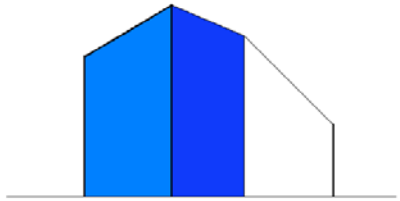

Regional Productivity and Socio-Economic Networks

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Thanks go to DI Andreas Wolf, now Austrian National Bank, for data evaluation while he was research assistant at EOS.

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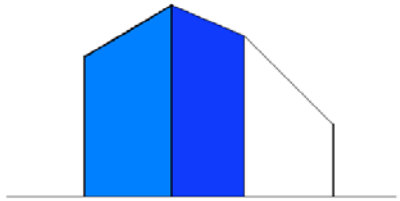
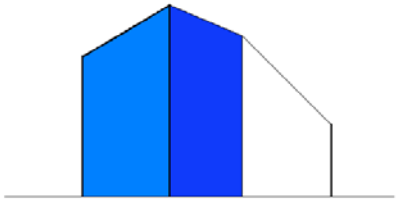
Overview



1. Motivation
2. Theoretical background
3. Spatial models
4. The data
5. Regional productivity
6. Productive diversity
7. Social renting and social cohesion

Conclusions

1. Motivation



To which extent do productivity and social cohesion depend on the interplay between the spatial allocation of productive activities and housing services ?

Contribution is to provide further evidence by means of spatial econometric models, with Austrian regional data.

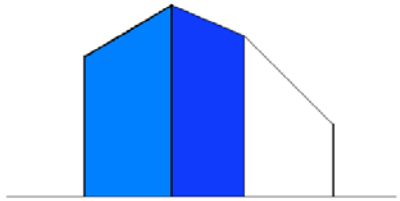
Paper first discusses the theoretical background, in a review of arguments from the influential work of Jane Jacobs up to the New Economic Geography. On these lines, we maintain the core thesis that labour productivity and economic benefit are the greater, the larger the productive diversity.

Productive diversity needs an equally differentiated pool of resources like skills, communicative services and knowledge transfers

⇒ Agglomerations are usually the more productive areas in an economy. But they do not only support progress, they are also zones of conflict between social groups, and

=> Impacts of skill composition on regional productivity open to research

1. Motivation (continued)



Thus, the cornerstone is the

Hypothesis: Firms are more productive (in terms of labour productivity) if the productive activities are more diversified, and less productive if regions are more specialized.

With that we will check the NEG and related approaches:

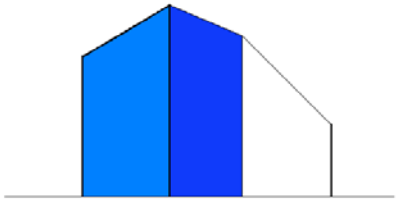
- Does there exist a productivity spillover between regions ?
- Which factors explain the degree of diversity of productive activities ?
- To which extent is regional diversity or specialisation tied to a polarisation of skills and earnings ?

Finally,

- Can the spatial distribution of current Austrian social renting be traced back to the spatial distribution of productive activities (together with their historical course), what may be the impacts for social cohesion ?

Object under study is the Austrian economy around pivotal year 2004, data drawn from Austrian household microcensus and regional Business statistics, aggregated to a panel on the mesoscale of NUTS3- regions.

2. Theoretical background



Theoretical cornerstone: "grand" hypothesis that societies are more productive and more robust against shocks whenever they encompass a greater variety of personal characteristics and activities.

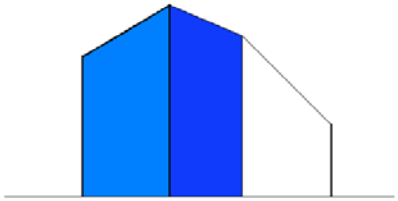
Classic contribution: Jane Jacobs “The Economy of Cities” (1970). Innovations, growth and sustainability origin in cities, which are endowed with diversity of talents and productive ventures.

Peter Hall (2001) “Cities in Civilization", recourse to Scandinavian milieu theory of Törnqvist (1983): Prospering cities are rich in social interactions and synergies. The more vivid communicative structures, the more productive the cities. But no smooth process, social cohesion often on trial.

John Quigley (1998): Agglomerations form because they allow for positive externalities and social interactions:

- in production, firms cover need for factors and resources,
- in consumption, households find richer basket of goods => consumer rent.

2. Theoretical background (contd.)



Paul Krugman (2009), New Economic Geography, identifies increasing returns as major criterion for locational choice and trade. Krugman claims that NEG solved puzzle of transition from interindustrial trade through comparative advantage to intraindustrial trade with baskets of similar type and size.

The NEG sees the determinants of locational choice in availability of “Marshallian” factors (already in Marshalls (1890) Principles)

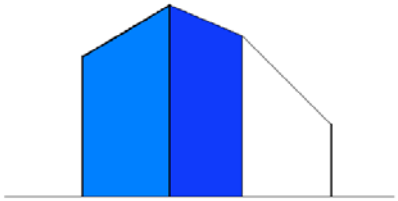
- skilled labour,
- complementary services,
- knowledge spillover.

$\Rightarrow$ firms tend to cluster in specific areas.

Clusters and problem of industrial concentration investigated in a number of studies, in particular Combes and Overman (2004)

Agglomerations offer opportunities for proximity between housing and work places => new challenges and perspectives

2. Theoretical background (contd.)



Rise of agglomerations: Migration towards urban centres, both from abroad and by domestic relocation from rural to urban areas

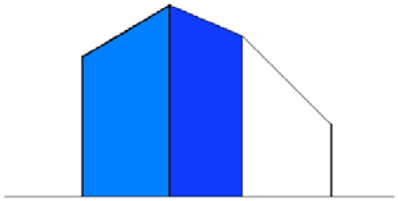
- Emergence of new socio-economic networks both in production and housing
- concentration of skilled and educated population in urban areas
- extra revenues generated by positive externalities absorbed by higher wages => accrue to skilled work, much less to unskilled
- Agglomeration characterized by economic polarisation (skills, incomes)
- problem of efficient spatial organisation of society

Historical development from 1960s:

From urban functionalism, portrayed by Henri Lefebvre (2000) as "production of space“: large scale estates built under strict separation of housing and work, ruling elite interested in efficient organization of the labour force =>

=> Today more individualistic structures, pertaining problem to maintain social cohesion over fragmented social groups

2. Theoretical background (contd.)



Differentiated structures do also enlarge scope of economic activities in physical reach and mix of neighbourhoods

Productive networks develop on physical proximity, Mark Lorenzen (2007)

New networks differ from historical class structures, together with materialized structures

"Stylized facts" in interplay between production and housing:

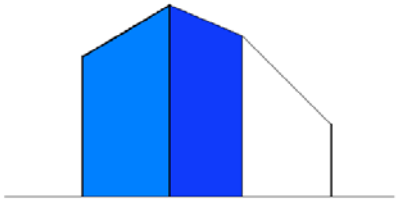
- Much of standardised production (manufacturing) moved out from urban centres to periphery over the last decades
- Knowledge-based and communicative activities remained within city borders, from universities to R&D, special craft, software support, finance and law services, public relations and publicity

Findings on NUTS3-levels within EU:

- technology-intensive and knowledge-based activities prefer urban locations more than other activities;
- productivity levels increase with density of work, indicating positive externalities on lines of NEG

Open question: impact and perspectives of labour skills

3. Spatial models



Spatial economics distinguishes between two types of spatial patterns:

- Specialisation: Relative to some standard, production is specialized if activity spectrum dominated by certain products, otherwise it is more diversified

- Concentration: The extent to which the activities are concentrated in certain parts of a given region. Industrial clusters are the case of interest.

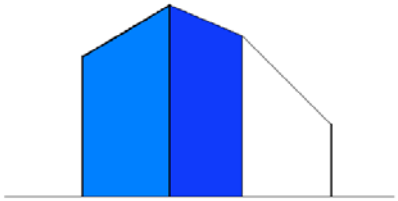
Specialisation and concentration overlap, but not identical.

Present study attempts to provide new evidence on regional specialisation / diversification, with extensions on skill qualification levels and housing choices of labour force

=> Can we identify spatial pattern of productivity and together with their “Marshallian” factors?

=> Can we still recognize a specific role for social renting in the spatial synchronisation of production and housing ?

3. Spatial economic models (contd.)



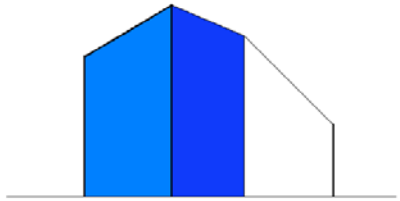
The main focus of the empirical part is to estimate and test

- the impacts of regional diversity on productivity, and
- to extend the results to issues of labour supply and housing

The empirical base, see next section, is analysed for a panel of N=35 Austrian NUTS3-regions. We use the notation

y	endogenous charcteristics, observations (N-vector)
X	exogenous characteristics, observations (N×K- matrix)
W	neighbourhood weights (N×K- matrix of 0/1 dummies)
α	Konstant parameter
β	Elasticities (K- Vector of parameters)
ρ	Autocorrelation parameter for endogenous variable
λ	Autocorrelation parameter for error terms
ε	error terms
σ	standard deviation of errors
u	auxiliary error terms

3. Spatial economic models (contd.)



For the sectors and their aggregates, we use spatial regressions with SAR and ML-estimation, see LeSage, K. Pace (2009) p.32

$$y = \rho W y + \alpha + X\beta + \varepsilon,$$

$$\varepsilon \sim N(0, \sigma^2 I_N)$$

For the aggregates we will also apply SEM:

$$y = \alpha + X\beta + u,$$

$$u = \lambda W u + \varepsilon, \text{ with } \varepsilon \sim N(0, \sigma^2 I_N)$$

and the composite model SAC:

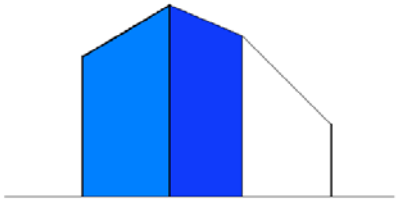
$$y = \rho W y + \alpha + X\beta + u,$$

$$u = \lambda W u + \varepsilon, \quad \text{with} \quad \varepsilon \sim N(0, \sigma^2 I_N)$$

The SAR-model is given preference, because for the aggregates the AIC-criterion turns out to be optimal. Instead, on the sectoral level, OLS would do in the majority of cases.

Model extensions will be analysed by simple OLS, see below.

4. Data



Problem to break down theory and evidence to geographical units

Compromise NUTS3-regions (Combes and Overmas)

We consider:

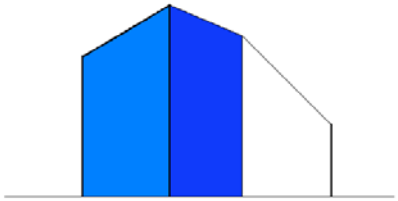
- Production side: selected sectors in manufacturing and services from Business Statistics of the Austrian Statistical Institute
- Factor and labour side: selected statistics and indicators from Microcensus data of the Austrian Statistical Institute

Data from pivotal year 2004, together with some long-term trends

Limitations:

- Business Statistic includes firms with different locations, but problem less pronounced in SMEs where majority of firms located at single place
- Sectors with high spatial concentration and locational clusters (car and railway production) may distort statistical analysis of spatial distribution => remain excluded except for separate analysis of total manufacturing
- Some NUTS3 statistics less reliable due to small sample sizes
- Commuting cannot be considered

4. Data (continued)



On production side, we use 6 selected sectors in manufacturing and services called “KEY-sectors“, compare Figure 1:

- CONS: Consumer products;
- META: Metal and steel products;
- MELO: Machines, electric, optical equipment;
- STRUC: Construction including auxiliary crafts;
- CARRS: Car repair + services (no production);
- KBAS: Communicative, knowledge based services

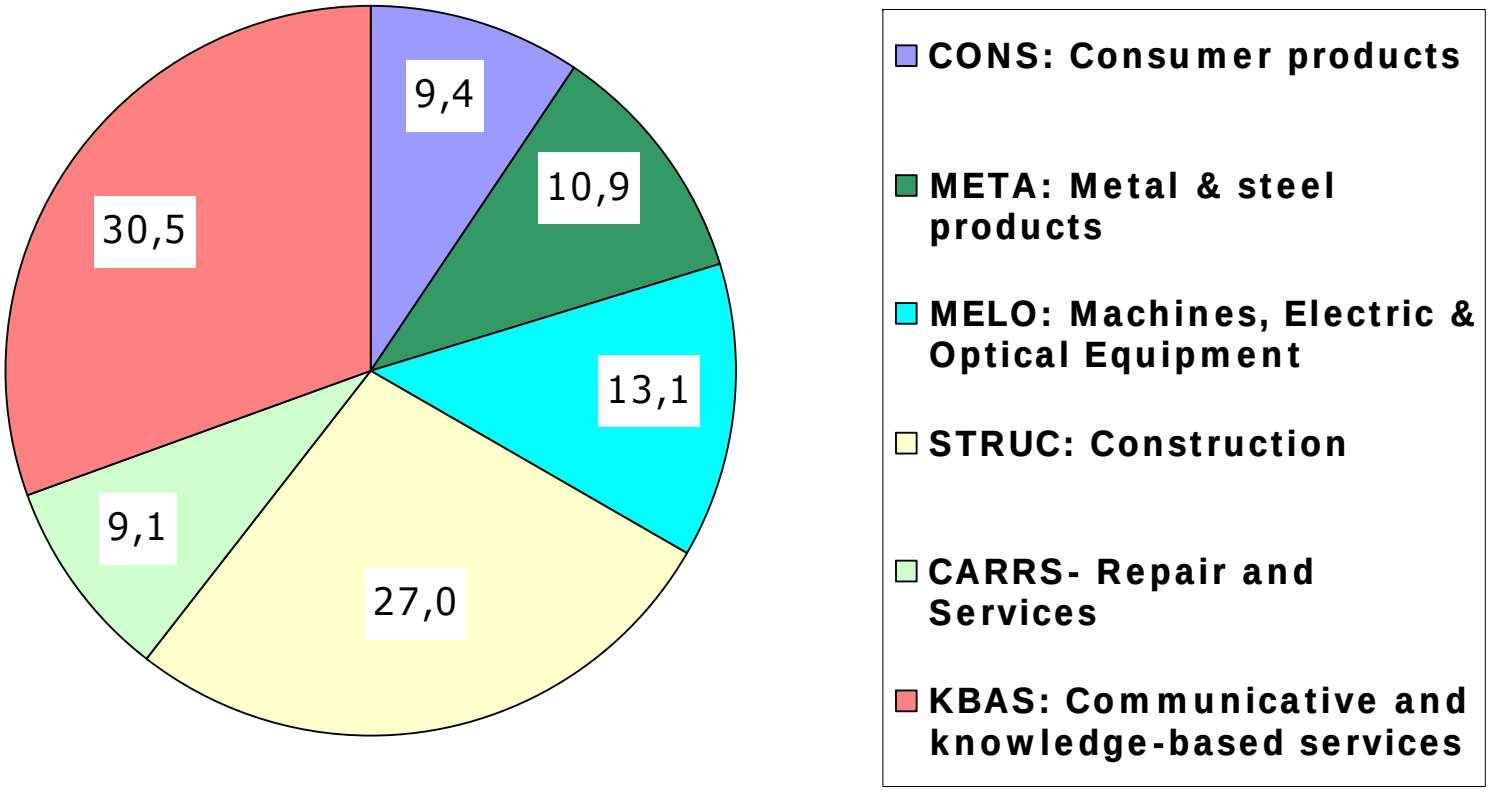
To anchor KEY-sectors in total manufacturing we also use

- TMANUF: total manufacturing (NACE-class D),
- SMANUF: small manufacturing in firms < 50 workers,

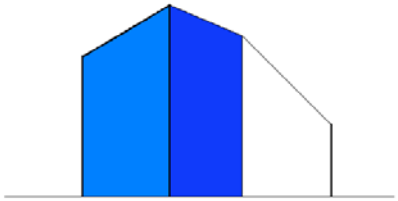
Characteristics used by sector * and region:

- *EMPLO: total employment in full time equivalents,
- *NFIRM: numbers of firms,
- *SIZE: average firm size *EMPLO/*NFIRM
- *PROD: gross GDP per employed *GDP/*EMPLO

Figure 1: Employment in the 6 KEY sectors 2004
Shares over all Austria in percentages
Source: Structural Business Statistics, own calculations



4. Data (continued)



Production data in pivot year form panel over 35 regions.

Basic statistics averaged over regions given in Table A.1

Search for index of specialisation:

Reference are activity shares observed over the whole of Austria. The more a region deviates from that basket, the higher its degree of specialisation => Does not exclude that region or Austria herself more specialised than reference region abroad.

Formally, degree of specialisation in region k defined by quadratic deviation from (underlines) average Austrian KEY-shares

$$KEYSPEC_k^2 =$$
$$(CONS_k - \underline{CONS})^2 + (META_k - \underline{META})^2 + (MELO_k - \underline{MELO})^2 +$$
$$+(STRUC_k - \underline{STRUC})^2 + (CARRS_k - \underline{CARRS})^2 + (KBAS_k - \underline{KBAS})^2$$

or

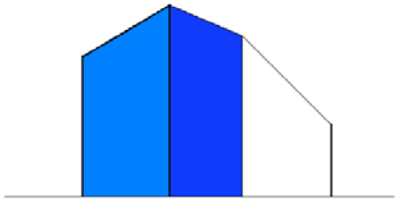
$$DIVERSITY = - KEYSPEC$$

We have KEYSPEC>0. The larger KEYSPEC, the more specialised region or the lower the degree of diversity

Spatial distribution of Diversity and Productivity over the aggregate of 6 Key-sectors shown in maps M1 and M2,

Index of specialisation shown in Figure 2 below.

4. Data (continued)



On factor and labour side, data panel over 35 NUTS3 regions is constructed for the pivotal year 2004 from various sources

Microcensus of Statistics Austria, characteristics averaged by regions and by means of observation years 2003-2005:

- AGE of persons in labour force
- LOWSKILL: basic school and auxiliary job,
- HIGHSKILL: university, executives, professionals
  (MIDDLESKILL: all in between, skill shares total 100%)
- SOCRENT: shares of social renting among tenures,

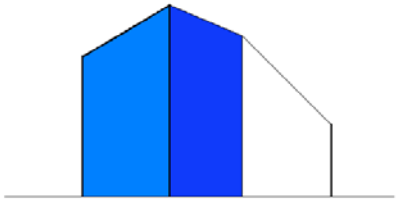
Migration statistic 2004 of Statistics Austria:

- NETMOBIL: ratio inflow : outflow of migrants by region, evaluated for sum of domestic plus international moves

Others:

- REMOTE: 0/1 dummy for NUTS3 distant from main traffic routes, own calculations

5. Regional productivity



Hypothesis: Firms are more productive (in terms of labour productivity) if the productive activities are more diversified, and less productive if regions are more specialized.

We test the hypothesis by spatial regression of

- log Labour productivity *PROD

against

- log firm size *SIZE
- log negative specialisation index DIVERSITY
- 0/1 dummy region REMOTE from main traffic routes

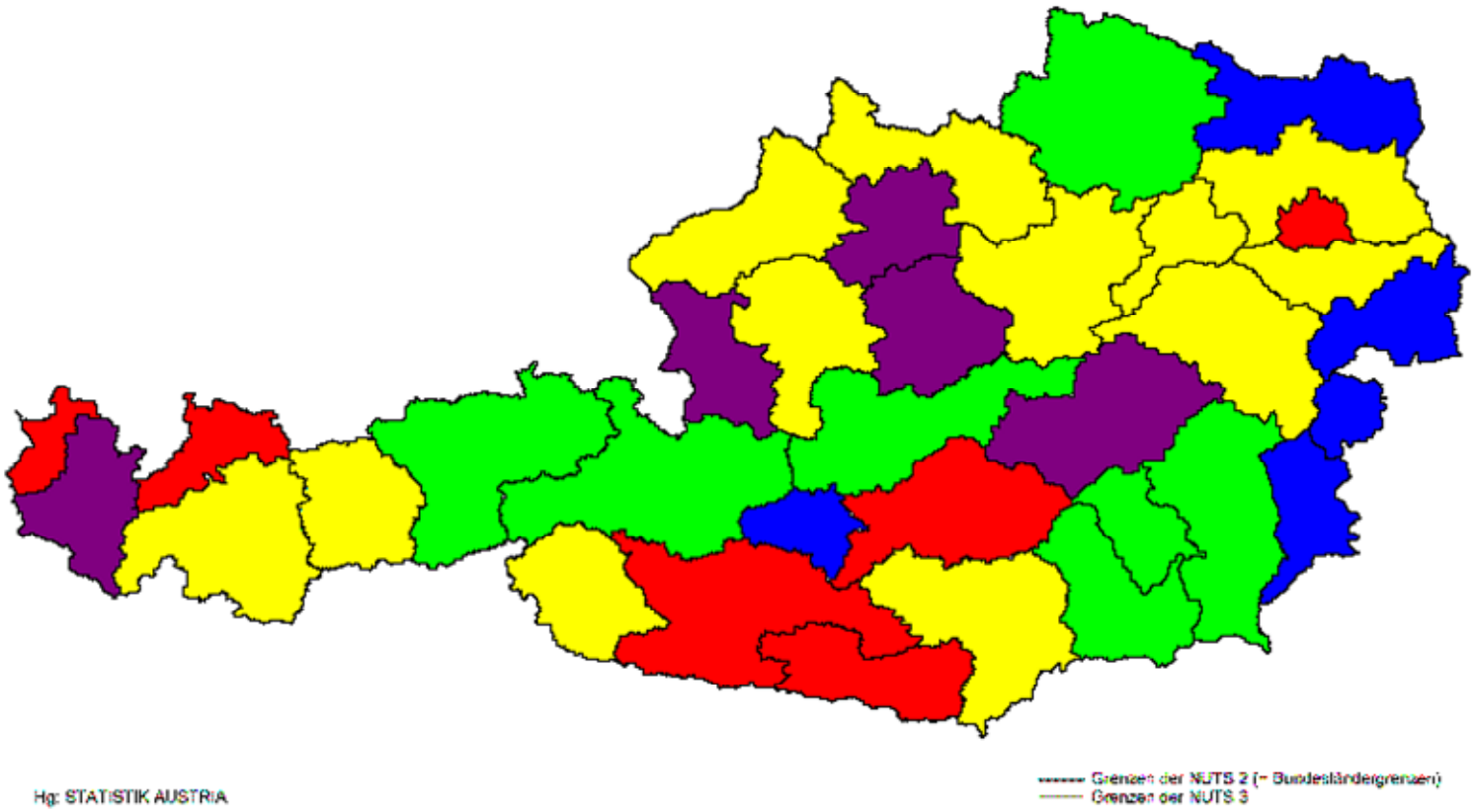
where * indicates sector under consideration,
DIVERSITY and REMOTE take the same values for all sectors.

The model is evaluated for unweighted NUTS3-panel

- for the aggregates KEYSECTORS, SMANUF and TMANUF, see Figure 3 and Tables A.2 with SAR
- with model selection tests listed in Tables A.3, and
- with SAR for the separate 6 Key-Sectors, needs detailed discussion and therefore delegated to the Appendix, see also Figure A.1 and Tables A.4.

Map M1: Productivity index in KEY sectors 2004 (Austria = 1)

Productivity = gross value added per employed

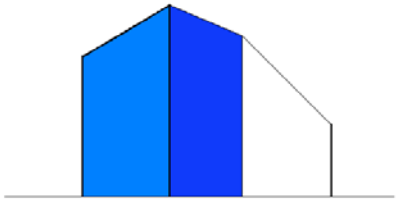


smallest		Productivity		largest
0,70 - 0,85	0,85 - 0,90	0,90 - 1,00	1,00 - 1,10	1,10 - 1,20

Averages over 6 selected KEY sectors

Source: Microcensus and Structural Business Statistics 2004, own calculations

5. Regional productivity (continued)



Most significant results conforming to hypothesis obtained from the SAR model for the aggregates

- KEYSECTORS (aggregate of 6 sectors) and
- small manufacturing SMANUF

Elasticities:

Internal economies of scale (Firm size) = 0,43 and 0,29 resp.

External economies of scale (Diversity) = 0,08 and 0,07 resp.

Productivity loss due to remoteness of region = 7% and 13% resp.

Autocorrelation coefficient RHO = 0,33 and 0,45 resp.

Outcome on RHO important finding => spatial productivity spillover, signals economic networks between neighbouring regions

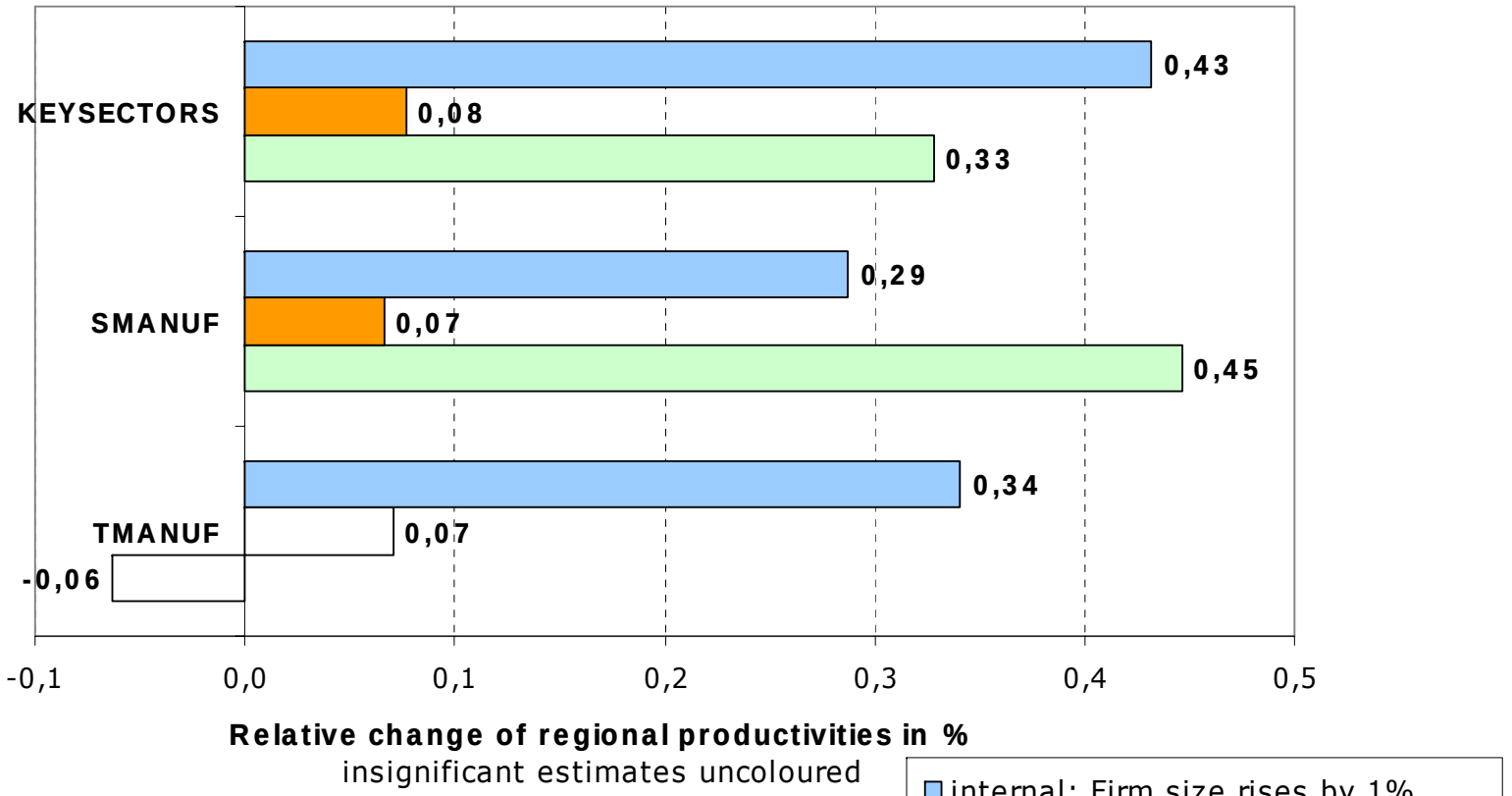
Total manufacturing conforms to that pattern only with regard to firm size and remoteness, with elasticities of 0,34 and - 7%.

Instead, the elasticity from diversity is totally insignificant => not surprising because total manufacturing includes the industrial clusters with multinational firms around Graz, Linz and Vienna.

Autocorrelation RHO is insignificant as well (supraregional networks ?)

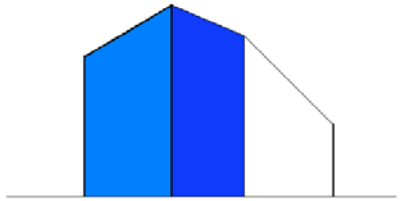
Figure 3: Productivity increase by economies of scale
Aggregate SAR-models by NUTS3-regions, 2004

Explanatories: size, diversity and remote
Source: Structural Business Statistics, own calculations



KEYSECTORS: aggregate of six selected KEY-sectors
SMANUF: small manufacturing firms up to 49 workers
TMANUF: all manufacturing (all firm sizes)
Numbers represent elasticities, obtained from SAR-model with variables in logarithms, to be interpreted as percentage increase of productivity under 1% increase of respective explanatory. Estimates and tests given in Tables A.2

6. Productive diversity



Index of diversity in Figure 2 drawn with abscissa referring to specialisation

KEYSPEC = - DIVERSITY.

Histogram: number of regions over index intervals of length 5

Support [7.7,48.0], with median 18.6 and mean 20.4

=> 10% change of KEYSPEC around the median roughly an index change from the median to the mean.

Most interestingly, all larger Austrian cities together with their suburban areas are below median, hence less specialised than the rest of Austria (the „countryside“)

Only exception is Vienna with index value of 21.5 => Vienna is more specialised, sector KBAS plays a prominent role.

An even more pronounced specialisation index is SMESPEC, constructed for Key-Sectors with SMEs up to 50 workers.

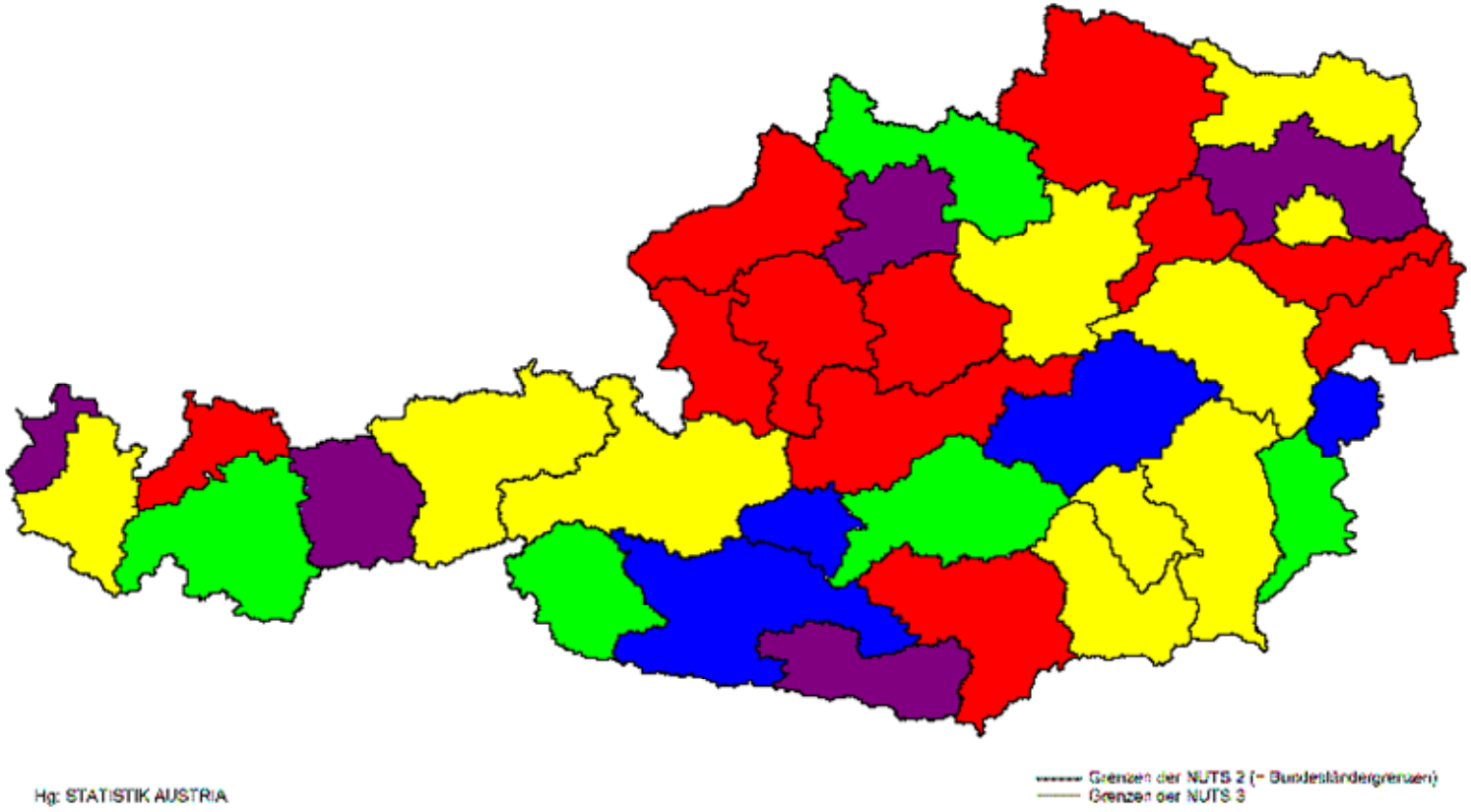
Index SMESPEC has support [4,30]

all larger Austrian urban areas within [4,12], while Vienna has index=20.

Alpine and remote regions are mostly specialized

Map M2: Regional specialization of the KEY sectors 2004

Index relative to Austrian specialization = 0 (maximum diversity)



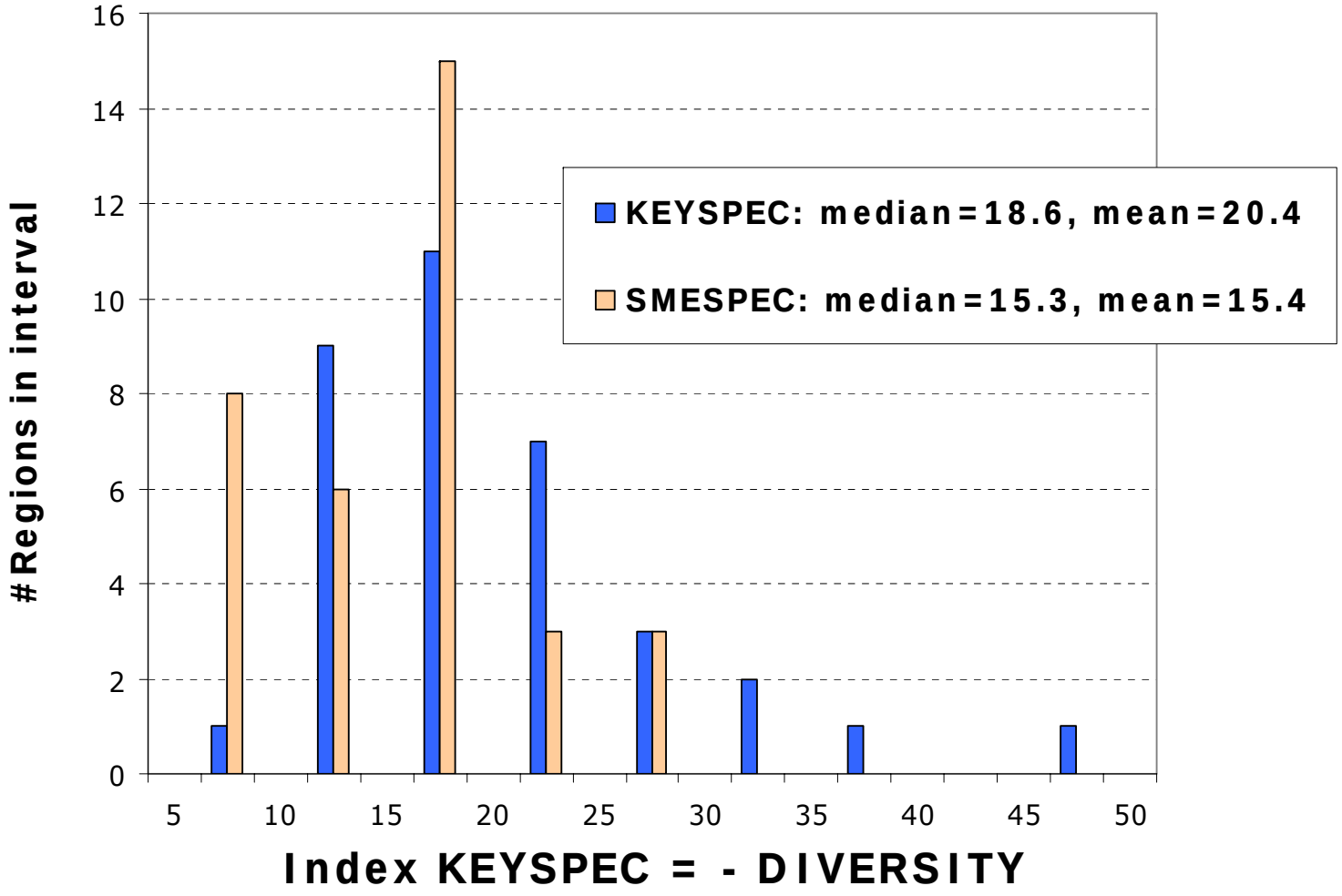
largest		Diversity		smallest
smallest		Specialisation		largest
7 - 12	12 - 18	18 - 24	24 - 30	>30

Source: Microcensus and Structural Business Statistics 2004, own calculations

Figure 2: Index of Specialisation

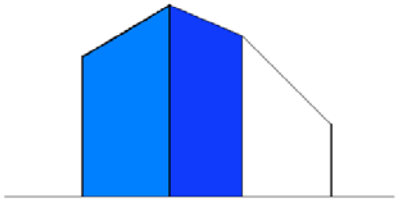
Histogram for KEY-sectors and SME-statistics

total of bars = 35 regions



Sources: Statistics Austria, SME-research, own calculations

6. Productive diversity (continued)



To which extent does diversity pattern of KEY-sectors spill over to the small and medium size enterprises? Simple OLS yields

OLS: Degree of specialisation in SME-firms						Table A.5d
SMESPEC	=	0.38	+	0.77*KEYSPEC		
t-values		(0.9)		(5.5)		
NOBS	=	35		adjusted R2	=	0.46

=> With attention to specific role of communicative and knowledge-based services KBAS, diversity is an urban phenomenon

But note: suburban regions have to be included !

Raises question about the determinants of diversity

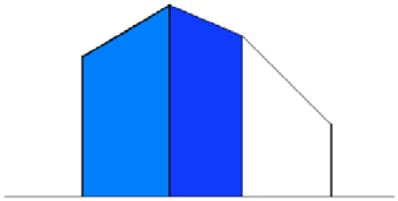
Econometric problem: multitude of collinearities between candidates for explanation

We therefore proceed with partial analysis by simple OLS:

(1) Impact of “Marshallian” skill characteristics

(2) Spatial distribution of complementary driving forces

6. Productive diversity (continued)



(1) Impact of skill characteristics: see Figure 4, upper part.

Shows percentage increase of diversity for 1%-increase in shares of skill levels LOWSKILL and HIGHSKILL.

In both cases elasticities of about 0.7.

Interpretation:

Skill shares of the Austrian labour force shown in Table.

In the long-term, share of HIGHSKILL rising, share of LOWSKILL decreasing, albeit sluggish in international comparison.

Skill distribution	2005	1989-2005
levels	% Shares	% Trend p.a.
LOWSKILL	19,5	-2,5
MIDDLESKILL	66,0	0,5
HIGHSKILL	14,6	2,9

Source: Austrian Microcensus, own calculations

Urban areas are more diversified => estimates indicate process driven by the skilled, with continuing trend.

Though: in a sense the process pulls the low skills into urban areas while middle skills more frequent in towns outside the cities

=> Growing polarisation of skills and incomes in cities and their suburban neighbourhoods

Figure 4: Factors for productive diversity
OLS-equations by NUTS3-regions, 2004
Source: Structural Business Statistics Austria, own calculations

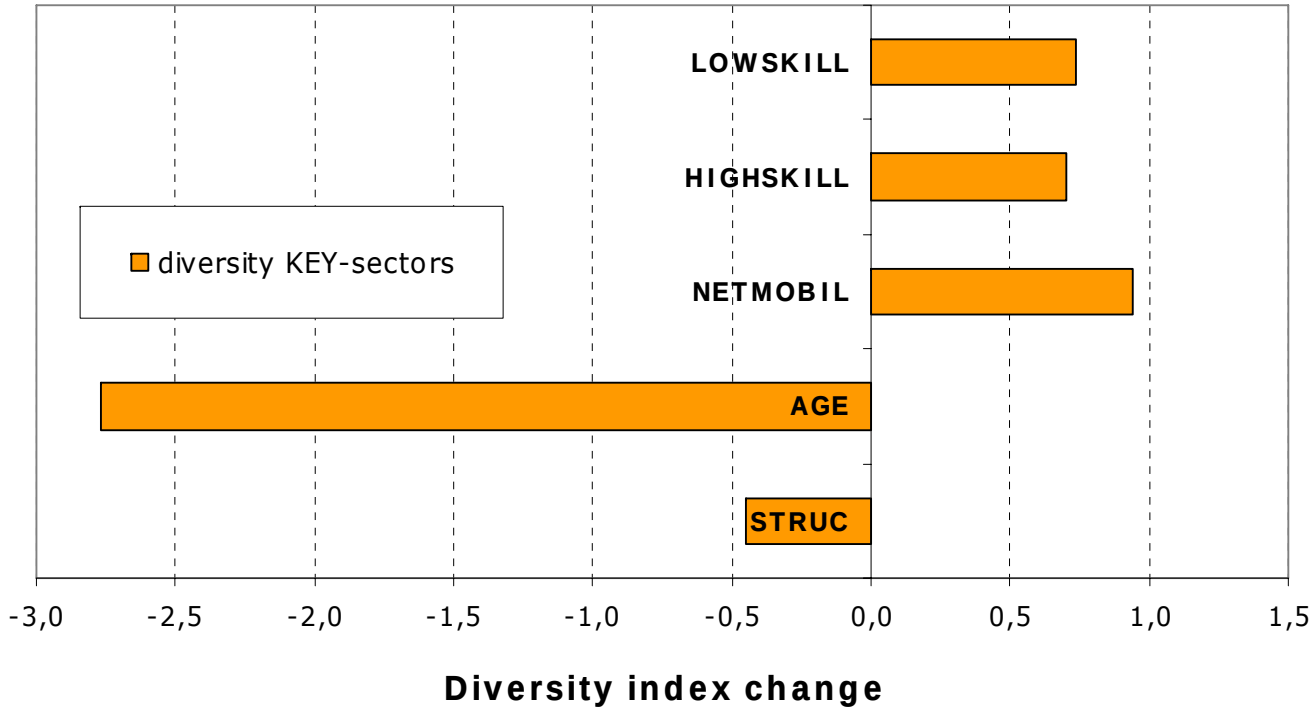
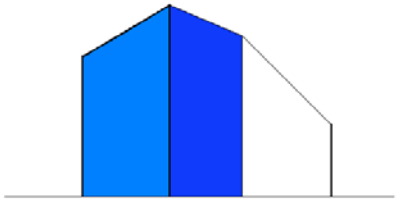


Figure shows elasticities. that is %-change of diversity for 1% change of explanatories:
LOWSKILL: regional share of low skills
HIGHSKILL: regional share of high skills
NETMOBIL: net inflow into area rises by 1%.
AGE: regional average age of population in labour force
STRUC: regional employment share of construction
The elasticities are significant throughout.
Because of multicollinearity 2 separate equations for KEY-sectors were estimated, with
(1) explanatories SKILLS,
(2) explanatories NETMOBIL, AGE and STRUC

6. Productive diversity (continued)



(2) Complementary driving forces, Figure 4, lower part

Set of prominent variables retaining significance in estimation:

NETMOBIL: net migration into a region fosters the degree of diversity with elasticity 0.95

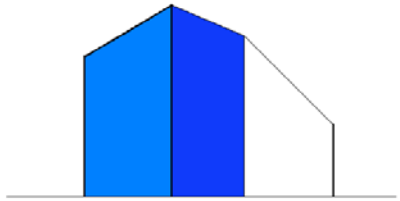
AGE: average age of regional labour force: regions with higher ages tend to specialization (or specialized regions give too little opportunities for the young), with elasticity -2.7, while the young search for diversified regions

STRUC: Higher employment shares of Construction in specialised regions, with elasticity -0.45 => Construction firms tend to locations in less preferred and rural areas with lower wage cost => environmental impact as traffic across regions gets stronger

Variant: employment share KBAS replaces Construction with elasticity of 0.40 => reflects migration of skilled to city centres

Results can be improved by use of principal components derived from complementary driving forces

7. Social renting and social cohesion



Contrary to several EU-countries, but similar to the Netherlands, France, Denmark, Sweden and to some extent also UK

⇒ Austria has maintained a rather dense spatial network of social housing, mixed tenure structures viewed as pillar to maintain social cohesion.

Austrian social renting has further expanded over the recent decade (from a tenure share of 21% around 2000 to 24% in 2010).

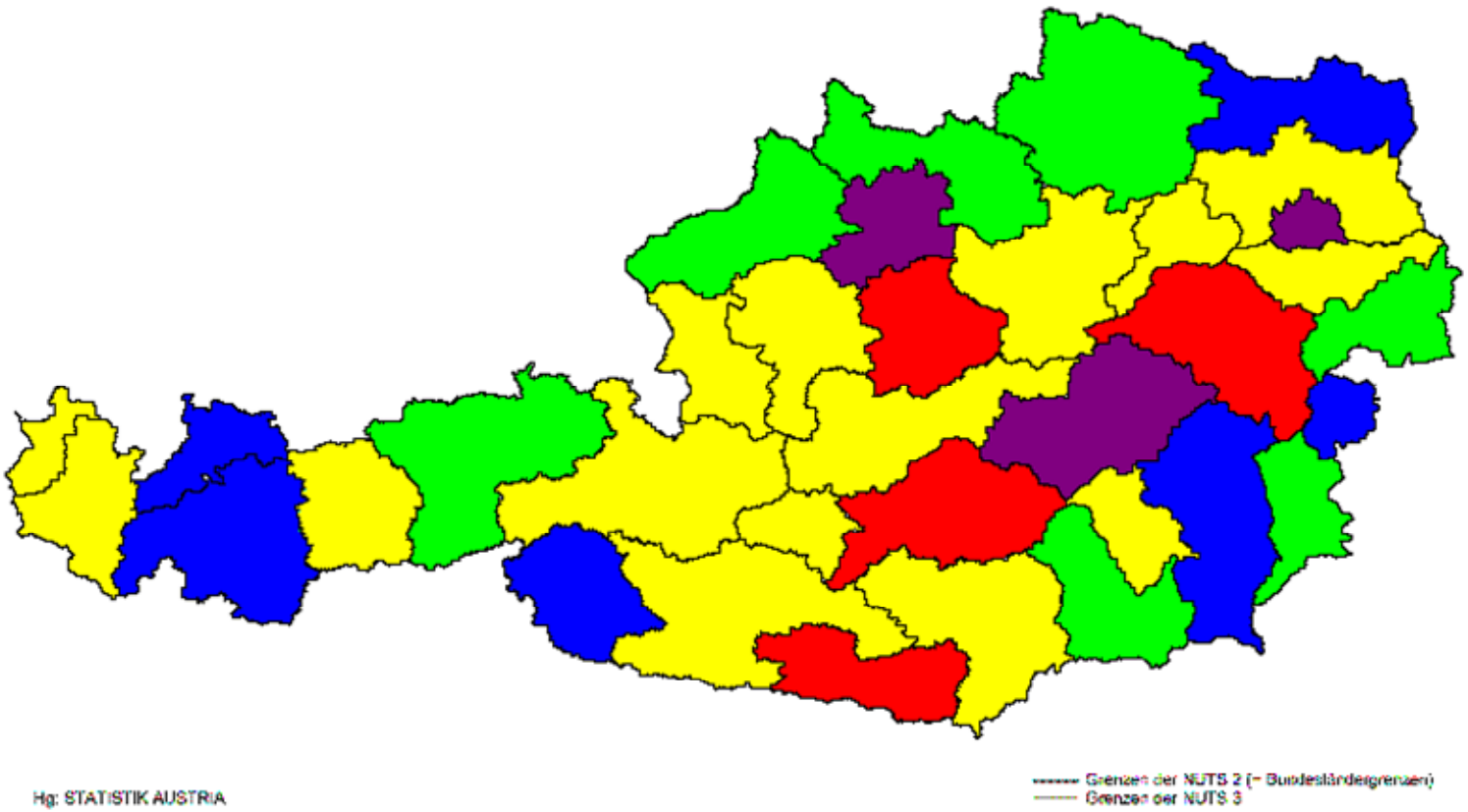
To understand the following, short glance on history:

Traditionally, Austrian social housing was supplied to a middle class rather than targeting the poor (in new developments, while poor allocated to old existing stock), compare Deutsch(2009)

Large scale estates rather the exception than the rule, dominant type of developing in certain periods and locations only (Vienna municipal housing in the 1920s, Austrian cities in functionalist era of the 1960s, recently built neighbourhoods in certain Viennese outskirts)

For the major part, social renting materialized in decentralized structures => the large limited-profit housing sector has grown historically around industrial areas, also in little towns, Map M.3

Map M3: Tenure shares of Austrian social renting 2004 among households in labour force



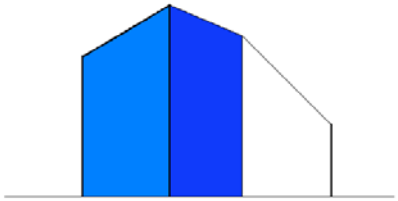
smallest **Shares** **largest**

3 - 6%	6 - 10%	10-20%	20 - 30%	30 - 40%

Household in labour force: Household head aged 20-59

Source: Mikrocensuses 2003-2005, ISIS-Statistic Austria, own calculations

7. Social renting, cohesion (contd.)



⇒ Austrian social providers are committed to supply and to develop residences in synchronisation with local housing needs

Social renting servicing a variety of workers and public employees

⇒ But recently, trend towards servicing a society at risk became prominent => case to ask for possible impact of the relocation of work places and strata on social cohesion and productivity.

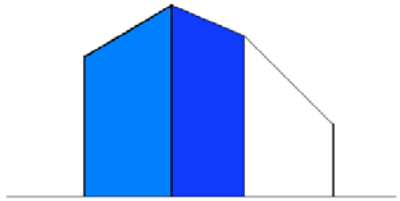
OLS: Social renting share by regional diversity **Table A.5c**

SOCRENT	=	6.08	+	1.53*DIVERSITY		
t-values		(3.7)		(2.8)		
NOBS	=	35		adjusted R2	=	0.16

OLS provides highly significant relation (even if fit moderate): The regional share of social renting rises with degree of diversity

Can also be seen from SAR estimation of regional productivity: The share SOCRENT replaces the explanatories DIVERSITY and REMOTE, which then become insignificant, see Tables A.2

7. Social renting, cohesion (contd.)



⇒ To be interpreted not as simple causality (as if social renting would create productivity) but in the sense of socio-economic networks:

- Spillover of knowledge between different activities in proximity of work places
- Job opportunities and alternatives in neighbourhoods

Dynamic of spatial relocation does mostly affect the sector KBAS: communicative and knowledge-based activities, Map M.4

⇒ Young skilled move into city centres

Polarisation between low and high skills dominant within narrower city borders while middle skills move to suburbia

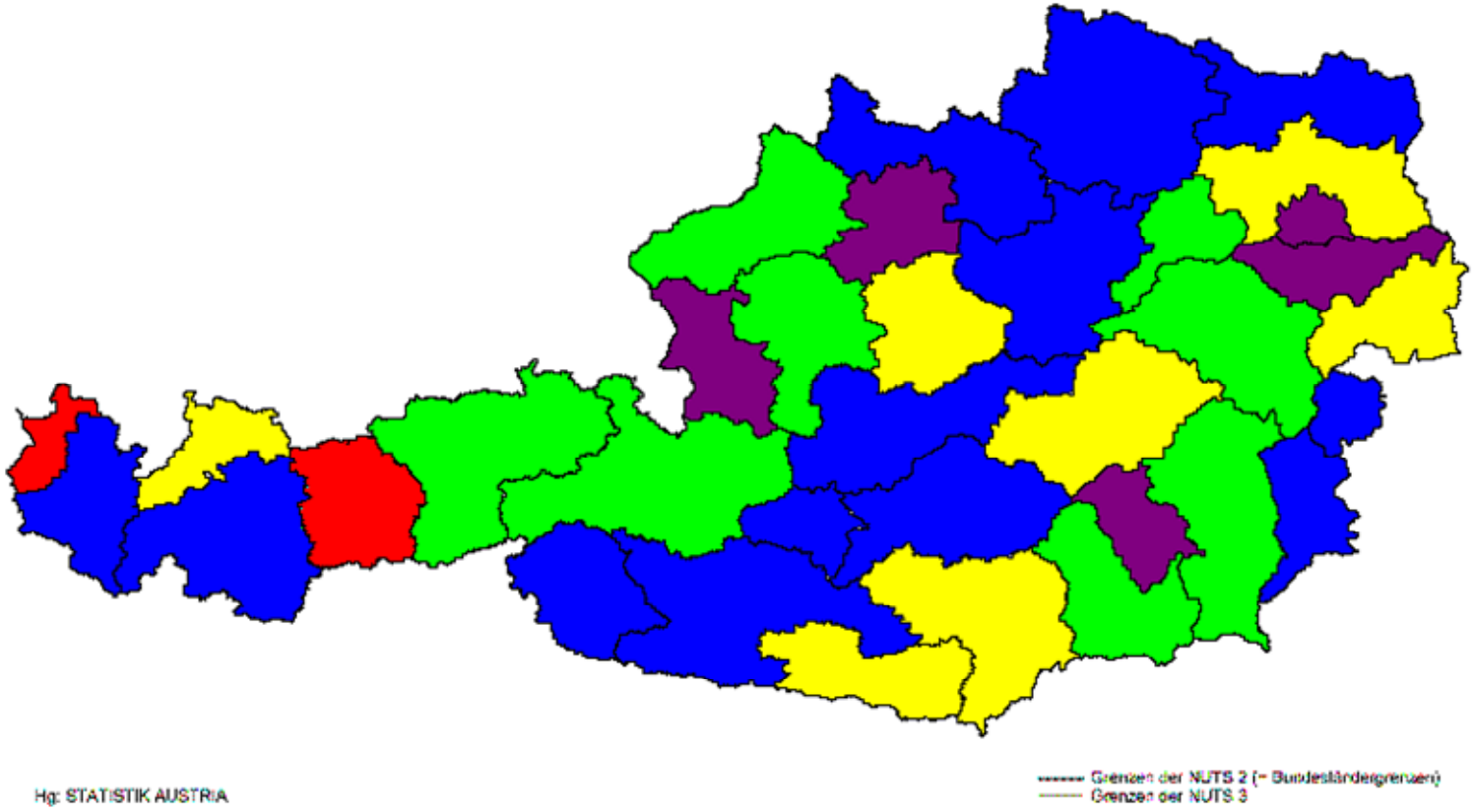
Workers in KBAS partly excluded from social renting by means testing, partly disinterested because of preference for ownership

=> Limited profit and municipal renting in cities looses middle-class incomes

Question: Does growing polarisation in cities put the sustainability of social renting at risk?

Map M4: Share of communicative services KBAS 2004

sectoral employment relative to total KEY-employment in %



smallest **Shares** **largest**

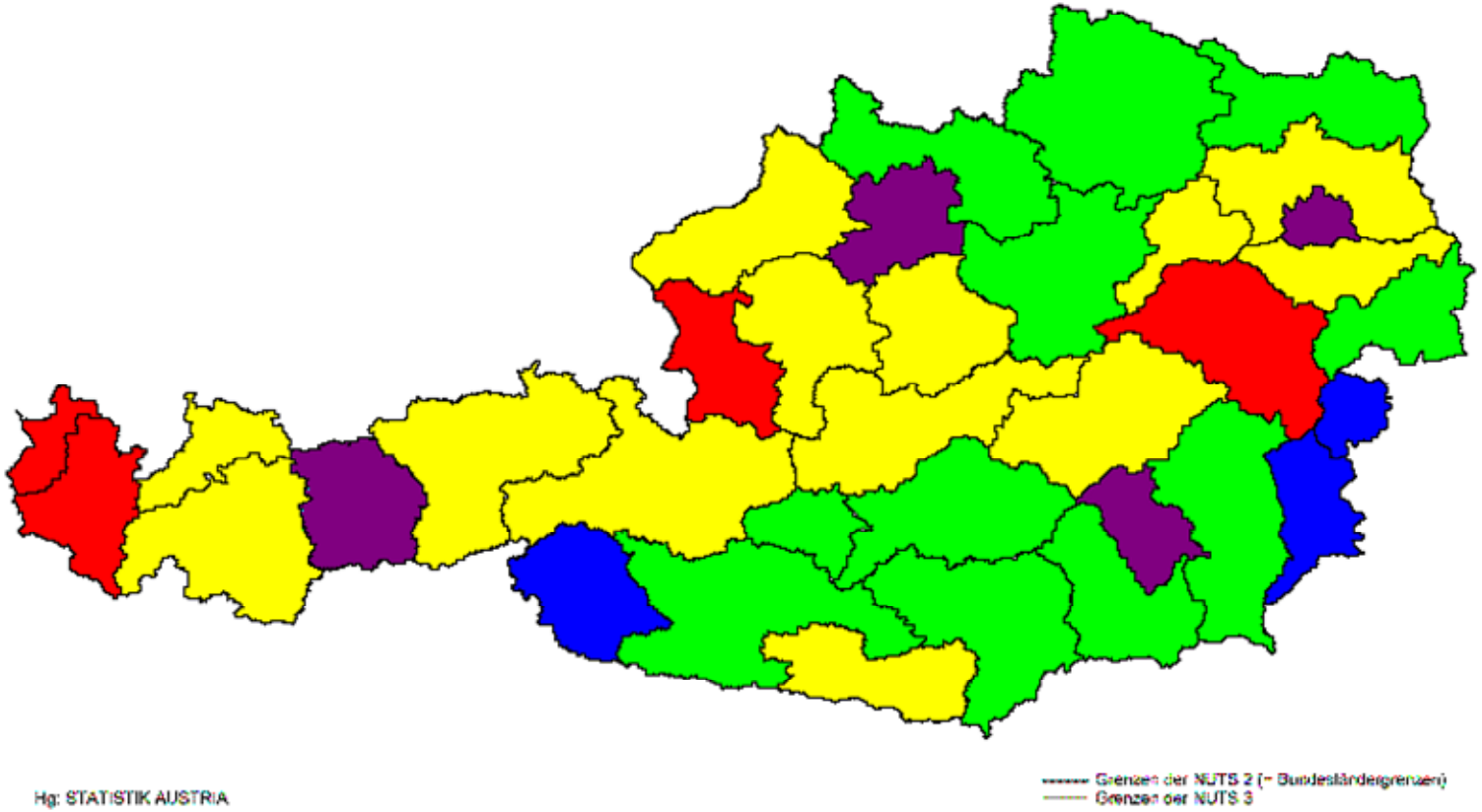
2 - 4	4 - 6	6 - 8	8 - 10	10 - 14

Averages of shares 2002-2004

Source: Structural Business Statistics 2002 und 2004, own calculations

Map M5: Rejuvenation and ageing by mobility, persons 2004

(mean age inflow) minus (mean age outflow)



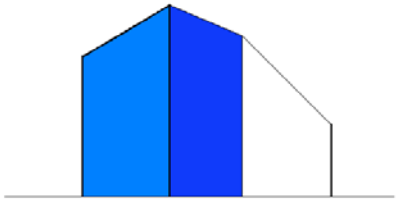
younger **Age difference** **older**

-3,0 - -1,0	-1,0 - 0,0	0,0 - 1,0	1,0 - 2,0	2,0 - 3,0

Population restricted to ages between 20 and 59, without persons in schooling

Source: Statistics Austria, Migration Statistic, own calculations

Conclusions



The study started from main thesis that productive diversity and agglomeration positively affects productivity => Genuine contribution to expand this framework to the sphere of housing.

With that, hypotheses corroborated within limits

- Skilled regional factor supply promotes product diversity and productivity, albeit with polarisation of labour skills in cities
- Social cohesion and networking, expressed as spatial proximity of workers living in social renting, likely contributes to productivity.

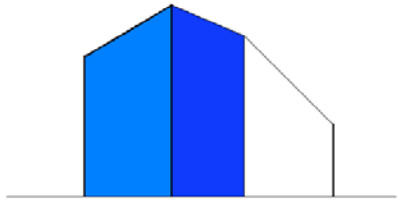
$\Rightarrow$ Social rented sector in cities at risk to sustain social mix

$\Rightarrow$ Approach infeasible for strongly segregated housing structures at local levels.

At the current stage of modelling, the many interrelated effects necessitate to test the hypotheses in separate models, which illuminate the structure from different angles.

Open question for spatial econometrics: design of coherently testable framework to assess propagation effects across regions.

APPENDIX: Model selection



Model selection between OLS, SAR, SEM and SAC

Fully treated in Tables A.2a and A.3 for the aggregate over the 6 Key sectors, endogenous variable KEYPROD

Main outcome:

In SEM model: spatial autocorrelation λ insignificant

In SAC model: spatial autocorrelation ρ significant in specification listed in last column, but autocorrelation λ remains insignificant

=> SAR model most informative because also parsimonious

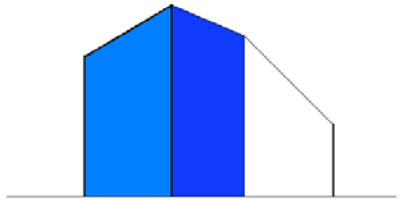
Shown by AIC- criterion that turns out to be remarkably consistent:

AIC in SAR.model with explanatories KEYFSIZE, DIVERSITY and REMOTE (column in bold) assumes the smallest value AIC = -75.8 among all other model specifications.

=> SAR model selected, and used for discussion.

Similar selection results obtained for SMANUF, available on request. For convenience, sectoral results are also drawn from SAR, see next.

APPENDIX: Sectoral productivity



The econometric outcome for the sectoral estimates is mixed, see Figure A.1 and Tables A.4.

In most cases, the elasticity of the internal economies of scale is in the same range as before, and also significant.

Notable exception is sector KBAS: communicate and knowledge based activities, with insignificant (and negative) internal economies of scale. The productivity of KBAS- firms does not rely upon firm size (a likely sensible result).

By contrast, sectoral results for external economies of scale poor. Positive significant elasticities only in MELO: Machines and electronic equipment and in CARRS: Car repair and services.

In KBAS negative and significant elasticity of -0,15: can be explained with cost of high skills, in particular academics.

In STRUC negative significant elasticity of REMOTE substitutes for otherwise positive elasticity DIVERSITY: Construction more productive in urban areas, but many firms evade competitive pressure by searching for locations in smaller towns

Autocorrelation RHO significant in construction: fits to networking

=> To sum up: Spatial spillovers on aggregate scale, not in single sectors (sensible w.r.t. horizontal and vertical activity patterns)

References

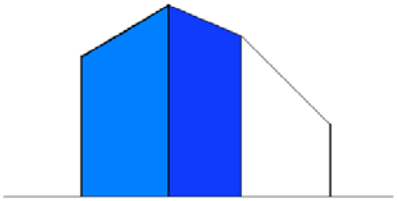


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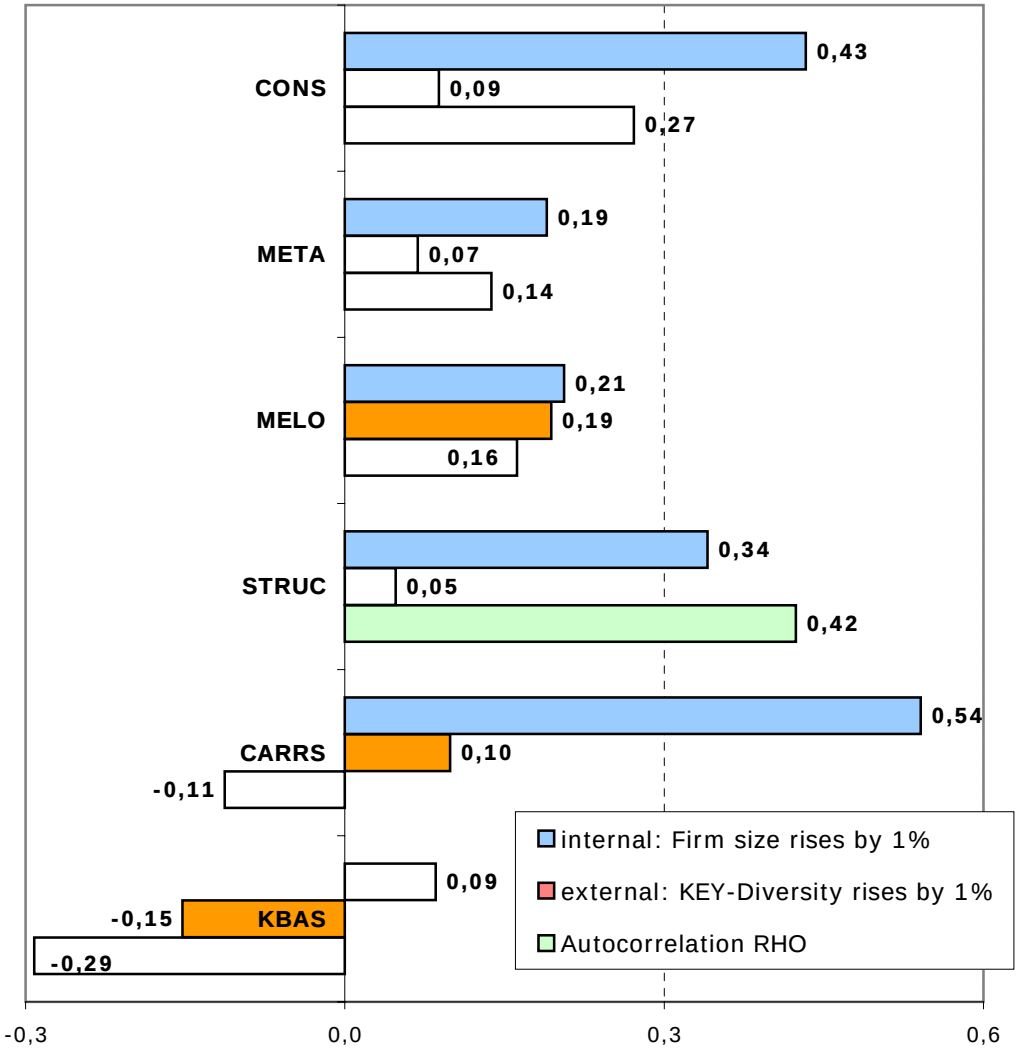
Figure A.1: Productivity increase by economies of scale
Sectoral SAR-models by NUTS3-regions, 2004
explanatories: size, diversity and remote
Source: Structural Business Statistics, own calculations



Relative change of regional productivities in %
insignificant estimates uncoloured

Bars refer to internal and external economies, and to autocorrelation
Numbers represent elasticities, obtained from SAR-model with variables in logarithms, to be interpreted as percentage increase of productivity under 1% increase of respective explanatory.
Full list of estimates and tests in Tables A.4

Basic Statistics									**Table A.1**
		Productivity			**Firm size**			**Employment**	
Symbol		Median	Mean	Stdev	Median	Mean	Stdev	Total	Shares
	Manufacturing:								
SMANUF	up to 49 workers	49,8	50,2	5,7	7,1	7,1	0,8	183,6	29,3
TMANUF	Total: all sizes	59,3	58,2	10,1	19,8	20,8	7,0	626,2	100,0
	Key sectors:								
CONS	Consumption goods	35,4	38,4	10,0	13,5	14,8	4,9	87,6	9,4
META	Metal products	72,4	73,6	11,9	21,4	24,9	17,2	100,7	10,9
MELO	Machines, Electronics	78,4	79,1	15,0	31,4	32,6	16,4	121,5	13,1
STRUC	Construction	39,1	40,1	4,6	10,2	10,6	3,1	251,0	27,0
CARRS	Car repair & services	25,4	26,9	5,8	7,3	7,9	2,8	84,2	9,1
KBAS	Communicative & Knowledge based	37,3	39,4	8,2	4,5	4,9	1,4	283,3	30,5
KEY	Total: 6 key sectors	46,7	47,2	5,8	10,0	10,1	2,1	928,2	100,0

Values averaged over 35 Austrian NUTS3 regions

Productivity: Gross value added per employed, full time equivalents, in 1000 EUR at prices 2004

Firm size: average firm size in full time equivalents

Employment: Persons in full time equivalents and their shares in totals.

Comments:

Firm sizes in Key sectors not restricted to SMEs, but sizes in STRUC, CARRS and KBAS mostly small.

Manufacturing covers CONS, META and MELO only (23,3% of all key sector workers)

KEYPROD	Productivity over 6 Key-Sectors					Table A.2a
Variable	OLS-Models		SAR-Models			
CONSTANT	-0,8292 ***	-0,8392 ***	-0,7682 ***	**-0,7701** ***	-0,8158 ***	
KEYFSIZE	0,4985 ***	0,4800 ***	0,4568 ***	**0,4318** ***	0,4003 ***	
DIVERSITY	0,1250 **	0,0966 *	0,1088 **	**0,0771** *	0,0607	
REMOTE		-0,0647 *		**-0,0671** **		
SOCRENT					0,0240 *	
Statistics						
RHO			0,29 °	**0,33** *	0,34 *	
NPAR	4	5	5	**6**	6	
WALD			3,14 °	**4,27** *	5,09 *	
(Pseudo-) R2	0,558	0,613	0,643	**0,709**	0,693	
SSQ	0,00701	0,00615	0,00567	**0,00463**	0,00488	
LogLikelihood	39,26	42,13	40,47	**43,90**	42,93	
AIC	-70,51	-74,26	-70,93	**-75,81**	-73,87	

SMANUPROD	Productivity of SME-manufacturing up to 49 workers					Table A.2b
Variable	OLS-Models		SAR-Models			
CONSTANT	-0,3717	-0,6134 *	-0,3218	**-0,5493** *	-0,4105	
SMANUSIZE	0,1622	0,2406 °	0,2133	**0,2874** *	0,0964	
DIVERSITY	0,1312 **	0,0786 °	0,1157 **	**0,0661** *	0,0495	
REMOTE		-0,1369 ***		**-0,1291** ***		
SOCRENT					0,0452 ***	
Statistics						
RHO			0,45 **	**0,45** **	0,33 °	
NPAR	4	5	5	**6**	6	
WALD			7,46 **	**8,64** ***	3,79 °	
(Pseudo-) R2	0,159	0,488	0,360	**0,631**	0,545	
SSQ	0,01158	0,00706	0,00882	**0,00508**	0,00627	
LogLikelihood	30,50	39,73	32,16	**41,79**	38,60	
AIC	-52,99	-69,46	-54,32	**-71,59**	-65,19	

TMANUPROD	Productivity in total Manufactoring, all firm sizes					Table A.2c
Variable	OLS-Models		SAR-Models			
CONSTANT	-0,8740 **	-0,8608 **	-0,8751 **	**-0,8655** **	-0,8622 **	
MANUFSIZE	0,3529 ***	0,3388 ***	0,3533 ***	**0,3403** ***	0,3272 ***	
DIVERSITY	0,0892	0,0697	0,0896	**0,0710**	0,0753	
REMOTE		-0,0585		**-0,0604**		
SOCRENT					0,0138	
Statistics						
RHO			-0,01	**-0,06**	-0,03	
NPAR	4	5	5	**6**	6	
WALD			0,00	**0,10**	0,02	
(Pseudo-) R2	0,486	0,495	0,545	**0,568**	0,551	
SSQ	0,01774	0,01744	0,01571	**0,01491**	0,01551	
LogLikelihood	23,02	23,88	23,02	**23,92**	23,25	
AIC	-38,04	-37,77	-36,04	**-35,85**	-34,50	

All variables in logarithms, except for 0/1 dummy REMOTE. Selected results in bold, column 4
Estimated elasticities (coefficients) of explanatories in rows of variables
Levels of significance: *** up to 0,1%, ** up to 1%, * up to 5%, ° up to 10%, blank from 10%
Numbers of observations: NOBS = N = 35 NUTS3 regions
Numbers of parameters = NPAR, totalling
K explanatories +1 for unknown SIGMA in OLS and SAR, and +1 for RHO in SAR
with SIGMA**2 = SSQ of residuals, SSY = sample variance of endogenous variable
RHO: estimated spatial autocorrelation in SAR-model
WALD: Wald statistic of estimates including RHO in SAR-model
(Pseudo-) R2: in OLS adjusted R2 at N-K dgfs, in SAR pseudoR2 = 1-SSQ/SSY at N-K-1 dgfs

KEYPROD	Productivity over 6 Key-Sectors			Table A.3
Variable	SEM-Models		SAC-Models	
CONSTANT	-0,8397 ***	-0,8287 ***	-0,8015 ***	-0,7074 ***
KEYFSIZE	0,4886 ***	0,4624 ***	0,4705 ***	0,4057 ***
DIVERSITY	0,1143 **	0,0876 **	0,1098 **	0,0742 *
REMOTE		-0,0606 **		-0,0722 **
SOCRENT				
Statistics				
RHO			0,20	0,50 *
LAMBDA	0,28	0,23	0,13	-0,26
NPAR	5	6	6	7
LR-Test	2,18	1,53	2,63	4,11
WALD	1,94	1,18		
Pseudo- R2	0,640	0,687	0,654	0,738
SSQ	0,00572	0,00498	0,00568	0,00430
LogLikelihood	40,34	42,89	40,57	44,18
AIC	-70,68	-73,79	-69,13	-74,36

All variables in logarithms, except for 0/1 dummy REMOTE.
Estimated elasticities (coefficients) of explanatories in rows of variables
Levels of significance: *** up to 0,1%, ** up to 1%, * up to 5%,
° up to 10%, blank from 10%
Numbers of observations: NOBS = N = 35 NUTS3 regions
Numbers of parameters = NPAR, totalling K explanatories +1 for unknown SIGMA
+1 for unknown LAMBDA in SEM resp. +2 for unknown RHO and LAMBDA in SAC
with SIGMA**2 = SSQ of residuals, SSY = sample variance of endogenous variable
LAMBDA and RHO: estimated spatial autocorrelations in SEM and SAC
WALD: in SEM Wald statistic of estimates including LAMBDA, in SAC not available
Pseudo- R2 = 1-SSQ/SSY, at N-K-1 dgfs in SEM and N-K-2 dgfs in SAC

CONSPROD	Key-Sector Consumption goods				Table A.4a
Variable	OLS-Models		SAR-Models		
CONSTANT	-1,0875 *	-1,0886 *	-1,0416 *	**-1,0494** *	-1,0436 *
CONSFSIZE	0,4517 ***	0,4522 ***	0,4300 ***	**0,4332** ***	0,4334 ***
DIVERSITY	0,1100	0,1101	0,0873	**0,0883**	0,0888
REMOTE		0,0007		**0,0055**	
SOCRENT					-0,0017
Statistics					
RHO			0,27	**0,27**	0,27
NPAR	4	5	5	**6**	6
WALD			2,34	**2,34**	2,30
(Pseudo-) R2	0,407	0,388	0,526	**0,527**	0,526
SSQ	0,03330	0,03438	0,02659	**0,02658**	0,02659
LogLikelihood	12,01	12,01	13,48	**13,48**	13,48
AIC	-16,01	-14,01	-16,96	**-14,97**	-14,96

METAPROD	Key-Sector Metal products				Table A.4b
Variable	OLS-Models		SAR-Models		
CONSTANT	-0,1858	-0,2197	-0,1883	**-0,2264**	-0,2893 °
METAFSIZE	0,1952 ***	0,1946 ***	0,1922 ***	**0,1897** ***	0,1884 ***
DIVERSITY	0,0906 *	0,0695	0,0910 *	**0,0686** °	0,0638
REMOTE		-0,0544		**-0,0585** °	
SOCRENT					0,0182
Statistics					
RHO			0,08	**0,14**	0,11
NPAR	4	5	5	**6**	6
WALD			0,26	**0,66**	0,42
(Pseudo-) R2	0,648	0,666	0,691	**0,720**	0,709
SSQ	0,00947	0,00900	0,00831	**0,00753**	0,00783
LogLikelihood	34,01	35,48	34,13	**35,81**	35,16
AIC	-60,02	-60,96	-58,26	**-59,62**	-58,33

MELOPROD	Key-Sector Machines and Electronic equipment				Table A.4c
Variable	OLS-Models		SAR-Models		
CONSTANT	0,0502	0,0385	0,0298	**0,0240**	-0,1254
MELOFSIZE	0,2079 ***	0,2091 ***	0,2052 ***	**0,2059** ***	0,1898 ***
DIVERSITY	0,1968 **	0,1923 **	0,1962 ***	**0,1938** **	0,1430 *
REMOTE		-0,0116		**-0,0062**	
SOCRENT					0,0346 °
Statistics					
RHO			0,17	**0,16**	0,14
NPAR	4	5	5	**6**	6
WALD			0,82	**0,77**	0,58
(Pseudo-) R2	0,491	0,476	0,562	**0,562**	0,602
SSQ	0,02017	0,02081	0,01738	**0,01738**	0,01577
LogLikelihood	20,77	20,80	21,13	**21,14**	22,87
AIC	-33,54	-31,60	-32,26	**-30,28**	-33,75

All variables in logarithms, except for 0/1 dummy REMOTE. Selected results in bold, column 4
Estimated elasticities (coefficients) of explanatories in rows of variables
Levels of significance: *** up to 0,1%, ** up to 1%, * up to 5%, ° up to 10%, blank from 10%
Numbers of observations: NOBS = N = 35 NUTS3 regions
Numbers of parameters = NPAR, totalling
K explanatories +1 for unknown SIGMA in OLS and SAR, and +1 for RHO in SAR
with SIGMA**2 = SSQ of residuals, SSY = sample variance of endogenous variable
RHO: estimated spatial autocorrelation in SAR-model
WALD: Wald statistic of estimates including RHO in SAR-model
(Pseudo-) R2: in OLS adjusted R2 at N-K dgfs, in SAR pseudoR2 = 1-SSQ/SSY at N-K-1 dgfs

STRUCPROD	Key-Sector Construction and Auxiliary activites					Table A.4d
Variable	OLS-Models		SAR-Models			
CONSTANT	-0,7145 ***	-0,6942 ***	-0,7262 ***	**-0,7055** ***	-0,7771 ***	
STRUCFSIZE	0,3729 ***	0,3376 ***	0,3807 ***	**0,3408** ***	0,3166 ***	
DIVERSITY	0,1005 *	0,0703	0,0875 *	**0,0478**	0,0328	
REMOTE		-0,0554 °		**-0,0659** **		
SOCRENT					0,0254 *	
Statistics						
RHO			0,33 *	**0,42** **	0,34 *	
NPAR	4	5	5	**6**	6	
WALD			4,28 *	**8,25** **	5,00 *	
(Pseudo-) R2	0,464	0,505	0,574	**0,651**	0,634	
SSQ	0,00692	0,00639	0,00549	**0,00450**	0,00472	
LogLikelihood	39,51	41,46	40,94	**44,02**	43,54	
AIC	-71,01	-72,91	-71,87	**-76,05**	-75,08	

CARRSPROD	Key-Sector Car Repair and Services					Table A.4e
Variable	OLS-Models		SAR-Models			
CONSTANT	-1,2185 ***	-1,2034 ***	-1,2520 ***	**-1,2341** ***	-1,2685 ***	
CARRSFSIZE	0,5621 ***	0,5428 ***	0,5596 ***	**0,5411** ***	0,5391 ***	
DIVERSITY	0,1105 *	0,0946 °	0,1148 *	**0,0989** *	0,1020 *	
REMOTE		-0,0472		**-0,0460**		
SOCRENT					0,0103	
Statistics						
RHO			-0,13	**-0,11**	-0,14	
NPAR	4	5	5	**6**	6	
WALD			0,57	**0,46**	0,64	
(Pseudo-) R2	0,676	0,681	0,717	**0,730**	0,721	
SSQ	0,01169	0,01152	0,01019	**0,00973**	0,01005	
LogLikelihood	30,31	31,15	30,54	**31,35**	30,76	
AIC	-52,62	-52,31	-51,08	**-50,69**	-49,53	

KBASPROD	Key-Sector Communicative + Knowledge based Activities					Table A.4f
Variable	OLS-Models		SAR-Models			
CONSTANT	-0,6776 °	-0,6400 °	-0,7418 *	**-0,7050** *	-0,8071 *	
KBASFSIZE	0,1250	0,0755	0,1338	**0,0852**	0,0854	
DIVERSITY	-0,1149	-0,1486 °	-0,1198	**-0,1527** *	-0,1525 °	
REMOTE		-0,1232 *		**-0,1208** *		
SOCRENT					0,0308	
Statistics						
RHO			-0,29	**-0,29**	-0,26	
NPAR	4	5	5	**6**	6	
WALD			1,59	**1,77**	1,24	
(Pseudo-) R2	0,007	0,105	0,178	**0,285**	0,215	
SSQ	0,02941	0,02655	0,02436	**0,02118**	0,02324	
LogLikelihood	14,16	16,54	15,00	**17,45**	15,90	
AIC	-20,33	-23,08	-19,99	**-22,89**	-19,80	

All variables in logarithms, except for 0/1 dummy REMOTE. Selected results in bold, column 4
Estimated elasticities (coefficients) of explanatories in rows of variables
Levels of significance: *** up to 0,1%, ** up to 1%, * up to 5%, ° up to 10%, blank from 10%
Numbers of observations: NOBS = N = 35 NUTS3 regions
Numbers of parameters = NPAR, totalling
K explanatories +1 for unknown SIGMA in OLS and SAR, and +1 for RHO in SAR
with SIGMA**2 = SSQ of residuals, SSY = sample variance of endogenous variable
RHO: estimated spatial autocorrelation in SAR-model
WALD: Wald statistic of estimates including RHO in SAR-model
(Pseudo-) R2: in OLS adjusted R2 at N-K dgfs, in SAR pseudoR2 = 1-SSQ/SSY at N-K-1 dgfs

Table A.5a			Table A.5b		
Skill levels explaining Key-diversity			**indicators explaining Key-diversity**		
Endogenous **DIVERSITY**			Endogenous **DIVERSITY**		
mean	2,944		mean	2,944	
stdev	0,385		stdev	0,385	
Explanatories			Explanatories		
CONSTANT	-6,739	***	CONSTANT	7,163	
LOWSKILL	0,733	*	NETMOBIL	0,944	**
HIGHSKILL	0,701	***	AGE	-2,768	*
			STRUCEMP	-0,447	**
NOBS / NPAR	35	4	NOBS / NPAR	35	5
adjusted R2	0,301		adjusted R2	0,496	
AIC	24,88		AIC	14,35	

Table A.5c			Table A.5d		
Key-diversity expl. social renting			**Key-diversity explaining SME-diversity**		
Endogenous **SOCRENT**			Endogenous **SMEDIV**		
mean	1,574		mean	2,656	
stdev	1,359		stdev	0,432	
Explanatories			Explanatories		
CONSTANT	6,077	***	CONSTANT	0,381	
DIVERSITY	1,529	**	DIVERSITY	0,773	***
NOBS / NPAR	35	3	NOBS / NPAR	35	3
adjusted R2	0,163		adjusted R2	0,459	
AIC	118,48		AIC	22,94	

All variables in logarithms, except for migration ratio.
Estimated elasticities (coefficients) of explanatories in rows of variables
Levels of significance: *** up to 0,1%, ** up to 1%, * up to 5%,
° up to 10%, blank (insignificant) from 10%
Numbers of observations: NOBS = N = 35 NUTS3 regions
Numbers of parameters NPAR for K explanatories + unknown SIGMA
adjusted R2 for N-K dgfs
Sources:

DIVERSITY	Statistics Austria: structural business survey, microcenses
SMEDIV	derived from annual survey of SME-research Austria and Employment count 2001 of Statistics Austria
SOCRENT	regional average tenure shares from Microcensus Austria
SKILL LEVELS	regional average skill shares from Microcensus Austria
NETMOBIL	Ratio inflow : outflow from Austrian migration statististics
AGE	regional average ages of labour force from Microcensus Austria
STRUCEMP	regional employment share of construction