

Difference in regional productivity and unbalance in regional growth

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Aim of this paper

- to investigate the relationship between the changes in productivity and economic growth in Danish regions;
- historical data shows that the productivity in the new and creative economic sectors in the urban regions is increased, but the traditional sectors such as agriculture and some of the industrial sectors have decreased;
- to investigate the inter-regional and inter-sectoral spillovers of the two sectors in urban and rural municipalities of Denmark;
- applying a model approach to test and identify the changes of labour productivity and the changes in regional economic growth;
- using scenario analysis to show the effects by difference in regional productivity on regional growth.

Literature

- Search for the literature on the long-term effects of productivity change on regional development and growth:
 - To understand the relationship between the labour productivity and other economic factors, such as growth of total factor productivity (TFP), capital stock, labour force with difference education background, human capital, R&D inputs and technology changes. For example,
 - Baier, Dwyer and Tamura (2006) - 14% of economic growth is directly contributed by the growth of TFP;
 - Beugelsdijk, Klasing & Milionis (2018) - 75% of differences in regional economic development can be attributed to differences in TFP;
 - Bronzini and Piselli (2009) - an increase of 1% in human capital and public infrastructure, productivity will increase by 0.38% and 0.11% respectively.
 - Others study relationship between the productivity and agglomeration effects, externalities and localization (Ciccone (2002), Mathys (2008), Broersma and Oosterhaven (2009), Azaeri, et al (2016), Cohen (2010)).

Research Questions

- Investigation focuses on
 - how can changing productivity assumptions in a regional economy have both inter-sectoral and inter-regional spillover effects?
- By using regional IO-CGE modelling techniques and the Danish inter-regional data and the model, we attempt to demonstrate:
 - whether there are any spatial variations in the spillover effects considering the regional typology (urban and rural);
 - whether there are variate effects on the future course of economic development in the selected sectors considering the regional typology (urban and rural).

Geography and Trends

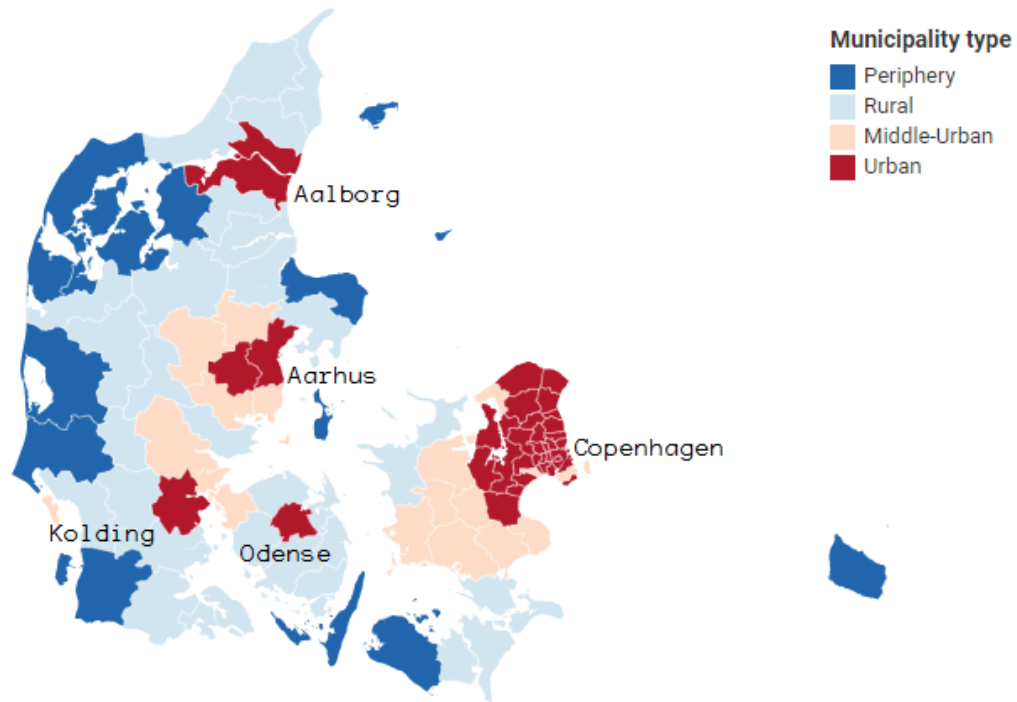
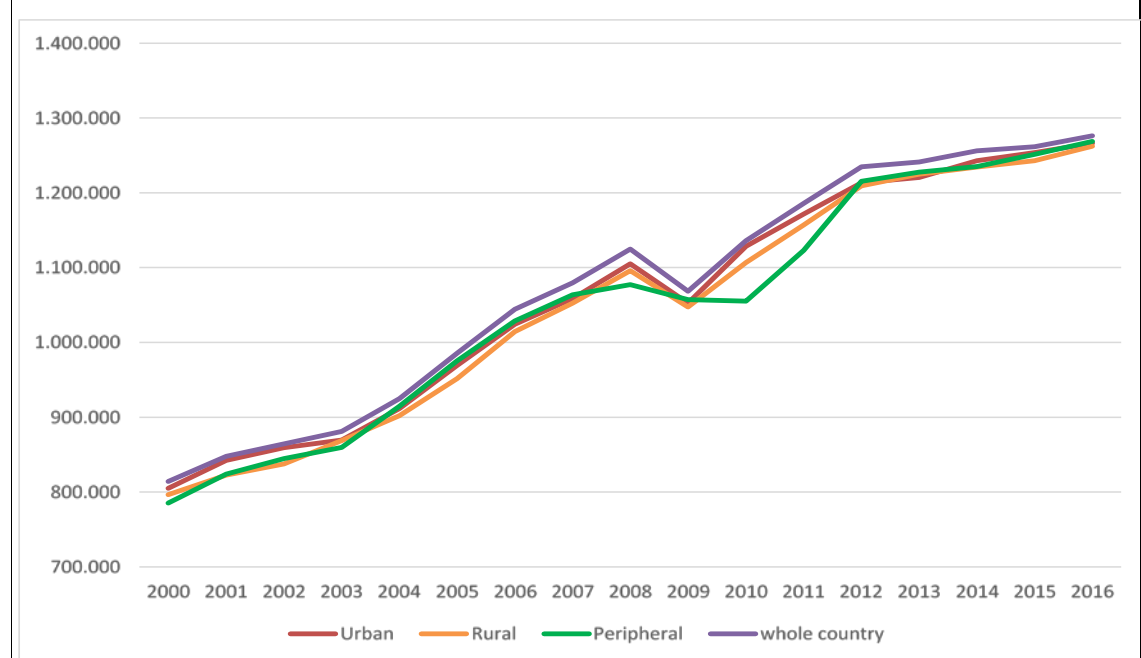


Figure 2. Labour productivity trend between 2000-2016 by spatial typology



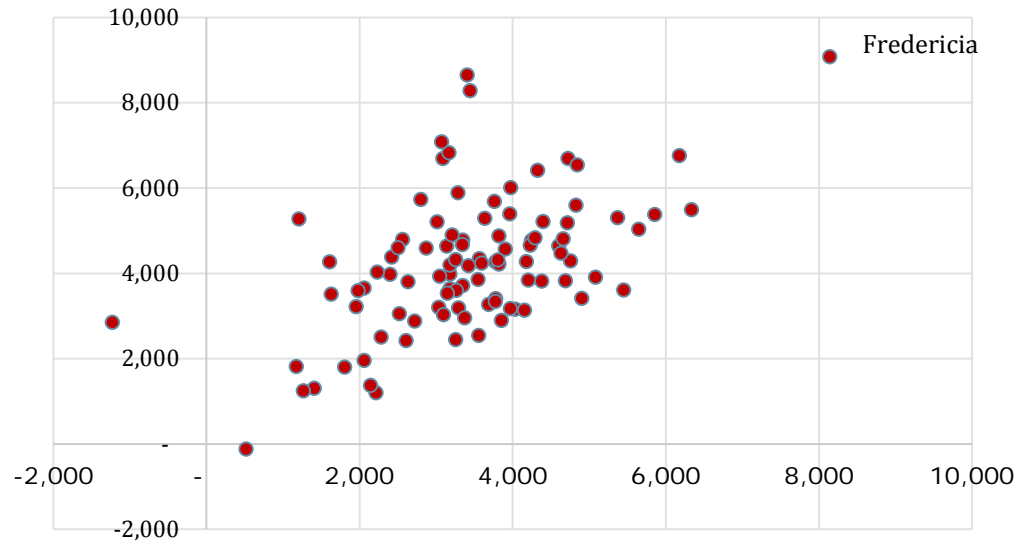
Source: Statistics Denmark and own calculations

Facts about regional development

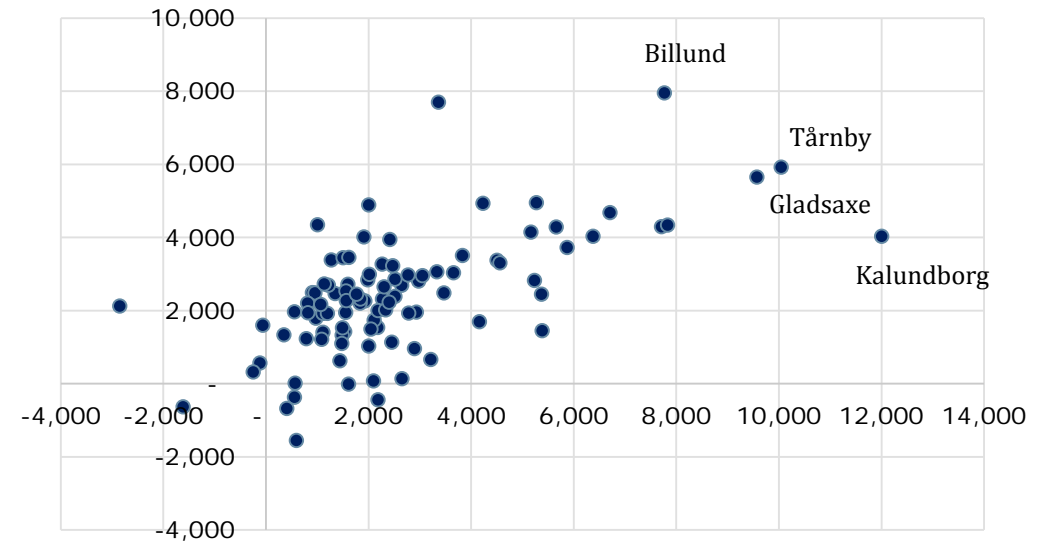
- Number of population in the larger cities in Denmark has been continuously growing in the last 10 years;
- Urbanization gained momentum in the first half of the 20th century than now. There is no indication that Denmark is more urbanized than the average of EU countries.
- Urbanization has in the last ten years meant growth in house prices in, for example, Copenhagen and other areas such as Western and South Zealand. This despite the fact that the number of homes has increased most in Copenhagen and the other major cities. The commute has increased during the period - and it is primarily the highly educated who commute.
- Jobs have also been geographically concentrated during the period. This may be due, for example, to productivity gains in large local labor markets and to greater growth in service industries, which are more and more located in cities.

Regional productivity growth vs regional economic growth 2000-2007 vs 2009-2016

Productivity vs economic growth 2000-2007



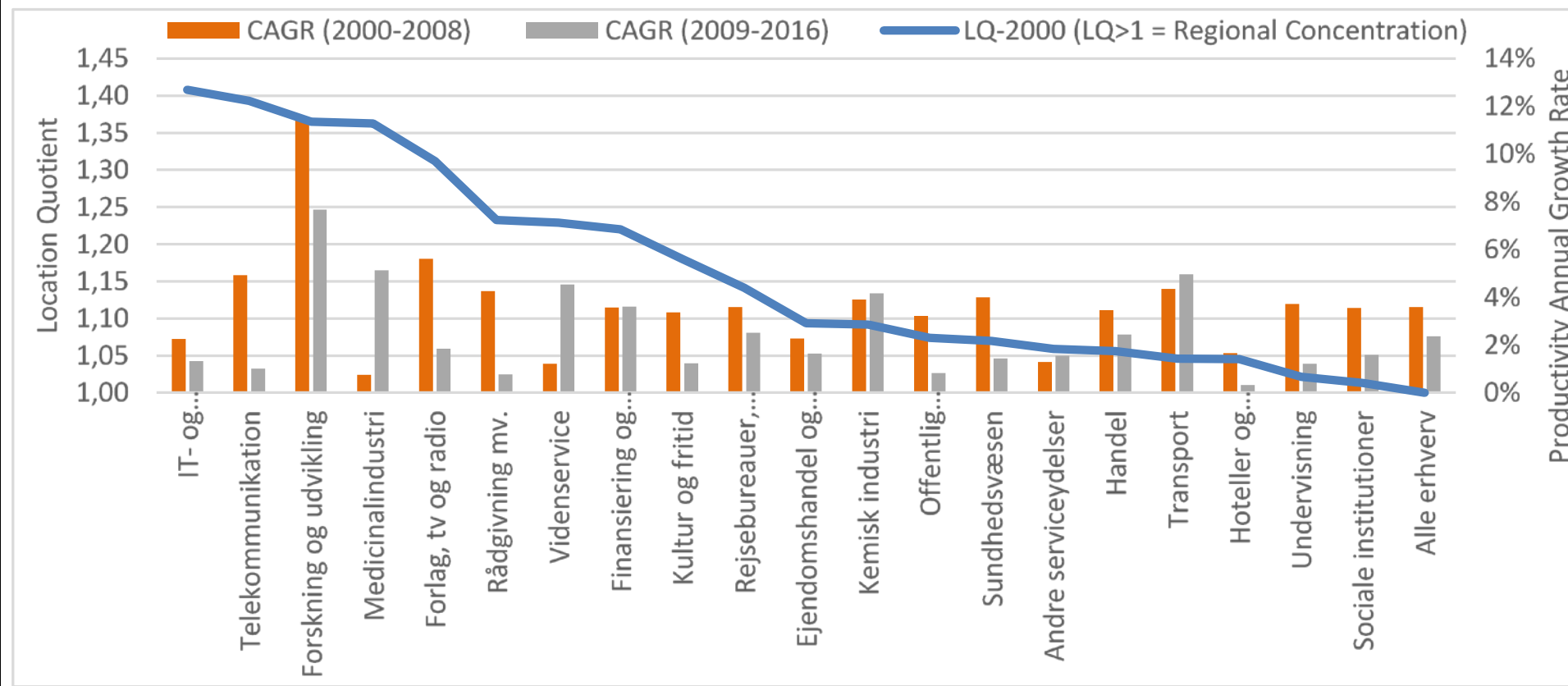
Productivity vs economic growth 2009-2016



Vertical axis is average economic growth rate (%) and horizontal axis is average productivity changes rate (%) in the period.

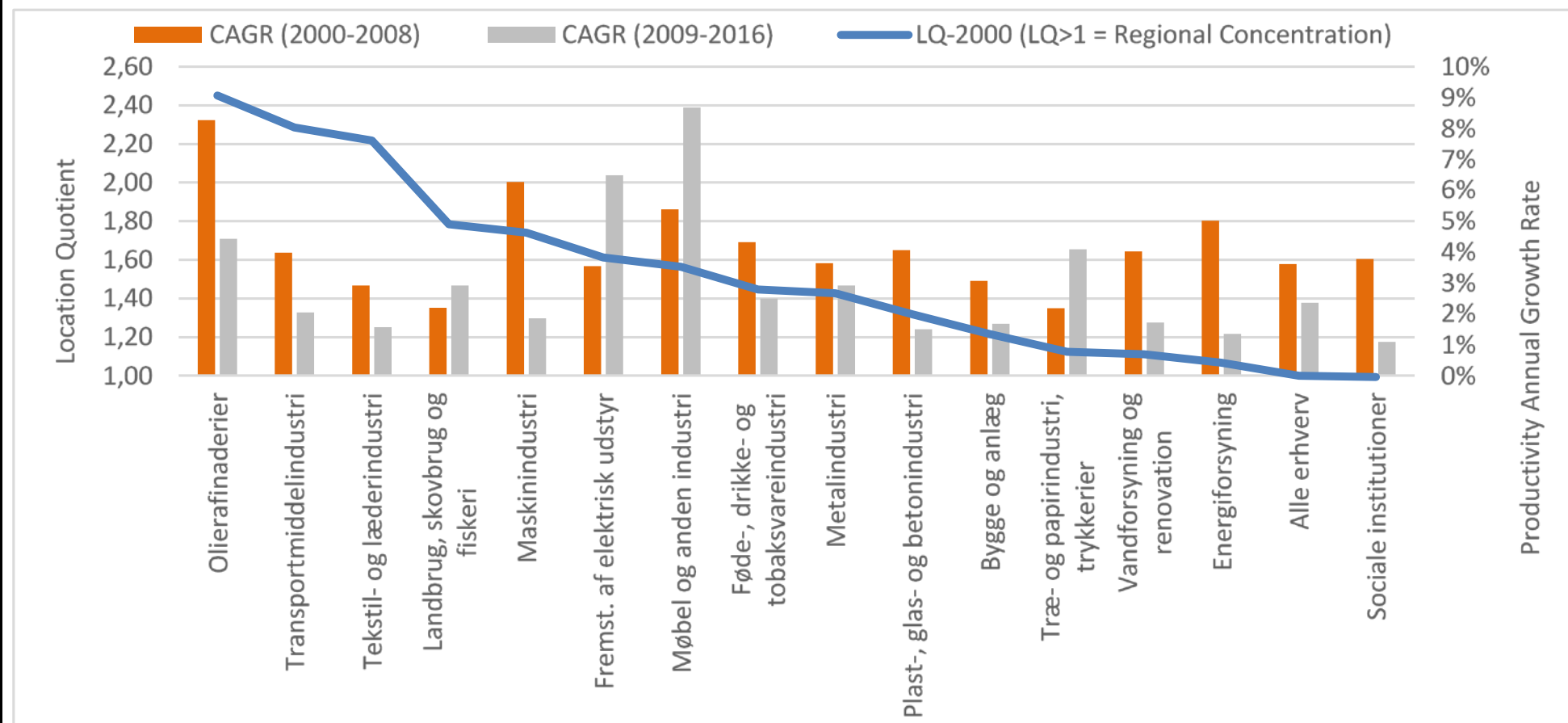
Regional concentration and productivity – urban regions

Figure 3. Regional Concentration by sector and productivity annual growth rate in Urban regions



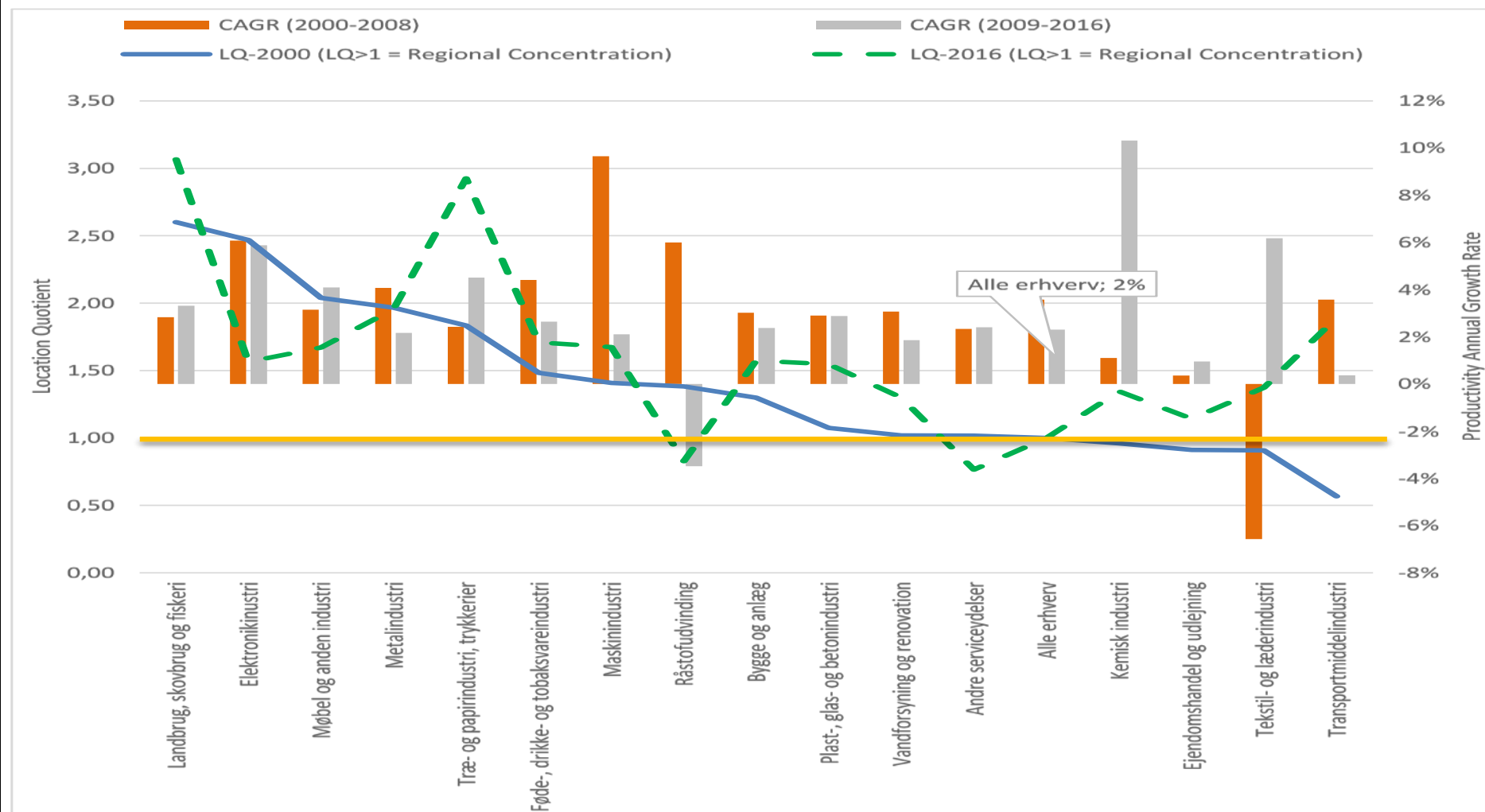
Regional concentration and productivity – rural regions

Figure 4. Regional Concentration by sector and productivity annual growth rate in Rural regions

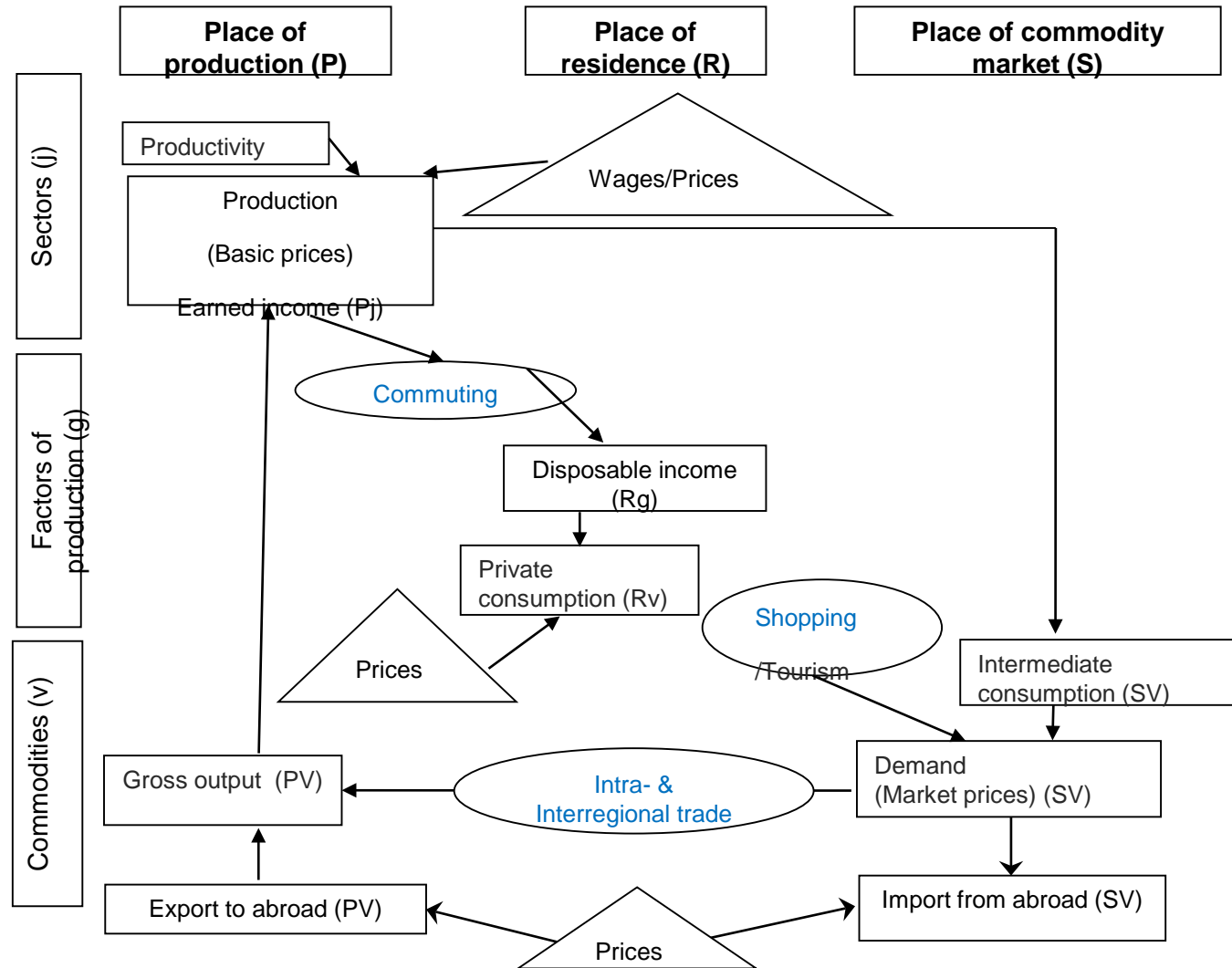


Regional concentration and productivity – peripheral regions

Figure 5. Regional Concentration by sector and productivity annual growth rate in Peripheral regions



The LINE model and main assumptions



- Short introduction of the LINE model with geographical and SAM frameworks;
- The baseline forecast to 2020 is based on ADAM model (2017 November version);
- Short-term model assumptions, i.e. unemployment is constant and assuming that the labour force is elastic;

Scenario analysis and assumption

- Scenario 1: Productivity in knowledge-based service increased by 10% in 2020
 - Baseline is forecasted until 2020, then we assume that each scenario has a set of regions (separately by urban, rural and peripheral regions) obtained an increase by 10% in productivity in knowledge-based service sector in 2020.
- Scenario 2: Productivity in machine industry sector increased by 10% in 2020
 - Baseline is forecasted until 2020, then we assume that each scenario has a set of regions (separately by urban, rural and peripheral regions) obtained an increase by 10% in productivity in machine industry sector in 2020.

By combination, we will have 6 scenarios to obtain results from the modelling.

Model results 1 regional changes in gross value-added

Inter-regional spillover

Table 1 Regional changes in GVA by 10% increase in knowledge-based service (in mil DKK)

Type of regions	Outskirts	Rural	Urban	Total
Outskirts	109	12	31	152
(%)	(0.72)	(0.08)	(0.20)	1.00
Rural	9	408	106	523
(%)	(0.02)	(0.78)	(0.20)	1.00
Urban	28	99	3,565	3,692
(%)	(0.01)	(0.03)	(0.97)	1.00
Total	147	520	3,702	4,369
(%)	(0.03)	(0.12)	(0.85)	1.00

Table 2 Regional changes in GVA by 10% increase in machine industry (in mil DKK)

Type of regions	Outskirts	Rural	Urban	Total
Outskirts	1,186	141	288	1,615
(%)	(0.73)	(0.09)	(0.18)	1.00
Rural	49	3,009	438	3,496
(%)	(0.01)	(0.86)	(0.13)	1.00
Urban	49	203	3,405	3,657
(%)	(0.01)	(0.06)	(0.93)	1.00
Total	1,285	3,354	4,131	8,770
(%)	(0.15)	(0.38)	(0.47)	1.00

Comments on Table 1 and 2

- In comparison of the two tables, it can be seen that 10% increase in productivity in machine industry has a larger effects on GVA in rural and peripheral municipalities in the absolute terms than the changes in knowledge-based service; while 10% increase in productivity in both sector seem to have the same income effects in urban municipalities;
- From the regional spillover effects, knowledge-based service is more concentrated in the urban municipalities (97%), the less is spilt over into other regions, while the same for machine industry, for which is more concentrated in rural municipalities (86%);
- It could be the regional effects spilt over to the neighbouring municipalities in the same region.

Model results 2 regional changes in employment

Inter-regional spillover

Table 3 Regional changes in employment by 10% increase in knowledge-based service (number of jobs)

Type of regions	Outskirts	Rural	Urban	Total
Outskirts	222	16	40	278
(%)	(0.80)	(0.06)	(0.14)	(1.00)
Rural	12	832	134	978
(%)	(0.01)	(0.85)	(0.14)	(1.00)
Urban	41	136	5,782	5,959
(%)	(0.01)	(0.02)	(0.97)	(1.00)
Total	276	985	5,956	7,217
(%)	(0.04)	(0.14)	(0.83)	(1.00)

Table 4 Regional changes in employment by 10% increase in machine industry (number of jobs)

Type of regions	Outskirts	Rural	Urban	Total
Outskirts	1,130	183	400	1,713
(%)	(0.66)	(0.11)	(0.23)	(1.00)
Rural	66	3,569	566	4,201
(%)	(0.02)	(0.85)	(0.13)	(1.00)
Urban	67	268	4,065	4,400
(%)	(0.02)	(0.06)	(0.92)	(1.00)
Total	1,264	4,021	5,031	10,316
(%)	(0.12)	(0.39)	(0.49)	(1.00)

Comments on Table 3 and 4

- Regional changes in employment got the same patterns as the GVA, however, it shows even clearly that 10% increase in productivity in machine industry has given increase in employment by 4,200 and 1,713 jobs in rural and peripheral municipalities; while 10% increase in productivity in knowledge-based service creates 5,959 jobs in urban municipalities, but only 4,400 job by machine industry. The job creation by the changes in productivity in knowledge-based service in rural and peripheral municipalities is also smaller.
- The regional spillover effects appear to be the same as GVA effects.

Model results 3 regional changes in gross value-added

Inter-sectoral spillover

Table 5 Regional changes in GVA by 10% increase in knowledge-based service (in mil DKK)

	Outskirts	Rural	Urban	Total
Direct effect	81	271	1,602	1,954
Total effect	152	523	3,693	4,368
Derived effect	71	252	2,091	2,414
Intra-sector derived effect***	17	61	511	589
Inter-sector derived effect****	54	191	1,580	1,825
Multipliers	1.88	1.93	2.31	

Table 6 Regional changes in GVA by 10% increase in machine industry (in mil DKK)

	Outskirts	Rural	Urban	Total
Direct effect	900	2,269	2,211	5,380
Total effect	1,615	3,495	3,658	8,768
Derived effect	715	1,226	1,447	3,388
Intra-sector derived effect***	106	165	184	455
Inter-sector derived effect****	609	1,061	1,263	2,933
Multipliers	1.79	1.54	1.65	

Model results 4 regional changes in employment

Inter-sectoral spillover

Table 7 Regional changes in employment by 10% increase in knowledge-based service (number of jobs)

	Outskirts	Rural	Urban	Total
Direct effect	177	625	3,276	4,078
Total effect	278	979	5,961	7,218
Derived effect	101	354	2,685	3,140
Intra-sector derived effect***	35	121	822	978
Inter-sector derived effect****	66	233	1,863	2,162
Multipliers	1.57	1.57	1.82	

Table 8 Regional changes in employment by 10% increase in machine industry (number of jobs)

	Outskirts	Rural	Urban	Total
Direct effect	735	2,556	2,420	5,711
Total effect	1,711	4,201	4,400	10,312
Derived effect	976	1,645	1,980	4,601
Intra-sector derived effect***	126	190	210	526
Inter-sector derived effect****	850	1,455	1,770	4,075
Multipliers	2.33	1.64	1.82	

Comments on Table 5-8

- Sectoral spillover effects can be observed by the changes in the direct effects and derived effects. When the productivity has been increased in one of sectors, the direct economic effects occur only in this sector. When the production in this sector is increased, it will increase the demand for intermediate consumption, this will no doubt spread into other sectors and other regions (i.e. indirect effects); at the same time the household income increases due to the increase in income of employees both by the direct and indirect effects, the increased will happen also in the private consumption (induced effects).
- The size of multiplier shows the relationship between the total effects (direct+indirect+induced effects) and direct effects. The larger multiplier is, the greater the spillover effects;
- Results from Table 5-8 show that multipliers in the urban region is greater than the other two regions, both in terms of GVA and employment;
- Peripheral municipalities have higher multipliers in machine industry, due to sectoral spillover is higher (into rural municipalities).

Discussion

- Urbanization is a global trend, that the population is more and more concentrate in the large cities. The consequences of this trend is that most creative and service sectors have also concentrate into the cities, productivities in the urban regions are increasing, the house prices in the large cities continuously grow, and the people commuting longer and longer distance to the job place.
- The urban municipalities have advantages in e.g. creative and knowledge-based service sector, while rural municipalities have advantages in machinery industrial sector.
- Regional spillover effects is greater in the sectors that have higher advantages, in the other words, the regional comparative advantage plays a role in both sectoral and regional spillovers;
- To keep the higher productivities, improvement of human capital, innovation activities and R&D inputs etc. are also important factors in the process.

Conclusion

- Level and growth rates of regional productivity, regional economic growth and the explanation for the difference in regional inequality are always the top issues in the regional policies;
- EU regional policy has mainly focused on business competitiveness, regional economic growth, job creation, sustainable development and improvement in citizens' quality of life;
- Danish government has recently stressed on the education efforts in training the potential labor force;
- The government has also put efforts on regional balance, and more recently government has decided to replace the nearly 4,000 state's working places from the capital cities to the rural and peripheral municipalities.
- More efforts are needed to achieve the regional balanced development, for example, training the labor force in the rural and peripheral municipalities, public investment in infrastructure, encouraging firms' innovation, etc.

Thank you for your attention !

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