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Creative destruction and economic welfare in Swedish regions: spatial dimensions of structural change, growth and employment

Working Paper

Institut für Regional- und Umweltwirtschaft
Institute of Regional Development and Environment

WIRTSCHAFTS UNIVERSITÄT WIEN

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SRE-Discussion 2008/03 2008

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Regional- und Umweltwirtschaft

Creative destruction and economic welfare in Swedish regions.

Spatial dimensions of structural change, growth and employment

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Abstract

In its aim to explore some of the concrete consequences of regional renewal, this paper deals with the question to what extent dramatic structural transformation and renewal in Swedish regions is paralleled by favourable developments of household income, employment growth and value added total growth. We studied the period 1978 to 2004, building on previous research concerning the regional consequences of the dramatic technology-shift process that has been taking place in Sweden. Long-term changes in the relationships between Swedish regions are analysed by establishing conceptual connections between regional long-term economic transformation and welfare. It is argued that there are time-lags as well as systemic spatial asymmetries when it comes to technology-induced restructuring, overall regional economic growth, employment creation, and income growth. We used data from the DEVIL (Databases of Evolutionary Economic Geography in Lund) combined with additional data sets from Statistics Sweden.

Introduction

Economic renewal and transformation: some unanswered questions

This paper deals with the connection between regional economic transformation/renewal and welfare creation. Our interest in this research field is spurred by two sets of questions.

Firstly, previous research efforts have revealed an increasing divergence in the Swedish regional system during the 1980s and 1990s (measured in production and productivity), accompanied by substantial aggregate growth in produced volumes and labour productivity (Svensson Henning, 2006; Lundquist, Olander, and Svensson Henning, 2005, 2008). Even if it might be argued that this divergence is an expected temporal phenomenon in times of dramatic economic transformation (i.e. that regional transformation is characterised by substantial time-lag effects within a regional system), it is an intriguing question if the transformation and growth at a national level in Sweden has been accompanied by economic welfare increases in all regions, or if the national transformation process is systematically benefiting some regions at the expense of others, which then 'pay' for the transformation process.

Secondly, there is the controversy regarding claimed processes of 'jobless growth' that characterised many contemporary economies during the 1990s.[1] According to the thesis, the old established connection between aggregate or productivity growth and quantitative employment change is replaced by a situation where aggregated growth (in volume or productivity) is to an increasing extent taking place without growth in employment opportunities. Such a situation could theoretically be explained by increases in labour productivity overshadowing increases in demand. The jobless growth thesis is a contested one, but has figured in the Swedish national economic debate for quite some time. But why some argue that the jobless growth is an effect of the rigid Swedish labour market, others question the thesis at large. For the moment, the last opinion is gaining ground due to the improving national labour market situation. However, the question whether we are stuck in a more or less job-less growth, nationally and permanently, can not been fully answered until national development is considered the aggregated outcome of regions starting their growth or

[1] For a discussion about productivity change and jobless growth, see Andersson (2006).

decline at various points of time during a national technology shift process. Therefore, the answer to the question may depend on the time period studied.

With this paper, we hope to contribute to a more insightful debate on the regional benefits and cost of national economic transformation and, although being proponents of the necessary structural transformation of economies, avoid naïve interpretations on the regional aspects of economic change. We will therefore try to measure and assess the importance of Schumpeter's 'creative destruction' on a regional level.

The writings of the early Schumpeter (for example Schumpeter, 1951, 1939) have inspired the development of an extensive neo-schumpeterian literature on innovation, economic change and growth, especially within the various stances of evolutionary economic thinking (Nelson and Winter, 1982; Fagerberg, 2003; Saviotti, 2001; Nelson, 2006; Freeman and Lourça, 2001). In recent years, the broad evolutionary framework has also diffused into the core discussion of other disciplines, such as economic geography (Boschma and Frenken, 2006; Boschma, 2004; Frenken *et al.*, 2004). Within more non-formalised stances ('appreciative,' Nelson and Winter, 1982) also subscribing to the basic theoretical suggestions posed by evolutionary economic theory, several scholars have discussed the occurrence of paradigms or structural periods of economic development and change, defining the main cognitive 'search area' of innovations and innovation implementation in the firm. These paradigms are often dominated by a defining key innovation, some may call it the pervasive impact of 'general purpose technologies'[2], and accompanied by new structures of relative prices (Dosi, 1988; Freeman and Perez, 1988; Schön, 2000). Sometimes the dominating forces of growth are theoretically associated with the co-development of dominant technologies and their complementarities, institutional structures and organisational structures (Schön, 2000).

In Swedish economics and economic history, structural research has had a long and vibrant tradition, mainly within the framework of the Swedish growth school (Erixon, 2005). More specifically, the works by Lennart Schön (Schön, 2000, 2006) formulate the 'technology shift' thesis, which forms the basic framework of this paper. By quantitative analysis of aggregated time series (among others investment, capital/labour quotas and productivity) as well as more qualitatively oriented evidence, Schön has identified reoccurring phases of development in the

[2] The concept of general purpose technologies was used earlier (if not invented) by Bresnahan and Trajtenberg (1995).

Swedish economy with similar characteristics in terms of investments, technology diffusion, systematic lag effects between industry and institutional structures, forge-ahead and lagging industries, pre- and post-crises behaviour among actors and distribution of wage/profit quotas. Within each reoccurring period (technology shift) of about fifty years, development is characterised by the stylized sequence of transformation – rationalisation – crisis. Schön's theories relate to the 'development block' thesis formulated by the Swedish economist Erik Dahmén in the 1940s and 1950s (Dahmén, 1950, 1988). By this, Schön provides explanations for the growth and demise of industries over time in a national production system and since the initiation of industrial capitalism, as well as to the dynamics of macro-economic crises and fluctuations in wage/labour quotas.

Each defined technology shift period has its own logic in terms of inherent causality between innovation diffusion, institutional change, change in productivity and volume, and relative factor prices. The thesis therefore questions the standard theories regarding economic evolution as a continuous process characterised by gradual transformation, where technology is often regarded as an exogenous factor of change and where movements towards equilibrium and convergence can be seen as normal states of transformation. Schön (2006) has shown the merits of the approach and convincingly argued for the causality behind the scientific logic. However, when it comes to the regional dimensions and the regional welfare aspects of economic long-term transformation, the technology shift thesis is in need of qualification. For example, previous research contributions have identified the 'regional receiver and development competence', which is assumed to determine the ability of a region to absorb, implement and commercially translate the growth forces of the technology shift (process and product innovation), based on different types of externalities (Lundquist and Olander, 2001; Svensson Henning, 2006; see also Karlsson and Nilsson, 2002). This competence varies in different parts of the regional hierarchy and should give rise to lead-lag relationships between regions in different stages of the technology shift process. But even if the research tradition about regional hierarchies or systems also goes back to theorists such as Lösch and Christaller (see Pred, 1973), more detailed studies remain to test and verify the nature, reasons and system behind regional lead-lag relationships. Therefore, the questions we pose in this paper have so far largely been left unanswered in the contemporary literature.

Aim and research questions

The aim of this paper is to, from reading the literature, empirically investigate whether there are time lags between regions in economic transformation and diffusion of growth within a regional system, and if regional economic transformation and growth is associated with increases in economic welfare (employment and household income) at a regional level. We aim to investigate the case for Sweden during the years 1978 to 2004, using a systemic regional approach where regions, on the basis of size, are divided into six classes (tiers). The following research questions are posed in the paper:

- Are there identifiable time lags in economic transformation/renewal between regions in the Swedish regional system during the period studied?
- Is there a relationship between regional economic transformation, on the one hand and regional aggregated growth, employment, and household income on the other?

From theory to method

Our assumptions derived from the literature are that general purpose technologies define main characteristics of economic transformation, renewal and growth during a technology shift process. These technologies create growth in new industries and revitalise older parts of the economy through productivity increases and lower costs. By definition, they affect almost the entire economy and open up to the growth of technological complementarities, defining new contexts for older and more mature technologies. We also assume that the impact on different industries and sectors are differentiated in various scale, but also at different points in time (Perez 1983). This would give growth patterns their cyclical characteristics during the period. Industry-specific technologies are assumed to exert minor influence in this context. These will not define the character of the growth trajectories over the whole period, but create only variations which arise between national as well as regional economies. It is of course a huge task to try to measure the direct and indirect effects of general-purpose technologies on growth, productivity, and investment for all industries in an economy, and to sort these effects out from all other influences. This is not our purpose. What we wish to achieve is to show that the traces of the technology shift are made clear to the extent that they cannot be neglected. We argue that they must be taken into account, especially when it comes to issues of regional development. We hope to inspire further research in this tradition.

How are we then to proceed to make it probable that we see the effects of the technology shift? Our point of departure is the technology shift thesis by Schön (2000; 2006) and the aggregate data that support his discussion. The time period during which the present technology shift takes place is derived from this literature, or rather, the first part of this shift that the Swedish economy has passed through so far. Schön's results encouraged us to define hypothetical and stylized combinations of growth and productivity trajectories to which characteristics of price-volume development must be added for this period. These are assumed to correspond to industries playing different roles in the technology shift process. Industries producing key inputs for new products associated with new GPT would for example show combinations of trajectories and price-volume changes differentiated from those of industries with other roles to play. These could for instance be early or late adopters of the new technologies, industries that serve as demand-driven suppliers to technology-driven industries, consumer goods industries driven by real wage increases, or industries that are not affected at all. The challenge is then to sort actual industries into these hypothetical and stylized combinations in order to reveal undercurrents of aggregate transformation. Therefore, there is a need to analyse the characteristics of actual industry growth curves during sub-periods of the technology shift period, not only growth between years defining the limits of the period. The technology shift thesis also makes it necessary to analyse the characteristics of actual industry productivity growth curves during the same sub-periods. Additionally, these different volume- and productivity growth curves with their combinations of sub period characteristics are also connected to the development of relative prices in relation to the development of relative volumes within industries during the whole period. Four ideal market situations come out from combining conceivable relative price and relative volume development on markets over time: market push (growth by strong innovation implementation or marketing), market pressure (increasing competition from product and process improvements), market pull (induced effects from growth/demise of other industries), and market contraction (increasingly obsolete manufacturing). The four market situations, derived from literature in the field (Dahmén 1950; Josefsson and Örtengren 1980; Ljungberg 1990), can be used to determine whether industries have been relatively supply-driven or demand-driven during a time period. This facilitates the interpretation of industry roles during the process.

Method

Thus, the joining of theory conceived volume- and productivity-growth characteristics with the four market situations make us create theoretically informed stylized industry groups, each assumed to have a different role to play during the technology shift process. 170 manufacturing industries are then to be put into these groups using consistent time series data for the years 1978 to 2004. This procedure consists of four stages[3]. The first stage entails identification of industry groups exhibiting similarities in their growth of value added in different temporal phases of the investment cycle. The second stage divides these industry groups into sub-groups based on similarities in their growth of labour productivity in the same temporal phases. A matrix is constructed with cells corresponding to various combinations of growth and productivity characteristics over time, each cell containing a number of industries. The three first stages are explorative. In the third stage, relative price and relative volume development for industries is used to distinguish between those within the cells/sub-groups that could be assumed to be more supply-driven in their development and those that could be assumed to be more demand-driven. Thus the matrix is doubled and the exploration is finished. In the fourth stage the theoretically stylized industry groups are linked to those matrix cells that contain actual industries. Once the stylized groups are filled with cell inhabitants, i.e. actual industries, they are called actor industries, reflecting their assumed

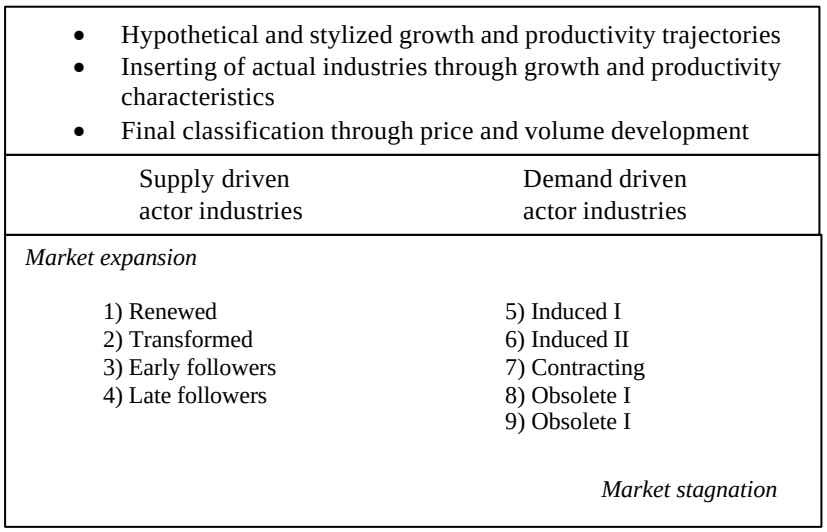

Figure 1. Classification of actor industries (manufacturing sector).

[3] More on data and methods can be found in working papers (Lundquist, Olander, and Svensson Henning, 2005, 2006), also downloadable on the internet (reference list).

roles in the technology shift process. The different actor industries represent a sliding scale from 'supply driven' to 'demand driven' and from 'market expansion' to 'market stagnation'. From this point on actor industries can be studied. Aggregated growth can thereby be dismantled and followed for industry groups affected by the technology shift in various ways. This classification will be used as a guide for selection of those manufacturing industries that could be used as indicators of the economic transformation, when it comes to estimate the impact on economic welfare later on.

For the service sector, we had to proceed according to quite a different logic. At a first stage, data created in the effort of constructing consistent time series (restricted to 1985-2004) were sorted into three groups based mainly on user orientation. In a second stage we divided these user-oriented groups into two sub-groups: 'strong to medium growth'; and 'medium to weak growth', based mainly on value added development, but controlling for productivity development. Since no relative price series are yet available for service industries, covering

- Groups of services according to market and user orientation
- Division of services groups through growth characteristic
- Final classification into supply and demand driven groups based on temporal growth variations.

Strong to medium growth service industries	Medium to weak growth service industries
Producer services	
Supply driven	*Demand driven*
1) ICT services	5) Financial and legal services
2) Advertising, design and other consultancy	6) Technical and engineering consultancy
3) R&D laboratories	7) Leasing of man. equipment
4) Security services	8) Industry-related wholesale
Consumer and general services	
Mainly demand driven	
1) Cleaning and sanitation	7) Other retail
2) Cons. related wholesale	8) Vehicle trade and maint.
3) Restaurants and hotels	9) Communication, postal s.
4) Retail/occasional products	10) Construction
5) Recreation and cultural s.	11) Other consumer services
6) Food retail	12) Dept stores/hypermarkets
	13) Electricity, gas, water

Figure 2. Classification of service industries.

our time period, service industries within the sub-groups could not be classified into supply-driven and demand-driven following the price/volume rationale. The growth rates and the temporal features of different service industries in combination with productivity development decide together with product/market characteristics if the industry should be classified as supply-driven or demand-driven. As for manufacturing industries, the classification method used for the service sector will guide a selection of service industries that will be used as indicators of the transformation later on.

A national picture

It has been shown that the actor industries within manufacturing and services display heterogeneous characteristics not only in terms of growth trajectories, labour productivity development, and price/volume development, but also in terms of anticipated economic behaviour like R&D investments, patents, and investments in fixed assets and production capacities over time (Lundquist, *et al.*, 2005, 2006, 2008). All these characteristics fit well with what could be expected from the technology shift thesis concerning affected industries and their various roles during the first investment cycle (Schön, 2000, 2006). In general and aggregated terms the Swedish economy following these studies has been characterised by dramatic shifts from severe downswings and crisis to dramatic expansion periods during the last thirty years. The period studied, 1978 to 2004, is called the first investment cycle of the current technology shift process, and commences with a severe crisis (1975/1980). However, the late 1970s were not just a time of crisis but also the starting point of the renewal/transformation phase of the new structural cycle. Growth rate therefore began to increase during the 1980s and was followed by a short crisis (1990/1993) where the last reminiscences of the former cycle were definitely shaken out. From then on growth increased even more during the 1990s, interrupted by a temporary downswing around the millennium shift. Evidence suggests an interpretation where the 2000 downswing is regarded as the transformation crisis of the first half of the structural cycle. This kind of crisis is the result of hectic growth, in the end causing frivolous entrepreneurship, over investment, and sometimes bottlenecks in production. Once the crisis is mastered, the economy will run more smoothly and a second investment cycle will most probably commence consisting of a rationalisation/culmination phase of ten to fifteen years. Growth is therefore expected to culminate in the years to come, but will, according to the technology shift thesis, decrease and end in a new crisis reminiscent of the one in the late 1970s.

Supply driven (Strong national growth industries)	Demand driven (Strong national growth industries)
1. Renewed (manufacturing industries) 2. ICT services 3. Advertising, marketing, other consultancy 4. R&D laboratories 5. Security services	1. Induced (I) (manufacturing industries) 2. Financial and legal services 3. Technical and engineering consultancy 4. Leasing of man. equipment 5. Industry-related wholesale 6. Cleaning and sanitation 7. Consumer-related wholesale 8. Retail/occasional products 9. Restaurants and hotels

Figure 3. Most salient supply and demand driven industries.

Based on detailed findings from these earlier studies, our account in this paper has to be simplified, in order to convey a broad-brush message about transformation, at the same time as the societal effects in terms of development in employment and income are highlighted. It is necessary to select only some actor industries from manufacturing and services and use them as indicators. Our choice is to select the ones that have grown faster than the economy as a whole during the period studied. These are selected from both manufacturing and services, and from both the supply- and demand-driven categories. Figure 3 displays which industries represent the most forceful development among the supply- and demand-driven industries, respectively (hence called 'most salient supply-driven and demand-driven industries'). Only the most prominent and marked industries from either the supply or the demand side are selected and indicated as driving the transformation. Industries not included in the figure are summarized as 'other' during the rest of the paper.

National growth during the first investment cycle is summarized in Figure 4, using selected industries. Despite simplifications made, the main characteristics of the development, as displayed in earlier studies, are still indicated in the graphical representation. Supply- or technology-driven industries were, for example, growing very early in the investment cycle. Already during the second half of the 1980s, growth was increasing faster than for other industries. After the crisis at the beginning of the 1990s, growth accelerated further and reached its first peak around the year 2000. Growth was at a standstill during the so-called transformation crisis, but then accelerated three years later. The most salient demand-driven

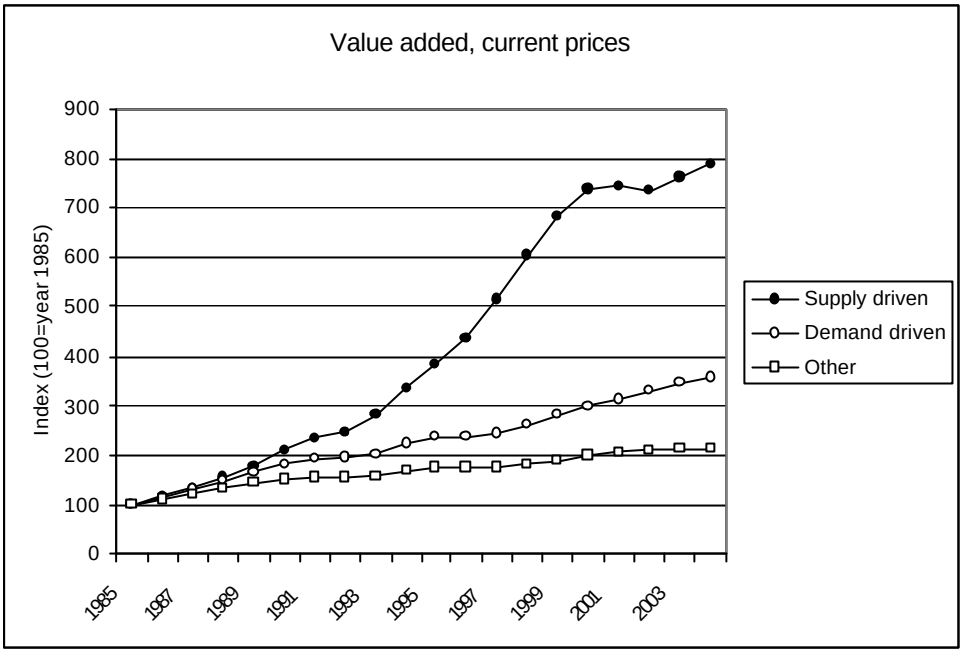

Figure 4. Growth index 1985-2004 of most salient supply driven and demand driven industries. Other industries for comparison.

industries could not keep up with the technology-driven industries in terms of growth, but grew faster than the rest of the market economy during the second half of the 1980s. The main effects of the technology shift on demand-driven industries however emerge much later. Not until a couple of years before the millennium shift did growth rates slowly begin to increase. Other industries grew at a slow and steady pace, so far only slightly and indirectly affected by the technology shift process.

Table 1 accounts for the growth of the same salient industries during different time periods and their shares of the market economy (i.e. public sector excluded) at different points in time. Supply-driven industries have grown almost four times as fast as the aggregate economy during the period. Growth rate peaked in the first period (1985-1994), mainly because the growth base was very small. Absolute growth, however, was higher during the second time period (1994-2004). In all, the shares of the supply-driven industries tripled during the period. But also the demand-driven industries grew faster than the economy as a whole. However, their shares increased by only a few percentage units. Other industries grew very slowly and decreased their shares with almost twenty percentage units. Industries that have been leading the transformation, on the supply, as well as on the demand side, have thus increased from

Table 1. Growth in value added in most salient supply driven and demand driven industries 1985-2004. Other industries for comparison.

	Growth in value added (%)			Shares of total value added in market economy		
	1985-1994	1994-2004	1985-2004	1985	1994	2004
Supply driven industries	239	143	725	7,9	13,7	21,7
Demand driven industries	128	59	264	21,3	24,9	25,7
Other industries	70	32	123	70,8	61,4	52,6
Total	95	54	201	100	100	100
Absolute figures	*403580936*	*445848820*	*849429755*	*422971126*	*826552062*	*1272400882*

Table 2. Employment in most salient supply driven and demand driven industries 1985-2004. Other industries for comparison.

	Growth in employment (%)			Shares of total employment in market economy		
	1985-1994	1994-2004	1985-2004	1985	1994	2004
Supply driven industries	42	90	170	7,7	11,5	18,8
Demand driven industries	10	20	32	22,7	26,2	27,1
Other industries	-14	1	-14	69,5	62,3	54,1
Total	-4	16	11	100	100	100
Absolute figures	*-87048*	*300564*	*213516*	*1935077*	*1848029*	*2148593*

one fourth to almost half of the market economy during the first investment cycle, now reaching its end. Drawing lessons from previous technology shifts, it could be expected that as the rationalization phase of the second investment cycle commences, a strong growth will characterise both supply- and demand-driven industries. Increased real wages and increased demand will also affect growth of other industries in a favourable direction in the coming years.

Table 2 shows that volume growth preceded employment increase on a national level. The supply- as well as the demand-driven industries increased their employment during the first time period when the employment in the whole market economy was decreasing, thereby giving support to the national job-less growth thesis. The most powerful increase occurred in the second period. Other industries have not yet contributed to any major increase in employment. The most salient supply- and demand-driven industries therefore accounted for nearly all of the increase in employment in the country during the second period, but this is also true for the whole of the period studied. The coming period will probably be characterised by the increase of employment in the whole economy, until the next severe structural crisis. Undoubtedly, almost the whole of the market economy will, in the coming years, contribute to the creation of new employment.

A systemic approach to regional development

A central issue in this paper is whether the transformation, growth and employment change that have been analysed on an aggregated national level has occurred simultaneously in all regions in the Swedish system. There are strong theoretical reasons for assuming that this has not been the case. A few reasons will be mentioned, but not further developed here. The GPT will for instance take their time to diffuse from "the new economy" to "the old economy" due to regional variation in receiver and development competence. Moreover, new products and processes will be decomposed over time and localised to plants scattered over many regions. Finally, supply-driven and demand-driven production of various age will not growth simultaneously from the same regions.[4]

In the following analysis, a systemic approach will be applied, where focus will be set on how regional development at different levels of the regional hierarchy relate to the national development and to each other. This means that the national development discussed earlier is used as a norm to benchmark the development of different regional groups. In the analysis, the seventy Swedish 'A-regions' (labour market regions) have been categorized into six groups based on regional size (population).[5] These groups are assumed to broadly reflect in-group coherence in receiver and development competence, and therefore also pinpoint the roles of regions in the system (Table 3). The core of the analysis will be the two main forces of the technology shift already discussed: the primary supply and technology effect, and the secondary or induced demand effect.

Table 3. The Swedish regional system

	Mean Population	Number of regions	Mean z-value
1st tier (Stockholm)	1536095	1	7,10558
2nd tier (Göteborg)	744927	1	3,13739
3rd tier (Malmö/Lund)	457919	1	1,69787
4th tier (Big city regions)	156745	15	0,18730
5th tier (Mid-sized regions)	90253	20	-0,14620
6th tier (Small regions)	45717	32	-0,36957

[4] The theoretical frame and detailed empirical evidence of how and when the basic actor industries, from which the most salient supply-driven and demand-driven industries are aggregated in this paper, start to grow and diffuse in the regional system is provided in Lundquist et al. (2006, 2008).
[5] The regional taxonomy is based on threshold values in size of regional population, identified via z-scores.

Table 4. Regional growth rates and share of value added in most salient supply driven and demand driven industries 1985-2004. Other industries in comparison.

	Growth in value added (%)			Regional shares of total national value added in the industries		
1st tier	1985-1994	1994-2004	1985-2004	1985	1994	2004
Supply driven industries	325	140	922	35	43	43
Demand driven industries	107	140	248	32	29	31
Other industries	74	42	147	18	18	19
Total	*115*	*74*	*275*	*22*	*24*	*27*
2nd tier						
Supply driven industries	220	288	1142	8	8	12
Demand driven industries	127	288	281	12	12	12
Other industries	68	50	152	10	10	11
Total	*92*	*80*	*245*	*10*	*10*	*12*
3rd tier						
Supply driven industries	317	142	910	5	6	6
Demand driven industries	142	142	292	7	7	8
Other industries	55	39	115	6	5	6
Total	*92*	*60*	*207*	*6*	*6*	*6*
4th tier						
Supply driven industries	208	138	635	23	21	21
Demand driven industries	144	138	289	24	25	25
Other industries	70	27	116	29	29	28
Total	*93*	*46*	*183*	*27*	*27*	*26*
5th tier						
Supply driven industries	163	124	491	17	13	12
Demand driven industries	143	124	252	16	17	15
Other industries	70	27	117	21	21	21
Total	*89*	*40*	*165*	*20*	*19*	*17*
6th tier						
Supply driven industries	145	74	327	12	9	6
Demand driven industries	128	74	230	9	9	8
Other industries	69	22	106	16	16	15
Total	*82*	*30*	*138*	*15*	*14*	*11*

Table 4 gives a first indication that regions on different levels of the regional system have been affected by the technology shift in varying ways. For example, growth patterns of the most salient supply- and technology-driven industries display obvious geographical (hierarchical) and temporal patterns. Growth in these industries was initialized and led primarily by the first tier region in the system. Later, a growth diffusion process took place, causing second and third tier regions to strengthen their positions in the supply-driven industries. Especially interesting is the dominant position that the first tier region already had in 1985, and that this was further consolidated during the period studied (1985-2004). All groups at lower levels of the regional hierarchy display a significantly lower growth rate during the period as a whole. Above all, this was the case for the sixth tier regions, those in the bottom end of the hierarchy. The renewal impulses induced by the technology shift have

thus primarily generated strong growth effects in the three top levels of the regional hierarchy, which leads to a diverging development in the regional system during the period as a whole. At the same time, it was noted that the difference in growth rates between different levels in the regional hierarchy diminishes during the second half of the period (1994-2004), which probably indicates the start of a 'catch up period' for regions just below the top of the regional hierarchy.

This first inspection of the regional data points to the fact that there are important regional differences in the ways growth forces of the technology shift are manifested geographically and temporally. In the following, these regional sequences are considered in more detail, as are the consequences of the development to different levels in the regional system.

Supply- or demand-driven regional transformation?

We now address the issue to what extent regions on different levels of the regional hierarchy have been characterised by differences in supply- or demand-driven transformation, and the nature of the relationship between these two forces. Figure 5 displays the position of the regions compared to the county as a whole and to each other during the whole period studied (1985-2004). A visual inspection of the graph shows that first, second and third tier regions were characterised by a considerably stronger growth rate in supply-driven industries than the country as a whole. The differences between these top regions and lower tier regions are obvious, indicating that the supply-driven transformation primarily could be considered as a top-hierarchy phenomenon. It is also apparent that the regional variation in growth rates was more extensive in the supply-driven part of the economy than in the demand-driven. The first tier region showed a lower growth rate in demand-driven industries than the country as a whole, but a stronger growth in the supply-driven industries. The second and third tier regions displayed a stronger development in both dimensions than the country as a whole. Fourth tier regional transformation was generally fuelled by demand-driven change, while the supply side growth was below national average. Fifth and sixth tier regions end up with low growth rates in both dimensions, indicating that they are only to a marginal extent able to draw on (or contribute to) the national transformation process.

As shown in Table 5, there are important time lags in terms of when the different growth forces reach and induce change in the different regional tiers. The supply-driven growth of the

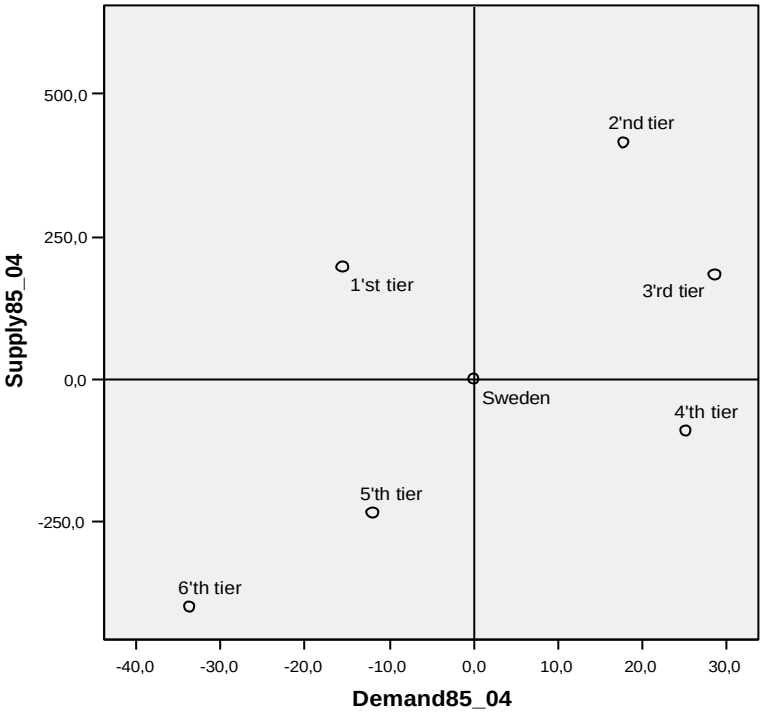

Figure 5. Relation between growth rates in value added in most salient supply driven respectively demand driven industries in different tiers of regions 1985-2004.
Note: Correlation coefficient (Pearson): 0,600.

first tier region was considerably stronger during the period 1985 to 1994 than for the period 1994 to 2004. In the later period, transformation was shifted to demand-driven industries instead. The transformation process in the top of the hierarchy is therefore, with time, characterised increasingly by induced or secondary growth forces. The same relationship applies to the third tier region. For the second tier region the development is quite the opposite, as the supply-driven growth starts later and not until the period 1994 to 2004 at full force. This indicates that there has been a shift from first to second tier regions in terms of

Table 5. Regional growth rates in value added. Deviations from national growth rates in percent units. Most salient supply driven vs most salient demand driven industries 1985-1994, 1994-2004 and 1985-2004.

	1985-1994		1994-2004		1985-2004	
	Supply driven	Demand driven	Supply driven	Demand driven	Supply driven	Demand driven
1st tier	86	-21	-3	9	197	-16
2nd tier	-19	-2	145	9	417	18
3rd tier	78	14	-1	3	185	29
4th tier	-31	16	-5	0	-90	25
5th tier	-76	15	-19	-15	-234	-12
6th tier	-94	0	-69	-15	-398	-34

Note: Correlation coefficient (Pearson) for period 1985-1994: -0,388, 1994-2004: 0,673 and 1985-2004: 0,600.

which region primarily drives the supply-driven growth of the national transformation process. It should, however, be underlined that the growth rates for the supply-driven economy converge between different levels of the national system during the second period (1994-2004). Above all, we see a catch up by the fourth tier regions. There is however nothing that signals a corresponding catch-up by the smallest regions, which continue to loose ground in the second period.

In conclusion, there was a larger variation in regional growth rates for the supply-driven industries, than for the demand-driven ones. The most important feature of the development is that the growth of the top tier regions was significantly stronger than the national average, while regions, arguably lacking receiver and development competence, on lower levels of the hierarchy tend to show a weaker growth than the national average. Furthermore, there was no unambiguous regional co-variation between the growth rates of the supply- and demand-driven industries, neither for the sub periods, nor for the period as a whole. Growth forces vary between different regional groups over time, but in a systemic and logical way that indicate different regional roles during the economic transformation process.

Relation between regional transformation and growth

Another important issue is how the different trajectories of supply-driven and demand-driven transformation affect the total regional growth in the market economy. In Figure 6, regions have been positioned according to growth in the supply-driven industries and the total growth in their market economies during the period 1985 to 2004. An almost linear relation appears between the two variables. The top levels of the regional hierarchy have the highest relative growth in the supply-driven industries for the period as a whole, in combination with a total economic (value added) growth clearly above national average. Below the top level, growth rates fall gradually in the regional system. The trajectories for fifth and sixth tier regions are troublesome and display a weak technological transformation in combination with low aggregate growth rates. For the first tier region, the strong growth is based on a superior supply-driven growth during the first period (Table 6). In most of the regional system, supply-driven growth has not yet started or is not strong enough to compensate for the phasing out of older activities in the wake on the technology shift. This means that the positive effects of the technology shift initially only benefit regional groups in the top of the hierarchy, while the

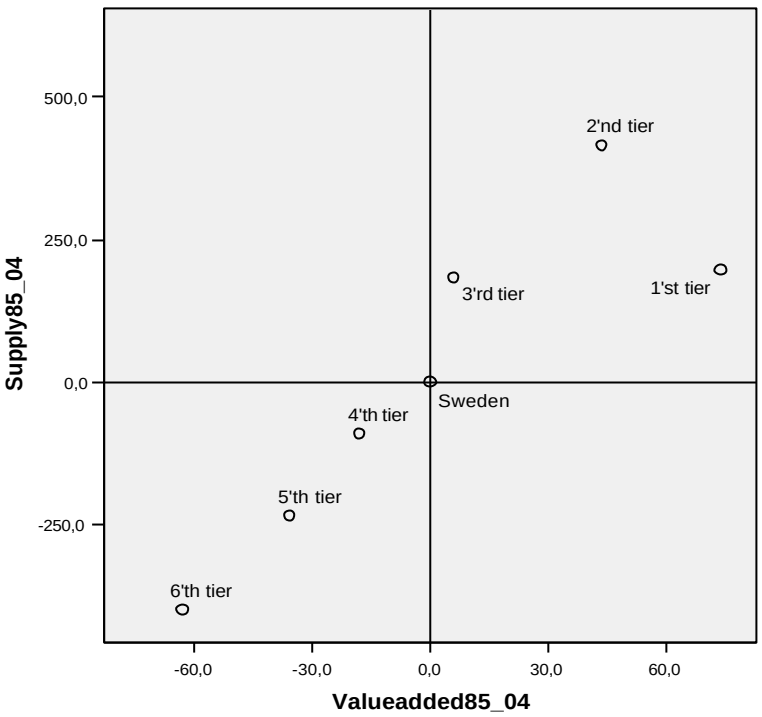

Figure 6. Relation between growth rates in value added in most salient supply driven industries respectively in total market economy in different tiers of regions 1985-2004.
Note: Correlation coefficient (Pearson): 0,885.

rest of the regions suffer relative losses in terms of growth and transformation. During the second period (1994-2004), differences in growth were converging, and the strongest supply-driven growth force could be found in second tier regions, showing quite high aggregate growth. There are therefore very distinct features in the graph that identify positive relations between strength of the supply-driven growth and total growth in the market economies during the first investment cycle. As indicated by the correlations this feature is equally strong during both periods.

Table 6. Regional growth rates in value added. Deviations from national growth rates in percent units. Most salient supply driven industries vs total market economy 1985-1994, 1994-2004 and 1985-2004.

	1985-1994		1994-2004		1985-2004	
	Supply driven	Total value added	Supply driven	Total value added	Supply driven	Total value added
1st tier	86	20	-3	20	197	74
2nd tier	-19	-4	145	26	417	44
3rd tier	78	-3	-1	6	185	6
4th tier	-31	-2	-5	-7	-90	-18
5th tier	-76	-6	-19	-14	-234	-36
6th tier	-94	-13	-69	-24	-398	-63

Note: Correlation coefficient (Pearson) for period 1985-1994:0,763, 1994-2004: 0,793 and 1985-2004: 0,885.

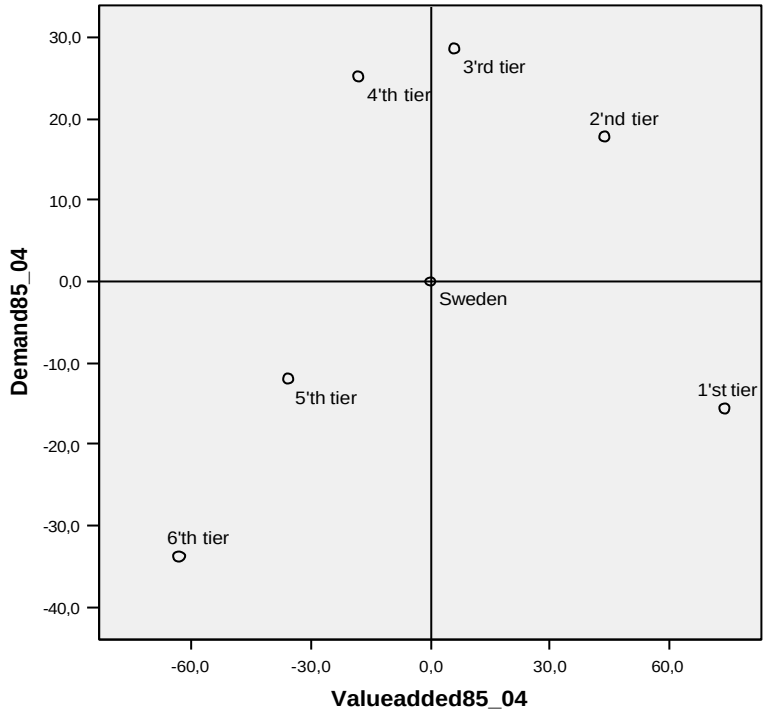

Figure 7. Relation between growth rates in value added in most salient demand driven industries respectively in total market economy in different tiers of regions 1985-2004.
Note: Correlation coefficient (Pearson): 0,289

The relation between demand-driven development of the regions and aggregate (volume) growth for their total market economies shows a more scattered picture for the period as a whole (Figure 7). It indicates that demand-driven growth so far has not had the same important role for regional aggregate growth as has supply driven growth. Consequently, there are no examples of regions that have had a higher growth than the national average solely based on demand-driven structural change. During the first period, the relations between demand-driven transformation and aggregate regional growth, as indicated by Table 7, are negative and turn strongly positive during the second period. This implies that the demand-driven effect is rather a complementary and lagged force in the first investment cycle.

During the second period, the importance of supply-driven growth is diminished at the same time as a broader set of regions draw on the advantages created by a demand-driven growth. An analysis of the different periods (compare Tables 6 and 7) clearly show how the driving forces of growth start in the supply oriented part of the economy, and subsequently is supplemented by and shifted towards the demand-driven industries in a hierarchical order.

Table 7. Regional growth rates in value added. Deviations from national growth rates in percent units. In most salient demand driven industries vs total market economy 1985-1994, 1994-2004 and 1985-2004.

	1985-1994		1994-2004		1985-2004	
	Demand driven	Total value added	Demand driven	Total value added	Demand driven	Total value added
1st tier	-21	20	9	20	-16	74
2nd tier	-2	-4	9	26	18	44
3rd tier	14	-3	3	6	29	6
4th tier	16	-2	0	-7	25	-18
5th tier	15	-6	-15	-14	-12	-36
6th tier	0	-13	-15	-24	-34	-63

Note: Correlation coefficient (Pearson) for period 1985-1994:-0,695, 1994-2004: 0,931 and 1985-2004: 0,289.

The analyses show that regions which during the first investment cycle have the strongest aggregate growth in the market economy also display strong growth in the supply-driven industries. Development in the top tier regions is clearly characterised by this interplay between supply-driven and aggregate regional growth. However, regions further down the hierarchy are characterised by a substantially weaker economic development, and these regions generally show a lower supply-driven growth than the national average. As for the importance of demand-driven industries, there is no support for a claim that these industries create substantial regional economic growth 'on their own' during the first investment cycle. Rather, we have witnessed complementary forces in regions that during some of the sub periods also are benefiting from a strong supply-driven growth. Supply-driven transformation is the totally dominating force behind regional growth during the first period of the investment cycle. During the second period, the focus is somewhat shifted to account for the demand-driven development also. As the Swedish economy is moving into the rationalization phase of the technology shift now, the demand-driven industries will most likely increase in importance. This goes for different types of services especially, which are expected to set the agenda for how the future growth will be distributed regionally.

Growth and employment

With a background in the discussed results concerning the positive relation between structural transformation and regional growth, we now expand the analysis by looking at the relations between regional (volume) growth and job creation. Thereby, we discuss one of the dimensions behind the previously mentioned jobless growth thesis. Looking at Figure 8, we

find a very strong descriptive connection between regional economic growth, measured in value added, and changes in the number of employees during the investigated period as a whole (1985-2004). The relation between the two variables appears to be almost linear. In the interpretation of the graph, one should keep in mind that the national average employment growth, which is set to zero in the graph, corresponds to a sixteen per cent increase during the period, equivalent to 210,000 employees. Consequently, regions performing worse than the national average might still have increased employment in absolute numbers. An important observation is though that the regions included in the fourth, fifth, and sixth tier groups on average displayed an absolute decrease or close to zero growth in employment during the period as a whole. A majority of the Swedish regions therefore displayed a development trajectory indicating some kind of jobless growth, or rather that the growth force in these regions only in the most favourable cases managed to sustain a growth level compensating for the jobs that have been phased out during the early stages of the investment cycle. Once again, primarily the top level regions concentrating on a supply-driven growth, had so far been accounting for the major increases in employment.

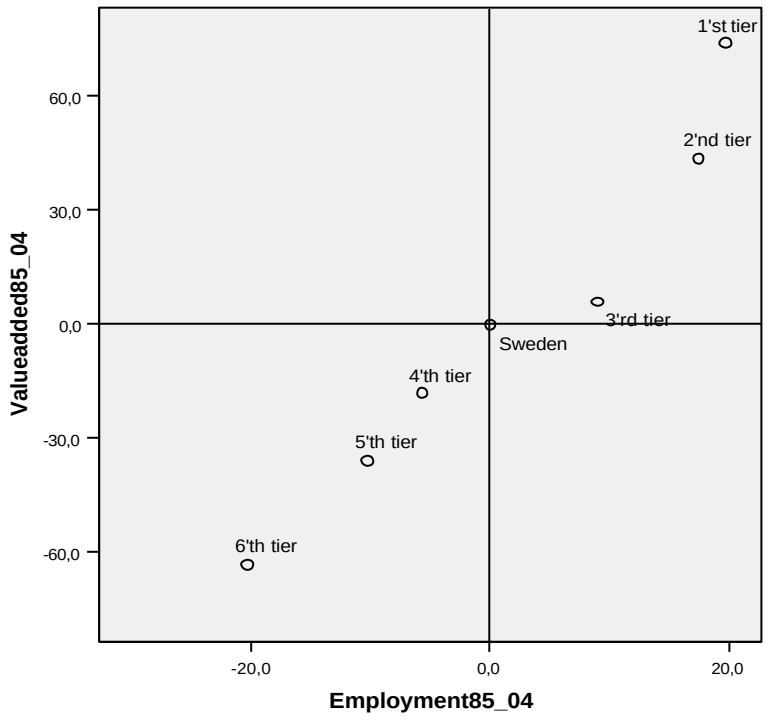

Figure 8. Relation between growth rates in value added in total market economy respectively growth in employment in different tiers of regions 1985-2004.
Note: Correlation coefficient (Pearson): 0,973.

Table 8. Regional growth rates in value added in total market economy and growth in employment. Deviations from national growth rates in percent units. 1985-1994, 1994-2004 and 1985-2004.

	1985-1994		1994-2004		1985-2004	
	Total value added	Employment	Total value added	Employment	Total value added	Employment
1st tier	20	4	20	15	74	20
2nd tier	-4	4	26	13	44	17
3rd tier	-3	3	6	5	6	9
4th tier	-2	0	-7	-6	-18	-6
5th tier	-6	-3	-14	-8	-36	-10
6th tier	-13	-6	-24	-15	-63	-20

Note: Correlation coefficient (Pearson) for period 1985-1994:0,675, 1994-2004: 0,986 and 1985-2004: 0,973.

Table 8 shows that the relation between employment increase and growth was weaker during the first period of the investment cycle (1985-1994). This period was characterised by decreasing employment numbers on a national level. This was also true for many regions further down the hierarchy. In general, only the top tier regions were close to defending their absolute quantity in employment in the market economy as a whole. As discussed earlier, the earliest supply-driven growth was initialized and developed in these regions. This is also indicated by the positive relation at regional level between supply-driven growth and employment growth. Also, during the first period, otherwise marked by a substantial decrease in employment at a national level, there was a clear relation between regional volume growth and employment growth. Regions displaying strong growth, initialized by supply-driven industries, in general performed better than the regions with demand-driven growth did. This relation is easily disguised if only the national level is analysed, as the national aggregate effectively hides the fact that it is within a national system, and in times of drastic renewal, successful and renewing regions exist together with backward, slow-growth regions. Jobless growth in advanced and well-developed economies is uncovered and left unexplained only when the influence of these less-performing regions exert an overwhelming influence on national growth numbers. It is exactly this that characterised the early years of the first investment cycle of the current Swedish technology shift.

During the period 1994 to 2004, the relation between regional growth and employment growth was further strengthened. In this period, the employment in the national market economy increased substantially, in absolute numbers 300,000 employees or a corresponding sixteen per cent. There was, however, considerable regional variation to this number. The top

level regions dominated the scene and combined strong volume growth with almost twice the growth in employment compared with the national average. These regions, to a large extent, still drove the national increase in employment. During this period national development was no longer hindered by other slow-performing regions in the system. These regions also showed employment increases in absolute numbers, however in most cases at a lower level than the top regions and the national average. But even if the relative growth levels were lower, the analyses point to the fact that the employment growth effects were diffused to a larger set of regions than was the case during the first period of the investment cycle. Also, the relations between different industries began to change. The demand-driven industries grew yet more in importance while the supply-driven ones lost some of their importance. Weak but positive employment effects are also discovered in the individual and general services that are included in the 'other industries' group.

To sum up, the analysis points to the fact that there was a clear relation between regional economic transformation and employment growth during the period 1985 to 2004. In the first period of the investment cycle, 1985 to 1994, characterised by massive losses in employment on a national scale, strongly growing regions, managed to some extent to create employment opportunities. These replaced some of the jobs that had been phased out nationally in declining industries. The vibrant dynamics of the renewing regions, that is the first, second and third tier regions, did not however suffice to compensate for the slower growth and job losses in the rest of the country. During the second period of the investment cycle, 1994 to 2004, the relation between growth and employment was further strengthened. Almost all regions now contributed to the positive employment growth that characterised development on a national scale. Even if the top level regions still dominated the development, the growth in other regions contributed to an absolute increase in employment numbers. The forceful top-level growth in combination with diffusion of employment effects to a larger spectrum of regions made the connection between growth and employment apparent also at a national level. The results indicate that when the phenomenon of jobless growth is studied in correct time frames and with consideration to the whole spectrum of the regional system, at least parts of the 'paradox' are resolved. The relations between variables studied become clearer and less ambiguous.

Growth and regional income

In a concluding analysis, regional mean income will be studied to see if this variable co-varies with the growth of regional market economies.[6] A visual inspection of Figure 9 tells us that there is no immediate descriptive connection between total growth in the regional market economies and the development of mean regional incomes. Only the first and second tier regions show a combination of stronger growth than the national average on both parameters. Third tier regions display a stronger growth than the national average, but a considerably less favourable development in mean income, indeed it has the weakest development of regional incomes among all the regions' tiers. At the beginning of the 1980s the mean income of the third tier region was slightly above the national average, but in 2004 this had changed to a situation where the regional mean income was well below national average. This weak development of regional mean income is somewhat surprising, especially considering the beneficial effects of transformation on growth and employment in the region, and considering how the other top level regions were more than well able to defend their positions in the income league from 1985.

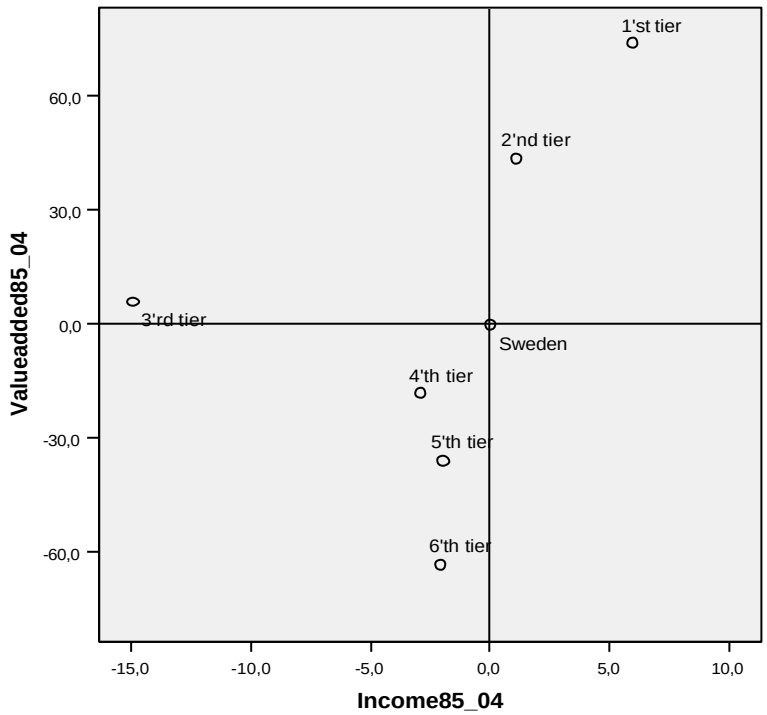

Figure 9. Relation between growth rates in value added in total market economy respectively growth in employment in different tiers of regions 1985-2004.
Note: Correlation coefficient (Pearson): 0,374.

[6] For 1985, income is defined for earners twenty years and above. For 2004, income of work and capital for the same group is defined. Non-income earners are included. Population is the number of inhabitants at the end of the year.

Summing up, we see no unambiguous relationship between regional growth in the market economy and the development of mean income in the regions. Nor is there other evidence suggesting that the mean incomes in any systemic way co-vary with any of the two growth forces (supply- or demand-driven) that we have analysed in this paper. There are also weak connections between employment growth and growth in mean regional income analysed in this paper. There could be many explanations to the evidence presented here, for example share of workforce employed outside the market economy (i.e. in the public sector), commuting outside the regions, level of unemployment, agglomerations of non-integrated labour force like new immigrants and students, and above all the design and efficiency of regional policies towards convergence of regional income. Despite the missing linear connection between growth and mean income development at a regional level, there is one very apparent feature in the data. The forceful structural change of the Swedish economy and the growth in its wake, taking place mainly in the top level regions, coincided with an acceleration of the mean income in the first and second tier regions (compared to the national average). It should also be acknowledged that there are individual regions that have performed true 'class travels', where the development of mean income has been considerably stronger than for their colleagues in the tier. For example, in the sixth tier several regions have shown a relative development well in line with the most successful top level regions in terms of income and employment growth. How many and diverging these 'residuals' are remains to be seen in future research, and there might also be future lessons to be learned for other regions from such success stories.

Conclusions

The theoretical framework of this paper – based on the macro consequences of evolutionary theorising and a geographical systemic approach to regional development – has allowed us to analyse both the time lags of transformation and renewal, as well as some of the societal aspects of the long-term renewal process working in the capitalist economy. While large parts of economic life are characterised by slow-moving patterns and geographical inertia, we have identified clear and systemic general geographical patterns (i.e. lead-lag relationships) in the development of the most dynamic industries in the first investment cycle. Within such an analytical framework, regional within-group variations are abstracted. These time lags, though of course interesting in themselves, also have consequences for job creation, but less for the development of regional income. Probably due to central policy initiatives, income

development for the worst performing regions are not as bad as suggested by their so far sluggish renewal, aggregated growth and employment growth. Jobless growth, to the extent that it exists at some levels in the regional system, seems to be a spatial and time-specific phenomenon in a specific stage of the first part of the technology shift process. The results of this study should however worry policy makers and inhabitants of the regions at the bottom of the hierarchy. Even though national economic transformation pays off and the effects also of the diverging first investment cycle on welfare variables are mitigated on a lower level in the regional hierarchy, questions do arise concerning the sustainability of the economies in small and mid-sized regions. Will growth and job creation diffuse also to these regions in later phases of renewal, as it has done in previous technology shifts? Data indicate a slower regional diffusion, and thus slower regional convergence, compared with what was the case during the last technology shift at the beginning of the 1970s. It should be emphasised that in all regional tiers there are outliers, i.e. regions performing better or worse than their colleagues in the tier. To identify who they are and why they are performing in different ways is an important future research field, opening up for multi-theoretical approaches within suggested structural framework. The lower end of the regional system could be of specific interest. We believe the structural and systemic analytic framework presented here could be used to formulate operational scenarios, explicitly connecting capitalist creative destruction with policy and welfare issues. Such a broad-reaching framework is necessary to understand the development of regional growth, and certainly its welfare consequences over time.

Acknowledgement

The research reported in this article was made possible through generous financial support from The Bank of Sweden Tercentenary Foundation to the research programme “Technology Shifts and Regional Economic Development – Economic Transformation in Time and Space”. Earlier versions of the article has benefited from being presented at the AAG Annual Meeting 17-21 April 2007 in San Francisco respectively at Gesellschaft fur Regionalforschung, German speaking section of Regional Science Association, Wintersemiar, 23 februar bis 1 März, Matrei/Osttirol, Österreich.

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