Agents of structural change

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industrial and structural change

- industrial dynamics and diversification: need to diversify into new industries to secure long-term economic development (Schumpeter)

- regional development is depicted as a branching process in which new, yet related industries spin out of existing activities (Boschma, Frenken, Hausmann, Hidalgo, Roderik, etc.)

- industrial change does not necessarily imply structural change

1. diversification in **related industries**: building on similar capabilities: industrial change **without** structural change

2. diversification in **unrelated industries**: expands the capability base of the region: the latter is defined as **structural change**
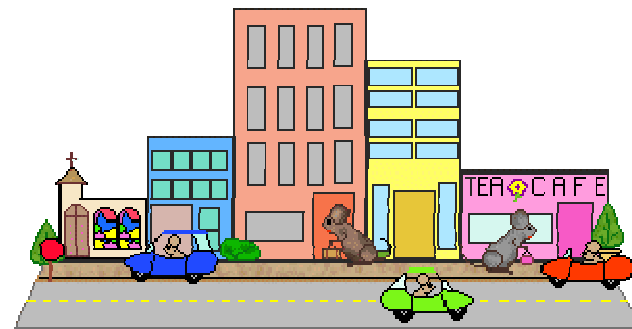
types of diversification

region A

region B

main question

- which economic agents induce merely industrial change, and which agents bring about structural change?

1. entrepreneurs or existing firms?
2. locals or non-local firms?

measuring structural change → measuring relatedness

- capabilities are hard to measure, but we can assess the **similarity** in capability requirements of different industries

- basic idea:

  (1) industries are **related** if they require similar capabilities (Teece et al. 1994)

  (2) when a region diversifies into an industry that is **unrelated** to its current industry mix, it expands its capability base

measuring structural change

- **skill relatedness**: how similar are the skill requirements of two industries?
  - **industry-industry characteristic**

- **embeddedness** of an industry in a region: how much related employment is there in the region for that industry?
  - **city-industry characteristic**

- **coherence (static)**: how well-embedded is the region's industrial mix in the local economy?
  - **city characteristic**

- **structural change (dynamic)**: how well-embedded is the region's industrial mix of year T+t in the local economy of a base year T?

- **structural change by agent type**: how well-embedded in the local economy of the base year T are the industries in which a given agent type destroys or creates employment?

step 1: skill relatedness

- how similar are the human capital requirements of 2 industries?

- the more similar they are, the larger the labor inflows between the 2 industries

- skill-relatedness indicator: compares observed inter-industry labor flows against a baseline

- baseline: expected inflows from industry i to industry j, assuming that j receives a share of total worker flows from i that is proportional to the share of inflows that j receives from any industry in the economy

- industries *i* and *j* are skill-related if their labor flows exceed this baseline: excessive labor flows between the two industries

step 2: embeddness

- how much employment is related to an industry *i*

- the more related employment in a region, the stronger the match of industry *i* with the region's capability base

- the capability match of industry *i* to region *r* in year *t* is defined as the degree to which the region is overspecialized in industries related to industry i (location quotient)

step 3: coherence

- how related is a set of industries to all other industries in a region: overlap in capability requirements

- **coherence** is the employment-weighted average capability match of all industries in a region

- the higher the coherence, the more related the industries in the region are to one another

step 4: structural change

- **structural change** by **agent type** is derived from the average capability match of the employment this agent creates or destroys in a given period to the industrial structure of the region in base year T

- it shows how strongly new (or destroyed) employment by an agent type is related to the local economy of base year T

- either agents **reinforce the regional capability base** (related):

  1. creation employment in local industries with high capability match values
  2. destruction employment in local industries with low capability match values

- or agents **shift the regional capability base** (unrelated or structural change):

  1. creation employment in local industries with low capability match values
  2. destruction employment in local industries high capability match values

data

- Sweden 1994-2010
  - employer-employee linked: employment history of all workers

- skill relatedness
  - labor flows (workers who change firms) among industries

- industrial and structural change against the base year of 1994
  - labor market areas (110)
  - traded industries: 5-digits (259)

- agents types
  - new plants that belong to larger firm → firm expansion
    - geographical origins: location of parent firm

  - new plants that do not belong to a larger firm → entrepreneurs
    - geographical origins: previous location of entrepreneurs
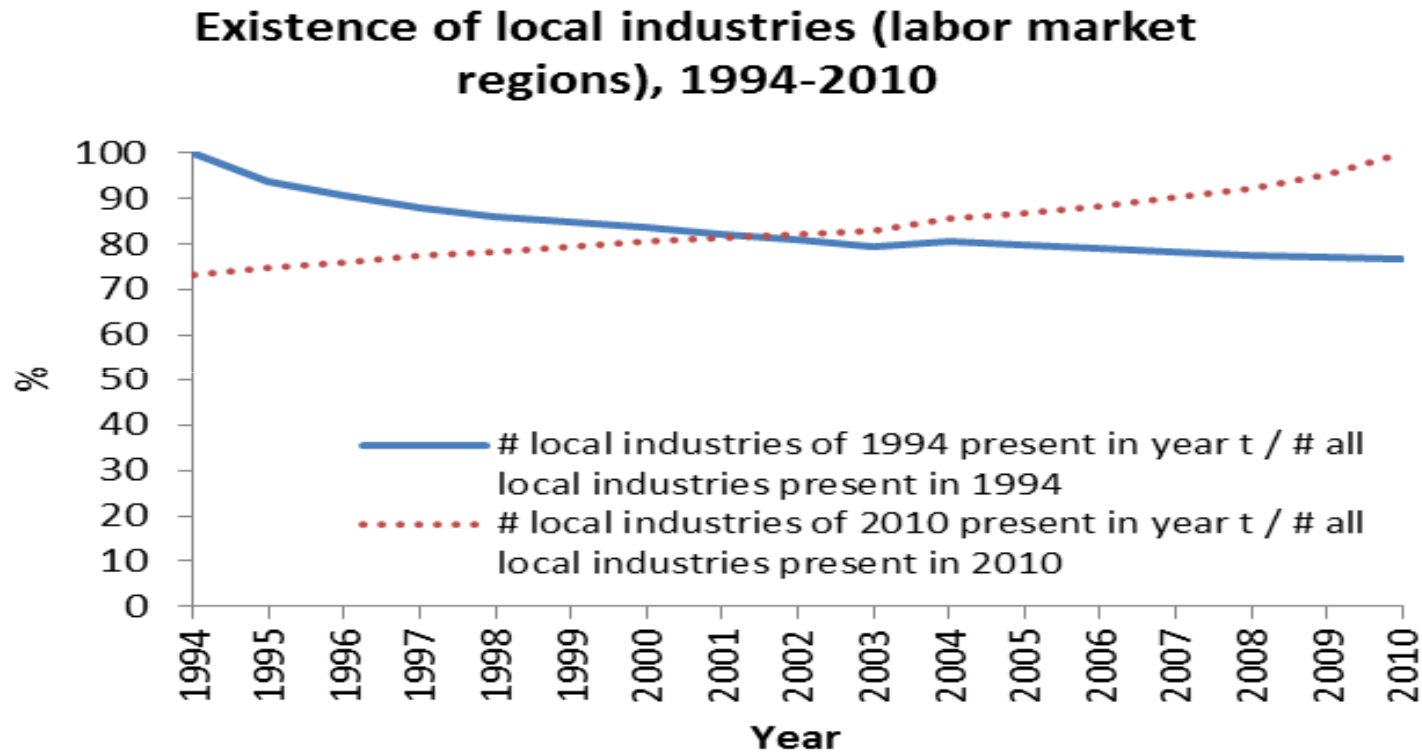
diversity
how diversified is Sweden?

Entropy labor market regions, tradable industries, 1994-2010
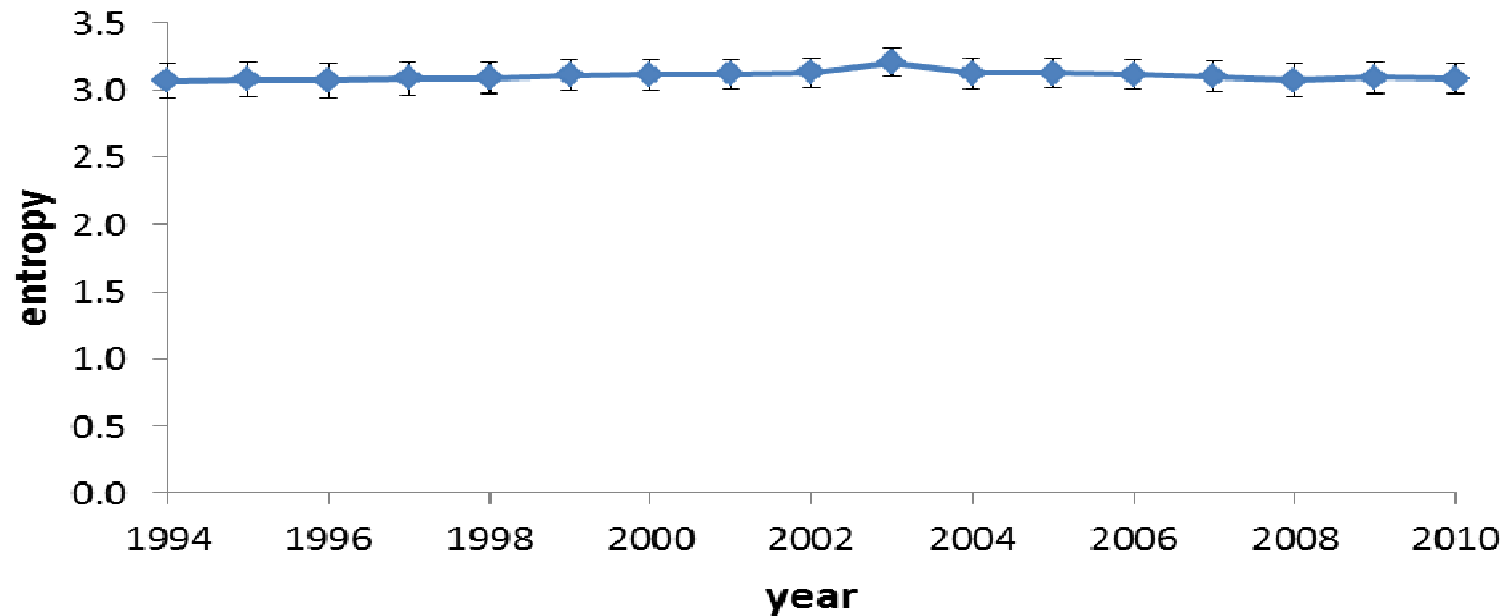
the diversity of local economies does not change much

industrial change
## how many local industries entered and exited?

Existence of local industries (labor market regions), 1994-2010

Legend:
- # local industries of 1994 present in year t / # all local industries present in 1994
- # local industries of 2010 present in year t / # all local industries present in 2010

many local industries come and go in regions
27% of all local industries in 2010 did not yet exist in 1994
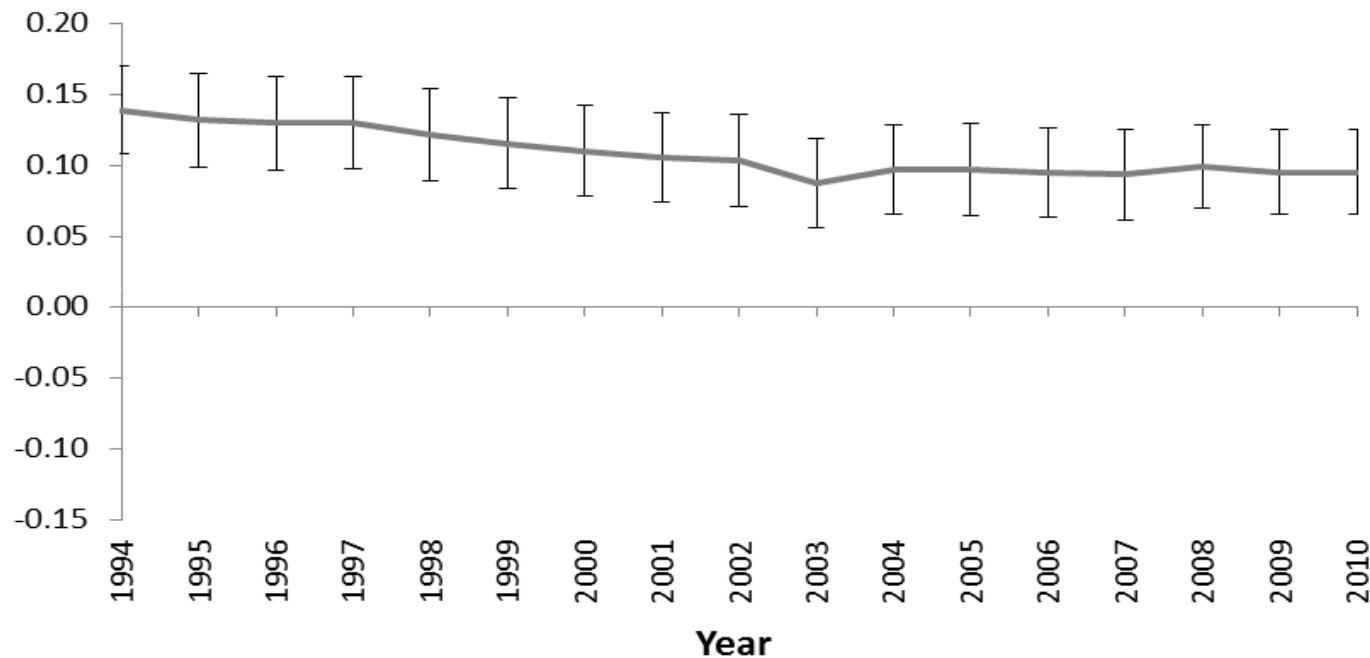**25% of all local industries in 1994 have disappeared by 2010**

coherence
how coherent are Swedish regions?
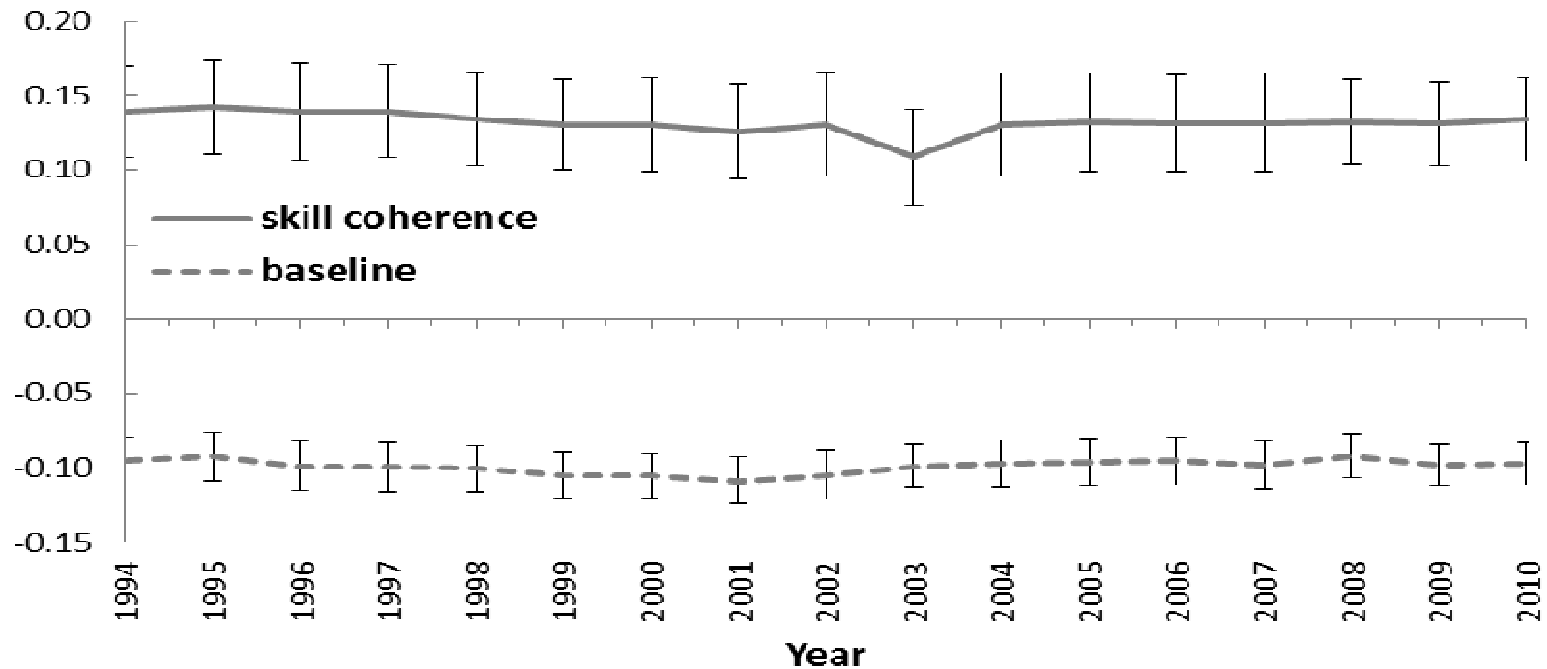
in spite of substantial diversification and changes in employment structures, the overall cohesion of Swedish regions did not change

structural change
did the skill structure change?

relatedness of a region's industry mix to the base line economy of 1994 progressively weakens, structural change unfolds very slowly
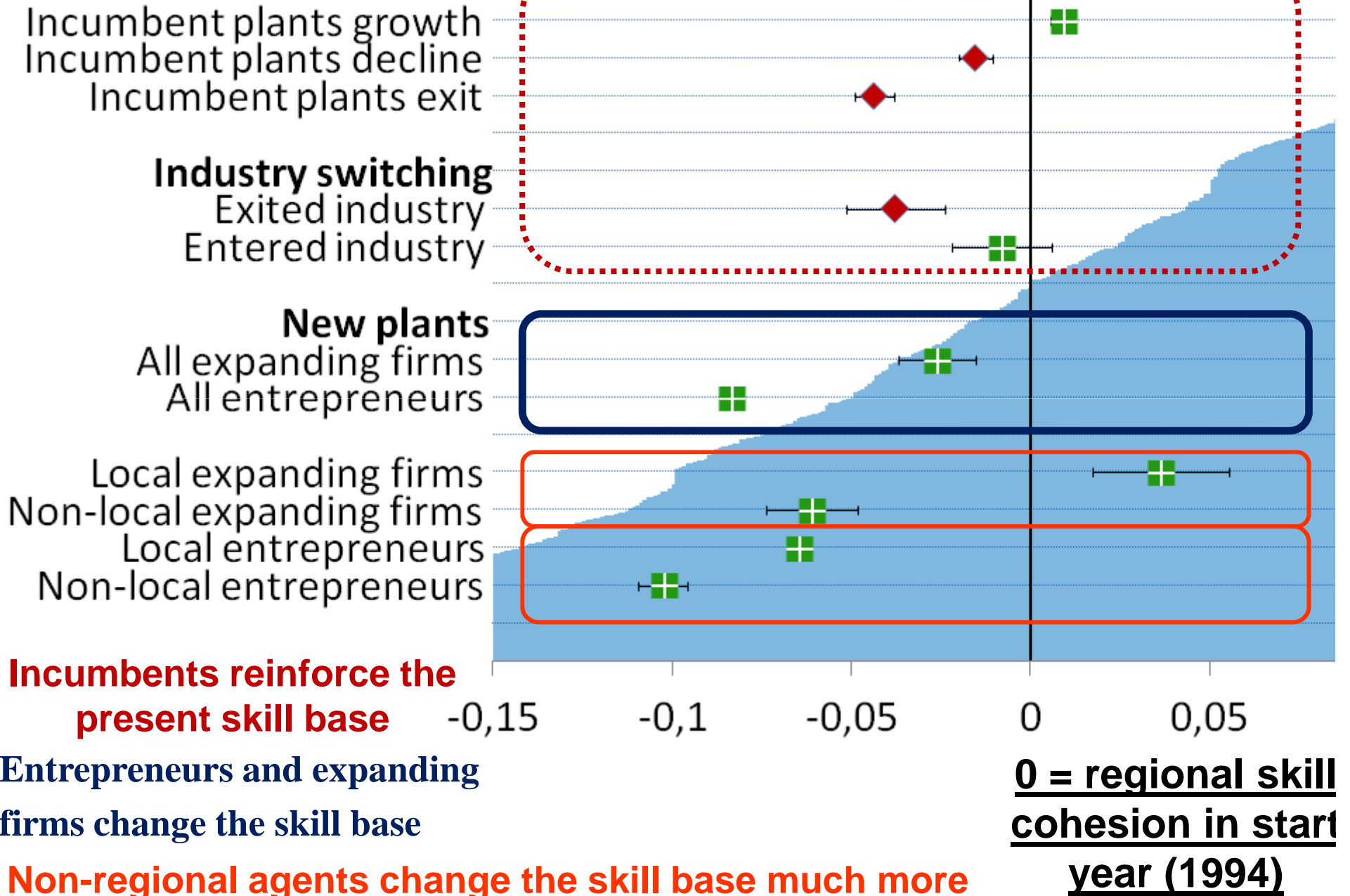
conclusions

- lot of change in industrial composition of Swedish regions

- in spite of this, very little structural change

- industrial change **balances out** in the aggregate: it might be the case that some economic agents move a region away from its traditional capability base, whereas other agents reinforce it
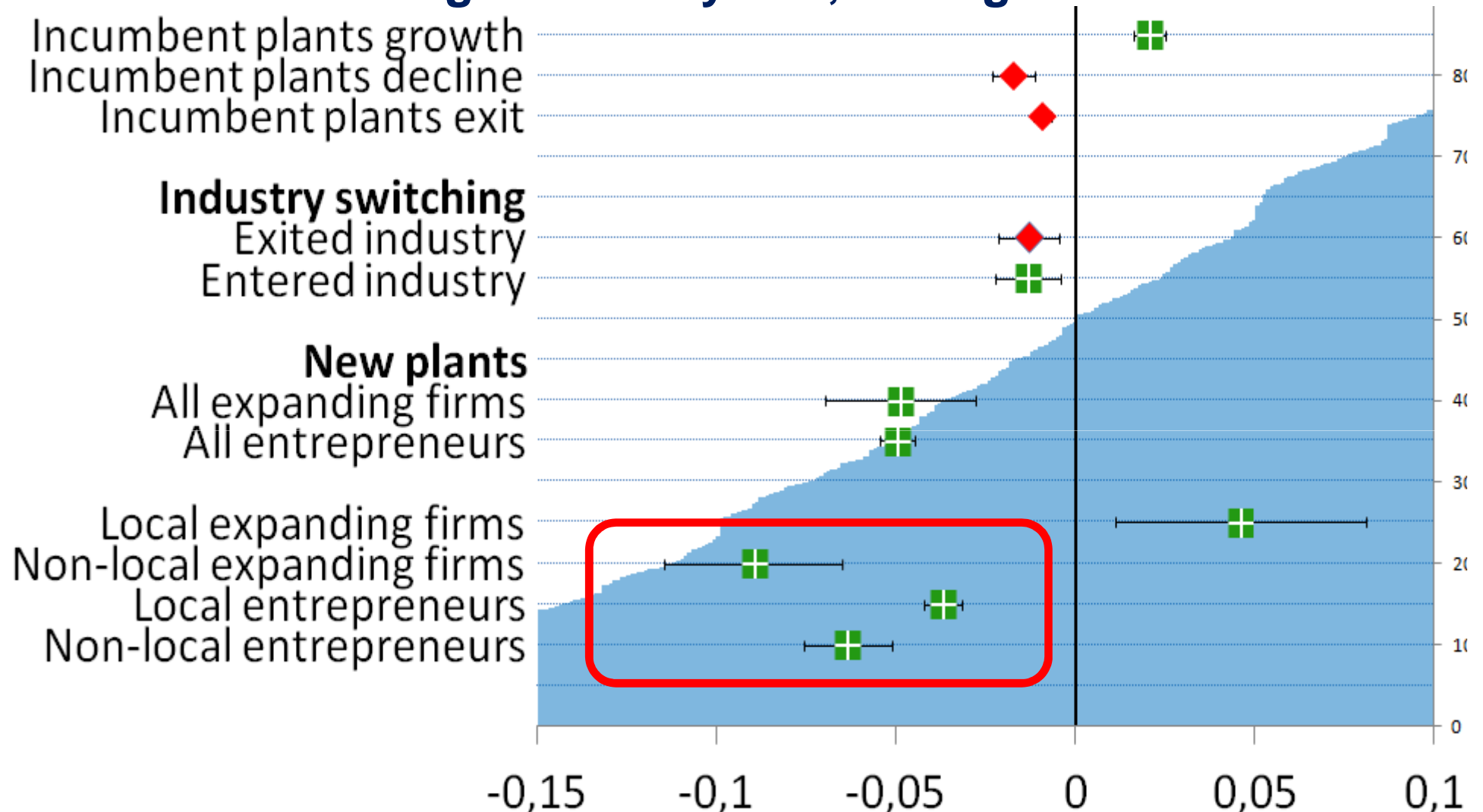
agents of structural change

1. incumbents
   a. growing
   b. declining
   c. exiting

2. new plants set up by
   a. entrepreneurs
      i. regional
      ii. from outside the region

   b. expanding firms
      i. regional
      ii. from outside the region

3. product switching

who induce change in regional skill base? Structural change after 1 year, average values

who induce change in the regional skill base? Structural change after 10 years, average values

Incumbent plants growth
Incumbent plants decline
Incumbent plants exit

Industry switching
Exited industry
Entered industry

New plants
All expanding firms
All entrepreneurs

Local expanding firms
Non-local expanding firms
Local entrepreneurs
Non-local entrepreneurs

-0,15   -0,1   -0,05   0   0,05   0,1

Long run: non-regional expanding firms overtake entrepreneurs as the most important agents of structural change

0 = regional skill cohesion in start year (1994)

regressions, controlling for industry, entry year, region fixed effects:

- does local related employment matter for the <u>survival chance (after 10 years)</u> of a new plant?

    - entrepreneurs: <u>yes, positive effect</u>,

    - expanding firms: <u>no</u>

- hence, to survive, entrepreneurs rely more on the local environment than expanding firms (the latter, instead, may be able to draw upon firm-internal resources)

inter-regional skill diffusion

- do non-local agents diffuse skills from their home region to their host region when they set up new plants?

Agent	Skill embeddedness in home region	Skill embeddedness in host region
Non-regional expanding firms	.072	-.019
Non-regional entrepreneurs	.001	-.019

conclusions
who induces most structural change?

- incumbents reinforce the skill base of regions

- structural change has to be brought in primarily by actors from outside the region: (1) non-local expanding firms; (2) non-local entrepreneurs; (3) local entrepreneurs

- to survive, expanding firms depend less on related employment in the region than entrepreneurs

- cross-regional skill diffusion requires mobility of entrepreneurs and firms: the home regions of non-local actors often have strongly-developed skill bases in the activities the actors introduce and undertake in the host region

caveats
who induces most structural change?

- the conclusions hold **given** an agent type, but the overall influence of an agent type also depends on its prevalence

    - incumbents represent the main employment share in the economy

    - entrepreneurs generate 5-6 times the employment than expanding firms do

    - entrepreneurs are very often local entrepreneurs, whereas expanding firms very often come from outside the region

    - long run versus short run: entrepreneurs have a harder time surviving in under-embedded local industries

paper is available on the working paper series:

Papers in Evolutionary Economic Geography,
Agents of Structural Change
2014, no. 14.10

Thank you for your attention!

regional branching and policy intervention?

- regional policy based on regional branching takes the existing industrial structure at the regional level as a starting point

- objective: to broaden and renew the industrial structure of a region: make it branch into new related fields by making connections between related industries

- no 'one-size-fits-all' policy

- no universal optimal policy model (no copying of best practices)

- do not start from scratch: region-specific assets as building blocks

- history matters: need for tailor-made policy strategies based on relatedness: focus on available options and probable outcomes of regional policy

where to intervene in the regional industrial structure?
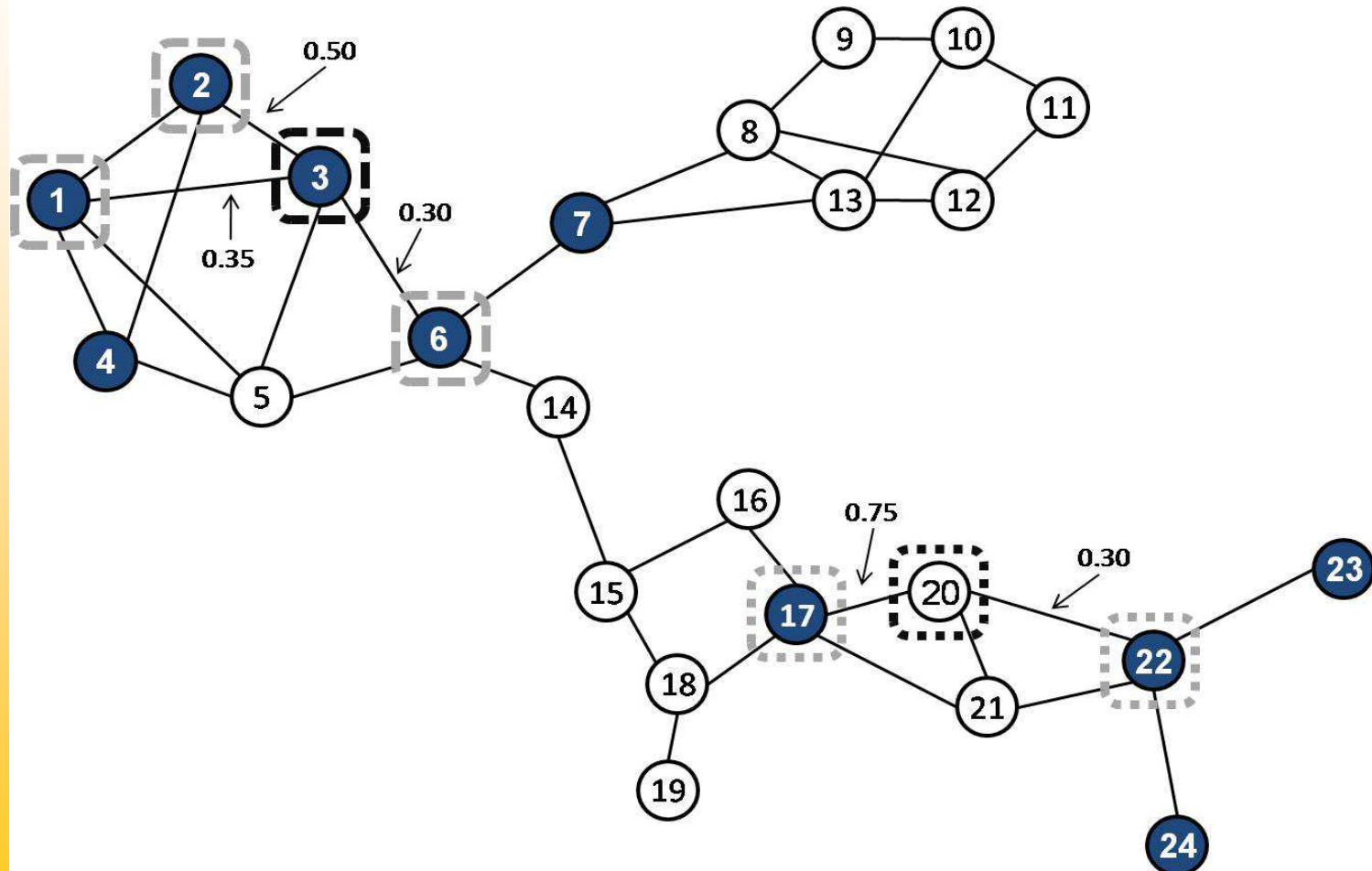
measurement of embeddedness

- **Embeddedness**: RCA (LQ) of related employment

$$M_{ir} = \frac{E_{ir}^{rel}/E_{.r}}{E_{i.}^{rel}/E_{..}}$$

How over-represented is industry i in region r?

- Skewed distribution → transform

$$M_{ir}^* = \frac{M_{ir} - 1}{M_{ir} + 1}$$

- Property: x% over-representation and x% under-representation are equidistant from 0

$$M_{ir}^* = f(M_{ir}) = -f\left(\frac{1}{M_{ir}}\right)$$

eq

coherence and structural change

- Embeddedness is an industry-city characteristic
- Calculate weighted averages of embeddedness at the city level:
  - How related is a set of industries to all other industries in the city?

- **Coherence**: average of M_{ir}^* weighted by city's employment structure

$$C_r = \sum_i \frac{E_{ir}}{E_r} M_{ir}^*$$

- **Baseline**: weights proportional to industry's national size

$$B_r = \sum_i \frac{E_{i.}}{E_{..}} M_{ir}^*$$

- **Structural change by agent type**: weights equal to the employment generated by different agents in year t

$$\Delta_t^a = \sum_{i,r} \frac{E_{irt}^a}{E_{.rt}^a} M_{irt_0}^*$$

graphs of structural change by agent type

- Calculate average embeddedness for each agent that adds or subtracts employment:

$$M_{ir} = \frac{E_{ir}^{rel}/E_{.r}}{E_{i.}^{rel}/E_{..}}$$

$$\Delta^a = \sum_{i,r} \frac{E_{ir}^a}{E_{.r}^a} M_{ir}^*$$

- Graph against the present employment structure
  - Right of zero: employment change takes place in industries that are reinforcing the current capability structure
  - Left of zero: employment change takes place in industries that is changing the current capability structure