Towards a New Framework for Accounting and Modelling the Regional Impacts of Tourism and Culture

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Abstract
Four different methods to estimate the regional impacts of tourism and culture based upon national accounting data and model approaches are identified: The simple supply or sector approach, the simple demand or commodity approach, the simple satellite account approach involving tourism satellite accounts and a SAM-approach and the extended satellite account approach, which involves modelling based upon a satellite account and a SAM-approach. In the paper both theoretical definitions of tourism and culture as well as a definitions based upon national accounting concepts are presented and examined. A general interregional quantity model for tourism and culture reflecting a national accounting approach is presented and examined. On the basis of the model, the four approaches to measure the regional impacts of tourism and experiences are given precise definitions. Tourism is characterized by specific types of private consumption taking place outside the daily environment, tourism being the opposite of local private consumption, including in principle all types of commodities. Culture on the other hand is defined as specific commodities, which are consumed both outside the daily environment and locally as part not only of tourism activities but also local consumption. Following the four approaches and based upon the general interregional quantity model for tourism and culture empirical evidence on the impacts of tourism and culture in Denmark is presented.

1. Tourism, culture and national accounting

For examination of phenomena such as tourism and culture it is important to have a conceptual basis for the understanding of tourism and culture as well as empirical tools to measure tourism and culture activities, involving both the tourism and culture activities themselves as well as their interrelationship with other activities within or outside the regional economic system. A conceptual and empirical framework for examination of tourism and cultural is in principle found in the national accounts and within economic modelling, which in turn most often is based upon data from national accounts. One important problem is however, that conventional national accounts and economic modelling, both in its national, regional and local versions often does not look at the variety and clustering of activities in the consumption and in the production and does not measure the values of non-market activities

Extended accounts such as satellite accounts (UN 1993, XXI) and social accounting matrices (SAM) (UN 1993, XXII) in different ways give more detailed pictures of activities within specific areas of interest. This kind of information is necessary for the examination of mixed and diverse activities, such as tourism and cultural activities. Satellite accounts give extended information for specific areas, such as transportation, tourism or environment. In tourism satellite accounts include information on demand for tourist products as well as both the origins of tourist demand and the production and employment impact of tourist consumption are included. Transport satellite accounts also include information on special activities not accounted explicitly in the national accounts, such as internal or firm transport. In the case of environmental satellite accounts information on emissions or consumption of nature resources are examples on non-market commodities has been added to the conventional national accounts. Satellite accounts therefore seem to be a fruitful path for the examination not only tourism but also culture.

Social Accounting Matrices (SAM's) highlight behavioural and distributional issues involving the complex relationship between production and consumption. In this sense SAM's are extensions of the national accounts and reflect the diversification in phenomena, such as tourism and culture activities. Extension of the national accounts with SAM involves the clustering of individuals into different archetype groups and the production units into different sectors/clusters. From a demand perspective a SAM includes information on the origins of demand for tourism and cultural commodities by type of persons. From a supply perspective the SAM shows the bundles of commodities by sectors or clusters as well as the intermediate consumption by commodity bundles and production factor demand by type production factor, such as labour. In the case of tourism and culture, a SAM may represent an aggregation of production units into different tourism and cultural sectors or clusters or an aggregation of specific types of labour working in tourism or culture sectors. For the commodity market, a SAM may give information on consumption patterns for different types of tourism and cultural groups as well as information on supply of bundles of commodities by sector / cluster. A SAM is therefore also a fruitful tool in the analysis of tourism and culture.

Satellite accounts and SAM's are interconnected. Often satellite accounts implicitly builds upon SAM's and vice versa. In satellite accounts actors are divided into different groups, such as types of tourists or clusters of tourism producers, which also in principle can be used in the SAM as clustering principle for individuals or production units. Similarly bundles of commodities can be aggregated to emphasis tourist or cultural aspects of the local and regional economy.

Satellite accounts and SAM's often are the point of departure for account based modelling. Different types of models, such as Keynesian income multiplier models, input-output models, SAM-based models, computable general equilibrium models or even micro simulation models builds directly upon account data, where the structure of the data and the account system also is reflected directly in the structure of the different models.

2. Tourism in accounting and economic modelling

There are therefore good reasons to look into both the national account and modelling tradition to learn more about how to examine the role and the impacts of tourism and culture in the regional and local economy. Especially there are good reasons to examine the existing tradition in tourism, where there is a tradition for accounting and modelling the economic impacts of tourism.

Four different approaches within tourism based upon national accounting data and modelling approaches can be identified: The ***simple supply or sector approach***, the ***simple demand or commodity approach***, the ***simple satellite account approach*** involving tourism satellite accounts and a SAM-approach and the ***extended satellite account approach***, which involves modelling based upon a satellite account and a SAM-approach. All four approaches have been established for measuring and modelling tourism impact for Danish regions and municipalities. In this section the characteristics of the four different approaches is

summarized and evaluated. In the following sections the four approaches are analysed within a general interregional model for tourism and the local economy. This model can also with some adjustments be applied for cultural sector and the local economy.

2.1 The simple supply or sector approach

Using the simple supply or sector approach tourism impacts can be identified on the basis of information on economic activities in tourism sectors, such as national account data on gross value added (GVA), and employment etc. in tourist sectors. Smith (1988, 1994) argues for a return to supply-side perspectives to be able to understand and analyze tourism as an industry and economic activity. Tourism impacts can be identified in absolute terms, such as number of employment or in relative terms, such as share of employment. One obvious critique is that sectors are mixed in the sense that tourist sectors produce commodities for other types of demand than tourism demand. Likewise, non tourism sectors produce commodities partly for tourism demand. The supply or sector approach therefore gives an imprecise and presumably either a substantial under- or overestimate the impacts of tourism depending upon which sectors are included in the definition of tourism.

Another problem is, that conventional tourism sectors, such as hotel sector often produce only a part of the tourism product and often a product, which is only derived demand (lodging) whereas the main tourist activity, such as beach or urban tourism activities, does not have its own sector. There is a tendency to exaggerate the role of lodging.

Finally, a critique of the simple supply or sector approach is that non-market impacts are not included in the evaluation of the impacts of tourism. The welfare from free commodities such as scenic views is not included in this approach.

2.2 The simple demand or commodity approach

The demand approach partly solves the problem in the sector approach in changing the focus towards the tourist: In the demand approach the point of departure is the tourism demand, starting with number of tourist, daily consumption generating the tourism consumption demand, all by type tourist. Type of tourist is usually classified according to geographical origin or by type of night. The demand is divided into demand by commodity reflecting the commodity composition of different types of tourism demand.

Many countries carried out tourism survey in order to understand tourism behaviour and tourist demand. Denmark National Tourism Organization (2004, 2006) have conducted tourist survey for many years. The survey tried to cover different types of tourists, such as both inbound and domestic tourists; both same-day and overnight tourist; also for different types of accommodations. The survey investigated, among the other questions, the tourist spending by commodity composition at destinations. This informationcan be used to analyse the tourism consumption patterns and tourism behaviour, etc.

One critique of the simple demand or commodity approach is that it is restricted to the demand side. Tourism impacts should also be related to production, income and employment. The problem in the simple demand approach is to use the demand to divide the production,

income and employment into a tourism component. Adding to this, impacts on the balance of payment of tourism, both from a national and a regional and local perspective, could not be analysed.

Another critique of the simple demand approach is that tourists are classified according to the type of night or the geographical origin – and not the motivation of the tourist activities, such as beach or urban tourism. Within tourism impact analysis, traditionally a type of night approach is used. In a type of night approach a tourist is classified as a hotel tourist, a camping tourist etc. according to the type of lodging. This reflects that the main expenditure connected with tourist activities normally is lodging, giving the rationale behind looking at "type of night"-tourist.

Finally, in the simple demand approach activities are delimited to include only market economic activities. The non-market value of tourism is not included in the evaluation of the impacts of tourism.

2.3 The simple satellite account approach

In the simple satellite account approach impacts of tourist activities is estimated from both the demand and production side: The point of departure is the demand effects of tourism as estimated in the simple demand approach. In the simple satellite account the direct impacts are traced both forward and backward. Looking forward the focus is on the origin of the direct tourist demand, both geographically (place of residence) and by type of tourist. Looking backward the interest is on the direct impact of the tourism demand on production and employment, both geographically (place of production) and by sector.

International organizations, like UN, UNWTO, OECD and Eurostat, have made efforts in many years to call for all the countries to follow their documents on "International Recommendations for Tourism Statistics" (UN and UNWTO, 2007) and "Tourism Satellite Accounts - Recommended Methodological Framework" (UN/Eurostat/ OECD/UNWTO, 2008). Many countries have made progression in compiling tourism statistics according to TSA methods, see Brændvang et al, 2001; Jones, et al, 2003; Kass and Okubo, 2003; Meis, 1999; and Zhang, 2005.The main principles from the tourism satellite accounts (TSA) are 1) TSA being a satellite account to national accounts; 2) to define tourism sectors or activities; 3) to adopt the product approaches, meaning that tourism demand is accounted by tourism-specific products, not by sector; 4) to link the demand side of tourism data with supply side. One of goals for TSA is to make Table 6, where each country presents the shares of tourism demand in their total supply by products. Finally, the TSA can provide a country's share of tourism by direct effects on GDP and employment. This information will provide comparison among the countries.

Although the simple satellite account approach, which normally will be referred to as regional tourism satellite accounts, represents a tremendous improvement in the evaluation of impacts of tourism there are some deficiencies in this approach. One important critique of the simple satellite approach is that tourist activities not only have direct effects, but also

derived effects: Intermediate consumption derived from the tourism production has impacts on the regional and local economy (indirect effects). Also tourism factor income has impacts on private consumption which in turn have impacts on production (induced effects). This calls for a modelling approach, where not only the direct but also the derived effects are included in the impacts of tourism.

Adding to this, the inherent problem of sector or type-of night approach is also a problem in the case of simple satellite account approach: The tourist should be defined according to main motive for being a tourist, which is not the problem of choosing type of accommodation. A simple satellite account approach based upon type of tourist classified according to type of tourist activity seems much more relevant.

2.4 The modelling approach - or the extended satellite account approach

The modelling approach does not only include the direct effects as measured in simple satellite account approach, but also the derived effects of tourist activities as measured in the extended satellite account approach. The derived effects from intermediate consumption (the indirect effects) and private consumption (the induced effects) are added, which does not only involve the first round effects, but also the second, third and many rounds of effects involving – in principle – an unlimited number of rounds. By a round by round approach the total impacts of tourism activities can be found, which now include not only the simple but also the derived effects as reflected in the extended satellite accounts. To model both the direct effects and the derived effects a general interregional quantity model must be established.

Many countries began to adopt both TSA accounting approach and a economic modelling approach to evaluate the tourism impact on the GDP and employment (see Dwyer, et al, 2003; Zhang, Madsen and Jensen-Butler, 2007). The modelling results give both direct and indirect (incl. Induced) effects of tourism on the regional economies, such as GDP, gross value added, governmental revenue and employment.

Criticism can be directed towards the basic assumption in the interregional quantity model, involving the assumption of flexible production capacity, which allows for unrestricted adjustment in the volume of production independent of the capacity of production, availability of labour etc. If these assumptions are not justified, mechanism in the model capturing shortages in production capacity etc. has to be applied. This involves formulation of a model for prices and cost of tourist production, which will not be included in this presentation. Together with the general interregional quantity model, the general interregional cost and price model has to be introduced forming a general interregional computable equilibrium model.

The problem of the sector approach defining tourist products according to type of night and not to motivation of tourist activities also prevail here as well as lack of inclusion of non-market impacts of tourism.

3. Culture and tourism

Using the tradition within national accounts and economic modelling and specifically the accounting and modelling within tourism, the impacts of culture can be examined. In section 3, culture is defined and the four approaches for impact assessment applied for culture are examined. In section 4 the general interregional quantity model for local economies, including both tourism and culture is presented. The solution to the general interregional model including the total direct and derived impacts of culture is presented as well as a mathematical formulation of the impacts following the four impact assessment approaches. Finally, in section 5 empirical results of an impact assessment of tourism on the Danish locale economy is presented. The empirical analysis is based upon the local economic model LINE and a social accounting matrix for Danish municipalities, SAM-K.

3.1 Culture and tourism in national accounts and modelling

Following the tradition within culture economy, culture can be defined in three ways:

Firstly, culture is defined as art, where high quality of cultural activities is implicitly assumed. Following national account terminology culture in this tradition is defined as a (very specialized) commodity or bundles of commodities. Within this tradition, culture can be defined narrow or broad, including only a few or several commodities. Looking at quality the cultural commodities can be defined narrowly, including only the "fine art(s)" or broadly including also popular art. Introducing another dimension, a narrow definition might involve the core cultural product, the performance or the product, or a broad definition also including ancillary activities or direct intermediate consumption for the cultural production process and retailing and wholesaling activities such as reviewing and advertisement for cultural events etc. Introducing the time perspective, from an investment point of view cultural activities may include both investment in human capital (education for cultural creation and performance) as well as research within fine arts etc. and investment in physical culture capital, such as investment in buildings, machines and equipment.

Secondly, culture can be defined as economic activity within sectors producing the main cultural products. This includes productions units / sectors such as museums, theaters, publishers, architects etc. and it might include market- as well as non-market-based subsidized activities. In national accounts the culture sectors include the production units where production of cultural commodities is most important. The productions units can both be market public and private, being public if more than 50% is financed by the public sector.

Thirdly, the culture can also be defined as activities within production units and by individuals, which are involved in the consumption and production of culture. The culture as such can be seen as ideas, values, norms and habits for persons and institutions constituting activities where consumption and production of culture takes place. The

internal and external relations within and between individuals and institutions in the cultural process constitutes different cultural groups, which are different in respect to the consumption as well as the production of culture.

These three definitions can be examined within the four approach framework established for tourism in section 2: The supply or sector approach matches the second definition of culture, whereas the simple demand or commodity approach follows the first definition. The satellite account approaches are according to the intension of seeing culture as a broad process involving both the origins of cultural consumption as well as the destination of the demand for cultural commodities in production and use of productions factors, such as labor in the production of cultural commodities. The third definition can be seen as a simple satellite account approach where culture is a phenomena going backward and forward in the local economy. Looking forward culture (products) involve individuals as well as institutions in the production of culture commodities putting the production factors within cultural production into work. Looking backward involve identification of the origin of the demand for cultural products. Although the fourth approach "the modelling approach - or the extended satellite account approach" has not been introduced, it is straight forward to see this approach as a natural extension and improvement of the 3 other approaches, including also the derived impacts from cultural activities.

3.2 The two-by-two-by-two principle and tourism and culture

The three definitions of culture or four approaches examining tourism and culture actually reflect and represent different actors and geographical dimensions in the national and regional economy. Actors and geographical dimensions can be classified according to the **two-by-two-by-two-principle** (Madsen & Jensen-Butler 2005 & Madsen 2008). This principle is the point of departure for setting up accounts and models to analyze impacts of culture and tourism.

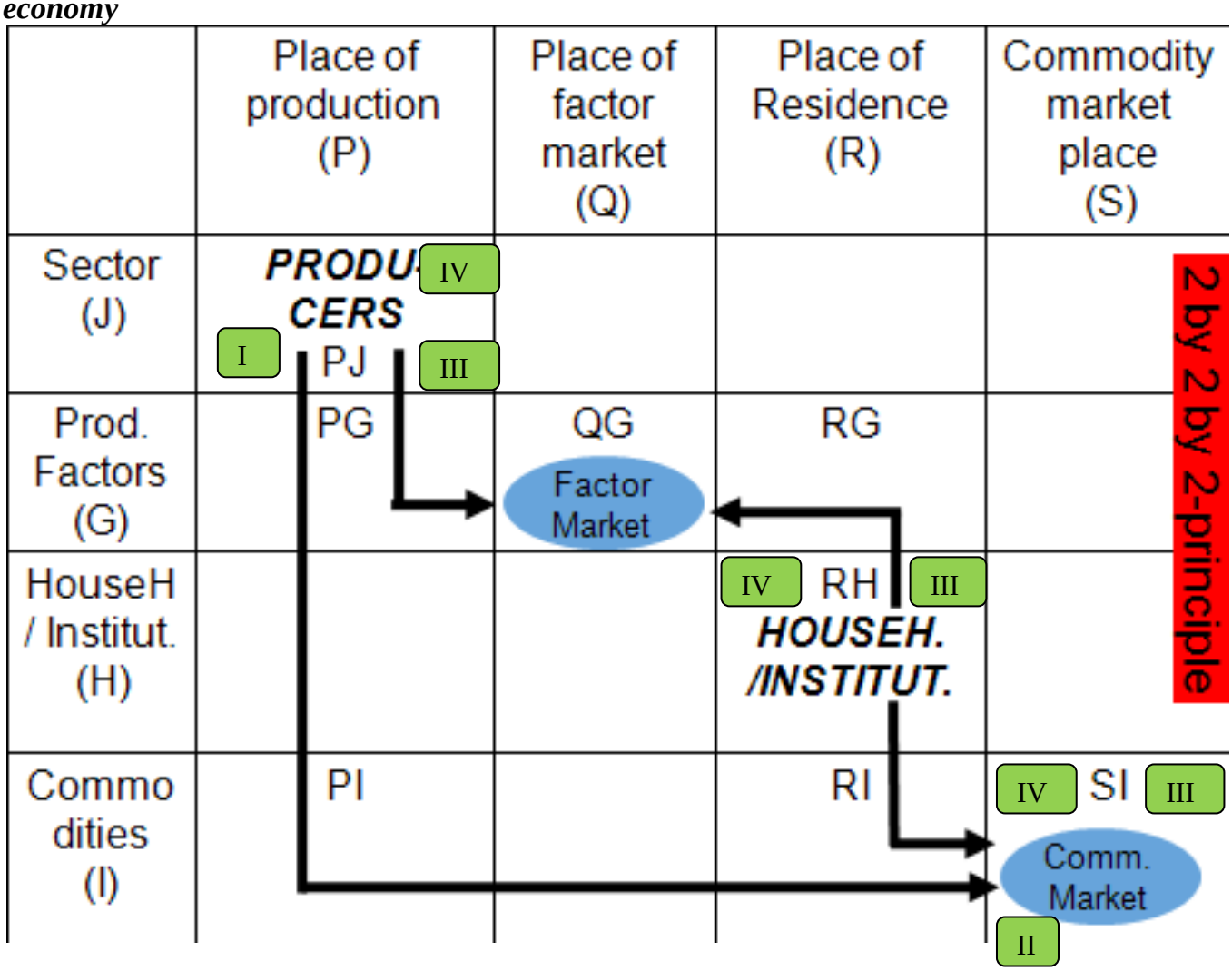
The two-by-two-by-two-principle includes the following three basic dimensions in a local economy: First, two **actors** in the local economy - producers and households – can be identified. Second, two **markets** (a commodity market and a factor market) link the two actors together. Third, interaction between markets and actors involve information on **origins and destinations of flows** between actors and markets, such as trade, commuting etc.

According to the two-by-two-by-two principle, economic actors can be classified according to **sector** of the producing units, as well as according to type of **institution** for the household or institutional units. Further, commodities consumed can be classified according to type of **commodity** or bundles of commodities. And production factors can be classified according to the type of **production factors**.

According to the two-by-two-by-two principle, economic activities can be classified according to **geographical location**: In “the simple production or sector approach”, culture is related to the **place of production**. Moving to the “simple demand or commodity approach” activities is related to the **place of commodity market**. Further, “the simple satellite approach” goes beyond the commodity market and traces the relations forward to the **place of residence** for the institutions and persons involved in the consumption of cultural commodities and backward to the sectors and production factors involved in the production of cultural commodities at the **place of production** and the **place of factor market**.

The two-by-two-by-two principle is illustrated in figure 1, is the point of departure for the general interregional quantity model for culture, which is presented in section 4.

Figure 1 The two-by-two-by-two principle for cultural activities in a local interregional economy



In the commodity market there is a distinction between place of residence (R), the commodity market place (S) and place of production (P). The commodity market place links the demand for the commodity (from place of residence to the market place for commodities) to the supply of the commodity (from place of production to the market place for commodities). Before the transformation to the market place for commodities, the demand for commodities is transformed from institutional group (H) to commodity (I). On the supply side, production by sector (J) is transformed into production by commodity (I) and then supply is related geographically to the commodity market place (S).

In the factor markets supply and demand of production factors are found. Demand for production factors (G) is determined by production by sector (J) at the place of production (P). Factor demand by sector is transformed into factor demand by type of production factor (G). On the supply side, supply of production factors by type of institution (H) is transformed into supply by type of production factor (G). Supply of a production factor is related to the

place of residence of the household or institution (R). The factor market is geographically assigned to the market place for factors (Q).

The four different approaches for impact assessment of tourism and culture can be illustrated in the diagram: The simple supply or sector approach is located in the cell PJ for place of production and sector (shown as "I"). The simple demand or commodity approach is located in the cell RH for place of commodity market and commodity (shown as "II"). The regional satellite account has three locations – in the cells SI, PJ and RH (shown as "III"). The extended satellite also includes three locations, which are similar to the three locations for the simple satellite account (shown as "IV").

3.3 Cultural and tourist commodities

From a local economy point of view culture and tourist commodities are in some respect similar but also very different. (In this analysis culture and tourist commodities is treated as bundles of commodities and not as single specific commodities). Firstly, culture and tourism bundles of commodities are in general similar, because tourist and culture commodities on demand side are both luxury goods. Opposite to basic necessary consumption goods, bundles of tourist and culture goods have income elasticity higher than one. However, looking into a bundle of tourist commodities, tourist consumption also include basic, necessary commodities, such as food, or even part of the tourism activities, which may be seen as purely reproductive, such as the first days of a holiday where the tourist "stress down". This is not the case for specific culture commodities. In line with this tourist consumption is not only high quality consumption, whereas culture is based upon a explicit quality assessment.

Secondly, however culture and tourist commodities are different, because tourism is consumption, which takes place outside the tourist's local environment and involve all kinds of commodities, whereas culture can take place both within and outside local environment of the consumer. This involves a division of private consumption into tourism demand and local private consumption and intermediate consumption into business tourism and business services provided locally. These dichotomies are the point of departure for not only the similarities in concepts of tourism and culture, but also the differences between the two phenomena. This characterization is summarised in the following table:

Table 1 Commodities by type within tourism and culture

		Private consumption[2]		Intermediate consumption	
		Local private consumption	Private tourism	Local intermediate consumption	Business tourism
Basic, necessary commodities	Non-tourist & non-culture commodities	Housing, food, clothing, entertainment for reproduction		Local intermediate products & services	
	Tourist commodities		Basic food		Work lodging, basic food and entertainment
Luxury commodities	Tourist commodities		Luxury food		Executive lodging, luxury food and entertainment
	Cultural commodities	Theatre, opera	Museums, opera	Paintings, sculpture, architecture	Museum, opera,

Vertically, commodities are divided into basic, necessary commodities and luxury commodities. Culture is purely luxury, whereas tourism commodities are also basic, necessary consumption. Horizontally, consumption is divided into private consumption and intermediate consumption, which both are sub-divided into local consumption and tourism consumption. These concepts enter into local and regional national accounts if consumption is limited to the market based consumption. If also non-market based consumption is included in extended accounts, local or regional satellite accounts can be applied.

4. The equations for the general interregional tourism and culture quantity model for local and urban economies in structural form

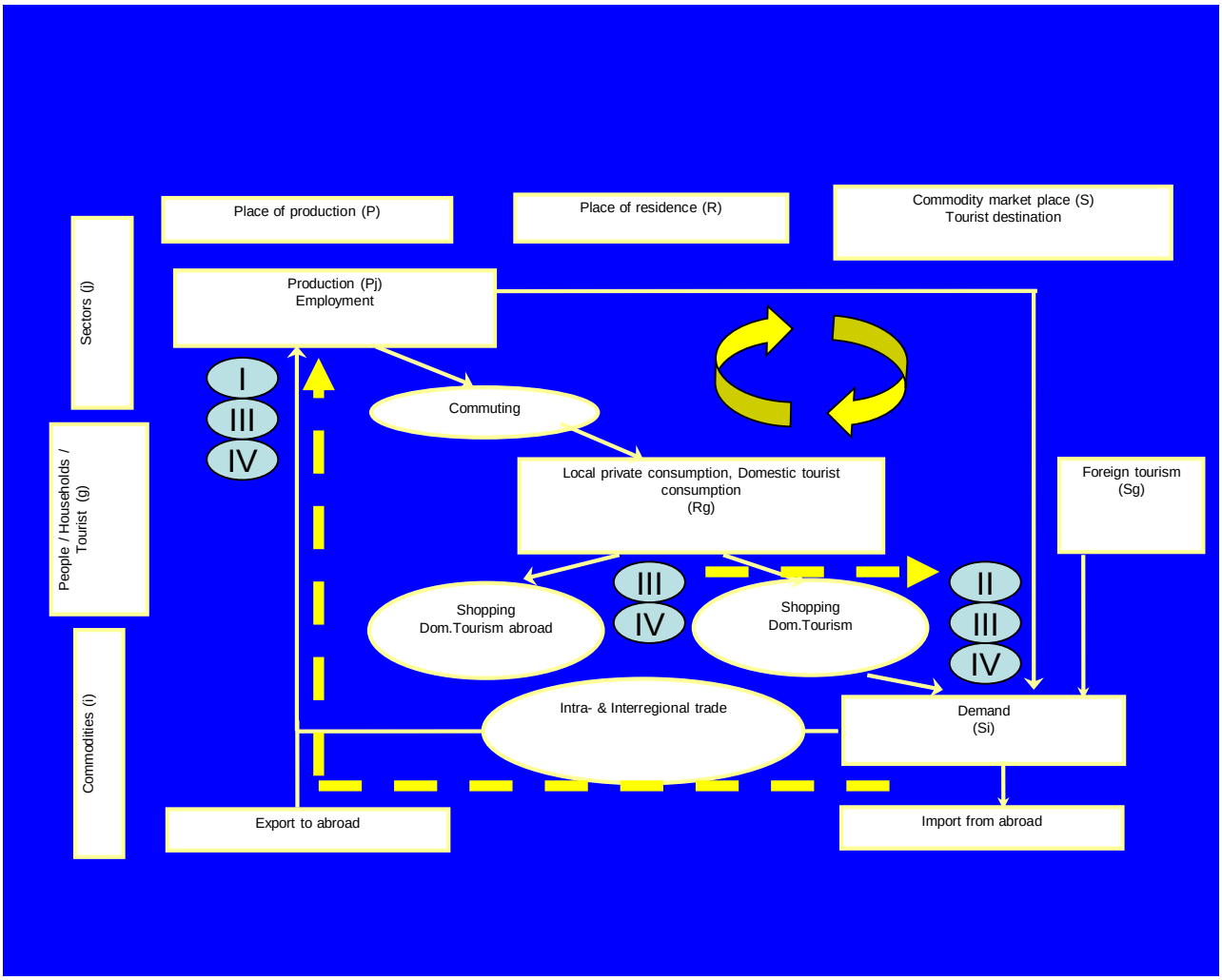
In this section, the equations of the general culture and tourism quantity model are examined in detail. First, a graphical presentation of the general model including an indication of the four approaches to measure the impact of tourism and culture are provided (see figure 2). Further – and on the basis of the graphical presentation - the mathematical notation used in the mathematical formulation of the general model is presented. Then the quantity model of the general culture and tourism model are presented. The analytical solution to the model is presented. Finally, the four impact assessment methods are given mathematical definitions based upon the general interregional quantity model for tourism and culture.

[2] To keep the table simple, governmental consumption has not been included in the table.

4.1 Graphical presentation of the general tourism and culture model for local and urban economies

The mathematical presentation of the model is based upon the sequential structure of the model following the circle as illustrated in figure 2:

Figure 2 The general interregional quantity model for tourism and culture – four approaches for impacts assessment



It can be seen, that the model differs from the presentation of the accounting of tourism and culture based upon the two-by-two-by-two principles in figure 1: First, to simplify and without loss of generality only 3 geographic and type of actors are included: Type of factor and type of institution have been merged into one as well as the place of factor market has been omitted. Second, the arrows now follow the sequential structure of the general interregional model, moving clock-wise with modelling of

- production at place of production and by sector (Pj)
- intermediate consumption going from place of production and by sector (Pj) to place of commodity market and to commodity (Si)

- commuting going from place of production and sectors (Pj) to place of residence and type of households /tourist (Rh/Rm)
- shopping going from place of residence and type of households /tourist (Rh/Rm) to commodity market place and by commodity / tourist (Si/Sm)
- trade going from place of commodity market and by commodity market (Si) and to production at place of production and by commodity (Pi)
- production at place of production going from commodity (Pi) to sector (Pj)

The quantity model corresponds to a demand driven Keynesian model and moves sequentially and clockwise in figure 2. Starting in the upper left corner (Pj), production generates intermediate consumption demand and employment by sectors (j) at the place of production (P). The employment is transformed from sectors (j) to age, gender and educational groups (g) and from place of production (P) to place of residence (R) through a commuting model. Labour force at the place of residence (R) depends upon population and activity rates all by age, gender and education (g). Labour force and employment determine the unemployment by age (g) at place of residence (R).

Real disposable income at the place of residence by age groups is determined by private consumption prices, employment and income rates (Rg). Real disposable income and commodity specific consumption rates are the basis for determination of private consumption by place of residence (R) and by commodity (i). Private consumption is sub-divided into tourism consumption and local private consumption. Tourism consumption is sub-divided into domestic and foreign tourism consumption. Domestic tourism consumption and local private consumption are assigned to place of commodity market (Si) using a interregional tourism and a shopping model. Governmental consumption and investment by commodity (i) are exogenously determined at the place of commodity market (Ri). Intermediate consumption at place of production (P) and by sector (j) is determined by gross output and transformed to place of commodity market (S). Intermediate, private and governmental consumption together with investment constitute the total local demand for commodities (Si), by commodity. Local demand is met by imports from other regions and from abroad in addition to local production (Si). Through a trade model exports abroad and to other regions and production for the region itself is determined (Pi). Gross output by commodity is determined by this demand. Through a reverse make matrix the cycle returns to production by sector (Pj).

In figure 2 the four approaches for impact assessment (I – IV) are indicated with their references to type of locations and type of actor such that

- the simple supply or sector approach (I), which is related to the place of production and sector (Pj)
- the simple demand or commodity approach (II), which is related to the place of commodity market and commodity (Si)
- the simple regional satellite account approach (III), which is related to
    - the place of commodity market and commodity (Si)

    - the origin of demand which is the place of residence and type of tourist and household (Rh)
    - the destination of the demand as production which is the place of production and the sector (Pj)
- the extend regional satellite account approach (IV plus the arrows), which is related to
    - the place of commodity market and commodity (Si)
    - the origin of demand which is the place of residence and type of tourist and household (Rh)
    - the destination of the demand as production which is the place of production and the sector (Pj)

4.2 The model – notation

The notation includes such information as variable names, sub-script, superscripts and mathematical operators. In general, the equations in the model involve tensor algebra, which is multi-dimensional matrix algebra. However, most of the notation from two-dimensional matrix algebra can be used in tensor algebra without further explanation.
The upgrading from matrix to tensor algebra is necessary, because most variables involve one or two regional specifications. For example commuting, which is employment at the place of production and the place of residence by age group, is 3-dimensional. If also age and education and the time axis are included, the tensors will be 6 dimensional.

Variables in the model

The variables in the general interregional tourism and culture model are denoted in the following way:

b:	Use share vector of demand
B:	Use coefficient matrix of demand
d:	Foreign import share vector
D:	Make coefficient matrix
g:	Employment content vector
G:	Factor demand and composition coefficient matrices
J:	Commuting coefficient matrix
h:	Income vectors
ph:	Income cost index
pu:	Price index vector for demand
q:	Employment
S:	Shopping matrix
T:	Trade coefficient matrix
u:	Demand vector
v:	Income rate vector
x:	Gross output by sector
z:	Trade vector

Superscripts:
Geographic axes
P: Place of production (regional axes)
R: Place of residence (regional axes)
S: Place of commodity market (regional axes)

Subscripts:
SAM-axes etc.
j: Sector (SAM-axis)
g: Groups of factors (SAM-axis)
m: Groups of motivation groups for tourist
i: Commodity (SAM-axis)
CT: Tourism
IC: Intermediate consumption
CP: private consumption
CO: Governmental consumption
I: Investments
D: Domestic
F: Foreign

Mathematical notation:
‘: Transposed
∘: Element to element multiplication
M: Capital letters for matrices (tensors)
v: Lower case letters for vectors

In the equations 1 – 26 in the following section the general local/urban quantity model are presented.

4.3 The general interregional quantity model in structural form

The equations in the general interregional quantity model goes clock-wise (see figure 3) and follow the sequential structure described in section 4.1:

Intermediate consumption and business tourism:

$u^{P}_{IC,j} = b_{IC} \circ x^{P}_{j}$ .....(1)

$u^{P}_{IC,i} = B_{IC} u^{P}_{IC,j}$ .....(2) *from j to i*

$u^{S}_{IC,i} = S_{IC} u^{P}_{IC,i}$ .....(3) *from P to S*

Employment, income and private consumption:

$q^{P}_{j} = g^{P}_{j} \circ x^{P}_{j}$ .....(4)

$q^{P}_{g} = G q^{P}_{j}$ .....(5) *from j to g*

$q^{R}_{g} = J q^{P}_{g}$ .....(6) *from P to R*

$h^{R}_{g} = pv^{R}_{g} \circ v^{R}_{g} \circ q^{R}_{g}$ .....(7)

$u^{R}_{CP,g} = b_{CP} \circ (pu_{CP,g})^{-1} \circ h^{R}_{g}$ .....(8)

Local private consumption

$u^{R}_{CL,g} = (i - b_{CT}) \circ u^{R}_{CP,g}$ .....(9)

$u^{R}_{CL,w} = B^{R}_{CL} u^{R}_{CT,g}$ .....(10) *from g to w*

$u^{S}_{CL,w} = S_{CL} u^{R}_{CL,w}$ .....(11) *from R to S*

$u^{S}_{CL,i} = B^{S}_{CL} u^{S}_{CL,w}$ .....(12) *from w to i*

Domestic tourism:

$u^{R,D}_{CT,g} = b^{R}_{CT} \circ u_{CP,g}$ .....(13)

$u^{R,D}_{CT,m} = B^{R,D}_{CT} u^{R}_{CT,g}$ .....(14) *from g to m*

$u^{S,D}_{CT,m} = S_{CT} u^{R,D}_{CT,m}$ .....(15) *from R to S*

$u^{S,D}_{CT,i} = B^{S,D}_{CT} u^{S,D}_{CT,m}$ .....(16) *from m to i*

Foreign tourism:

$u^{S,F}_{CT,m} = b^{S}_{CT} \circ tour^{S}_{m}$ .....(17)

$u^{S,F}_{CT,i} = B^{S,F}_{CT,m} u^{S,F}_{CT,m}$ .....(18) *from m to i*

Governmental consumption:

$u^{R}_{CO,g} = b^{R}_{CO} \circ pop^{R}_{g}$ .....(19)

$u^{R}_{CO,i} = B_{CO} u^{R}_{CO,g}$ .....(20) *from g to i*

$u^{S}_{CO,i} = S_{CO} u^{R}_{CO,i}$ .....(21) *from R to S*

Demand, trade and production

$u^{S}_{i} = u^{S}_{IC,i} + u^{S}_{CL,i} + u^{S,D}_{CT,i} + u^{S,F}_{CT,i} + u^{S}_{CO,i} + u^{S}_{I,i}$ .....(22)

$z^{S,D}_{i} = (i - d^{S,F}_{i}) \circ u^{S}_{i}$ .....(23)

$z^{P,D}_{i} = T z^{S,D}_{i}$ .....(24) *from S to P*

$x^{P}_{i} = z^{P,D}_{i} + z^{P,F}_{i}$ .....(25)

$x = D x^{P}_{i}$ .....(26) *from i to j*

Starting in the upper left hand corner in figure 3 at place of production by sector (cell Pj), in equation 1 intermediate consumption $u^P_{IC,i}$ is determined. *u* is demand and the subscript IC indicates intermediate consumption by commodity i. The superscript shows, that intermediate consumption is determined at the place of production P. Intermediate consumption is a function of the gross output vector x^P (by place of production P and by sector j) and the intermediate consumption share vector b_{IC}, which is intermediate consumption as share of production. In equation 2, intermediate consumption by commodity $u^P_{IC,i}$ is determined on the basis of a use matrix for intermediate consumption B_{IC} and the intermediate consumption by sector from equation 1 (u^P_{IC}). In equation 3, intermediate consumption is transformed from place of production $u^P_{IC,i}$ to place of commodity market $u^S_{IC,i}$ using a shopping matrix for intermediate consumption goods (S_{IC}). Intermediate consumption in tourism commodities is business tourism involving shopping as the geographical origins and destinations for the business tourists.

Continuing in the upper left corner in figure 3 (cell Pj), production generates employment q^P_j by sector j from gross output by sector (equation 4) and the reverse productivity. Further employment by type is determined on the basis of employment by sector q^P_j and labor content G (equation 5). Then employment by group (equation 6) is transformed from place of production P to place of residence R through a commuting model (from cell Pg to cell Rg). Multiplying employment with average wage rate v^R_g and the wage inflation rate pv^R_g income by type of labor is found (equation 7). Income and prices on private consumption by age group h^R_g are the basis for determination of private consumption place of residence $u^R_{CP,g}$ (cell Rg) (equation 8).

Private consumption $u^R_{CP,g}$ is divided into local private consumption $u^R_{CL,g}$ and domestic tourism consumption $u^{R,D}_{CT,g}$, where local private consumption is determined by real income and local private consumption rate (equation 9) and domestic tourism consumption is determined by a domestic tourist consumption share (equation 13).

Local private consumption by bundle of commodity $u^R_{CL,w}$ is determined on the basis of a use matrix for private consumption (B^R_{CL}) (equation 10), whereas domestic tourist consumption is divided into type of tourism ($B^{R,D}_{CT}$) (equation 14).

Private consumption including both tourism (domestic and international) and local private consumption (cell Ri) is assigned to the place of the commodity market (cell Si) using a shopping model for local private consumption (equation 11) and for domestic tourism (equation 15).

Finally, local private consumption are transformed from bundles of commodities to commodities (equation 12), whereas domestic tourist demand are divided are transformed from type of tourist to commodity (equation 16).

Foreign tourist consumption is determined by number of tourist by type of tourist and daily consumption (equation 17), which in turn are transformed from type of tourist to commodity (equation 18).

Governmental consumption (cell Ri) is determined by population by group of labor (u_g^R) and labor type specific consumption rates (b_{CO}^R, see equation 19). Governmental consumption by commodity $u_{CO,i}^R$ is determined on the basis of a use matrix for governmental consumption (B_{CO}) (equation 20).

Intermediate consumption together with private consumption, governmental consumption and investment constitute the total local demand for commodities (cell Si) (equation 21). Local demand is met by imports from abroad and other regions in addition to local production (equation 22). Domestic demand is fulfilled by foreign import and by domestic supply (equation 23) involving import from other region and production from the region itself.

Through a trade model exports to other regions and production for the region itself is determined (equation 24). Adding export abroad, gross output by commodity is determined (cell Pi) (equation 25). Through a reverse Make matrix the cycle returns to production by sector (cell Pj) (equation 26).

4.5 The solution to the model

By rearranging the model in structural form (equation 1-26), the solution to the model is obtained:

$$x = \left[I - DT(i-d_i^{S,F}) \circ S_{IC} B_{IC} b_{IC} - \begin{bmatrix} DT(i-d_i^{S}) \circ B_{CL}^{S} S_{CL} S_{CL} B_{CL}^{R} (i-b_{CT}^{R}) \\ +DT(i-d_i^{S}) \circ B_{CT}^{S,D} S_{CT} B_{CT}^{R,D} b_{CT}^{R} \end{bmatrix} \circ b_{CP} \circ (pu_{CP,g})^{-1} \circ pv_g^R \circ v_g^R \circ JGg_j^P \right]^{-1}$$

$$\begin{bmatrix} DT(i-d_i^{S,F}) \circ B_{CT,m}^{S,F} b_{CT} \circ tour_m^{F,S} \\ +DT(i-d_i^{S,F}) \circ S_{CO} B_{CO} u_{CO,g}^R \\ +DT(i-d_i^{S,F}) \circ u_{I,i}^S \\ +z_i^{P,F} \end{bmatrix} \quad \text{.....(27}a\text{)}$$

Formulating the solution as power series expansion the round by round solution to model is

derived:

$$x = \begin{bmatrix} I + \left[DT(i-d_i^{S,F}) \circ S_{IC} B_{IC} b_{IC} + \begin{bmatrix} DT(i-d_i^{S}) \circ B_{CL}^{S} S_{CL} S_{CL} B_{CL}^{R} (i-b_{CT}^{R}) \\ +DT(i-d_i^{S}) \circ B_{CT}^{S,D} S_{CT} B_{CT}^{R,D} b_{CT}^{R} \end{bmatrix} \circ b_{CP} \circ (pu_{CP,g})^{-1} \circ pv_g^R \circ v_g^R \circ JGg_j^P \right]^1 \\ + \left[DT(i-d_i^{S,F}) \circ S_{IC} B_{IC} b_{IC} + \begin{bmatrix} DT(i-d_i^{S}) \circ B_{CL}^{S} S_{CL} S_{CL} B_{CL}^{R} (i-b_{CT}^{R}) \\ +DT(i-d_i^{S}) \circ B_{CT}^{S,D} S_{CT} B_{CT}^{R,D} b_{CT}^{R} \end{bmatrix} \circ b_{CP} \circ (pu_{CP,g})^{-1} \circ pv_g^R \circ v_g^R \circ JGg_j^P \right]^2 \\ + \left[DT(i-d_i^{S,F}) \circ S_{IC} B_{IC} b_{IC} + \begin{bmatrix} DT(i-d_i^{S}) \circ B_{CL}^{S} S_{CL} S_{CL} B_{CL}^{R} (i-b_{CT}^{R}) \\ +DT(i-d_i^{S}) \circ B_{CT}^{S,D} S_{CT} B_{CT}^{R,D} b_{CT}^{R} \end{bmatrix} \circ b_{CP} \circ (pu_{CP,g})^{-1} \circ pv_g^R \circ v_g^R \circ JGg_j^P \right]^3 \\ + o\ o\ o\ o\ o \end{bmatrix}$$

$$\begin{bmatrix} DT(i-d_i^{S,F}) \circ B_{CT,m}^{S,F} b_{CT} \circ tour_m^{S,F} \\ +DT(i-d_i^{S,F}) \circ S_{CO} B_{CO} u_{CO,g}^R \\ +DT(i-d_i^{S,F}) \circ u_{I,i}^S \\ +z_i^{P,F} \end{bmatrix} \quad \text{.....(27}b\text{)}$$

From both formulations in equation 27a and 27b it can be seen, that the impact of ***foreign tourist consumption*** depend upon

- number of tourist $tour_m^{S,F}$
- daily tourist consumption b_{CT}
- commodity composition of tourist consumption $B_{CT}^{S,F}$

The impact of ***domestic tourist consumption*** depend upon

- the share of domestic tourist consumption out of local private consumption b_{CT}
- daily tourist consumption b_{CT}
- commodity composition of tourist consumption $B_{CT}^{S,F}$

- shopping structure or travelling patterns of domestic tourist $S_{CT}^{R,S}$
- commodity composition of domestic tourist consumption $B_{CT}^{S,D}$

Further, ***business tourist consumption*** depend upon intermediate consumption in expenditure in travelling, lodging, meals and more specialized services such as conference services etc. For business tourist expenditure the impact depends upon

- the share of business tourist commodities out of total intermediate consumption B_{IC}
- shopping structure or travelling patterns of business tourist $S_{CT}^{R,S}$

Total impact of demand for tourist commodities depend upon

- foreign import shares d_i^S and
- the inter- and intraregional trade T in tourist commodities as well as all other commodities.

4.5 Four approaches to impact assessment – a mathematical definition

Using the general interregional quantity model impacts on employment of tourism and culture can now be defined mathematically:

In the ***simple production and sector approach*** (=approach I) the impacts is the summation of employment in tourism or culture sectors:

$$I_{Employment,Tourism}^{Approach\ I} = i_{j=tourism}' q_j^P \qquad (28a)$$

$$I_{Employment,Culture}^{Approach\ I} = i_{j=culture}' q_j^P \qquad (28b)$$

In the ***simple demand or commodity approach*** (=approach II) the impact is the summation of tourism demand or the summation of demand for culture commodities:

$$I_{Consumption,Tourism}^{Approach\ II} = i_{i=tourism}' u_{IC,i=tourism}^S + i_{i=total}' u_{CT,i}^{S,F} + i_{i=total}' u_{CT,i}^{S,F} \qquad (29a)$$

$$I_{Employment,Culture}^{Approach\ II} = i_{j=culture}' u_i^S \qquad (29b)$$

In the ***simple regional satellite account approach*** (=approach III) the impacts are three fold:

1. The impact on demand as in simple demand or commodity approach – see equations (30a)=(29a) and (30b)=(29b)
2. The direct impact on employment of the demand for tourism and culture
3. The direct impact from type of households from direct impacts demand

Ad 2. The direct impact on employment of the demand for tourism and culture

The direct impacts on employment can be found by inserting the direct impacts on demand into equations (23) – (26) and equation (4), which gives the following results:

$$I^{Approach\ III}_{Employment,Tourism} = g^P_j \circ DT(i - d^F_i) \circ I^{Approach\ II}_{Consumption,Tourism} \qquad (30c)$$

$$I^{Approach\ III}_{Employment,Culture} = g^P_j \circ DT(i - d^F_i) \circ I^{Approach\ II}_{Consumption,Culture} \qquad (30d)$$

Ad 3. The direct impact from type of households from direct impacts demand on private consumption gives the following impacts:

$$I^{Approach\ III}_{Consumption,Residential\ Tourism} = S^{Reverse}_{CT} \circ I^{Approach\ II}_{Private\ Consumption,Tourism} \qquad (30e)$$

$$I^{Approach\ III}_{Consumption,Residential\ Culture} = S^{Reverse}_{CP} \circ I^{Approach\ II}_{Private\ Consumption,Culture} \qquad (30f)$$

In the ***extended regional satellite account approach*** (=approach III) the impacts also include the derived effects, including the indirect and the induced effects are also three fold:

1. The impact on demand as in extended demand or commodity approach
2. The direct impact on employment of the demand for tourism and culture
3. The direct impact from type of households from direct impacts demand

Ad 1. The impact on demand as in extended demand or commodity approach
The point of departure in the extended satellite account approach is the solution to the general interregional model for gross output, which gives the following impacts on employment:

$$q^P_j = g^P_j \circ x$$

$$= g^P_j \circ \left[\begin{array}{l} I - DT(i - d^{S,F}_i) \circ S_{IC} B_{IC} b_{IC} \\ - \left[\begin{array}{l} DT(i - d^S_i) \circ B^S_{CL} S_{CL} S_{CL} B^R_{CL} (i - b^R_{CT}) \\ + DT(i - d^S_i) \circ B^{S,D}_{CT} S_{CT} B^{R,D}_{CT} b^R_{CT} \end{array} \right] \circ b_{CP} \circ (pu_{CP,g})^{-1} \circ pv^R_g \circ v^R_g \circ JGg^P_j \end{array} \right]^{-1}$$

$$\left[\begin{array}{l} DT(i - d^{S,F}_i) \circ B^{S,F}_{CT,m} b_{CT} \circ tour^{F,S}_m \\ + DT(i - d^{S,F}_i) \circ S_{CO} B_{CO} u^R_{CO,g} \\ + DT(i - d^{S,F}_i) \circ u^S_{I,i} \\ + z^{P,F}_i \end{array} \right] \qquad (31a)$$

5 Regional Tourism Impact for Danish municipalities

Tourism revenue in Denmark was 9.8 billion euro (equivalent to 13.6 billion USD) in 2006. Tourism total contribution to national gross domestic product was 7.3 billion euro (equivalent to 10.2 billion USD) in 2006, which accounted for 4% of national GDP. Tourism created 126 000 jobs in Denmark, which accounted for 4.6% of total employment.

5.1 The simple supply or sector approach (share of employment in tourism sectors)

Tourism supply shares can be measured by production value, GDP or employment in the tourism related sector as a share in all sectors. It is important to define the tourism sectors in order to make accounting of production, GDP and employment for these sectors. A single sector within the national accounts that is called "tourism" sector does not exist due to the fact that tourism is a typically demand-driven activity. According to UNWTO, a certain economic sectors (the main economic activities are tourism) are defined as tourism industries (UNWTO, 2008), such as hotels and restaurants, main transport services which are mainly related to the passenger transport, car rental, travel agencies and tourist guide service and a certain cultural service and sport activities.

In this paper the employment is applied to calculate the tourism supply shares in each municipality. The tourism supply shares represent the shares of employment in the tourism related sectors – which is accounted by a detailed level of sectors. Figure 3 shows tourism supply shares by municipality in Denmark, which can be seen that the islands and peripheral regions have high shares of tourism related industries. Nearly all the islands have more than 10% of the employment in tourism industries. Copenhagen is the single city that has relatively high share (7%) of employment in tourism sectors. Other large cities have 4-5% of employment in tourism.

5.2 The simple demand or commodity approach (Tourism demand as share of private consumption)

Tourism demand shares are measured by the shares of tourism spending in the regional total private consumption. The tourism demand shares represent the shares of consumption spent by tourists in the region. Figure 4 shows tourism demand shares by municipality in Denmark. Again the islands and peripheral municipalities normally have the highest shares of tourism consumption. The extreme case is island Fanø that has 65% of private consumption due to tourist spending. Other islands communities also have quite high shares in tourism consumption. Large city, like Copenhagen has 23% and Aalborg has 11% of tourism consumption. Other two large cities, Århus has 7.3 and Odense has 6% of tourism consumption in the total private consumption.

5.3 The simple satellite account approach (Tourism direct employment effects as share of employment)

By applying the local macroeconomic model – LINE, the tourism expenditure at the place of demand can be transformed into place of production by a trade model between the regions. As most of tourism services are non-tradable goods and services, such as hotels and restaurants, the place of demand is also the place of production. The model can provide estimation of tourism direct effects on production, GDP and employment, which could be distributed into regions and sectors. For example, by reducing (or increasing) a certain amount of tourism spending or assuming tourism spending as zero, the model gives tourism direct employment effects after finish one round of circuit. The tourism direct effects indicate the number of jobs will be directly affected in the tourism sectors if tourism expenditure is reduced (or increased) or become zero. In this case the tourism indirect and induced effects have not been included yet.

Figure 5 shows the tourism direct employment effects by municipality. A special case is the island Fanø, 27% of employment will be affected by tourism. Other 14 municipalities, most of them are islands or peripherally located in Denmark, have 4.5% to 10% of direct employment effects. Copenhagen has 4.45% of a direct employment effect, while other cities, apart from Aalborg has 3.1%, Århus and Odense have only 1.5% of direct employment effects.

5.4 The extended satellite account approach (Tourism total employment effects as share of employment)

Tourism total employment effects are direct, plus indirect and reduced effects. Practically in the impact calculation, the model will continue a number of rounds in the circuit, until the changes are so small that we can neglect it. Theoretically explaining for the indirect effects is that tourism sectors have backward linkage, i.e. the sectors need inputs, such as hotels need to purchase food from food sectors in order to give breakfast at hotels. The induced effects are created by the spending of employees at hotels and food sectors. This spending brings other rounds of multiplier effects in the economy.
Figure 6 shows the tourism total employment effects by municipality. The island Fanø is still shown as the highest share of total employment effects. Most of island and peripherally located municipalities have higher shares than the other regions due to their attraction to tourists. The total tourism effects have nearly the same pattern as the direct effects.

5.5 Comparison and discussion

Tourism revenue covers six types of tourism, i.e. inbound same-day and inbound overnight tourism; domestic leisure same-day and domestic leisure overnight tourism; domestic business same-day and domestic business overnight tourism. Number of tourists or tourism revenue by these types is quite different among the municipalities. For example, inbound same-day tourism only visited certain border regions; most of summer cottage type of tourists concentrated on the coastal regions. Hotel guests are more likely staying in the cities, while tourists staying in summer cottages and camping sites are preferred in the coastal and peripheral regions. Tourist attractions among the regions are also quite different. The cities have multiple cultural facilities that give tourists more cultural experiences, the islands and peripheral regions attract tourism by the ‘nature’ and the unique environment. There are also numbers of attractions that were built for tourism purposes, such as ‘Legoland’.

Table 2 presents the top 21 municipalities in the four impact approaches. The position for municipalities could be changed by different approaches. The factors that determined the regional tourism impact by direct and indirect effects have been discussed by Zhang, Madsen and Jensen-Butler (2007). Tourism direct effects are normally influence by volume of tourists and their spending: more tourists and more spending gives high impacts. Tourism indirect and induced effects depend on several factors. First of all, the composites of tourism expenditure give different effects. For example, the tourists spend more on services (hotel, restaurants, transport), it more likely tourism create relative large effects on the destination regions. The tourist spending on goods will have leakage from the regional economy;

secondly, the regional trade patterns will influence the magnitude of indirect effects; thirdly, the commuting patterns in the regions will also influence the sizes of tourism total impacts, especially for the induced effects. For example, a large share of employed persons in the tourism sectors in one region do not live in the region, instead they commute every day. Therefore the income they earn from tourist spending in the region will transfer to the regions where they live (by paying the income taxes to the local municipalities and their private consumption spend on the region they live). Fourthly the productivity at the tourism sectors will also give a difference in the tourism impact. When tourism productivity is relatively higher in the large cities, the employment multipliers are relatively smaller than the peripheral regions where the productivities are lower.

Table 2 The top 21 tourism relatively important municipalities in Denmark

	Tourism supply shares		Tourism demand shares		Tourism direct employment effects		Tourism total employment effects	
1	Læsø *	17,76	Fanø *	64,62	Fanø *	27,14	Fanø *	46,54
2	Fanø *	15,22	Læsø *	31,38	Læsø *	9,79	Læsø *	16,84
3	Samsø *	14,04	Copenhagen #	22,96	Jammerbugt	7,16	Bornholm *	12,44
4	Ærø *	11,00	Langeland *	21,01	Bornholm *	7,09	Jammerbugt	12,02
5	Bornholm *	9,49	Jammerbugt	20,93	Langeland *	6,59	Langeland *	11,94
6	Syddjurs	8,37	Bornholm *	20,45	Frederikshavn	5,82	Frederikshavn	9,62
7	Frederikshavn	7,08	Frederikshavn	18,74	Nyborg	5,37	Helsingør	9,51
8	Copenhagen #	7,07	Tårnby	18,49	Dragør	5,33	Nyborg	9,16
9	Hjørring	6,60	Samsø *	17,70	Syddjurs	5,30	Syddjurs	9,11
10	Stevns	6,51	Varde	17,66	Helsingør	4,91	Dragør	8,85
11	Solrød	6,45	Ringkøbing-Skjern	17,18	Halsnæs	4,57	Samsø *	8,63
12	Langeland	6,43	Tønder	16,64	Tønder	4,54	Copenhagen #	8,26
13	Nyborg	6,39	Syddjurs	15,47	Varde	4,51	Tønder	8,23
14	Svendborg	6,36	Helsingør	14,57	Samsø *	4,49	Halsnæs	8,00
15	Gribskov	6,25	Odsherred	14,14	Copenhagen #	4,45	Gribskov	8,00
16	Jammerbugt	6,03	Struer	13,91	Odsherred	4,27	Odsherred	7,99
17	Varde	5,96	Vesthimmerlands	13,67	Vesthimmerlands	4,20	Varde	7,88
18	Middelfart	5,91	Nyborg	13,58	Gribskov	4,16	Stevns	7,25
19	Helsingør	5,79	Billund	12,31	Ærø *	3,97	Tårnby	7,07
20	Fredensborg	5,74	Hjørring	11,83	Ringkøbing-Skjern	3,95	Vesthimmerlands	7,01
21	Morsø *	5,73	Aalborg #	11,16	Tårnby	3,91	Ærø *	6,77

Notes: the * denotes for island municipalities and # denotes for large cities.

6. Summary

In this paper, 4 approaches for evaluating the impacts of tourism and culture – the supply or sector approach (I), the demand or commodity approach (II), the simple satellite account approach (III) and the extended satellite account approach (IV) – are identified. The four approaches are examined using the two-by-two-by-two principle, putting focus on different type of actors and geographical location for economic activities: Actors are the producers

within tourism and culture (tourism or culture sectors), commodities (such as tourism and culture commodities), production factors or labour (such as tourism or culture workers) and households or tourist groups (such as beach tourists or urban tourists). Geographically, the places of production, residence, commodity market and factor market are identified. On this basis the general model for tourism and culture is presented. The model is solved mathematically and formulas for the impacts based on the four approaches are presented.

Impacts of tourism on local economy in Danish municipalities are presented. Impacts are measured in relative terms and are highest for island municipalities and for urban centres, especially for the centre of Copenhagen where absolute number of tourists is highest. Tourism impacts in relative terms tend to show the tourism importance in the local economies. Relative impacts differ according to impact methods, but results are strongly correlated. Especially, there are differences in simple regional tourism satellite and extended satellite accounts reflecting differences in multipliers, where closed municipalities (islands). Accordingly, for big municipalities the derived effects are bigger, because of relatively smaller leakages. For integrated urban areas (Greater Copenhagen as one area and bigger urban areas such as Aarhus and Aalborg) the leakages are also smaller, which increases relative impacts in the extended satellite account.

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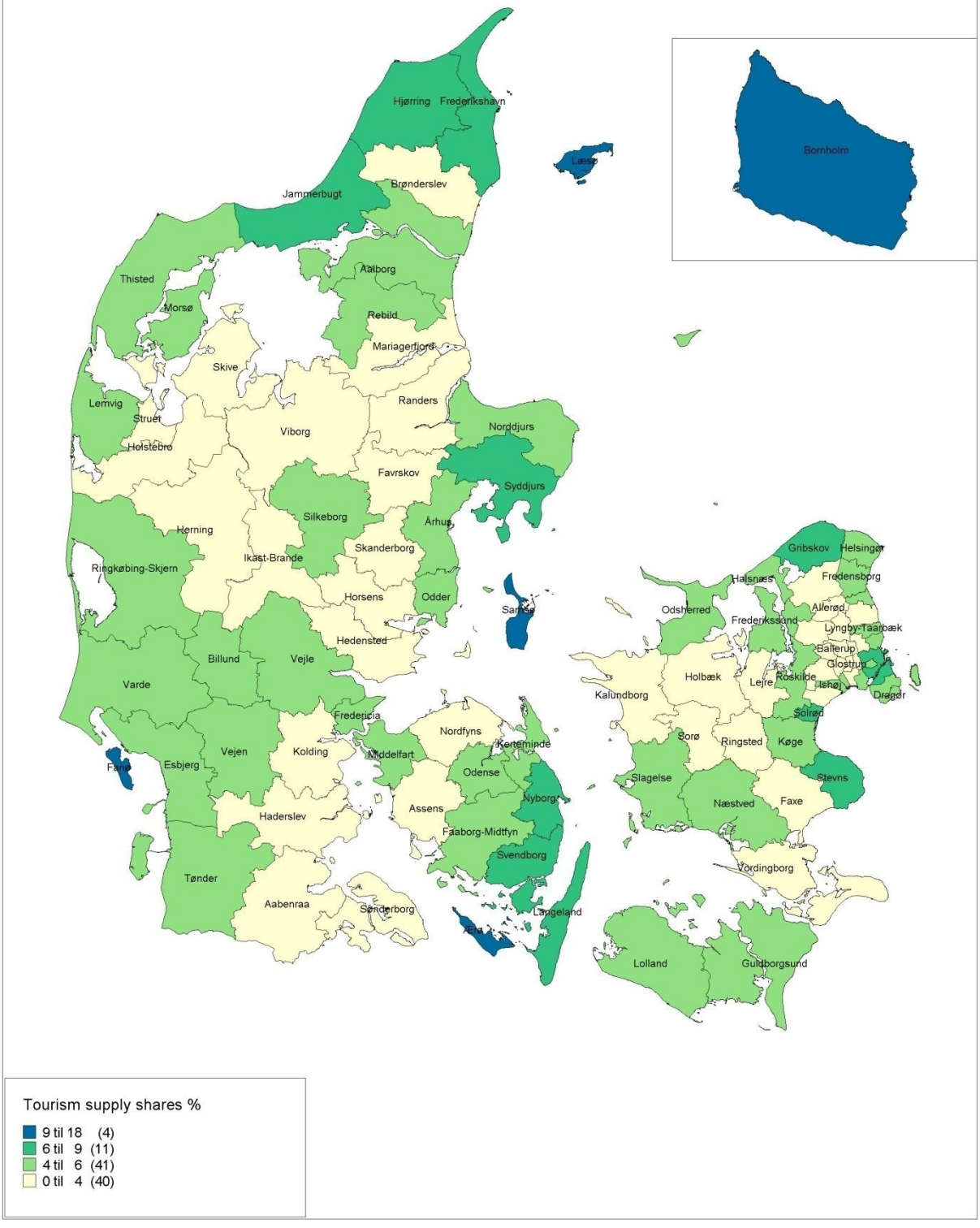
Appendix: Figure 3-6 are GIS maps for the tourism impacts at municipalities in Denmark.

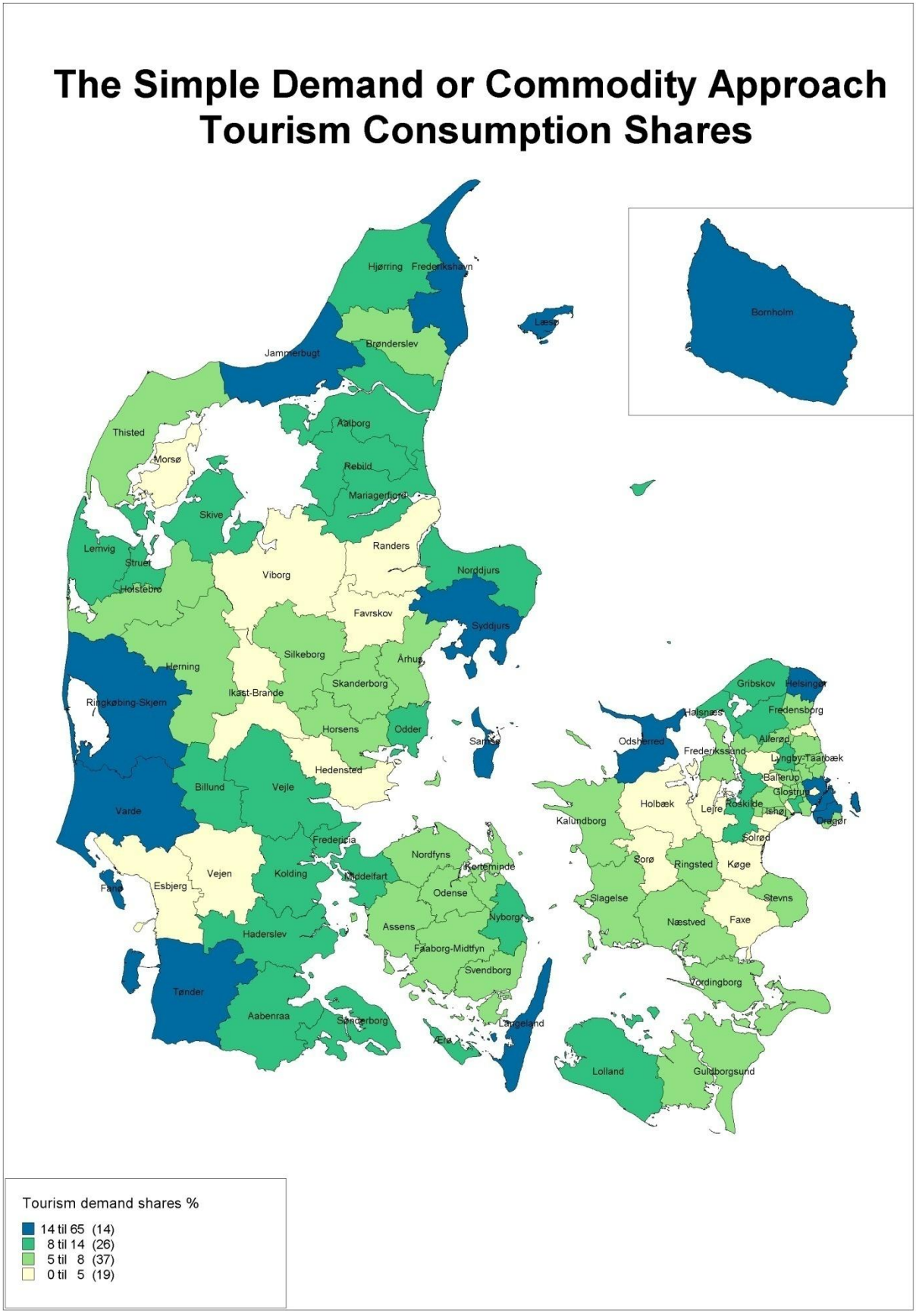
The Simple Supply or Sector Approach
Tourism Employment Shares



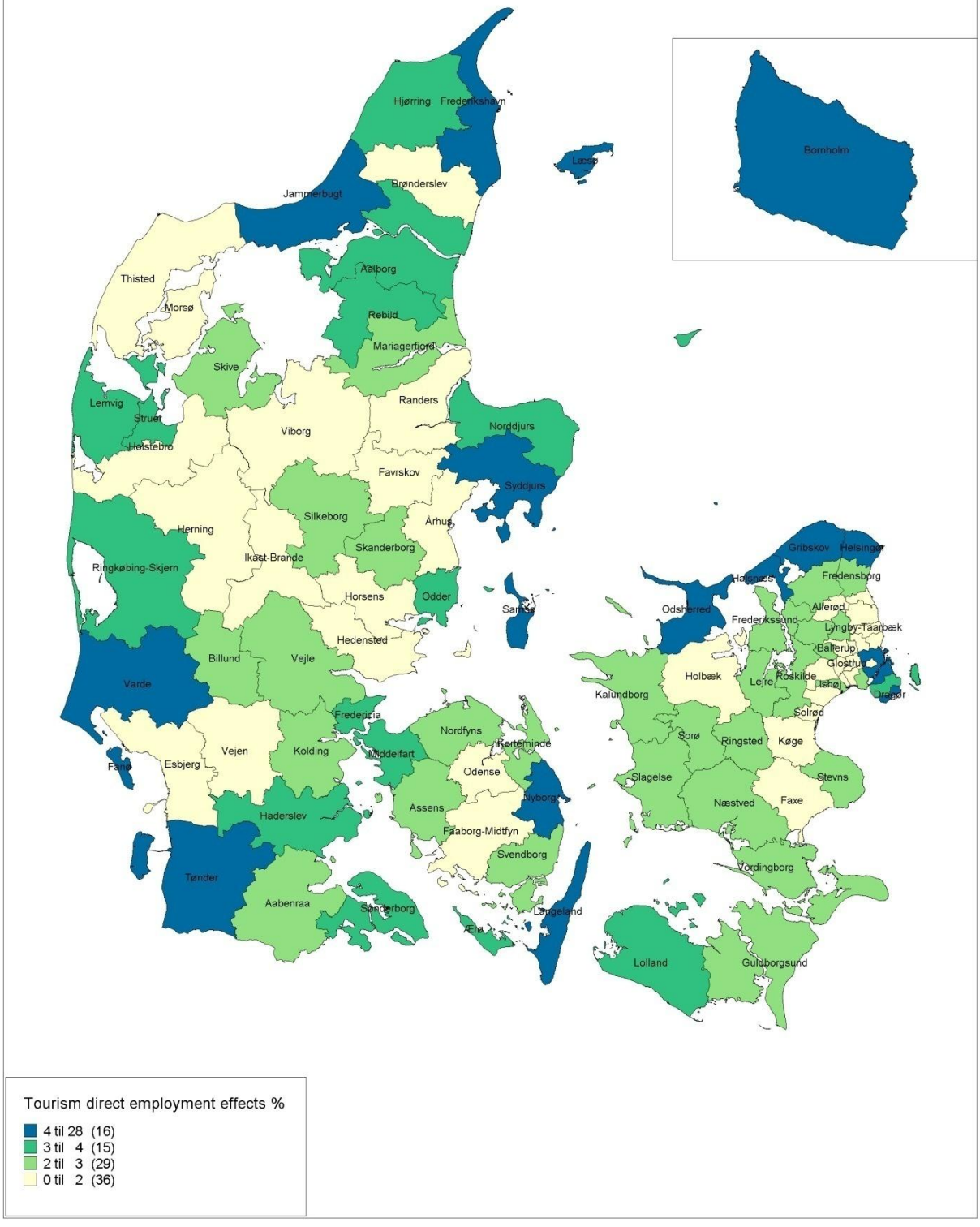
Tourism supply shares %

- 9 til 18 (4)
- 6 til 9 (11)
- 4 til 6 (41)
- 0 til 4 (40)

The Simple Demand or Commodity Approach
Tourism Consumption Shares



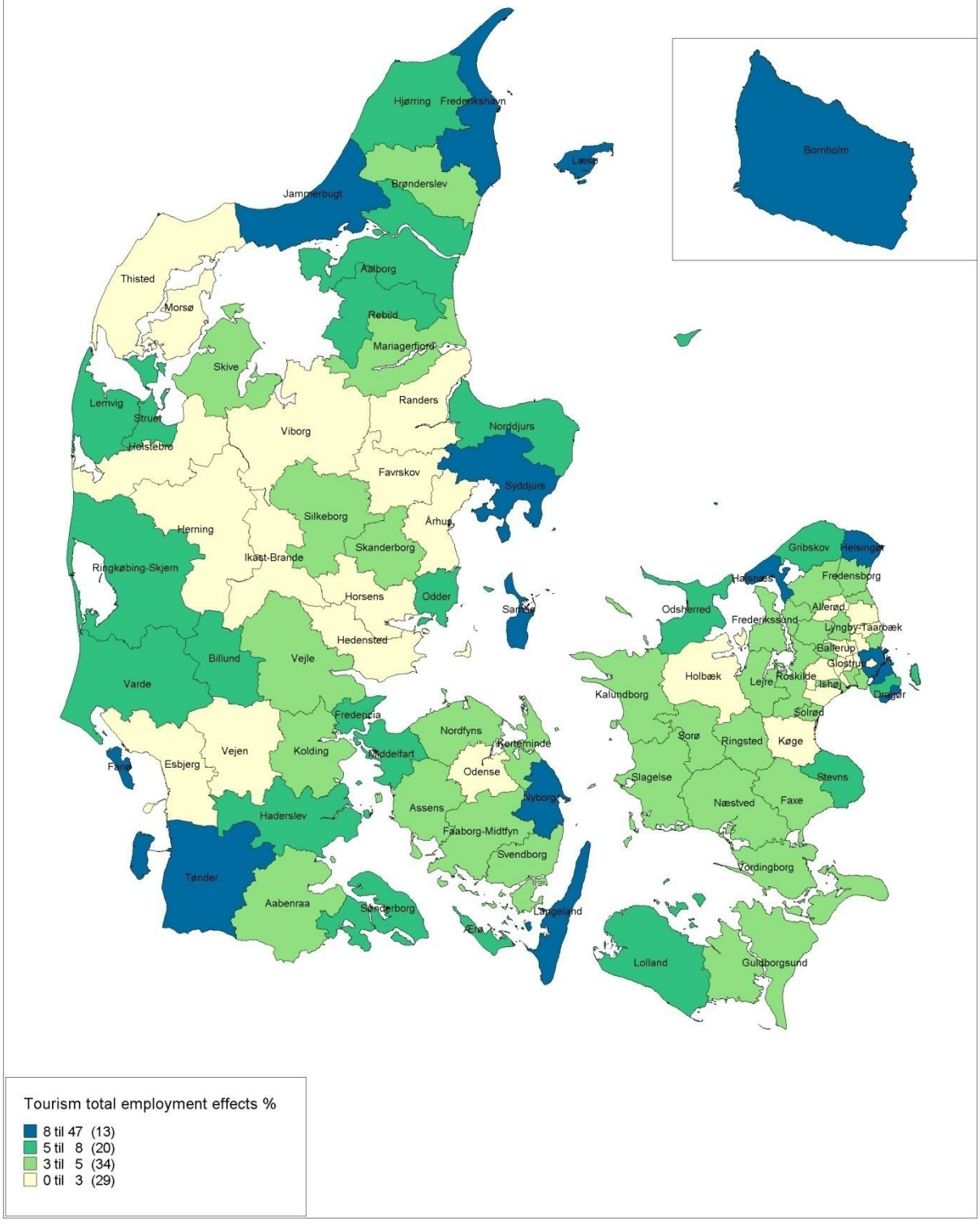
The Simple Satellite Account Approach
Tourism Employment Shares



Tourism direct employment effects %

- 4 til 28 (16)
- 3 til 4 (15)
- 2 til 3 (29)
- 0 til 2 (36)

The Extended Satellite Account Approach
Tourism Employment Shares



Tourism total employment effects %

- 8 til 47 (13)
- 5 til 8 (20)
- 3 til 5 (34)
- 0 til 3 (29)