2012), Rigby (2012), Balland et al. (2013), Essletzbichler (2013) and Boschma et al. (2013). Hence, economies tend to diversify into activities that re-use the capabilities of the activities in which economies are already specialized.

In this paper, we conceptualize and analyze structural change in terms of changes in the skill cohesion of regions: the entry and exit of new activities that require *to some* extent different skills than the pre-existing local skill base. We investigate what the sources of structural change are, distinguishing between the growth and decline of existing plants, the entry of new plants, and product-switching of plants. To do so, we carry out an empirical study on structural change of local economies in Sweden between 1994 and 2010. We use annual matched employer-employee data from Statistics Sweden that cover all individuals in the Swedish labor force (about 4,5 million each year).

The paper is structured as follows. Section 2 elaborates on the theory of structural change. Section 3 presents the data and develops an empirical framework to analyze the extent to which the different sources have induced diversification and structural change of local economies over time. Section 4 gives an overview of structural change in Sweden between 1994 and 2010 and presents the results of the analysis. Section 5 ends with a conclusion.

2. Theory

How do new regional growth paths emerge? A key finding on this question of the research in the 1980s was that newly emerging industries did not necessarily arise in leading regions, but often triggered growth and development in quite unexpected places, such as Silicon Valley in the United States and Bavaria in Germany (e.g. Norton and Rees, 1979; Marshall, 1987; Hall and Preston, 1988; Scott, 1988; Storper and Walker, 1989). Following this, many case studies have shown that new local industries are often deeply rooted in related activities in the region (e.g. Bathelt and Boggs, 2003; Glaeser, 2005; Klepper, 2007). For instance, Boschma and Wenting (2007) found that in the early development stage of the UK automobile industry, firms had a higher survival rate when their

entrepreneurs had previously worked in related industries like bicycle making, coach making or mechanical engineering, and when their regions featured a strong presence of these related industries.

Recent studies have tried to identify systematic patterns of the diversification of economies. Hidalgo et al. (2007) found that countries are more likely to diversify into industries that are closely related to their existing activities. They contribute this to the fact that it is easier to produce a new product when the capabilities (e.g. infrastructure, skills, networks, institutions, and so on) needed to produce it are already present in a country. Using a similar approach as Hidalgo et al. (2007), research by Neffke et al. (2011) and Boschma et al. (2013) find similar results at the regional level. They show that although many new industries appear and old industries disappear in regions over time, the coherence of regions in terms of capabilities hardly changes. Hence, the industrial specialization of regions is organized around certain capabilities rather than the activities undertaken, which is in line with the coherence and diversification of the portfolios of plants (e.g. Teece 1986, 1994). Because new industries arise from related industries in regions through the re-combination of existing capabilities in new activities at the regional level, structural change is found to be a highly path dependent process.

In this paper, we analyze structural change in terms of changes in the skill cohesion of regions. Human capital is a prime resource for most firms, and it is used economy-wide, in manufacturing as well as in service industries. This differs from the existing studies that use output-based measures to assess inter-industry similarity in capabilities. For instance, Hidalgo et al. (2007) measure industry relatedness by the extent to which products are exported in tandem by countries across the world, which they argue indicates that products require similar production resources. Other studies following Hidalgo et al. (2007) have applied similar output-based measures based on products or patents (e.g. Neffke et al. 2011; Colombelli et al., 2012; Rigby, 2012; Balland et al. 2013; Essletzbichler, 2013; Boschma et al., 2013).

We investigate what are the sources of structural change, which is a result of the growth, decline and exit of pre-existing plants, new activities undertaken by pre-existing plants, and the entrance of new plants. These sources may change the skill cohesion of regions over time. Most often, entrepreneurial entries are regarded as sources of novelty as they commercialize on new opportunities (Acs et al., 2009). As such, they may be vital to regional growth as they may prevent regions from ‘locking-in’ by infusing them with new activities (Grabher, 1993, Martin and Sunley, 2006). This may especially be true for new entrants that come from outside a region as they may be less likely to rely on existing social networks, social conformity, norms, and so on, most of which are bounded at the local level (e.g. Breschi and Lissoni, 2005)..

3. Methodology

3.1 Data

We analyze diversification and structural change in Sweden over a period of 16 years, between 1994 and 2010. We use annual matched employer-employee data that are available from Statistics Sweden and are registered the 1st of November each year. Of every individual in the labor force (around 4,5 million on average each year), we know at which plant he or she is employed each year (except for some workers that are assigned to multiple plants – e.g. maintenance workers) and the industry and municipality of the corresponding plant. Every plant has a specific plant identifier and firm identifier assigned to it by Statistics Sweden (see Andersson and Arvidsson, 2006), which allows one to follow the plants over time regardless of changes in ownership or legal status. We know in which year a plant is set up, when it exits, and whether plants are part of firms that own multiple plants. The industry of a plant is defined at the 4-digit level based on the Swedish Standard Industrial Classification 1992 (astSNI92), which corresponds to the European NACE Rev. 1 classification. As the astSNI92-classification changes slightly in 2002 to correspond to the new European NACE Rev. 1.1 classification (about 1% of the industry codes merge into one industry code or split up into multiple industry codes), we merged some industry codes to obtain one industry classification that is valid between 1994 and 2010. In total, 753 different 4-digit industries are distinguished.

3.2 Unit of analysis

We analyze diversification and structural change of the economies of municipalities. There are 286 Swedish municipalities in total between 1994 and 2010. They are highly independent as a majority of the country's income tax comes from municipality-specific taxes, and a large proportion of government expenditures is undertaken by municipalities.

3.3 Sources of local industrial diversification

Local industrial diversification is a result of employment changes in local industries over time, which is caused by the growth and decline of existing plants, the entry of new plants and product switching of plants. We identify a product switch when the main industry of a plant at the 4-digit level switches between years *t* and *t + 1*. Regarding new plants, we distinguish between entrepreneurial entries (new plants by new firms) and expanding firm entries (new plants by existing firms). Furthermore, we distinguish these according to where the founder(s) worked or where the parent firm was located the year before: local entries (from the same municipality), regional entries (from the same labor market region) and non-regional entries (from outside the labor market region). The founder of plants set up by entrepreneurs is/are the person(s) in the new plant whose occupational status is/are identified as the entrepreneur(s) by the national tax office. We were unable to identify the founder of 40% of entrepreneurial plant entries, which we classify into a separate category (unknown entrepreneurs).

We focus only on the growth and decline of local industries that are open to competition from industries elsewhere (outside of municipalities), namely 'traded industries' (or 'export industries'). These industries characterize the industrial specialization of local economies because they constitute a region's inter-regional competitive advantage. Contrary to traded industries, 'local industries' and 'natural resource dependent industries' are most often located in, and attracted to, municipalities

because of local demand (e.g. bakeries / retail shops) or natural resources (e.g. ore mining) – see Porter (2003). Traded industries are defined as all manufacturing industries (Standard Industrial Classification, SIC codes 1500-3999), financial intermediation industries (SIC 6500-6999), computed and related activities (SIC 7200-7399), and other business activities (SIC 7400-7499). Defined as local industries and natural resource dependent industries are agriculture (SIC 0-1499), electricity, water supply and construction (SIC 4000-4999), wholesale and retail trade (SIC 5000-5999), transport, storage and communication (SIC 6200-6419), real estate activities (SIC 7000-7199), and public administration, education, health services and community services (SIC 7500-9999).

3.4 Inter-industry skill relatedness

We assess the degree of capability similarity between industries based on the extent to which industries employ similar skills. We use the skill-relatedness measure developed by Neffke and Henning (2012) and Neffke et al. (2013). The idea behind this measure is that the higher the extent to which labor flows between two industries are excessive in comparison to a baseline, the more skill-related those industries are. This is because individuals, to limit the destruction of their human capital when switching jobs, tend to switch to industries that require similar skills. Hence, we do not rely on the nested hierarchical structures of existing industrial classifications, such as the Standard Industrial Classification. Often, the higher the number of initial digits the industries share, the more they are regarded as being related. This approach is most often used in traditional studies on structural change that apply some sort of accounting-based shift-and-share analysis of changes in employment or output shares (e.g. Fabricant, 1942; Maddison, 1952; Herzog and Olsen, 1977; Knudsen, 2000). However, little theoretical justification exists that such hierarchies necessarily reflect similarities (e.g. scope economies) between industries.

We define two industries to be related if the labor flow between them is higher than what is expected by chance whilst controlling for the total inflow and outflow of the industries. To calculate the measure, we use annual labor flows in Sweden between 1994 and 1999, the beginning of the period investigated. In this period, about 1,3 million people switched jobs, of whom about 1 million switched to another industry. Hence, our inter-industry relatedness measure is based on 1 million job switches. Formally, let ${W^t}_{ij}$ be the observed labor flow between industry *i* and industry *j* in year *t* and let $\hat{W}^t_{ij}$ be the fitted labor flow in the regression of ${W^t}_{ij}$ on the regressors above. Skill-relatedness from *i* to *j* in year *t*, ${SR^t}_{ij}$, is then defined as:

$$ {SR^t}_{ij} = \frac{{W^t}_{ij}}{\hat{W}^t_{ij}} \qquad (1) $$

A value of ${SR^t}_{ij}$ higher than 1 indicates that the labor flow between two industries is larger than what is predicted from the baseline, which means that those industries are regarded as skill-related. For instance, the “Medical practice activities” industry (SIC 8512) is found to be highly skill-related to the “Hospital Activities” industry (SIC 8511). About 1000 people on average switch from the former to the

latter industry each year. Because the measure is skewed to the right (values of 0 to 0,99 indicate less skill-relatedness than predicted, 1 corresponds to the baseline prediction, and 1 to infinity indicate more skill-relatedness than predicted), we transform it to the interval [-1, 1] :

$$SR^{t}{}_{ij}{}' = \frac{SR^{t}{}_{ij}-1}{SR^{t}{}_{ij}+1} \qquad (2)$$

For every industry pair, we then calculate the mean of this measure across the years 1994-1999. Hence, industry *i* is skill-related to industry *j* when the mean SR value across those years is higher than 0. In total, 4,5% of all possible industry combinations are found to be skill-related, which is similar to Neffke and Henning (2012).

3.5 Local embeddedness and structural change

Knowing the relatedness between all industries, we now calculate for each local traded industry the amount of related employment in a municipality. Let E_{mi} be the employment of traded industry *i* in municipality *m*, then related employment is given by:

$$E_{mi}^{rel} = \sum_{j \neq i} I^{rel}(i,j) E_{mj} \qquad (3)$$

where $I^{rel}(i,j)$is an indicator function that has a value of 1 if industry *j* is related to industry *i*. E_{mi}^{rel} is thus the sum of local employment in industries related to industry *i*. Next, since we are interested in the industries in which a municipality is specialized, we calculate the location quotient of the related employment:

$$LQ_{mi}^{rel} = \frac{E_{mi}^{rel} / E_{m}}{E_{i,SWE}/E_{SWE}} \qquad (4)$$

We call this measure *local embeddedness*, which we measure for every local traded industry (industry-municipality combination). The higher the value on this measure, the higher the fit between local traded industry *i* and the rest of the local economy. As this measure is skewed to the right (relative underspecialization runs from 0 to 1 and overspecialization runs from 1 to infinity), we transform it to the interval [-1, 1]:

$$LQ' = \frac{LQ-1}{LQ+1} \qquad (5)$$

We are interested in the extent to which the employment gained and lost in the different sources matches with the industrial portfolio of a municipality. For instance, if an existing firm in Gotenburg sets up a new car manufacturing plant in Malmö in 1995 with 15 persons, the car manufacturing industry in Malmö experiences growth in employment of 15 persons between 1994 and 1995 caused by a non-regional expanding firm. If the car manufacturing industry in Malmö is already highly related to

industrial portfolio of Malmö in 1995, which is measured by the *local embeddedness* indicator of equation (5), this expansion event likely increases the local industrial specialization.

To measure this, let E_{mi}^{S} be the employment change associated with source *S* in municipality *m* and traded industry *i,* and let E_{m}^{s} be the total employment change from source *S* in municipality *m*. The degree to which the employment change of source *S* matches with the pre-existing industrial portfolio of municipality *m* is measured as:

$$M_{m}^{S,rel} = \sum_{i} \frac{E_{mi}^{S}}{E_{m}^{S}} LQ_{mi}^{rel} \qquad (6)$$

The weights $\frac{E_{mi}^{S}}{E_{m}^{S}}$ in this match measure reflect the local traded industry's share of the total employment change induced by source *S* in municipality *m.* A Match measure is created for each source in each municipality, measuring the extent to which industries that are related to the industries in which a source creates or destroys employment are related to the industrial portfolio of the municipality. In other words, it measures the 'degree of newness to the local economy' of the employment that is created or destroyed by a source.

We calculate two baseline indices to which the Match measure above can be compared:

$$M_{m}^{own,rel} = \sum_{i} \frac{E_{mi}}{E_{m}} LQ_{mi}^{rel} \qquad (7)$$

$$M_{m}^{prop,rel} = \sum_{i} \frac{E_{mi}^{prop}}{E_{m}^{prop}} LQ_{mi}^{rel} \qquad (8)$$

where E_{mi} denotes employment of municipality *m* in traded industry *i* and $E_{mi}^{prop} = \left(\frac{E_m}{E}\right) E_i$. We refer to equation (7) as the *present-employment-structure baseline*. It calculates the match of a municipality's present employment structure with itself. In other words, the more a municipality's employment in traded industries is related to other industries in which a municipality is overspecialized, the higher the score on this index. We refer to equation (8) as the *proportional-employment-structure baseline*. It calculates the match of a municipality's present employment structure with a hypothetical employment structure where the share of each municipality's industry is equal to the country-wide employment of the industry, proportional to the total employment size of the municipality. This index can be reflected as a random distribution of industrial activities across the municipalities.

The Match and baseline values can be interpreted as follows. If the value of the present-employment-structure baseline of equation (7) is higher than the value of the proportional-employment-structure baseline of equation (8), the industrial portfolio of a municipality is more specialized than what is expected by chance. The industrial portfolio is then skill coherent, i.e. organized around a set of skill-related industries. If the value of the match measures of the different sources (e.g. employment growth

caused by local entrepreneurs) as defined in equation (6) is lower than the value of the present-employment-structure baseline, they induce reduce the industrial specialization of the local economy as they introduce new activities that require different skills to the municipality. A higher Match value, on the other hand, means that a source increases the local industrial specialization. For instance, take a hypothetical industrial portfolio of municipality *m* in 1994 that is organized around office-machinery-manufacturing industries. If the new plants set up by local entrepreneurs in municipality *m* between 1994 and 1995 operate mainly in aircraft-manufacturing industries (which is unrelated to office-machine-manufacturing), the Match value of these local entrepreneurs with the economy of municipality *m* in 1994 is lower than the present-employment-structure baseline of municipality *m* in 1994, which implies that the local entrepreneurs between 1994 and 1995 have decreased the industrial specialization of the municipality. If these new aircraft-manufacturing plants are still operating in 2010, the local entrepreneurs of1994-1995 have induced a long-term effect of decreasing specialization of the local economy. In municipality *m*, the Match of the local economy in 1994 with the employment in 2010 generated by plants set up by the local entrepreneurs between 1994 and 1995 would then still be lower than the present-employment-structure baseline in 1994. *Structural change* has then been induced by these local entrepreneurs, which we are able to measure at a very fine-grained level.

4. Results

4.1 Evolution of the Swedish economy, 1994-2010

Table 1 shows annual plant and employment entry and exit rates in Sweden between 1994 and 2010. About 25% of all existing plants each year (about 115.000 plants on average) are classified as plants in traded industries. These plants employ about 30% of the whole labor force each year (about 1 million people). Regional diversification is a result of the employment that is created and destroyed in traded industries in local economies each year, which amounts to about 200.000 jobs. Hence, 20% of all employment in traded industries is re-allocated between plants each year. These are jobs involved in the growth, decline and exits of incumbent plants, product switching and relocation of incumbent plants, and the entry of new plants. Of all new jobs created in traded industries annually, about 60% is created by incumbent plants and 40% by new plants. At the same time, of all jobs lost annually, about 35% is lost through employment decline in incumbent plants and 65% is lost through the exit of plants. Each year, there are also considerable employment shifts between industries as a result of and municipality switches (about 2500 plants, 9000 people) and product switches (about 3500 plants, 37000 people). The latter, the amount of employment that is shifted between industries as a result of product switches of plants, is considerably large: on average, the amount of employment lost in the original industries is about as high as the employment lost in industries as a result of plant exits, and the amount of employment gained in the destination industries is almost as high as the employment created by new plants.

<INSERT TABLE 1 ABOUT HERE>

To assess the degree of diversification of the economy between 1994 and 2010, we calculate the cosine similarity of employment shares across all industries between 1994 and subsequent years. Hence, the reference point in every year is the industrial composition in 1994, the first year of the time period investigated. The cosine of the angle θ is defined as:

$$\cos\theta = \frac{\sum_{i=1}^{n} S_{i,t} S_{i,1994}}{\left(\sqrt{\sum_{i=1}^{n} S_{i,t}^2}\right)\left(\sqrt{\sum_{i=1}^{n} S_{i,1994}^2}\right)} \qquad (9)$$

where $S_{i,t}$ is industry's *i* share of total employment in year *t* and *n* is the total number of industries. Figure 1 shows the cosine similarity of industry employment shares over time, for all industries as well as well as for traded industries only. National industry employment shares are used to calculate the cosine similarity for Sweden as a whole and employment shares of industry-municipality pairs are used to calculate the cosine similarity for each municipality. For the latter, we calculated the mean across all municipalities. In almost each subsequent year the industrial composition is more different from the industrial composition in 1994. A relatively large deviation is visible between 2002 and 2003, which is likely a result of the much slower GDP growth that Sweden experienced during this time in comparison to the years before and after. The magnitude of diversification is higher in municipalities than in the country as a whole: more employment changes take place in local industries than in national industries.

<INSERT FIGURE 1 ABOUT HERE>

Figure 2 plots the share of local industries in 1994 and 2010 as a percentage of all local industries that exist in each year, for all industries as well as for traded industries only. A local industry (industry-municipality combination) 'exists' when it has non-zero employment. The industrial portfolio in 2010 consists for 70% of local industries that were already present in 1994. This number is lower for traded industries, namely 64%. Taking the reverse perspective, 82% of all local industries in 2010 already existed in 1994, and this number is 75% for traded industries. Hence, the industrial compositions of the municipalities in terms of industry employment shares have substantially changed over time.

<INSERT FIGURE 2 ABOUT HERE>

Figure 3 shows the extent to which the industrial portfolios of municipalities are organized around traded industries that are skill-related to the rest of the local economy, reflecting the values of the baselines of equations (7) and (8). Across all years, the present-employment-structure baseline (Match 1) lies well above the proportional-employment-shares baseline (Match 2). This implies that the

industrial portfolios of the municipalities are highly specialized, skill-coherent. This is reflected in the red skill coherence line in the graph, which measures the absolute difference between the two baselines. Regional industrial portfolios remain skill coherent over time: the skill coherence line roughly follows the same horizontal curve. Hence, despite the sectoral changes that have taken place in the local economies between 1994 and 2010, the skill coherence of the local economies has hardly changed.

<INSERT FIGURE 3 ABOUT HERE>

4.2 Sources of diversification and structural change

We now assess the diversification that has been induced by the different sources by measuring the extent to which they have increased or decreased the industrial specialization of the local economies in the short run as well as in the long run. We measure the extent to which the employment created and destroyed by them in local economies matches with the pre-existing industrial portfolio of the local economies. We select a 5-year cohort of the sources, namely those between 1994 and 1999, and we analyze their match with the local economies within these years (at the time of entry) as well as until 2010 (up to 16 years after entry).

Short-term impact of different sources on local economies

To determine the short-term impact of the different sources, we calculate the match at the time of entry and exit of the different sources. This is the match of the local economies in year *t* with the employment gained / lost by the different employment sources between years *t* and *t + 1,* averaged across the years 1994-1999. For instance, we calculate the Match of the employment created by local entrepreneurs between 1994 and 1995 (the 1st of November each year) with the local economy in 1994, then do the same for subsequent years until 1998-1999, and then we calculate the average Match across those years. In Table 2 we report the average match value of each source and compare it to the proportional-employment-structure baseline and present-employment-structure baseline. In Table 3 we compare the Match values to one another. We apply paired t-tests to test whether the Match values differ significantly from the present-employment-structure baseline (Table 2), which indicates whether sources increase or decrease local industrial specializations, and whether the Match values differ significantly from one another (Table 3). To be on the conservative side, we rely on and report the two-sided p-values of the t-tests.

<INSERT TABLE 2 ABOUT HERE>

<INSERT TABLE 3 ABOUT HERE>

Incumbent plants

Employment changes in incumbent plants, in the short term, increase the existing industrial specialization of local economies. About 55000 jobs in incumbents are gained through growth each

year, which is about the same number that is lost through employment decline and plant exits. The employment lost through plant employment decline and plant exits is concentrated in local industries that are mostly unrelated to the local economies. This can be seen from the incumbent decline and plant exit Matches, which are significantly ($p < 0,01$) lower than the present-employment-structure baseline (Table 2). Hence, as it is mostly unrelated employment that is lost through these channels, these sources increase the specialization of local economies. The effect of plant exits is strongest as its Match is significantly lower than the Match of incumbent plant decline (Table 3). Incumbent growth itself decreases the local industrial specialization as its Match is lower than the present-employment-structure baseline. This match, however, lies much closer to the present-employment-structure baseline than the employment decline and plant exit matches, and all three matches are significantly different from one another (Table 3). Hence, overall, the short-term effect of employment gains and losses in incumbent plants is one of increasing specialization of local economies.

Product-switching plants

What strongly reinforces the specialization of local economies in the short term is the product switching behaviour of plants. Plants tend to switch their production focus to industries that are much better related to the industrial portfolio of local economies, to industries that are better related to the industrial portfolio than the pre-existing portfolio is related to itself. As traded industries make up the industrial portfolio of the municipalities, especially interesting is what happens in them. We find that employment is shifted from traded industries that are mostly unrelated in local economies (the tradable exit Match is significantly lower than the present-employment-structure-baseline) to traded industries that are much better related in local economies (the tradable entry Match is significantly higher than the present-employment-structure baseline). These two matches differ significantly from one another (Table 3). On average, about 1700 plants switch between traded industries each year, with about 30000 jobs overhauled between traded industries as a result. As we noted earlier, this number is considerably large as it is about as high as the employment that is gained and lost in traded industries each year through new plant entries and plant exits.

New plants: local, regional and non-regional entrepreneurs and expanding firms

All different types of new entries are found to decrease the industrial specialization of local economies in the short term. The Match values of local, regional and non-regional expanding firms and entrepreneurs are all significantly lower than the present-employment-structure baseline (Table 2). Entrepreneurs set up about 30 times more plants than expanding firms (14279 versus 430 plants on average respectively) and employ about 5 times as many people as expanding firms each year (30260 versus 6433 people on average). Hence, the plants set up by expanding firms are much larger, but entrepreneurs set up much more plants. Of all new entries, we find that most change is induced by regional and non-regional entrepreneurs. Their Match values are significantly lower than the Match

values of regional and non-regional expanding firms and local entrepreneurs (Table 3)[1]. Hence, most change is induced by entrepreneurial entrants from outside local economies. The amount of change induced by local, regional and non-regional expanding firms is similar as we find no significant differences between them.

Long-term impact of different sources on local economies

We now investigate the extent to which the different sources have induced a long-term effect of increasing or decreasing specialization of local economies, the latter which we define as structural change. To make claims about structural change, it is necessary to investigate not only the Match of the employment created by the different sources at the time of entry, between years *t* and *t + 1,* but also the Match of the employment created by them in the long run with the local economies at the time of entry. For instance, if the employment created by regional entrepreneurs at the time of entry, which is found to decrease the local industrial specialization, disappears in the long run, the amount of structural change induced by regional entrepreneurs in the end is zero. Therefore, using the same 1994-1999 cohort of sources, we now analyze the extent to which the employment created by them in the long term, until 2005 and 2010, matches with the local economies of 1994 . Hence, we now follow the sources for up to a period of 16 years after entry. Their Match values are compared to the present-employment-structure baseline of 1994, shown in Table 4. Table 5 compares the Match values to one another. To conserve space, Table 5 only present the p-values of the t-test that the Match values of the sources differ from one another. When the number of observations (number of municipalities in which a source adds or destroys employment) is lower than 30, the test is not carried out.

We find that the long-term effects of most sources, until 2005 as well as until 2010, are similar to the short-term effects. Only the matches of the employment created by incumbent plants and plants that switch from non-traded to traded industries are no longer found to be significantly lower than the present-employment structure baseline. Hence, in the long term, incumbent growth is found to neither decrease nor increase the industrial specialization of local economies. The employment in 2010 in plants that switched products between traded industries 11 to 16 years earlier is concentrated in industries that were highly related to the local economies in 1994. Product switching behavior thus has a long term effect of strongly increasing the industrial specialization of local economies (the tradable entry Match in 2005 and 2010 is significantly higher than the present-employment-structure baseline in 1994). It is the only form of local industry entry that has such an effect. As we showed earlier, the local industry exit sources are the other causes of increasing industrial specialization (the employment lost as a result of product switching is concentrated industries that are mostly unrelated locally, which applies as well to the employment lost as a result of incumbent plant decline and exit, and out-migration of plants).

[1] Since we are comparing Match values of different sources to one another, the number of observations (N in Table 3) is much lower as only taken into account are municipality-year combinations in which both expansion events took place (e.g. the N of regional expanding firms versus regional entrepreneurs is 122, which means there were 122 municipality-year combinations that experienced expansion events by *both* regional expanding firms and regional entrepreneurs).

Structural change is induced mainly by non-regional entrepreneurs from outside local economies. Their Match values in 2005 and 2010 are significantly lower than the present employment structure baseline in 1994. The employment created by local entrepeneurs until 2005 and 2010 still matches closely with the existing structure at the time of entry (the Match value is not significantly different from the present-employment-structure baseline). The same effect is found for local expanding firms in the long term. Outside entrepreneurs set up more plants, employ more people overall, and are present in more local economies than non-regional expanding firms. The plants of outside expanding firms are much larger in terms of people employed and are located in much fewer municipalities.

5. Conclusion

The question of how new regional growth paths emerge receives increasing attention, by policy makers as well as by scientists. Regional economies are subject to a never-ending process of creative destruction, which was identified by Joseph Schumpeter as the driving force behind economic development. In the long run, regions depend on their ability to create new activities in order to offset decline and destruction in other parts of their economies**.** In this paper we investigate the different sources of employment gains and losses that increase the industrial specialization of local economies on the one hand, and induce structural change on the other hand. We analyze the drivers responsible for the changes in the industrial composition of all Swedish municipalities between 1994 and 2010.

We find that the industrial portfolios of municipalities are organized around skill-related activities, and that the rise and fall of local industries between 1994 and 2010 does not really alter the skill cohesion of the local economies. On the one hand, the skill cohesion of municipalities is reinforced by the exit of existing plants and product-switching behavior of plants. Employment lost in plant exits is concentrated in industries that are underembedded in local economies and product-switching plants tend to switch to industries that are much better embedded in local economies. Decreasing local skill cohesion, in the short as well as in the long run, is induced mainly by non-local entrepreneurs from outside municipalities. Much of the employment they generate is concentrated in industries that are under-embedded in local economies. We do not find evidence of such an effect for local entrepreneurs.

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Table 1: Employment, entry and exit numbers between years *t - 1* and year *t*, Swedish economy, 1994-2010														
	Traded and non-traded industries				Traded industries									
Year	# plants in non-traded industries	Employ-ment in plants in non-traded industries	# plants in traded industries	Employ-ment in plants in traded industries	Employ-ment growth in incumbent plants	Employ-ment decline in incumbent plants	# new plant entries	Employ-ment in new plant entries	# plants exits	Employ-ment lost in plant exits	# plants that change municipality	Employ-ment shifted in plant municipality relocations	# plants that switch products	Employ-ment shifted in plant product switches
1994	289366	2192743	84488	891334	-	-	-	-	-	-	-	-	-	-
1995	292077	2215510	88164	926850	54540	25699	14709	36693	11246	31051	2057	9675	3324	40883
1996	295031	2194346	90910	937789			14429	35046		29733	2039	8662	3053	38093
1997	296920	2155660	94974	944381			17082	43440		37417	1830	7892	3512	57417
1998	302241	2225031	98703	985523			16234	42776		37692	1604	6871	3075	40733
1999	302786	2260047	101464	1001213			16232	49735		42421	2162	12192	3292	47070
2000	306871	2309808	106199	1043180			18402	53000		41221	2755	13701	3345	55569
2001	307802	2343585	108095	1032650			17066	48164		43476	2772	9845	3020	48533
2002	306284	2350426	109706	1018523			17565	41595		47513	2852	9582	3395	63672
2003	310636	2312789	111430	988030			20116	42256		45240	2560	8955	4106	36191
2004	329226	2368831	121806	1002958			27018	48343		37686	2790	8877	3387	28096
2005	333302	2398451	127712	1003733			23730	42694		38063	2987	8231	5132	27218
2006	340653	2462404	130670	1019070			23475	40303		37464	2946	10827	4261	26673
2007	345214	2524414	133808	1055164			24555	41775		37885	3042	9876	7246	46414
2008	351493	2553594	138275	1055834			25054	41284		36204	3072	10254	4072	33383
2009	359068	2507420	141347	996159			25071	41029		40441	3059	9167	3351	24882
2010	368226	2584096	146244	1013184			28342	43220		37321	3190	10061	2628	16154
Total							**329080**	**691353**		**620828**	**41717**	**154668**	**60199**	**630981**
Mean	**319835**	**2350539**	**113764**	**995034**			**19358**	**40668**		**36519**	**2454**	**9098**	**3541**	**37117**

Table 2: Match of local economy in year t with employment gained / lost by employment source between years t and t + 1, averaged across the years 1994-1999

Employment source	# plants (mean 1994-1999)	Employment gained/lost (1994-1999)	Proportional-employment-structure baseline (mean 1994-1999)	Present-employment-structure baseline (mean 1994-1999)	Match: mean (mean 1994-1999)	p-value* (paired t-test: *Present-employment-structure baseline = Match)*	N (# municipality-year combinations)
Incumbent growth		54540	-0,0846	0,0504	0,0418	0,006	1432
Incumbent decline		25699	-0,0846	0,0504	0,0302	0	1432
Incumbent plants exits	11246	31051	-0,0846	0,0504	0,0151	0	1432
Exit-to-non-tradable-product	1157	8846	-0,0786	0,0564	0,032	0	1148
Entry-from-non-tradable-product	1364	7325	-0,0783	0,0631	0,0436	0,001	1210
Exit-from-tradable-to-tradable-product	1729	30738	-0,0795	0,0545	0,0344	0,001	1253
Entry-from-tradable-to-tradable-product	1729	32525	-0,0795	0,0544	0,0666	0,047	1254
Out-migration	1827	8038	-0,0792	0,0553	-0,0101	0	1157
In-migration	1827	8712	-0,0764	0,0538	-0,0043	0	1131
All expanding firms	430	6433	-0,0698	0,0574	0,0317	0,006	613
Non-regional expanding firms	318	3724	-0,0672	0,0508	0,0321	0,07	510
Regional expanding firms	41	944	-0,0602	0,091	0,0431	0,014	125
Local expanding firms	71	1765	-0,052	0,0676	0,04	0,085	144
All entrepreneurs	14279	30260	-0,0844	0,0508	0,0128	0	1431
Non-regional entrepreneurs	1361	1748	-0,0808	0,0545	-0,0103	0	1271
Regional entrepreneurs	1638	1938	-0,0741	0,0587	-0,0071	0	923
Local entrepreneurs	5107	7194	-0,0835	0,052	0,0136	0	1403
Unknown entrepreneurs	6173	19380	-0,0843	0,0509	0,0148	0	1420

Table 3: Comparison of Match values between entry and exit sources and between new plant entries, between years t and t + 1 with local economy in year t, averaged across the years 1994-1999					
Employment source 1	**Employment source 2**	**Match employment source 1**	**Match employment source 2**	**p-value*** **(paired t-test: *Match employment source 1 = Match employment source 2)***	**N (# municipality-year combinations)**
Incumbent plants exits	Incumbent growth	0,0151	0,0418	0,000	1432
Incumbent plant exits	Incumbent decline	0,0151	0,0302	0,001	1432
Incumbent decline	Incumbent growth	0,0302	0,0418	0,009	1432
Exit-to-non-tradable-product	Entry-from-non-tradable-product	0,041	0,0452	0,571	1014
Exit-from-tradable-to-tradable-product	Entry-from-tradable-to-tradable-product	0,0344	0,0667	0,000	1253
Out-migration	In-migration	-0,0016	-0,0018	0,977	968
All expanding firms	All entrepreneurs	0,0317	0,0225	0,289	613
Non-regional expanding firms	Non-regional entrepreneurs	0,0348	-0,0042	0,000	488
Regional expanding firms	Regional entrepreneurs	0,0536	0,0225	0,079	122
Local expanding firms	Local entrepreneurs	0,0396	0,0337	0,741	143
Non-regional expanding firms	Regional expanding firms	0,0439	0,0561	0,653	63
Non-regional expanding firms	Local expanding firms	0,0605	0,0458	0,497	93
Regional expanding firms	Local expanding firms	0,0791	0,0748	0,888	32
Non-regional entrepreneurs	Regional entrepreneurs	-0,0021	-0,0036	0,831	832
Non-regional entrepreneurs	Local entrepreneurs	-0,0107	0,0131	0,000	1254
Regional entrepreneurs	Local entrepreneurs	-0,006	0,0182	0,000	909
Unknown entrepreneurs	Non-regional entrepreneurs	0,0154	-0,0088	0,000	1263
Unknown entrepreneurs	Regional entrepreneurs	0,0126	-0,0060	0,002	917
Unknown entrepreneurs	Local entrepreneurs	0,0153	0,0144	0,849	1393

Table 4: Match of local economy in 1994 with employment gained / lost by employment source between 1994 and 2005 + 2010												
Employment source (1994 until 1999 cohort)	**# plants in 2005**	**Employ-ment gained/ lost until 2005**	**Present-employmen t-structure baseline in 1994**	**Match in 2005**	**p-value*** **(t-test: *Present-employme nt-structure baseline = Match)***	**N (# municip alities)**	**# plants in 2010**	**Employ-ment gained/ lost until 2010**	**Present-employmen t-structure baseline in 1994**	**Match in 2010**	**p-value*** **(t-test: *Present-employm ent-structure baseline = Match)***	**N (# mun icipa lities)**
Incumbent growth		92699	0,0526	0,0627	0,209	284		89759	0,0528	0,06	0,429	281
Incumbent decline		54576	0,0484	0,048	0,974	284		62271	0,0502	0,0437	0,535	286
Incumbent plants exits	42317	229152	0,0502	0,0374	0,07	286	46280	273430	0,0502	0,0393	0,127	286
Exit-to-non-tradable-product	1880	19394	0,0498	0,0625	0,328	264	1517	17576	0,0553	0,0825	0,032	256
Entry-from-non-tradable-product	1055	10651	0,0542	0,0496	0,744	223	648	7628	0,044	0,0465	0,862	181
Exit-from-tradable-to-tradable-product	2669	57280	0,0502	0,0377	0,272	277	2344	48932	0,0533	0,0392	0,248	275
Entry-from-tradable-to-tradable-product	1634	37560	0,0478	0,0936	0	257	1053	25769	0,0443	0,0861	0,002	234
Out-migration	2097	13109	0,0467	0,0015	0,001	246	1600	11659	0,0486	-0,0061	0	242
In-migration	953	7522	0,0516	0,0078	0,004	186	539	5625	0,0599	0,0323	0,085	152
All expanding firms	473	11276	0,051	0,0958	0,036	148	319	8465	0,0518	0,1138	0,004	132
Non-regional expanding firms	383	8205	0,0297	0,0978	0,006	126	260	6158	0,0368	0,1292	0	111
Regional expanding firms	36	1072	0,1263	0,0727	0,241	32	25	737	0,1215	0,064	0,156	24
Local expanding firms	54	1999	0,0626	0,0591	0,902	29	34	1570	0,0541	0,0587	0,888	21
All entrepreneurs	12200	63105	0,0502	0,0456	0,628	286	6728	47058	0,0506	0,049	0,878	284
Non-regional entrepreneurs	1103	2858	0,0558	0,004	0,001	237	578	1989	0,067	0,0257	0,012	188
Regional entrepreneurs	1414	2764	0,0605	-0,0001	0	170	698	1646	0,0695	0,0015	0	137
Local entrepreneurs	4940	17124	0,0486	0,0317	0,149	278	2793	13675	0,0487	0,0474	0,91	260
Unknown entrepreneurs	4743	40359	0,0492	0,0449	0,682	284	2659	29748	0,0567	0,0493	0,531	271

Table 5: p-values of t-test on differences between match values of employment gained / lost by different employment sources until 2010 with local economy in 1994																		
Employment source: 1994 until 1999 cohort	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
(1) Incumbent growth	.	.307	.045	0	.102	.234	.729	.226	.055	.03	.003	.	.	.353	.011	0	.325	.203
(2) Incumbent decline	.307	.	.738	.027	.336	.038	.256	.626	.003	.001	0	.	.	.764	.062	.014	.959	.943
(3) Incumbent plants exits	.045	.738	.	.001	.466	.001	.771	.936	0	.004	0	.	.	.351	.098	.012	.425	.533
(4) Out-migration	0	.027	.001	.	.111	0	.034	.003	0	0	0	.	.	.001	.042	.19	.004	.001
(5) In-migration	.102	.336	.466	.111	.	.039	.296	.075	.004	.067	.02	.	.	.768	.55	.029	.218	.523
(6) Exit-to-non-tradable-product	.234	.038	.001	0	.039	.	.305	.021	.521	.113	.056	.	.	.018	.006	0	.011	.059
(7) Entry-from-non-tradable-product	.729	.256	.771	.034	.296	.305	.	.985	.045	.3	.268	.	.	.463	0	.048	.778	.373
(8) Exit-from-tradable-to-tradable-product	.226	.626	.936	.003	.075	.021	.985	.	.001	.027	.008	.	.	.588	.307	0	.392	.88
(9) Entry-from-tradable-to-tradable-product	.055	.003	0	0	.004	.521	.045	.001	.	.418	.048	.	.	.002	.002	0	.002	.011
(10) All expanding firms	.03	.001	.004	0	.067	.113	.3	.027	.418	.	.43	.	.	.022	.021	.004	.007	.043
(11) Non-regional expanding firms	.003	0	0	0	.02	.056	.268	.008	.048	.43	.	.	.	.005	.001	.007	.001	.01
(12) Regional expanding firms	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(13) Local expanding firms	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
(14) All entrepreneurs	.353	.764	.351	.001	.768	.018	.463	.588	.002	.022	.005	.	.	.	.02	.004	.477	.695
(15) Non-regional entrepreneurs	.011	.062	.098	.042	.55	.006	0	.307	.002	.021	.001	.	.	.02	.	.14	.337	.088
(16) Regional entrepreneurs	0	.014	.012	.19	.029	0	.048	0	0	.004	.007	.	.	.004	.14	.	.002	.04
(17) Local entrepreneurs	.325	.959	.425	.004	.218	.011	.778	.392	.002	.007	.001	.	.	.477	.337	.002	.	.674
(18) Unknown entrepreneurs	.203	.943	.533	.001	.523	.059	.373	.88	.011	.043	.01	.	.	.695	.088	.04	.674	.

Figure 1: Cosine similarity of industry employment shares, 1994-2010

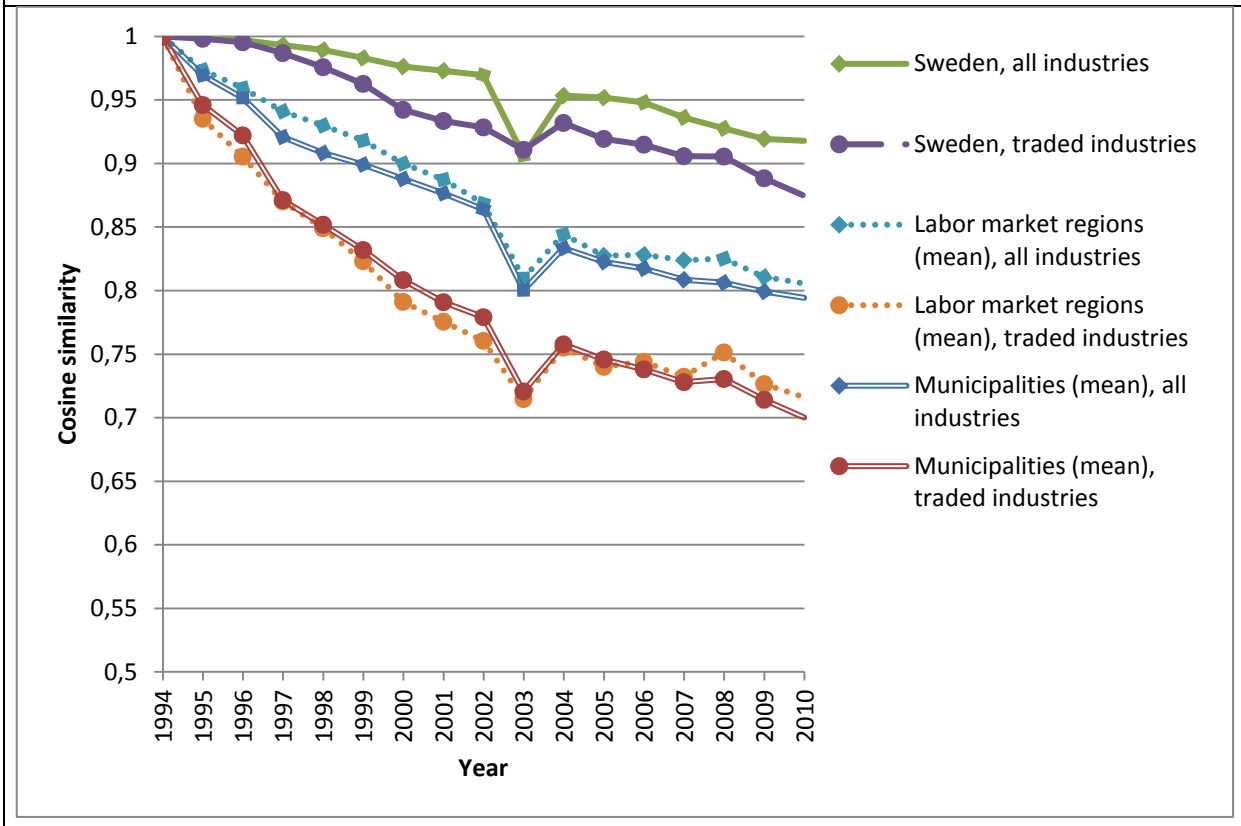


Figure 2: Existence of industries in municipalities (local industries), 1994-2010

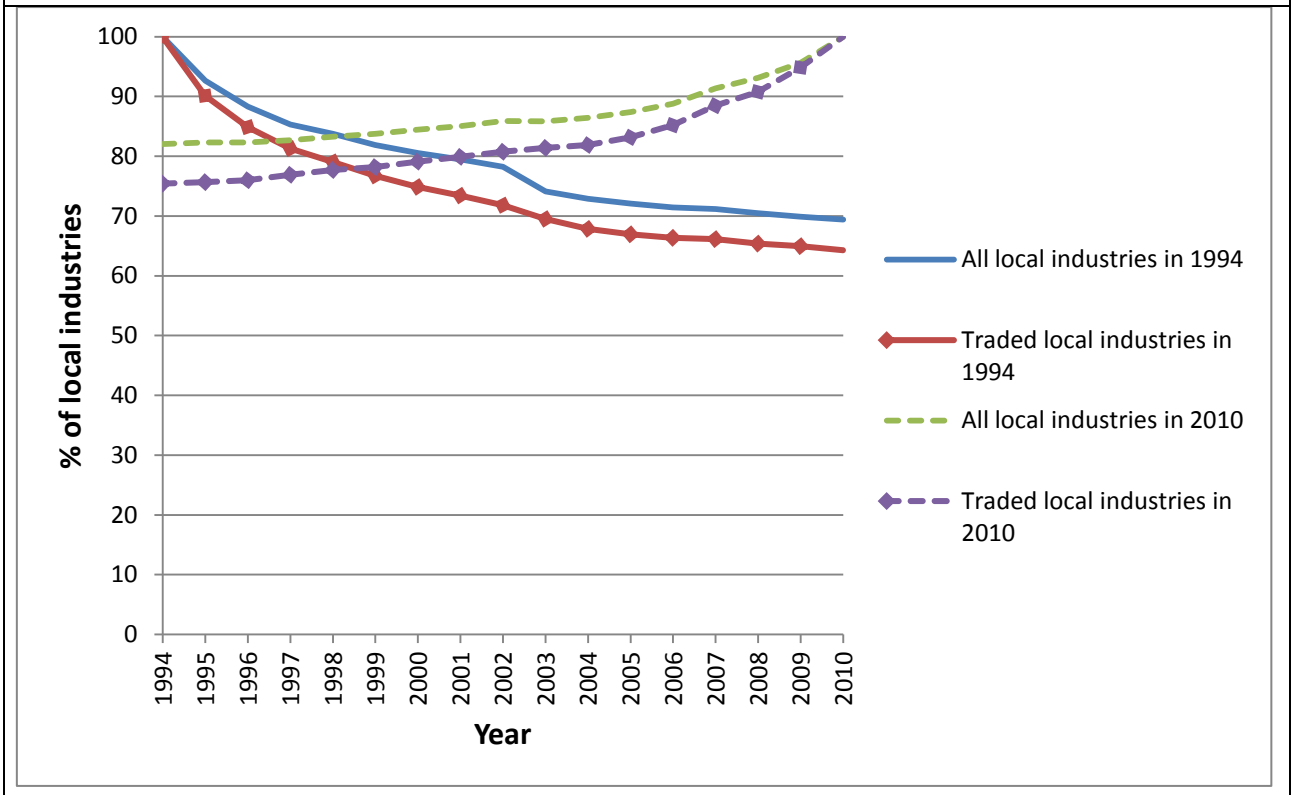
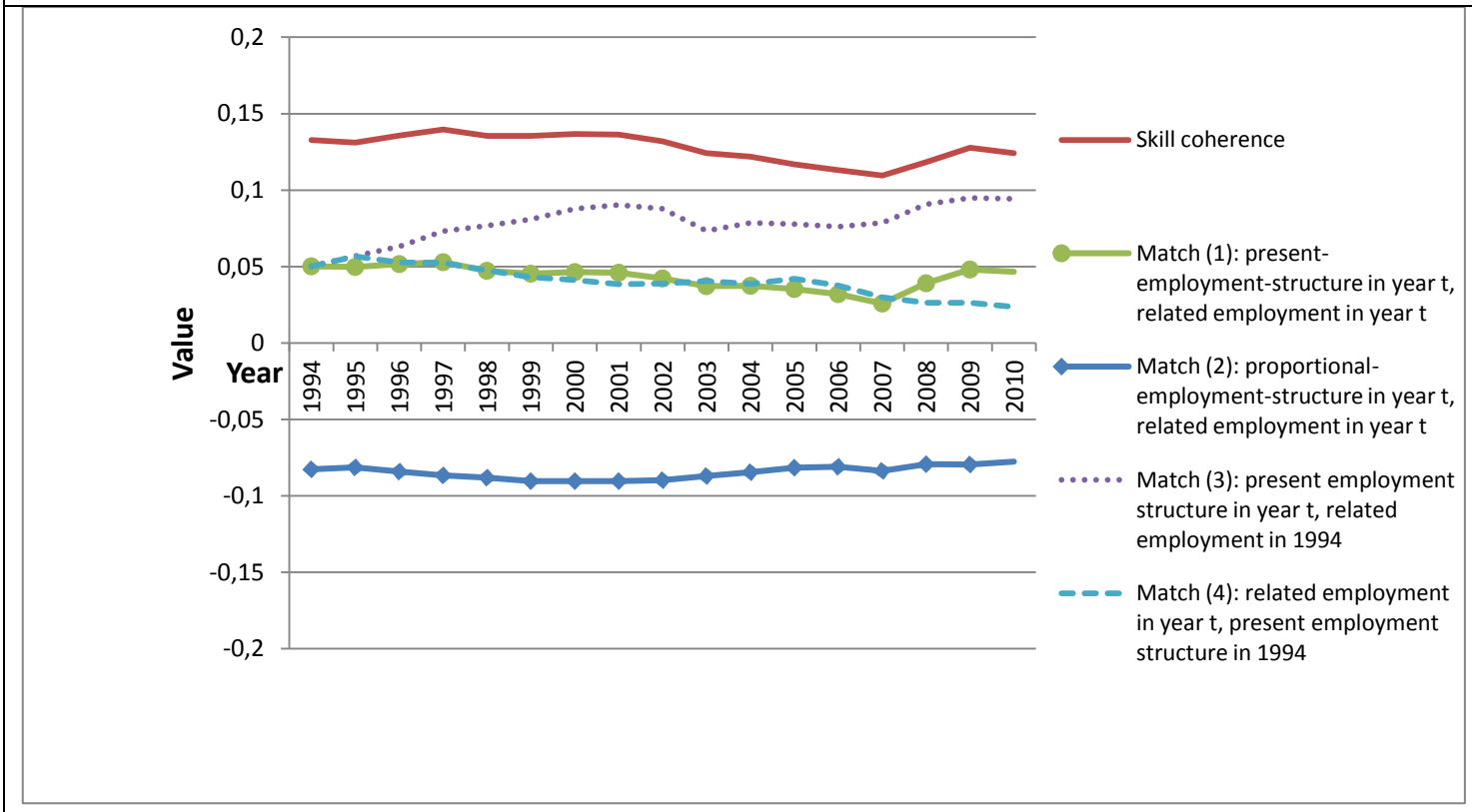


Figure 3: Match of local economies, averaged across all municipalities, 1994-2010



- Skill coherence is the absolute difference between the present-employment-structure Match (1) and the proportional-employment-structure Match (2). Hence, it represents the match of the local economies with themselves whilst taking into account if the employment shares of industries were distributed across municipalities randomly (i.e. following national shares).
- Matches 1 to 4 are the employment weighted location quotients of employment in related industries (Eqs. 7 and 8), averaged across all municipalities.