

***INTER-CONNECTEDNESS IN
THE DANISH LOCAL ECONOMY
APPLICATIONS WITH THE
LINE-MODEL***

by
Bjarne Madsen

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Outline

- SAM-K and the LINE-model
- The impact of 10% increase of foreign export from Danish municipalities
- Leakages in Danish local economies (Danish kommuner/municipalities)
- The 2 by 2 by 2 principle and the general interregional quantity model
- Multipliers – and what explains the the size of multipliers
- Future research and model development

SAM-K and LINE

- SAM-K = **S**ocial **A**ccounting **M**atrix for Municipalities
- LINE = **L**ocal **I**Nterregional model for **E**conomic activity
- Users: Danish regions, VisitDenmark, Ministries, municipalities (Bornholm), Research/universities etc.
- Forecast with LINE (= basis version – Financial crisis scenario), based on
 - **National forecast with ADAM**
 - Regional trends in productivity, commuting etc.**

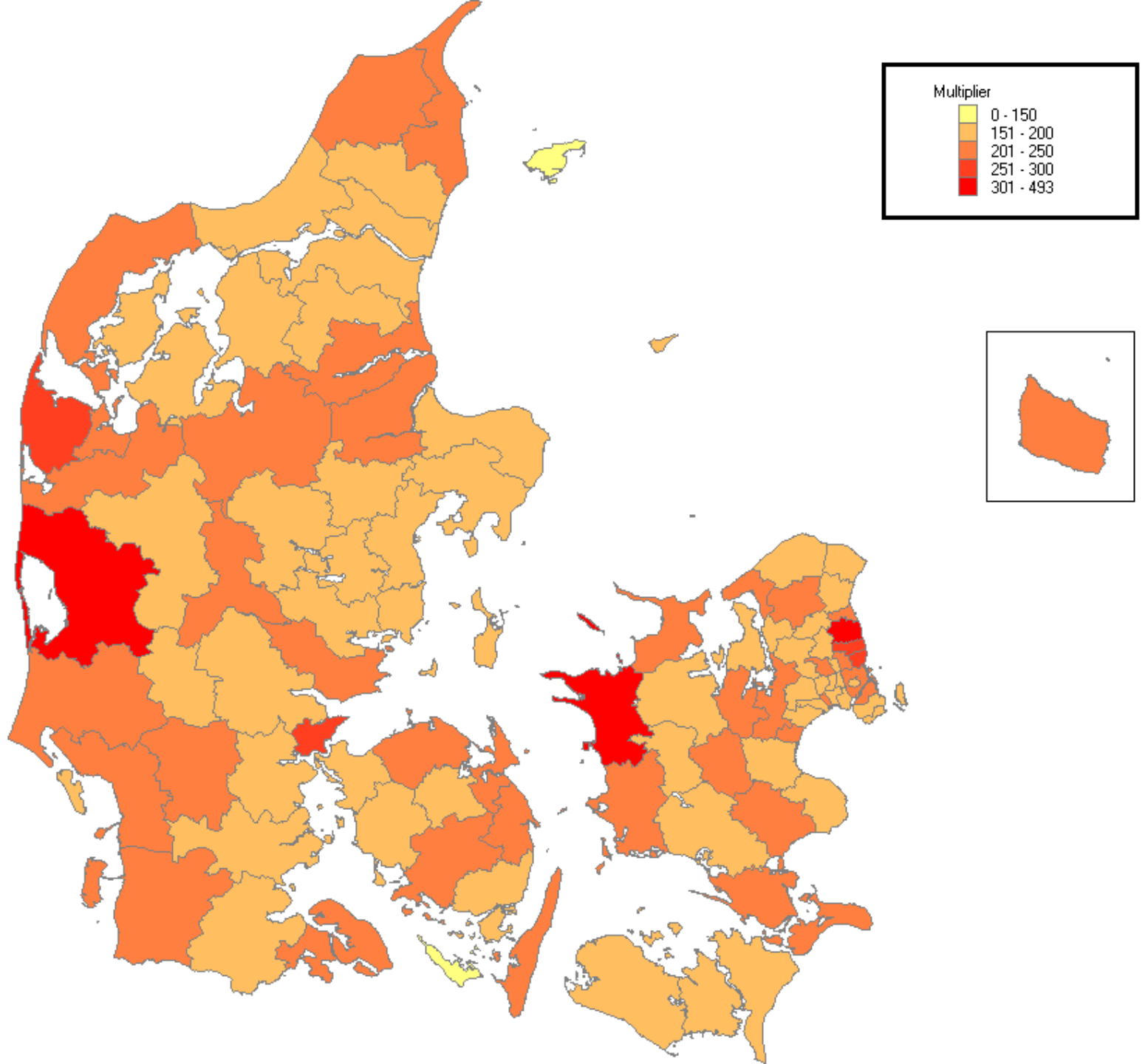
LINE

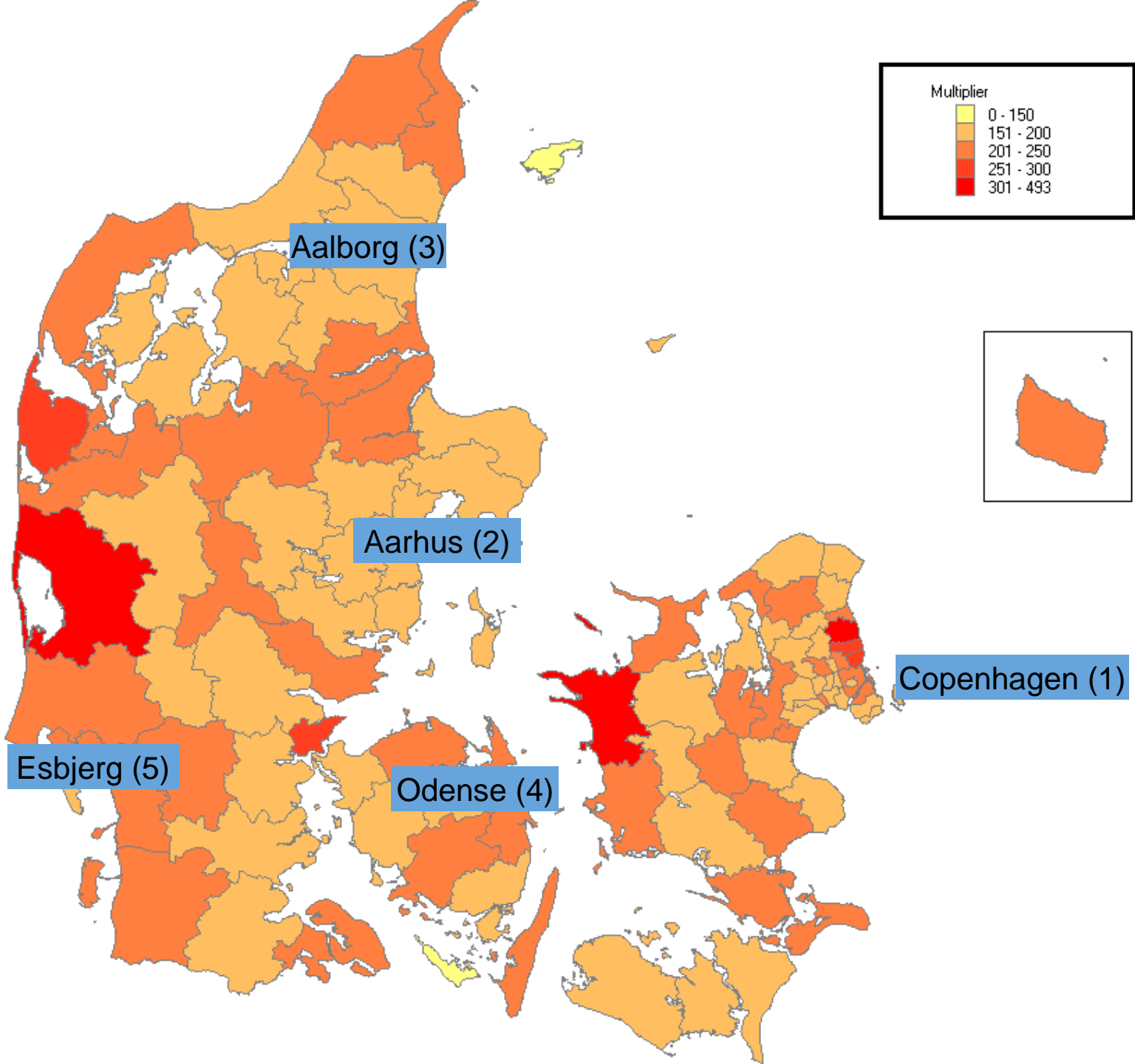
Local Interregional Economic Model for Danish municipalities

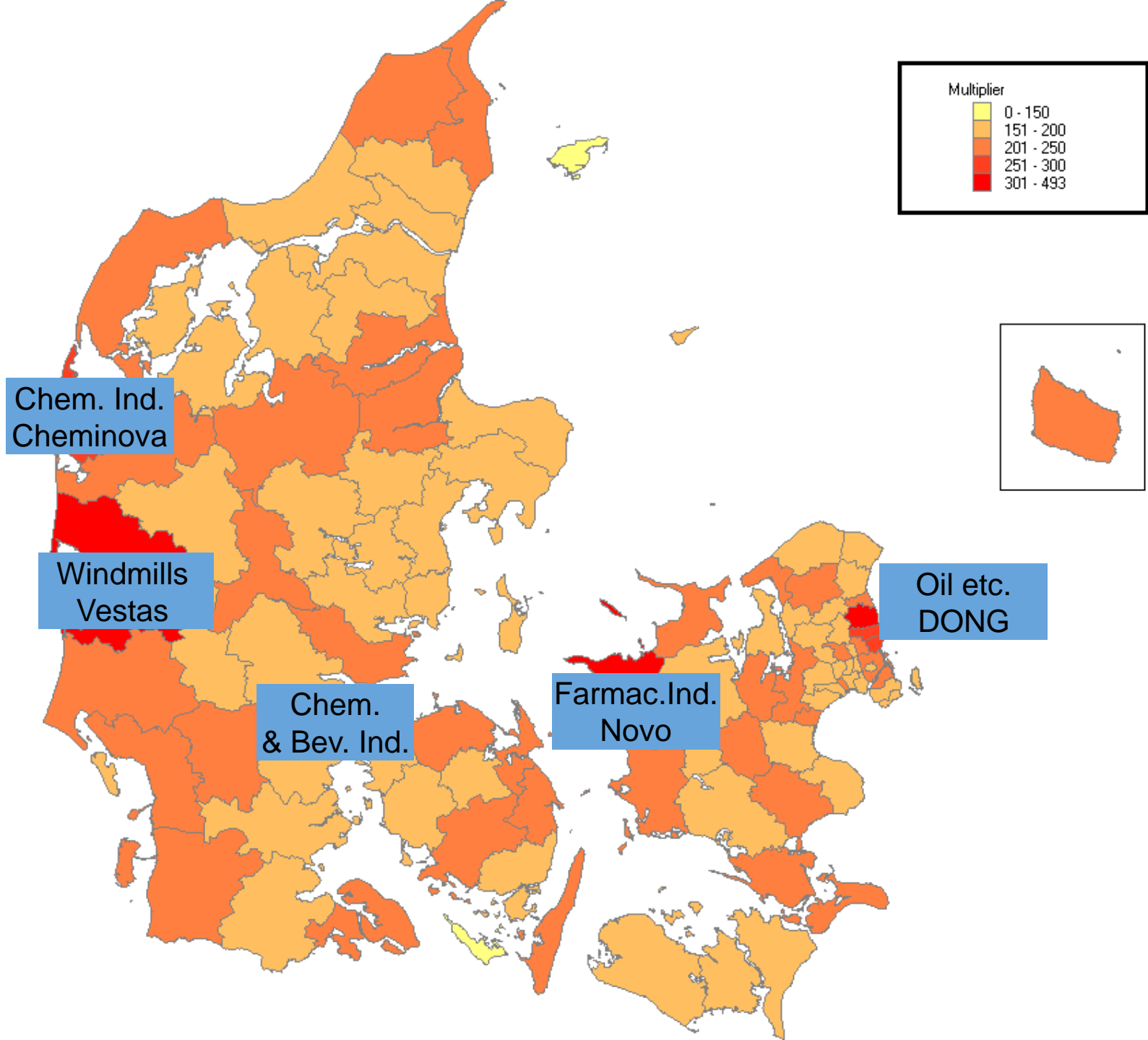
- LINE :
 - **General Interregional Quantity Model**
 - **General Interregional Price Model**
 - **Links between the two models (CGE)**
- LINE is based on SAM-K, which in its basis version has the following dimensions:
 - **37 sectors**
 - **Gender/20 age/20 educ.**
 - **4 household**
 - **50 commodities**
- Multiplier experiments with LINE
 - **10% increase in foreign export for each municipalities**

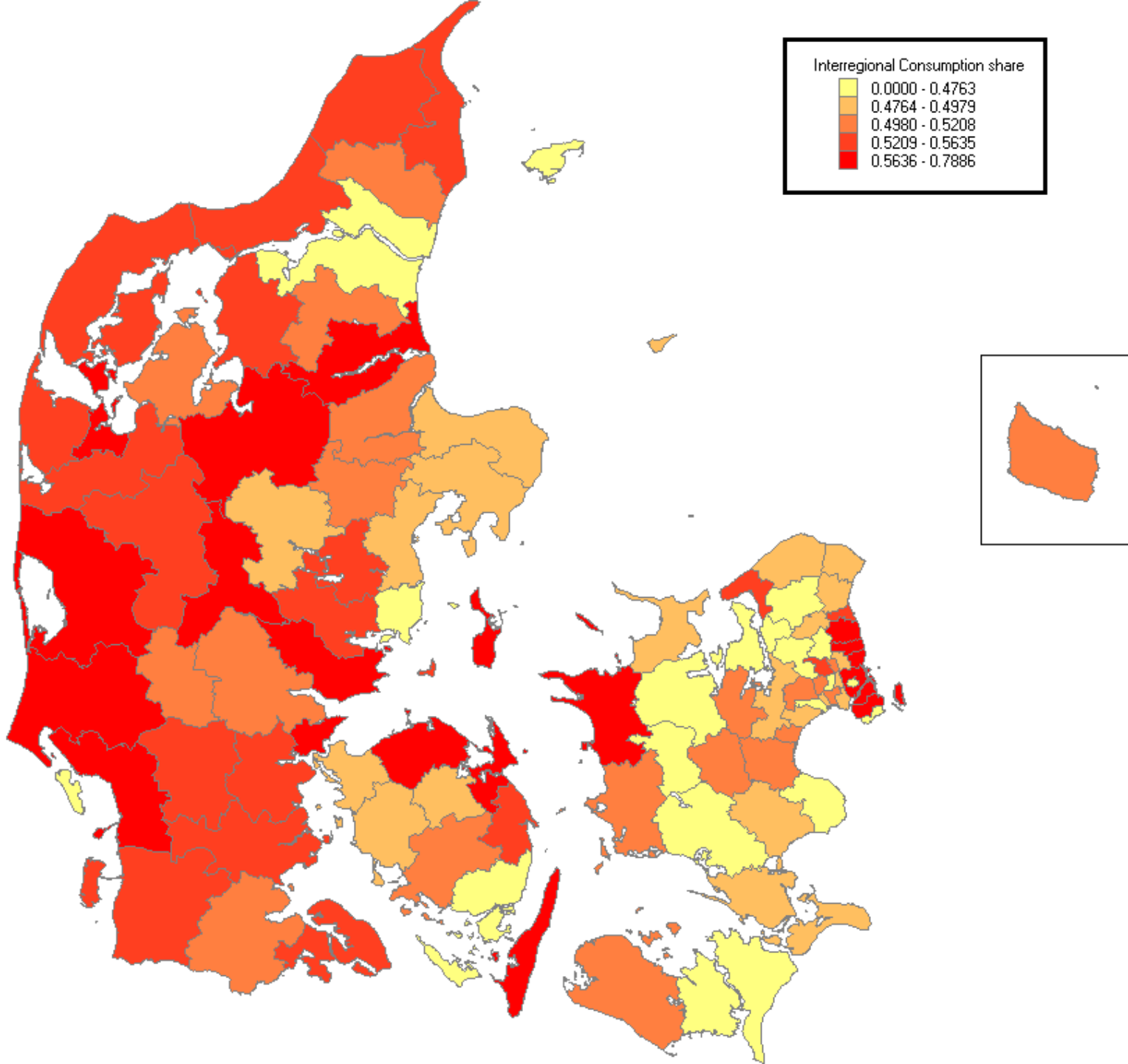
Experiments with LINE

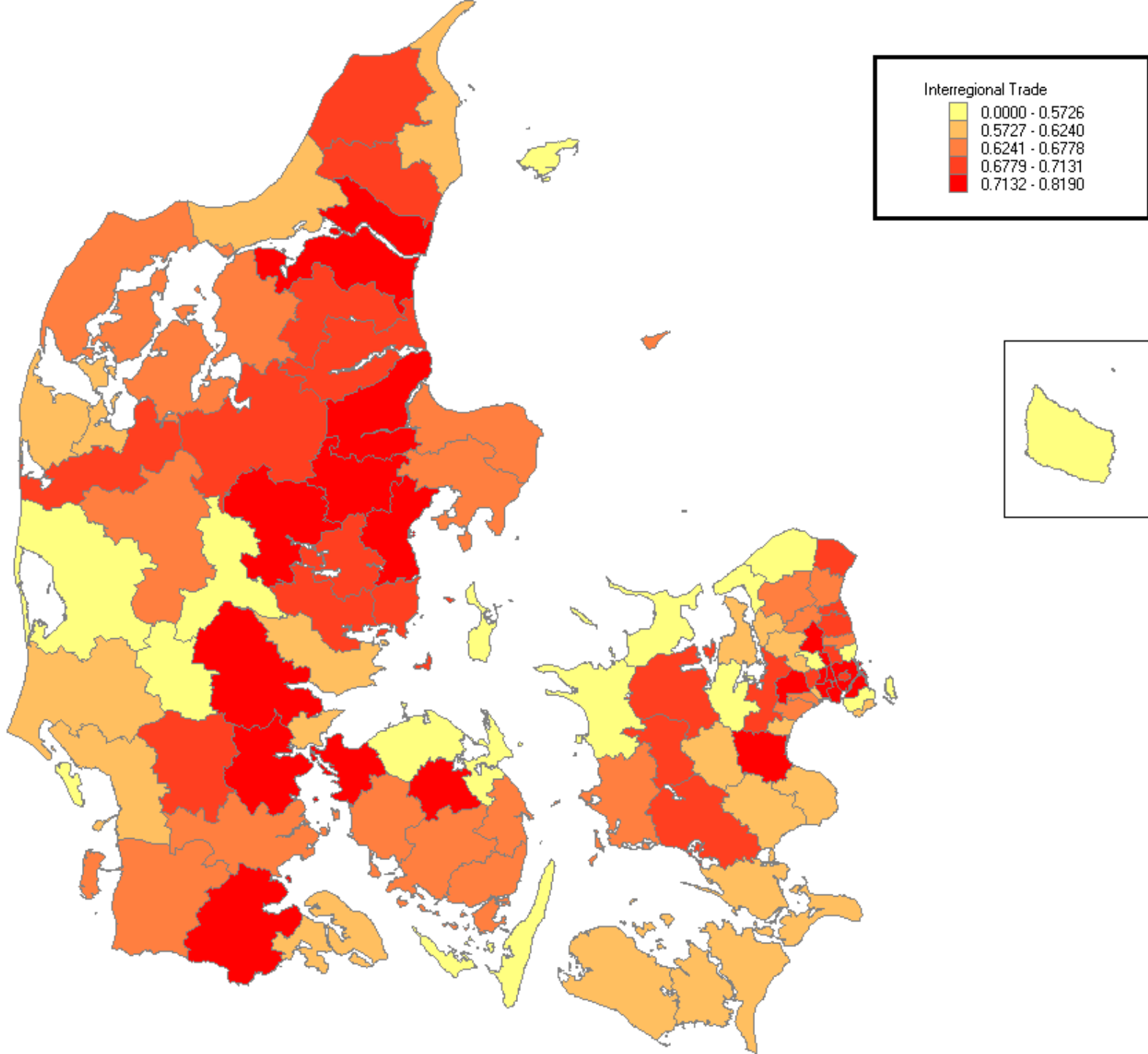
- The impact of 10% increase of foreign export from Danish municipalities
- Leakages in Danish local economies (Danish kommuner/municipalities)
 - **Intermediate consumption share**
 - **Intraregional trade**
 - **Intraregional Commuting share**
 - **Intraregional shopping share**
 - **Intraregional tourism share**

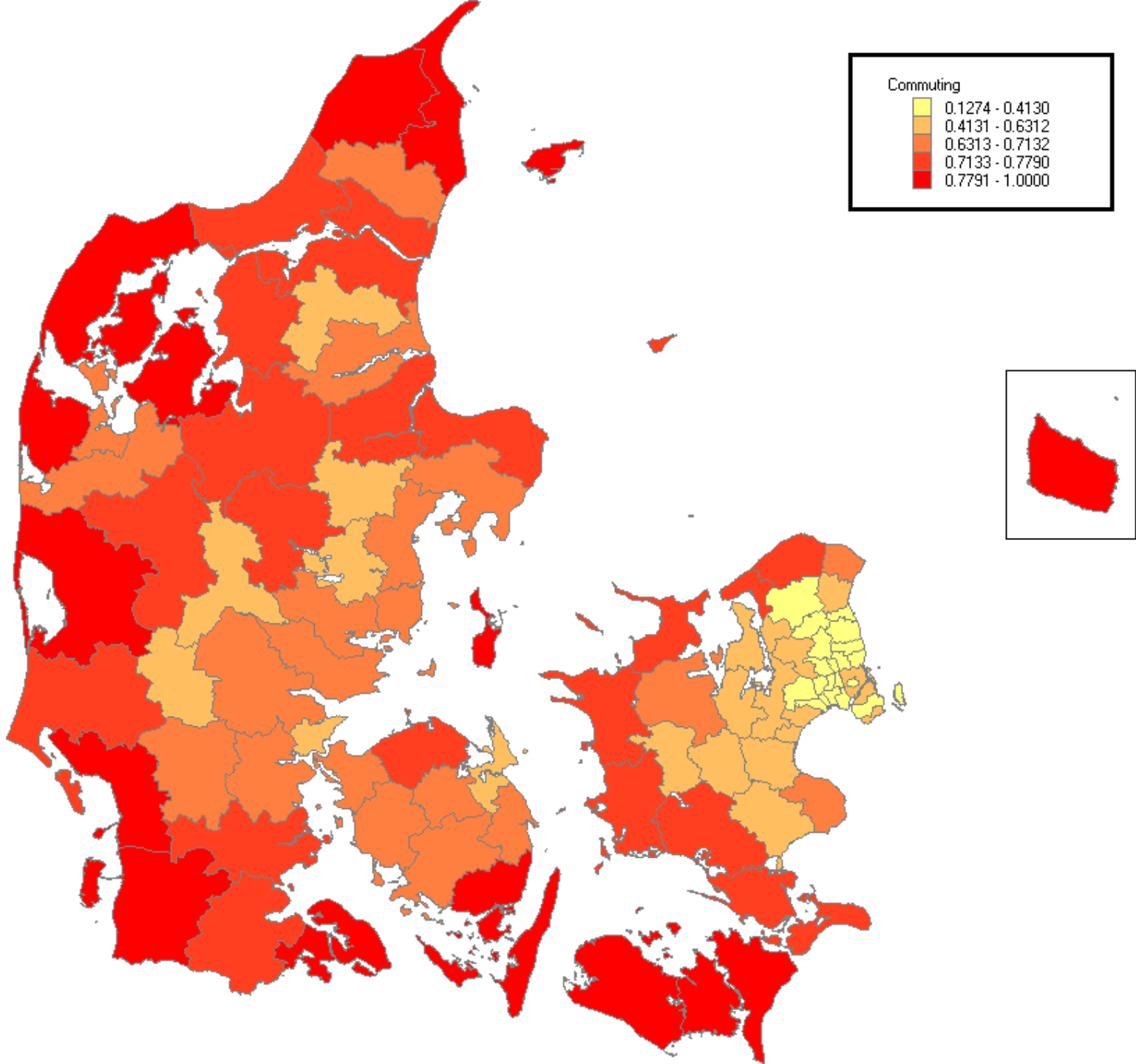


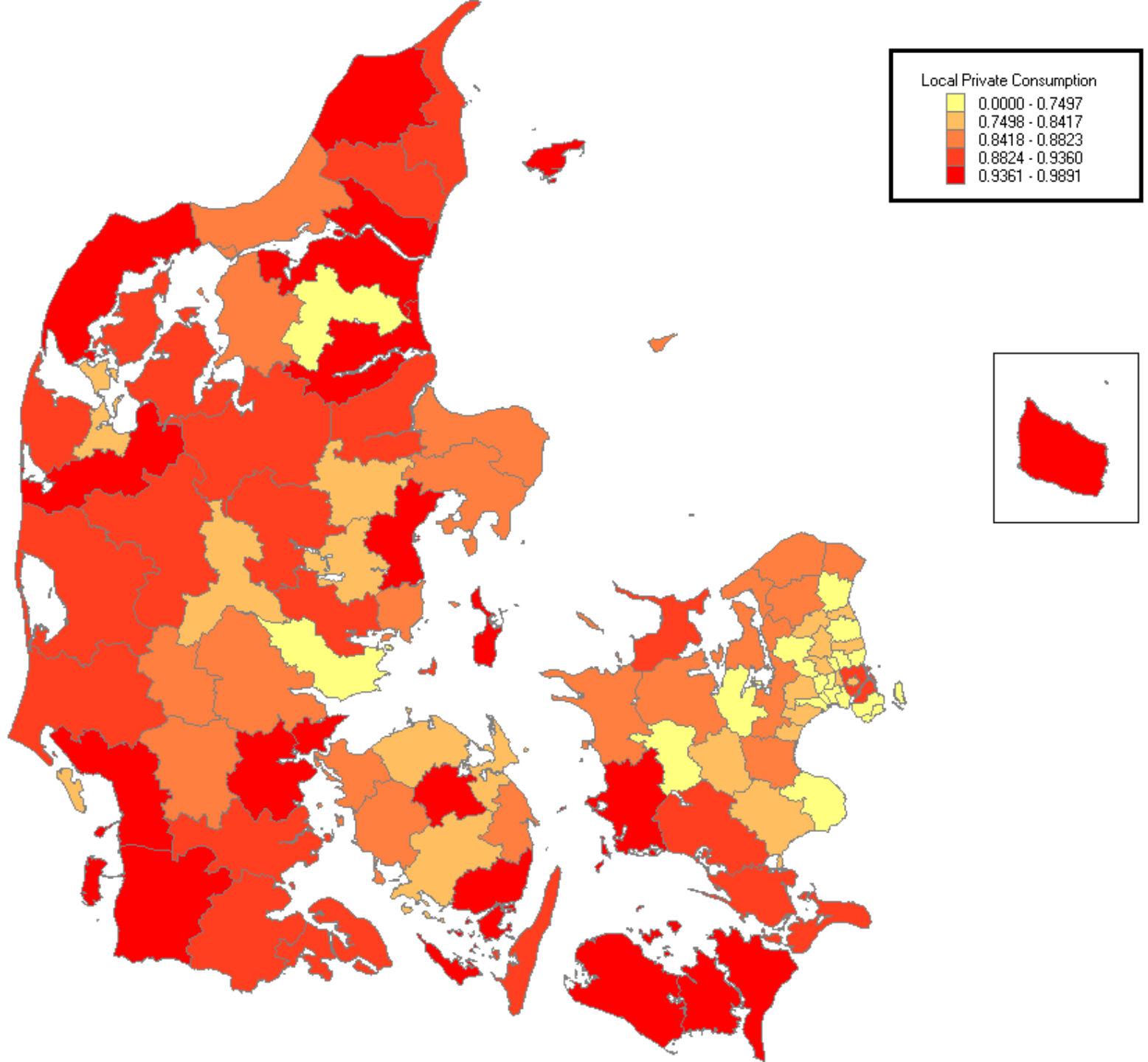


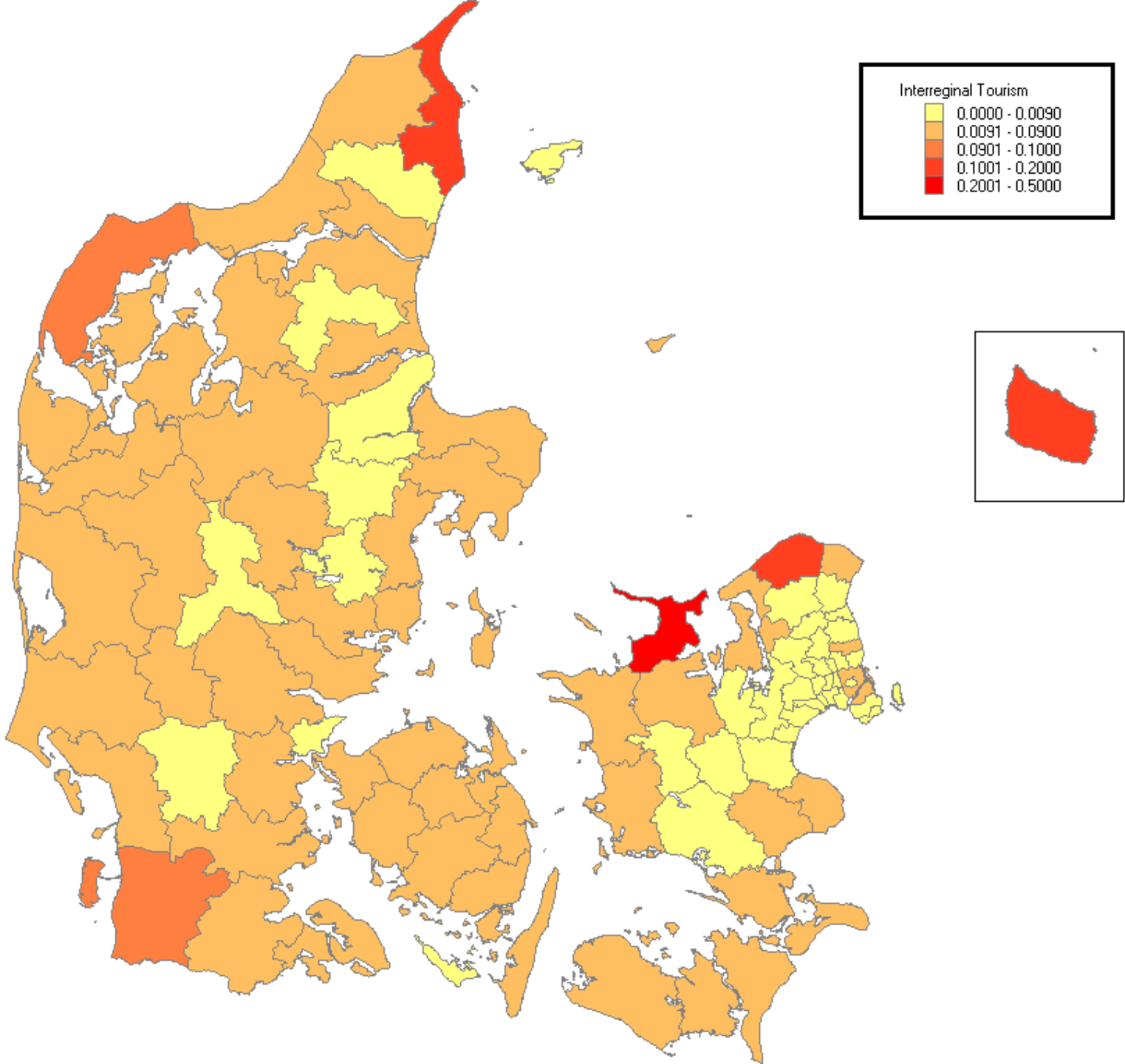








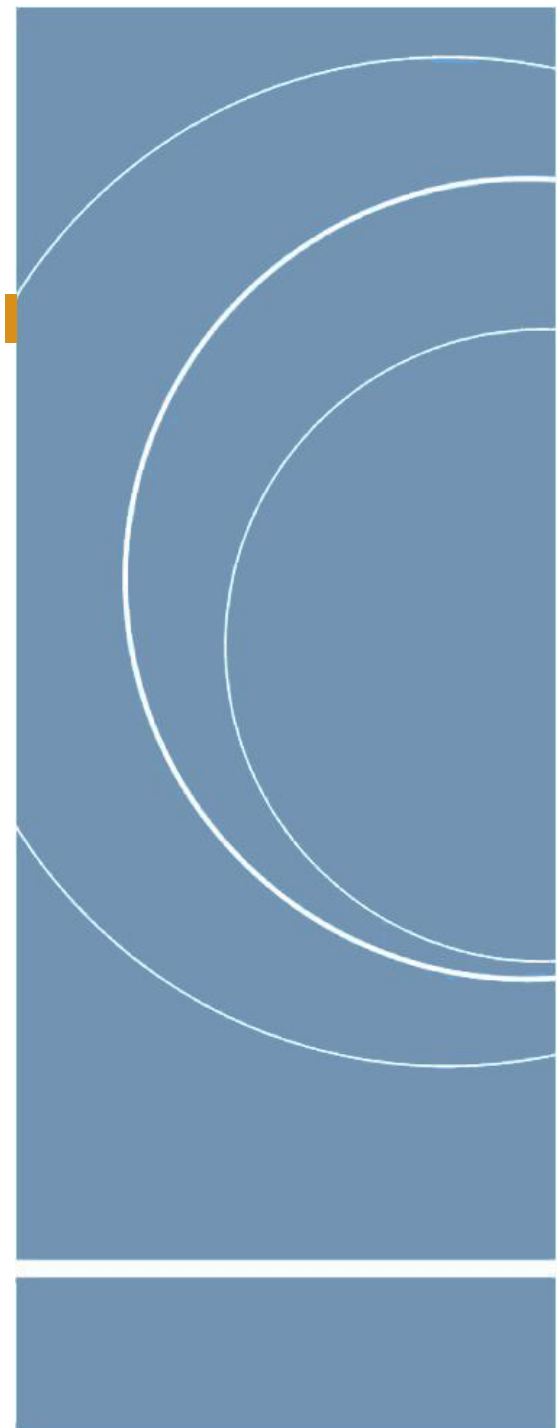






Basic economic structure of the local economy

The "2 by 2 by 2"-principle

- Geography
 - Place of production
 - (Place of factor market)
 - Place of residence
 - Place of commodity market
- Actors
 - Sectors
 - Production factors
 - (Household types)
 - Commodities
- Interaction
 - Trade
 - Commuting
 - Shopping / tourism

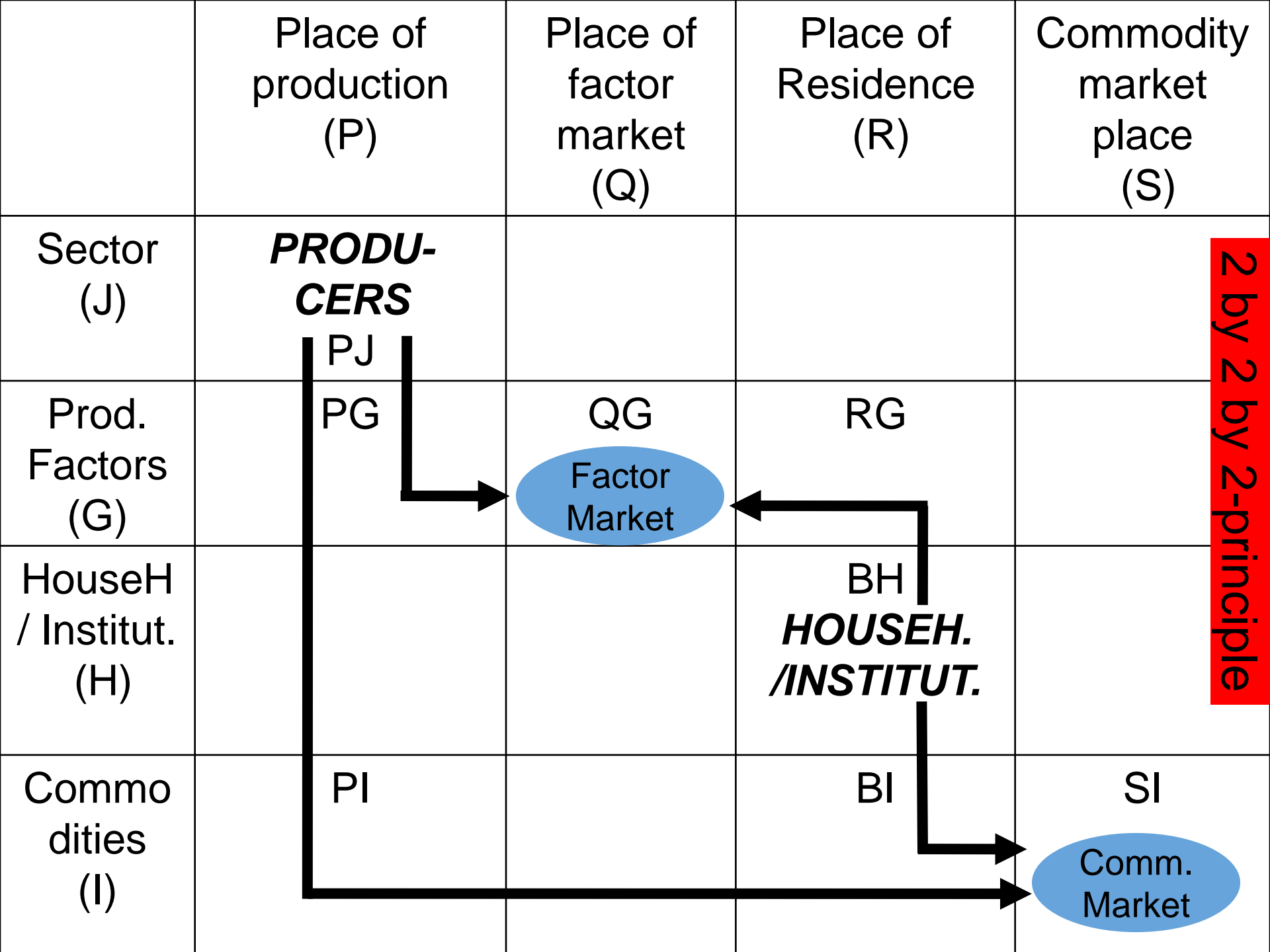


	Place of production (P)	Place of factor market (Q)	Place of Residence (R)	Commodity market place (S)
Sector (J)				
Prod. Factors (G)	PG	QG	RG	
HouseH / Institut. (H)				
Commodities (I)	PI		BI	SI

2 by 2 by 2-principle

	Place of production (P)	Place of factor market (Q)	Place of Residence (R)	Commodity market place (S)
Sector (J)	<i>PRODUCERS</i> PJ			
Prod. Factors (G)	PG	QG	RG	
HouseH / Institut. (H)			BH <i>HOUSEH. /INSTITUT.</i>	
Commo dities (I)	PI		BI	SI

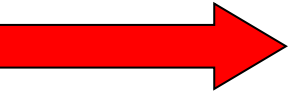
2 by 2 by 2-principle



The "2 by 2 by 2"- principle

2 markets (commodity market and market for production factors)

2 actors (producers and institutions)



4 basic regional concepts

(Place of production (P), place of factor markets (Q), place of residence of institutions (R) and place of commodity markets (S))

4 basic SAM-actors

(Sectors (J), production factors (G), institutions (H) and commodities (I))

Origin / destination for all flows

The one-region "A-model"



CENTER FOR REGIONAL- OG TURISMEFORSKNING

From the "A-model" to the "2 x 2 x 2"-principle-model

The point of departure for our model construction is the one-region Leontief quantity model, where gross output is determined by demand:

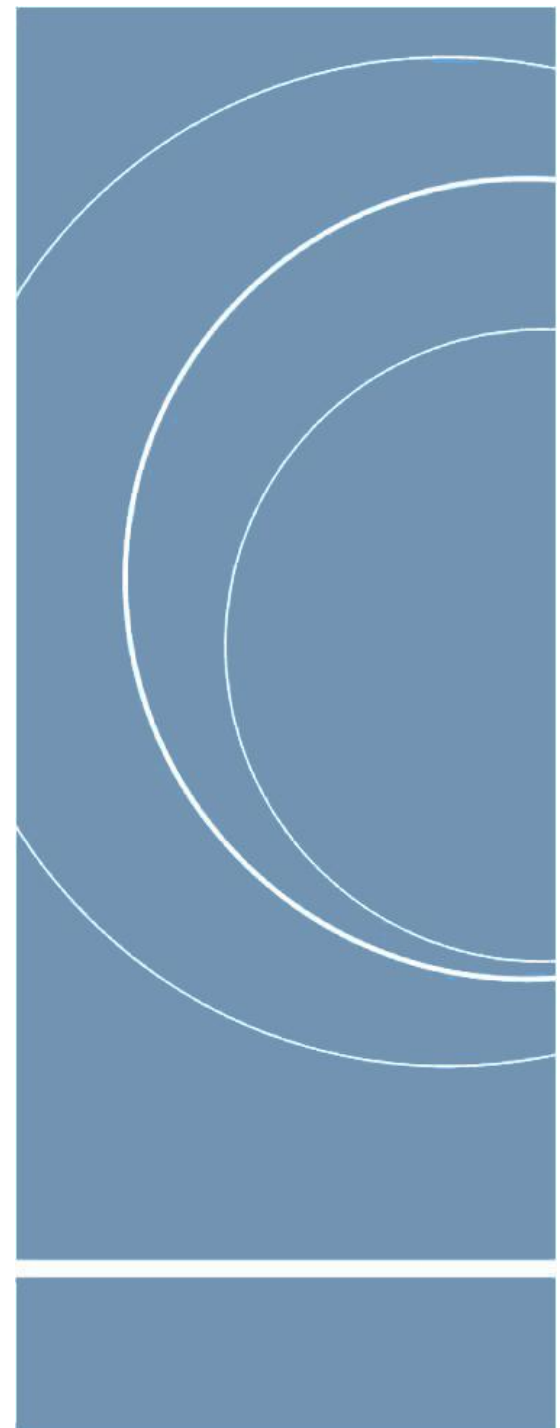
$$\mathbf{x} = \mathbf{Ax} + \mathbf{f} \dots\dots\dots(1)$$

where

x : gross output by sector and region

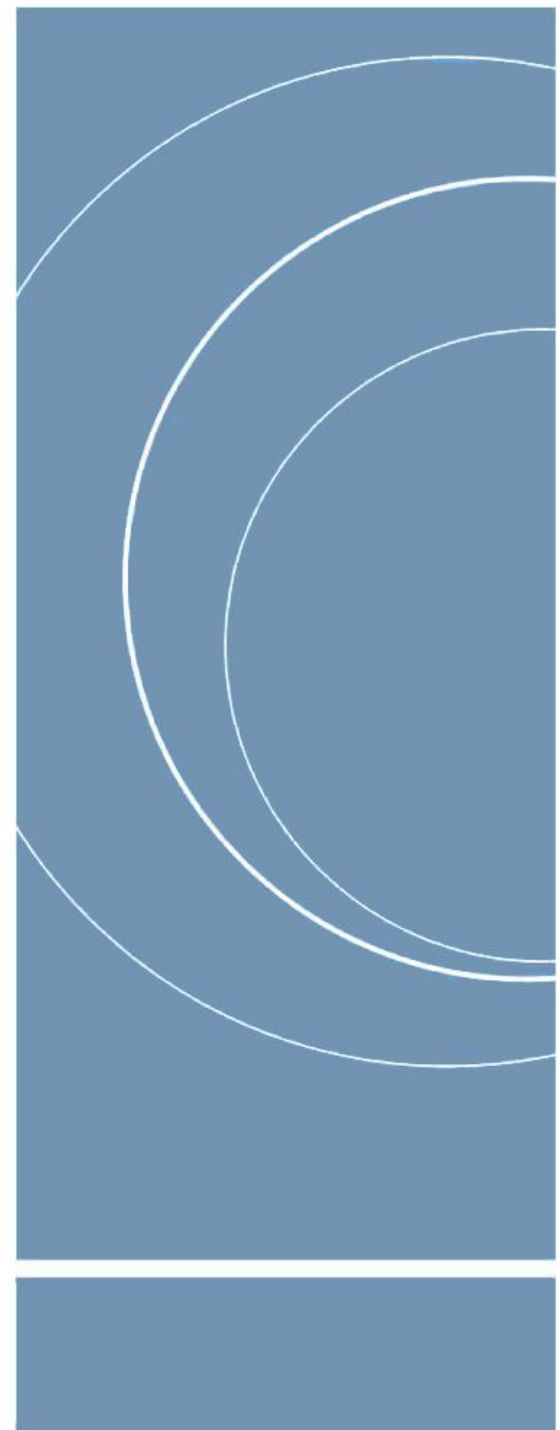
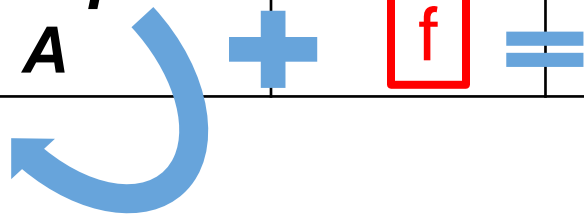
A: intermediate consumption by sector of origin as share of gross output, by purchasing sector and region

f : final demand, by sector and region



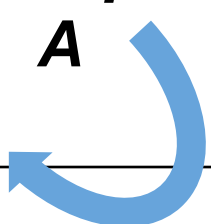
The one-region "A-model"

	Sector (J)	Final demand (I)	Total output
Sector (J)	<i>Intermediate consumption</i> A	f	x

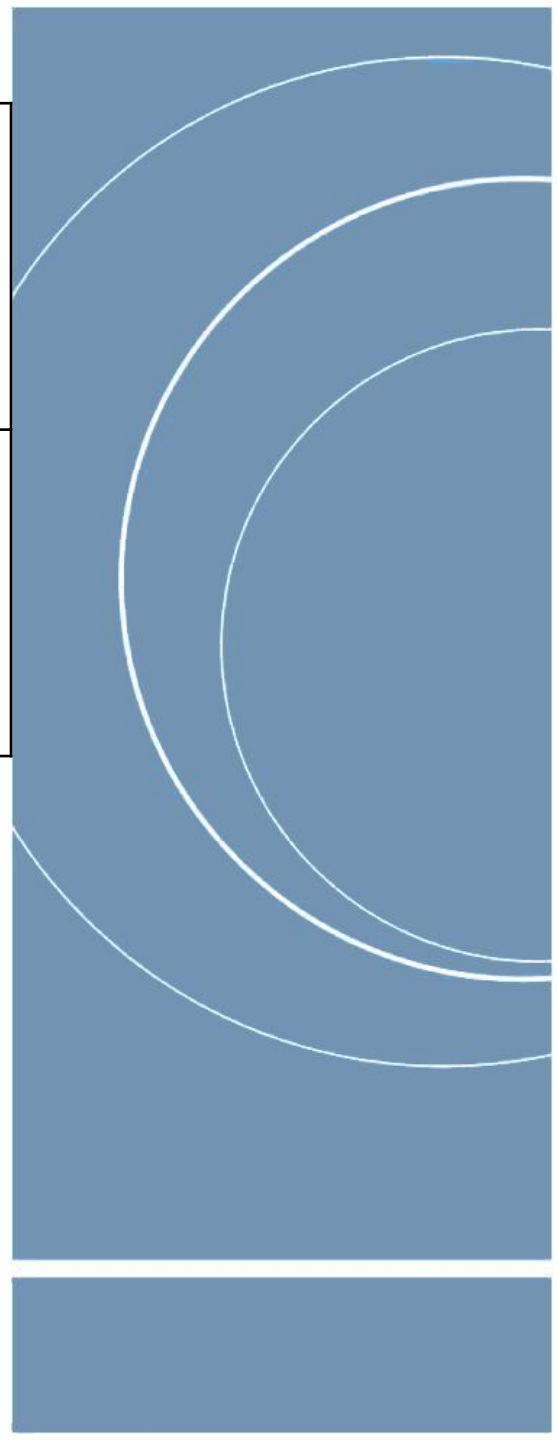


the Isard interregional "A-model"

	Sector (J) / Region (r)	Final demand (I) Region (r)	Total output Region (r)
Sector (J) Region (r)	<i>Intermediate consumption</i> A	f	x



$$A + f = x$$



the Isard interregional "A-model"



From the "A-model" to the "2 x 2 x 2"-principle-model

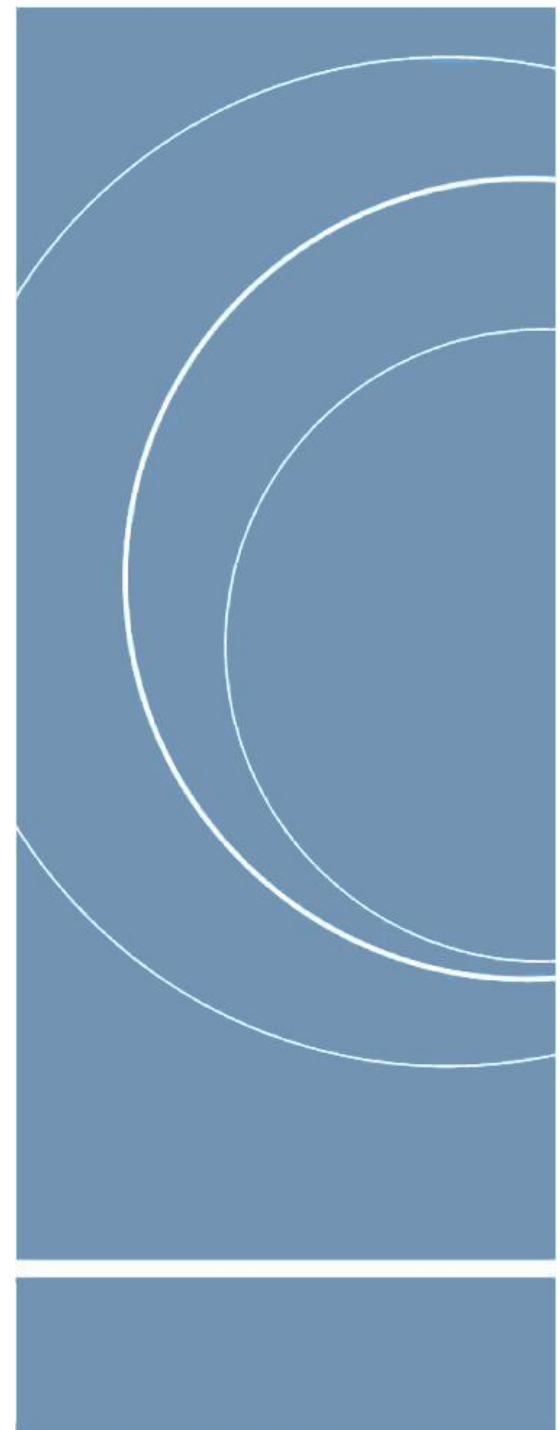
The interregional quantity model

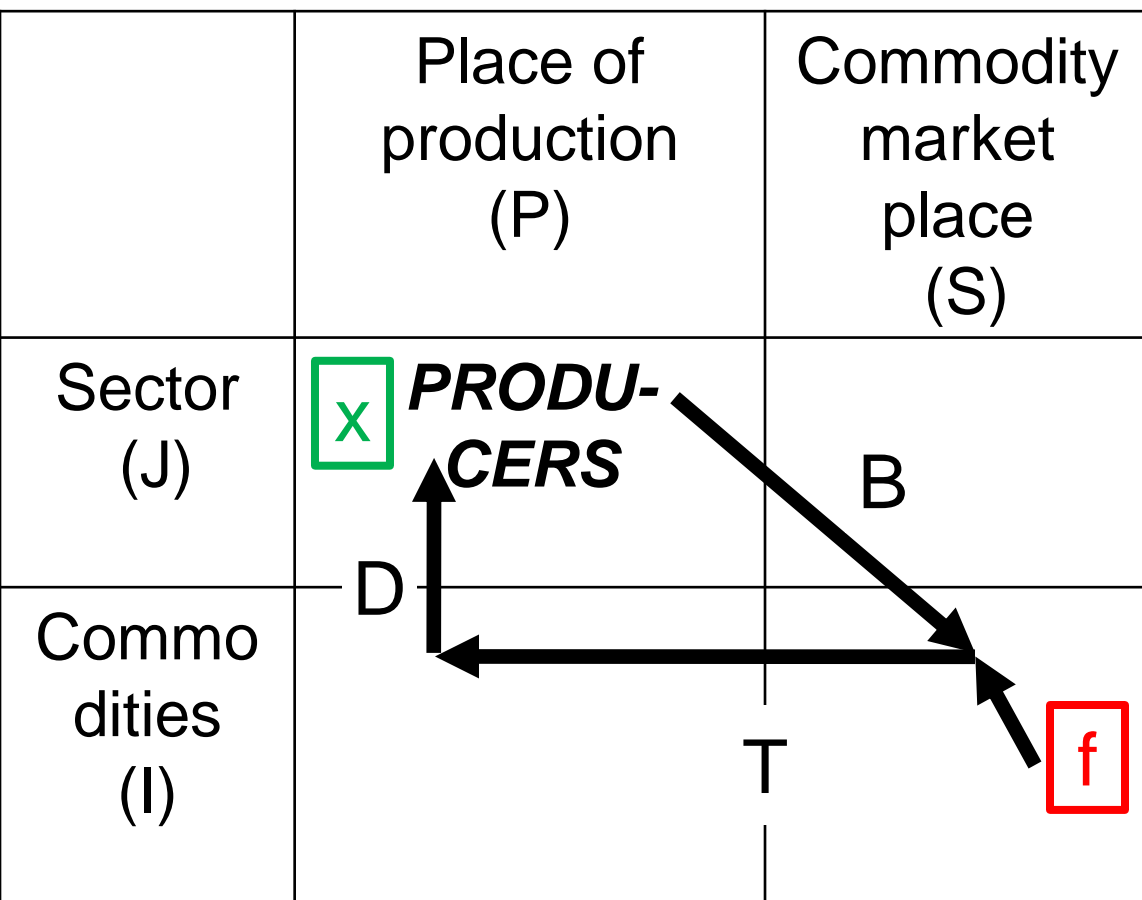
$$\mathbf{x} = \mathbf{Ax} + \mathbf{f} \dots\dots\dots(1)$$

The analytical solution to the Interregional quantity model is:

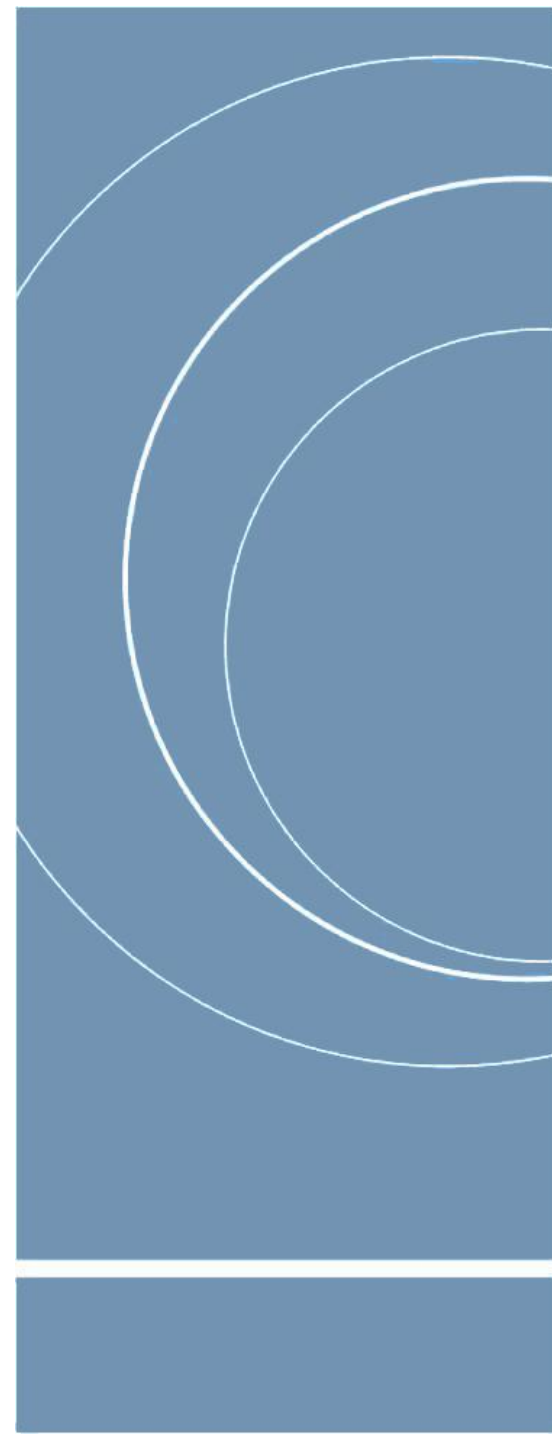
$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1} \mathbf{f} \dots\dots\dots(2a)$$

$$= (\mathbf{I} + \mathbf{A}^1 + \mathbf{A}^2 + \mathbf{A}^3 \dots\dots) \mathbf{f} \dots\dots\dots(2b)$$





2 by 2 by 2-principle model



$$\begin{aligned}
 x &= DTBx + DTf \\
 x &= (I - DTB)^{-1} DTf \\
 x &= (I + DTB^1 + DTB^2 + DTB^3 + \dots) DTf
 \end{aligned}$$

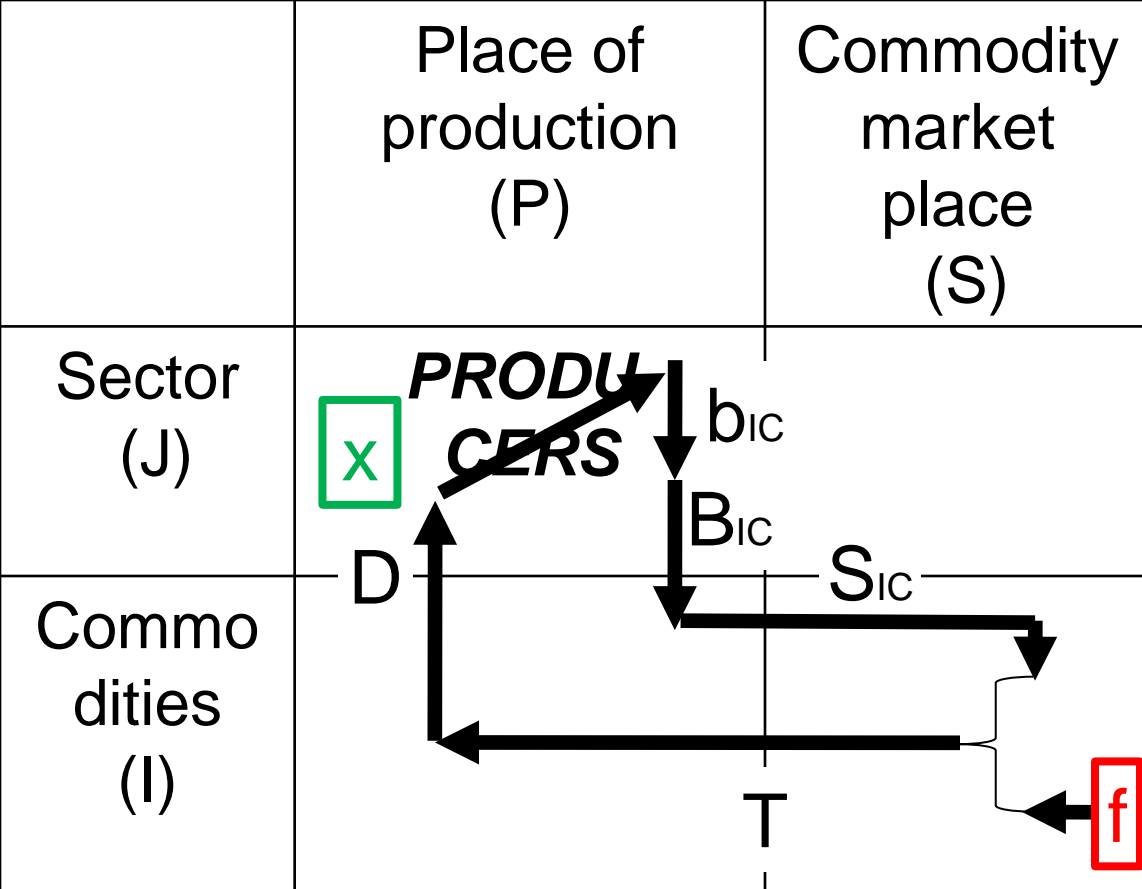
instead of

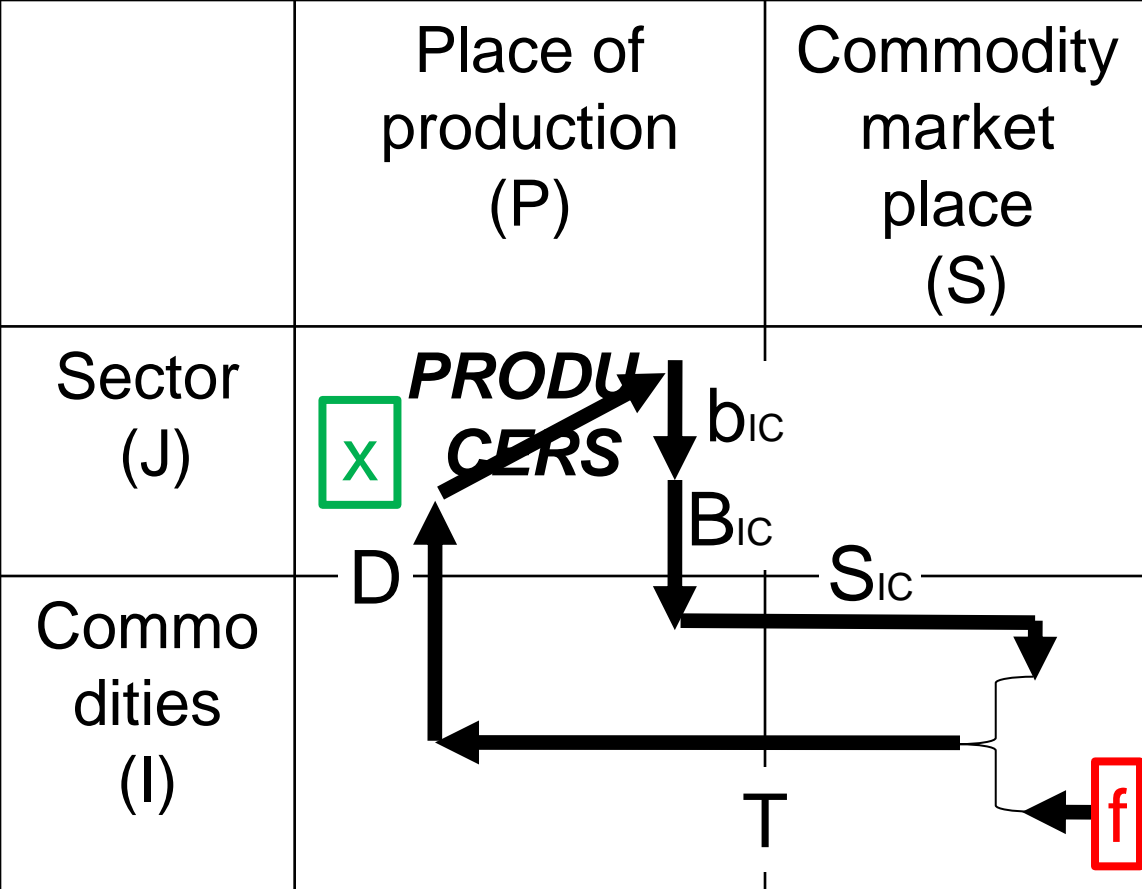
$$\begin{aligned}
 x &= Ax + f \\
 x &= (I - A)^{-1} f \\
 x &= (I + A^1 + A^2 + A^3 + \dots) f
 \end{aligned}$$



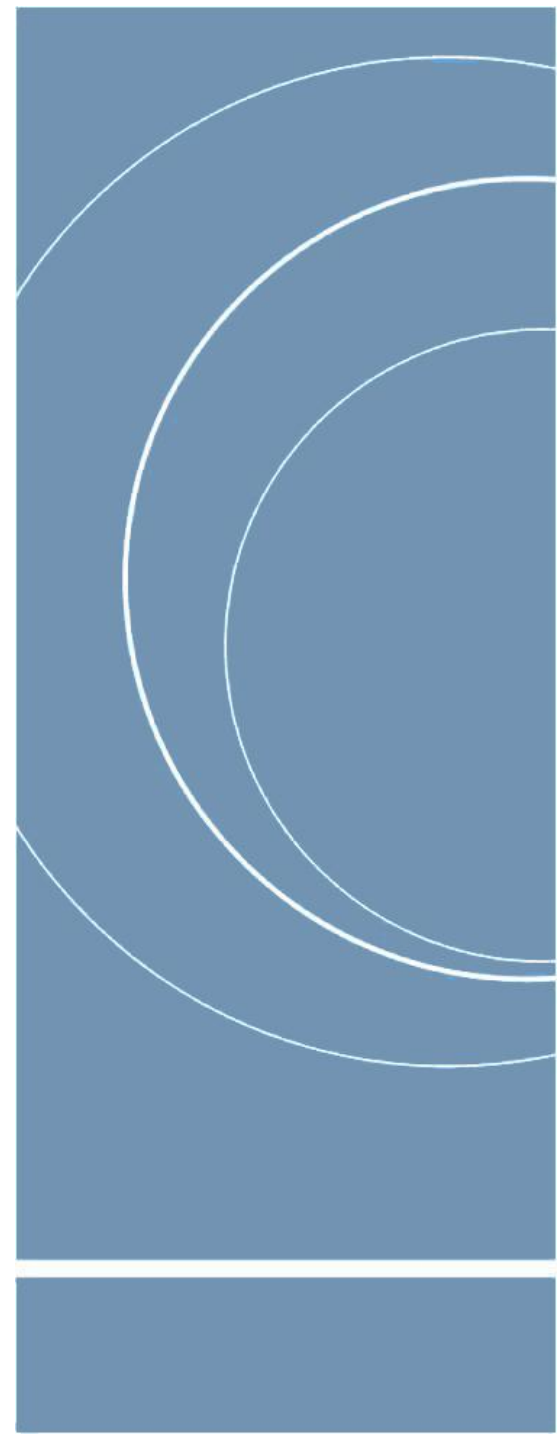
Make-Use Approach

Institutional Approach





2 by 2 by 2-principle model

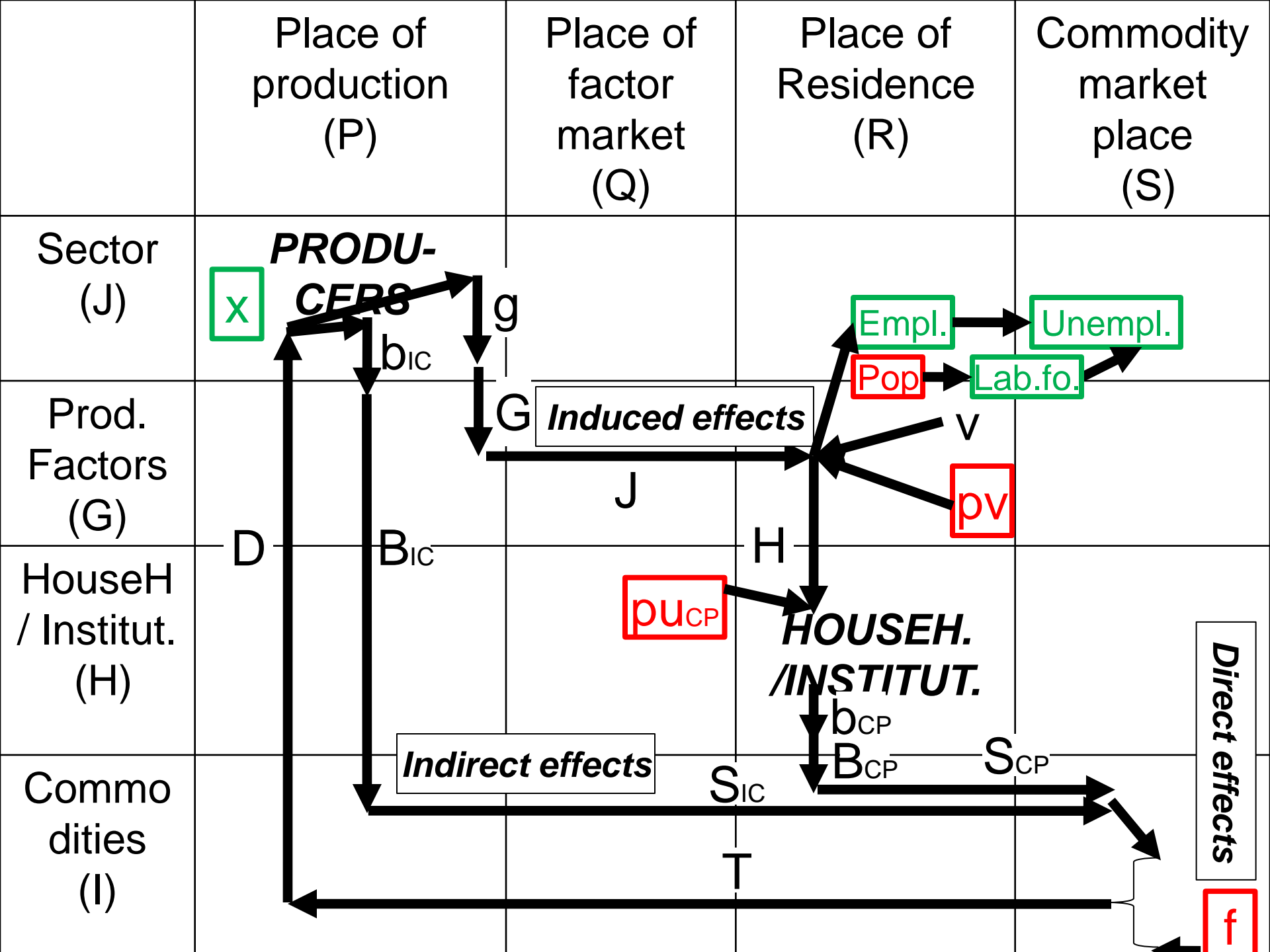


$$\mathbf{x} = \mathbf{DTS}_{IC}\mathbf{B}_{IC}\mathbf{b}_{IC} \circ \mathbf{x} + \mathbf{DTf} \dots \dots \dots (3a)$$

$$= \mathbf{DT}(\mathbf{S}_{IC}\mathbf{B}_{IC}\mathbf{b}_{IC} \circ \mathbf{x} + \mathbf{f}) \dots \dots \dots (3b)$$

$$\mathbf{x} = (\mathbf{I} - \mathbf{DTS}_{IC}\mathbf{B}_{IC}\mathbf{b}_{IC})^{-1} \mathbf{DTf} \dots \dots \dots (4a)$$

$$= (\mathbf{I} + (\mathbf{DTS}_{IC}\mathbf{B}_{IC}\mathbf{b}_{IC})^1 + (\mathbf{DTS}_{IC}\mathbf{B}_{IC}\mathbf{b}_{IC})^2 + (\mathbf{DTS}_{IC}\mathbf{B}_{IC}\mathbf{b}_{IC})^3 + \dots \dots) \mathbf{DTf} \dots \dots \dots (4b)$$



From the "A-model" to the "2 x 2 x 2"-principle-model

$$\begin{aligned}
 \mathbf{x} &= \mathbf{DTS}_{IC} \mathbf{B}_{IC} \mathbf{b}_{IC} \mathbf{x} && \text{(indirect effects)} \\
 &+ \mathbf{DTS}_{CP} \mathbf{B}_{CP} \mathbf{b}_{CP} \circ \mathbf{pu}_{CP}^{-1} \circ \mathbf{pv} \circ \mathbf{v} \circ \mathbf{JGg} \circ \mathbf{x} && \text{(induced effects)} \\
 &+ \mathbf{DTf} \dots \dots \dots (7a) && \text{(direct effects)} \\
 &= \mathbf{DT}(\mathbf{S}_{IC} \mathbf{B}_{IC} \mathbf{b}_{IC} \mathbf{x} + \mathbf{S}_{CP} \mathbf{B}_{CP} \mathbf{b}_{CP} \circ \mathbf{pu}_{CP}^{-1} \circ \mathbf{pv} \circ \mathbf{v} \circ \mathbf{JGg} \circ \mathbf{x} + \mathbf{f}) \dots \dots (7b)
 \end{aligned}$$

$$\begin{aligned}
 x &= (I - DTS_{IC} B_{IC} b_{IC} - DTS_{CP} B_{CP} b_{CP} \circ pu_{CP}^{-1} pv \circ v \circ JGg)^{-1} DTf \dots \dots (8a) \\
 &= (I + (DTS_{IC} B_{IC} b_{IC} - DTS_{CP} B_{CP} b_{CP} \circ pu_{CP}^{-1} pv \circ v \circ JGg)^1 \\
 &\quad + (DTS_{IC} B_{IC} b_{IC} - DTS_{CP} B_{CP} b_{CP} \circ pu_{CP}^{-1} pv \circ v \circ JGg)^2 \\
 &\quad + (DTS_{IC} B_{IC} b_{IC} - DTS_{CP} B_{CP} b_{CP} \circ pu_{CP}^{-1} pv \circ v \circ JGg)^3 \\
 &\quad \dots \dots) DTf \dots \dots \dots (8b)
 \end{aligned}$$

10 highest multipliers

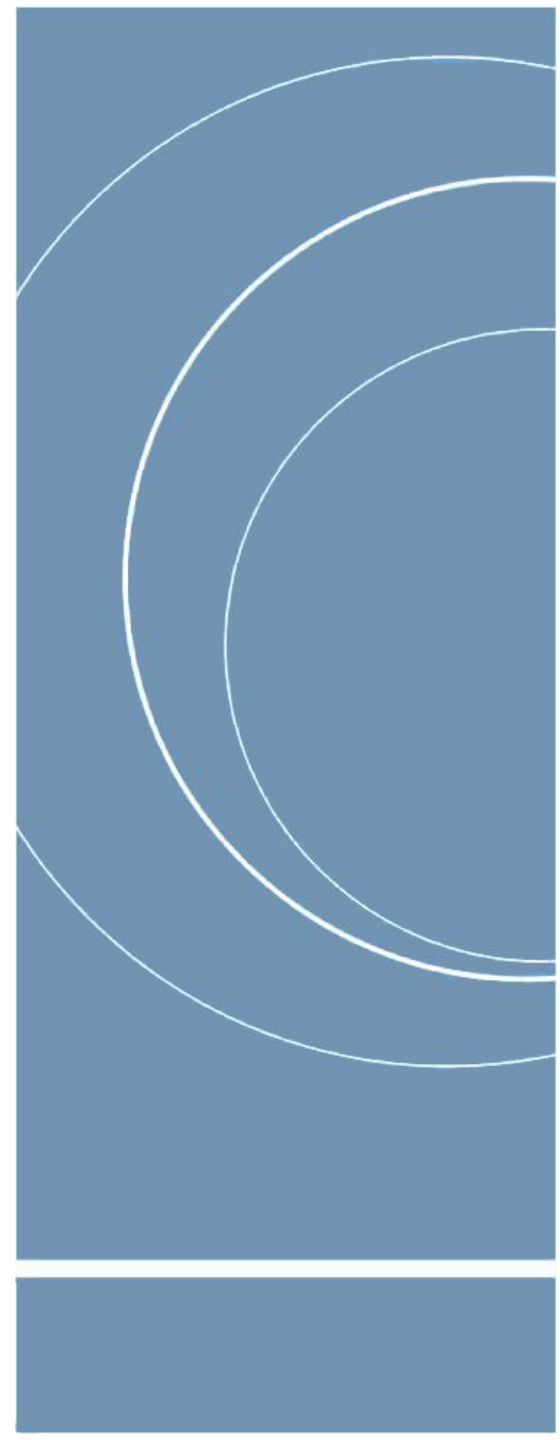
Top 10 and bottom 10 municipalities	Rank	Multiplier	Rank	Intra-regional Consumption share	Rank	Intra-regional Commuting share	Rank	Intraregional Local Private Consumption share	Rank	Intra-regional Tourism share	Rank	Intra-regional Trade share
Kalundborg	1	493	1	0,7885	26	0,7510	40	0,8796	12	0,0655	92	0,4726
Rudersdal	2	437	7	0,6161	82	0,3081	93	0,6774	59	0,0081	35	0,6846
Ringkøbing-Skjern	3	302	3	0,6895	16	0,7805	21	0,9322	9	0,0703	84	0,5509
Gentofte	4	295	11	0,5917	85	0,2742	88	0,7009	69	0,0000	83	0,5621
Fredericia	5	267	14	0,5749	62	0,5746	16	0,9422	66	0,0067	72	0,5951
Lyngby-Taarbæk	6	259	6	0,6201	93	0,2447	73	0,7849	54	0,0122	54	0,6352
Lemvig	7	252	22	0,5506	9	0,8157	33	0,9123	44	0,0192	79	0,5727
København	8	248	9	0,5935	72	0,4981	38	0,8892	36	0,0253	1	0,8190
Esbjerg	9	247	4	0,6401	18	0,7791	9	0,9553	33	0,0289	78	0,5811
Lejre	10	245	58	0,4986	69	0,5355	95	0,6376	64	0,0074	98	0,3289

10 lowest multipliers

Top 10 and bottom 10 municipalities	Rank	Multiplier	Rank	Intra-regional Consumption share	Rank	Intra-regional Commuting share	Rank	Intraregional Local Private Consumption share	Rank	Intra-regional Tourism share	Rank	Intra-regional Trade share
Gribskov	89	171	72	0,4817	36	0,7223	41	0,8791	4	0,1042	82	0,5629
Fanø	90	171	91	0,4514	32	0,7388	71	0,7921	18	0,0479	96	0,3959
Greve	91	170	78	0,4769	78	0,4131	72	0,7899	93	0,0000	42	0,6731
Frederiksberg	92	169	94	0,4445	88	0,2662	74	0,7641	94	0,0000	28	0,6915
Rødovre	93	168	69	0,4843	89	0,2633	70	0,7924	95	0,0000	18	0,7138
Billund	94	165	44	0,5164	64	0,5647	46	0,8719	41	0,0209	85	0,5414
Sorø	95	161	97	0,4327	70	0,5215	81	0,7450	96	0,0000	36	0,6803
Syddjurs	96	151	67	0,4866	39	0,7078	56	0,8498	13	0,0645	46	0,6646
Ærø	97	148	88	0,4561	3	0,9345	4	0,9634	97	0,0000	80	0,5722
Læsø	98	135	87	0,4673	2	0,9375	17	0,9391	98	0,0000	97	0,3793

Future research / Development of SAM-K and LINE

- The Economic base
 - **Reduction in economic base (pure exogeneity)**
 - **More interaction (Shopping with public goods endogenous)**
 - **“Higher multipliers”**
- Combined micro and macro simulation model (extended Walrasian model)
 - **Price model (has been developed)**
 - **Links between Q & P-models**
 - **Micro-simulation models and the 2 x 2 x 2 principle**



Sequential calculation of the general Micro & makro-simulation model

Direction of calculation

General micro-simulation model for for producers

From PJ to RH

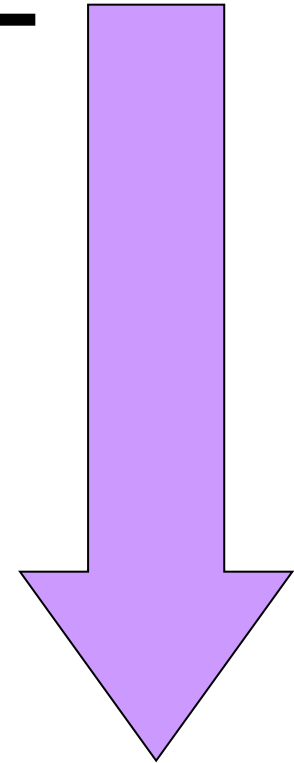
General micro-simulation model for households

From RH to PJ

Price model

General micro-simulation model for for producers

From PJ to RH



It 1

It 2

***THANK YOU FOR YOUR
ATTENTION***