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## Tourism Impact Analysis on Danish Regions

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# Tourism Impact Analysis on Danish Regions

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# 1. Introduction

Over the last quarter of the century, tourism has gradually become an important industry in many countries in the world. Tourism revenue has become one of the important sources of export earnings and the key factors in the balance of payment for many developing countries and regions. Tourism plays a more and more significant role in both national and regional economies, as tourism has a potential to be a new economic and job generator. For example, World Travel and Tourism Council (WTTC) estimated that international tourism and travel in 1998 created 10 percent of the global GNP and created 212 million jobs in the world<sup>1</sup>.

Tourism impact analysis has been conducted in many countries for several decades now. The dramatic growth of tourism demand in both urban and rural regions in the past thirty years has drawn the academic interest to the tourism impact studies. Some researches used Leontief's input-output model for tourism impact analysis, and others applied Keynes' model or general equilibrium model. The purpose of modeling is to find an appropriate tool for analyzing the regional consequences of tourism.

The purpose of this paper is twofold, i.e. to introduce our tool - the Danish interregional general equilibrium model, LINE, and to apply the model for tourism impact analysis. The paper contains six sections. Section two discusses the methodology of measuring tourism impact. After an overview of different models in the tourism impact studies, the theoretical framework for setting up models is examined. Section three presents the Danish LINE model. It focuses on presenting the two circles in the model and the tourism sub-model. The fourth section shows the tourism demand in each of the Danish regions and makes a comparison upon them. The tourism data sources in Denmark and methods of using the data are presented here. It is also provided, in the section, with the information concerning regional tourism consumption compared with the regional GDP at factor cost, as well as the information about tourism employment in the regions. Section five presents the results from the analysis. Tourism impact is modeled based on different scenarios. Three scenarios are conducted in the analysis: 1) foreign same-day tourist consumption in Denmark, 2) foreign ordinary tourist consumption in Denmark, 3) domestic tourist consumption, and finally the overall tourism consumption. Several regional economic indicators are presented and discussed in the section. Finally, a conclusion is given in the last section.

## 2. Methodology of measuring tourism impact

Making a literature survey on tourism impact analyses, one can easily find many contributions in this field. At the same time one may ask for the methodology applied in these analyses. The Leontief's input-output (IO) model is a traditional method that has been applied the most frequently in tourism impact studies, for example, Fletcher (1989)<sup>2</sup>, Archer and Fletcher (1996)<sup>3</sup>, Freeman and Sultan (1997)<sup>4</sup>, Frechtling and Horvath (1999)<sup>5</sup> and etc. Wagner (1997)<sup>6</sup> has applied a SAM model in his tourism impact analysis. Zhou *et al.* (1997)<sup>7</sup> used both computable general equilibrium (CGE) model and the IO model to examine the impact of tourism on the regional economy. They compared the results from both models and gave comments on the two models.

Hansen (1970)<sup>8</sup> points out that “two static general equilibrium systems have dominated modern macro-economics, i.e. the Keynes’ system and the Leontief’s input-output system” (p. 71). The Keynes’ model is based on the premise that the value of the multiplier is derived from the ratio of exogenous expenditure to the proportion of leakage experienced by the economy, such as saving, import, etc. Compared to Keynesian model, Leontief’s input-output model is more simple and straightforward. The IO model is based on an inter-industry transaction table, focusing upon the flows of transactions between the various productive sectors of the economy.

The consequence of changes in exogenous expenditure based on the Keynesian model will give several rounds of extra increases in other economic indicators, such as gross output, income, taxation and employment in the economy. These effects can be included as both direct /indirect multipliers and total multipliers (induced effect is normally included in the total multipliers). In an IO model, there are also two types of multipliers based on two types of models. Type I income (or employment) multiplier refers to the ratio of “direct + indirect” income (or employment) effect to direct income (or employment) effect. The model is normally called “an open model”, as it is based on simple household income multiplier by assuming that the household sector remains exogenous to production (Miller and Blair, 1985<sup>9</sup>). Type II multiplier refers to the ratio of “direct + indirect + induced” effect to direct effect, which is calculated based on “a closed model” with respect to households. I-O type closed model is a partially closed model, because only a household sector is included into the transaction table, which makes the household private consumption endogenously determined.

Some researchers have already made comprehensive comparisons between the Keynesian models and the IO models (see Fletcher and Archer (1991)<sup>10</sup>, Briguglio (1993)<sup>11</sup>, Zhou *et al.* (1997)<sup>12</sup> and Wagner (1997)<sup>13</sup>). Briguglio L. believed that “the main advantage of an input-output model over a Keynesian expenditure macro-model for computing multipliers is that with the former the effect of an exogenous change can be decomposed at industrial or sectoral level”. The above-mentioned disadvantage for the Keynesian model has been overcome by constructing SAM models with sectoral linkage, in which the impact on industries or sectors can also be revealed. Zhou *et al.* claimed that “IO models include intersectoral flows of intermediate inputs and capture one major source of linkages in the economy. However, the IO model ignores the flows from production sectors to factors of production (value added) and then to entities such as the government and household sectors and finally back to the demand for goods”.

In spite of the distinction that exists between the Keynesian models and the IO models, it is argued in this paper that two types of models can be combined into one system, in a way that the advantages of each model should be preserved. Fletcher and Archer wrote “In fact Leontief’s equilibrium system can be fully absorbed into the Keynesian general equilibrium system as it has been modified throughout the neo-Keynesian period”. An IO model can be seen as a Keynesian system that incorporates the production of intermediate goods. Wagner supported this view, by saying that “an IO model can do similar analysis as an SAM, the latter is a more thorough methodology. In fact an IO model is a subset of an SAM.” This point could be explained by the following theoretical formulas.

A standard Keynesian model can be expressed simply at an aggregated level by

$$Y = C + G + I + (X - M)$$

If  $Y = Z - V$   
 Then  $Z - V = C + G + I + (X - M)$   
 Or  $Z + M = V + C + G + I + X$  (1)

where Y - GDP; C - private consumption; G - governmental expenditure; I – investment; X – export; M – import; Z - gross output; V - intermediates purchased demand.

The left side in formula (1) represents the total supply of the economy and the right side is the total demand of the economy.

Import can be separated into two parts. One part of import is required by intermediate demand, and the other part is demanded from final demand, hence

$$M = M_1 + M_2$$

where  $M_1$  is import for intermediate demand;  $M_2$  is import for final demand.

The final demand (D) for domestic goods is

$$D = C + G + I + X - M_2$$

where  $M_2$  represents a leakage for national economy.

Intermediate purchased demand (U) can now be shown by two matrices

$$U = V + M_1$$

where V represents intermediate purchases from domestic industries and  $M_1$  is intermediate purchase demand from abroad. The formula can now be expressed by

$$Z_i = \sum_j U_{ij} + D_i \quad (2)$$

There is a relationship between  $Z_i$  and  $U_{ij}$ . We assume that

$$a_{ij} = \frac{U_{ij}}{Z_i} \quad (3)$$

then

$$Z_i = \sum_j a_{ij} Z_j + D_i \quad (4)$$

where  $Z_i$  is gross output in sector  $i$ ;  $D_i$  is final demand for products from sector  $i$ ;  $a_{ij}$  is a matrix of input-output coefficients, which here is represented by two matrices: the intermediate input matrix,  $V_{ij}$  and the import input matrix,  $M_{2ij}$ .

Formula (4) now is seen quite similar to a standard input-output formula (5) and (6):

$$X_i = A_{ij} X_j + Y_i \quad (5)$$

$$X_i = (I - A_{ij})^{-1} Y_i \quad (6)$$

where  $X_i$  is gross output in sector  $i$ ;  $Y_i$  is final demand for commodities produced in sector  $i$ ;  $A_{ij}$  is a matrix of technical coefficients.

The advantage of Keynes-type models over the IO models is that a full national accounting system has been built in order to let the demand side get feedback from changes in productive sectors. Furthermore, CGE models based on the full national accounting system can be more flexible and complete than the IO models in simulating and evaluating the economic consequence initiated by the changes in exogenous variables. They are also superior in capturing the intersectoral and macroeconomic linkages between the different actors in the economy. If the price-cost circuit is built in the CGE model, the endogenous price effect and other factors should also be reflected in the model.

### 3. The Danish LINE model

LINE is an interregional general equilibrium model for the Danish local economy developed by the Institute of Local Government Studies - Denmark (AKF) (see Madsen *et al.* (2001)<sup>14</sup> and Madsen *et al.* (2001)<sup>15</sup>). The LINE model is built in the same framework as the computable general equilibrium, however, several features or characteristics are added in the model. Firstly, spatial dimensions are available in the model, which are distinguished by place of production, place of residence and place of demand. Because of this feature, sub-models for commuting, tourism, shopping and inter-regional trade can be easily constructed in the LINE model. Secondly, make and use matrices are appropriately applied in the LINE model. The make matrix tells us about which productive sectors produce which commodities, and the use matrix informs us with which commodities are bought by sectors from intermediates demand and which commodities are demanded by different components of final demand. Therefore, sectors from production side and components from final demand side can be linked with each other by commodities in the commodity market. The third feature is that data construction is based on a social accounting matrix (SAM). SAM for Danish municipalities (SAM-K) contains five accounts: “productive sectors”, “qualification groups, such as age, gender and education”, “institutions, such as household, firms, government and others”, “components of final demand” and “commodities”. The fourth feature is that the model structure is presented by two circles: a real circle, in accordance with Keynesian demand theory, and a price-cost circle, in accordance with procedures from production cost to market price.

To show more clearly the characteristics of the LINE model, the following table is presented.

Characteristics of models	Choice of the LINE model
Spatial	National:    Regional:    Interregional: X
Computable	Theoretical:                      Computable: X
General	General: X                              Partial:
Equilibrium	In commodity market: X    Labor market:    Capital market:
SAM	SAM: X                                      IO:
Make and Use matrices	Make-Use matrices: X    Activity matrices:

Note: X -sign shows the feature that the LINE model comprises.

The LINE model, on the one hand, is a general equilibrium type with respect to commodity market and private consumption. The total supply and demand at commodity level reaches to full equilibrium after each round of modeling. The make and use matrices match with each other in the commodity market. Private consumption by household is fully

integrated into the model and it is determined by the disposable income of residential households. It is assumed a constant share of the households' private consumption and the saving to their disposable incomes. On the other hand, the model has not reached to equilibrium in the labor market, as it is assumed that the labor market is fully elastic and there is no constraint in the supply of labor, as addressed by Briassoulis (1991)<sup>16</sup>. The model is still a static one, as investment multiplication and technology dynamics have not been included in the model. The governmental function is partially included in the model, as income tax, other taxes, transfer income to unemployed labor and value-added tax are included in the model, however, a general public expenditure still functions as an exogenous variable.

Figure 1 shows the general model structure of the LINE model. The horizontal vector shows spatial dimension: "place of production" (A), "place of residence" (B) and "place of demand" (D). The vertical dimension shows the SAM-K structure by "sector" (E), "qualification group" (G), "institution" (H), "component" (W) and "commodities" (V).

The real circle goes clockwise, as shown in Figure 2, corresponding to the Keynesian demand theory. It starts from the upper left corner, where production generates factor incomes in basic prices including the part of income used to pay commuting costs. This factor income is transformed from place of production by sector (AE) to place of residence by group (AG), then further to place of residence by group (BG) through a commuting model. Employment follows the same path from place of production by sector (AE) to place of production by group (AG), then eventually to place of residence by group (BG). Employment and unemployment, earned income and income transfers, taxes and disposable income are determined in this square.

Disposable income is calculated in current prices where taxes are deducted, and income transfers and other incomes are added. Disposable incomes are distributed from factors (BG) to households and firms (BH). Disposable income is the basis for determination of private consumption in market prices, by place of residence (BW). Private consumption is assigned to place of demand (DW) by using a shopping model. Private consumption, together with intermediate consumption, public consumption and investment, constitutes the total local demand for commodities (DV) in basic prices through a USE matrix. In this transformation from market prices to basic prices (from DW to DV), commodity taxes, value-added taxes and trade margins are subtracted from the market prices. Local demand is met by imports from other regions and abroad in addition to local production. Through a trade model, exports to other regions and production for the region itself is determined i.e. from DV to AV. Adding export abroad, gross output by commodity is determined. Through a reverse make matrix the circle returns to the production by sector (AV to AE).

The price-cost circle, shown in Figure 3, goes anti-clockwise, corresponding to a mark-up procedure where additional cost elements are added to the price of the commodity as a route from place of production to the market and the buyer. In the diagram AE, the sector basic prices (in current prices) are determined by costs of inputs (i.e. by adding up intermediate consumption, value-added taxes and the indirect taxes). Through a make matrix, factor prices by sector are transformed into sector price by commodity (from AE to AV). It is also transformed from place of production to place of demand (from AV to DV), and then transformed into market prices through inclusion of retailing and wholesaling margins, value-added taxes and the indirect taxes. It is further transformed to demand by component (from DV to DW). This transformation takes place using a reverse use matrix. Finally, private consumption is transformed from place of demand to place of residence in market prices (from DW to BW), and further to place of residence by household (from BW to BH).

The tourism sub-model is integrated into the LINE model, as tourism consumption, covering both domestic tourism and foreign tourist expenditure in Denmark, is part of private consumption. Private consumption by residence is determined by disposable income of residential households. The model for private consumption is composed of four sub-models: 1) residential local private consumption, 2) Danish tourist consumption, 3) foreign ordinary tourist expenditure in Denmark, and 4) foreign same-day tourist expenditure in Denmark.

Figure 4 shows the tourism sub-model in LINE. The tourism sub-model starts from the upper left corner (i.e. BH diagram in Figure 2), where disposable income is the starting point. Disposable income of households generates both local private consumption and Danish tourist expenditure, which cover both domestic tourist expenditure and Danish tourist expenditure abroad. Both local private consumption and the domestic tourist expenditure are transformed into place of demand by a shopping model and a tourism model. Foreign tourist expenditure, both ordinary tourists and same-day tourist expenditure, is assigned to place of demand. Therefore, private consumption by component at place of demand is obtained by adding up four sub-models (DW). The documentation of the private consumption, the tourism sub-model and the data construction is provided in Zhang and Madsen (2001)<sup>17</sup>.

One of the important features in SAM-K system is that a level of aggregation for LINE is more flexible than the previous models. In the present version of the tourism model, it has 13 sectors, 7 social groups, 11 households, 15 components and 21 commodities. There are three levels of aggregations for the data. The data sources are located at the most detailed level, such as there are 275 municipalities, 133 sectors and 128 commodities and 72 consumption components, etc. The middle level is aggregation level for the transformation and the calculation of the data. Eventually data are arranged at the most aggregated level for modelling. This feature makes the model quite flexible in the sense of both spatial dimension and the dimension of the social accounting matrix. The model calculation for this tourism analysis applies the County Model, i.e. interregional model is based on 14 regions in Denmark.



The LINE model creates a large number of regional economic variables, including key indicators as follows:

- Gross output by sector and by place of production
- GDP at factor cost by sector and by place of production
- Employment by sector and by place of production
- Employment and unemployment by sector and by place of residence
- Employment by qualification group and by place of residence
- Disposable income by type of household and by place of residence
- Taxes and different region-based taxes by place of residence
- Transfer incomes by qualification group or by household and by place of residence
- Private consumption by component and by place of demand
- Interregional exports and imports by commodity
- Retailing and wholesaling margins by commodity
- VAT and commodity tax by commodity

#### **4. Tourism Demand in Danish regions**

The Danish Tourist Council has since 1996 carried out a comprehensive tourism survey, called TØBBE<sup>18</sup>. The survey tried to cover all kinds of tourism activities, from business to leisure visitors, from hotel, camping, and summer cottage to yachts, cruises, visiting family/friends and same-day tourists. The survey also covers all regions in Denmark and it includes both domestic and foreign tourism.

Statistics Denmark collects the information about the number of nights spent in various registered places of accommodation. The information about number of visitors in cruises, festival, visiting family/friends and same day visitors is supplemented by the Danish Tourist Council with other sources. Tourist average daily spending is estimated from the basis of around 41,000 interviews. The average daily spending covers the information on nationality, type of accommodation, regions where tourists stayed and regions where tourists made their consumption. The information of daily spending is also distributed to consumption component. This information makes it possible to distribute tourist consumption to different consumption groups. Tourism revenue is calculated as the product of the estimated average daily spending and the number of nights spent in the regions of Denmark. The tourism information from TØBBE is hereafter called TØBBE data, as there is another source of tourism information in Denmark, i.e. from Statistics Denmark. The latter uses payment statistics to estimate the tourism revenue from foreign tourists. The estimation is based on the bank records of currency exchanged by tourists. The tourism data from Statistics Denmark is hereafter called Statistics data.

As Statistics Denmark has no information about domestic tourism, TØBBE data for Danish tourist expenditure are used to separate the tourist consumption from the total private consumption, hence, residential local private consumption is estimated. The foreign same-day tourist expenditure in Denmark is treated as a part of tourism revenue in Denmark.

However, the Danish same-day tourist consumption is treated as residential local private consumption, as we argue that visitors go to museums, amusement parks or eat in restaurants across their own region's border is exactly like going shopping in other regions of Denmark. Hansen and Jensen (1996) have given a comprehensive discussion on definition of tourism in Denmark<sup>19</sup>.

Statistics Denmark has information of foreign tourist consumption in Denmark and private consumption in hotel category within the total private consumption. Differences exist between the TØBBE data and the Statistics data with respect to foreign tourist consumption in Denmark and private consumption in hotels. For example, the TØBBE data show that foreign tourist consumption in Denmark in 1996 is 25.8 billion DKK in 1995 fixed price (approximately equal to 3.9 billion USD<sup>20</sup>), while in the Statistics data it is 19.8 billion DKK (3 billion USD). Regarding private consumption in hotels, TØBBE data reveal it as 9.3 billion DKK (1.4 billion USD), while in the Statistics data it is 2.6 billion DKK (0.4 billion USD).

In the present version of the model, both foreign tourist consumption in Denmark and private consumption in hotel are made in consistence with the Statistics data. Therefore, both variables from the TØBBE data have been scaled down according to the Statistics data. This adjustment no doubt will influence the results of economic consequence analyses by two different data sources.

Table 1 shows tourism consumption by region in Denmark in 1999, with both the TØBBE data and the data used in the model. The total tourism consumption in Denmark according to the TØBBE data in current price, is 41.8 billion DKK (approximately equal to 6.4 billion USD). The largest tourism consumption is placed in the Greater Copenhagen area, where most expensive hotels and tourism attractions are located. The tourism consumption in the Copenhagen area accounts for 21.2 percent of the national total. The counties of Sønderjylland and Nordjylland, located respectively at the south and north part of Jutland peninsula, receive the second and the third largest tourism consumption in Denmark. After scaling down foreign tourist expenditure in Denmark and private consumption in hotels according to the Statistics data, the tourism consumption data applied in the model are lower than that in the TØBBE data. The total tourist consumption applied in the model in 1995 fixed price, shown in the table, is 31.6 billion DKK, which accounts for 85% of the TØBBE data in the fixed price (i.e. 37.2 billion DKK). From Table 1, it can be found that Sønderjylland becomes the region that receives the largest tourism consumption, while the Greater Copenhagen is reduced to the second largest. The reason for the changes is that the effect is great in the region where it has a large share of foreign tourist expenditure, especially a large expenditure in hotels, as is apparently the case for the Greater Copenhagen.

Table 2 compares tourism consumption by region with regional GDP at factor cost. Sønderjylland and Bornholm (an island located in the middle of the Baltic Sea) occupy the first (16.8%) and the second (12.7%) places in shares of own region's GDP. Counties of Frederiksborg, Nordjylland and Ribe follow after them. The shares of these five regions are all above the national average (4.2%), while the Greater Copenhagen is below the average. The table reveals how important a role the tourism plays in the regional economies. For example, tourism consumption on the island of Bornholm accounts for only 2 percent of the national total, but tourism revenue on Bornholm accounts for 12.7 percent of its GDP, showing that tourism is far more important in the regional economy<sup>21</sup>.

Table 3 shows employment in the main tourism sectors and shares of tourism employment in regional total employment. Hotel, restaurant and recreation are the main tourism sectors shown in the table. However, other sectors, such as transport, retailing and private services, which also have different degrees of linkage to the tourism activities, are omitted here. From Table 3 it is found that tourism employment in the Greater Copenhagen and Bornholm accounts for larger shares than the national average. One could expect counties like Sønderjylland, Frederiksborg and Nordjylland should also have large shares of tourism employment. The explanation for the shares being not very high in these three regions is that they have large shares of foreign same-day tourism. Border-shopping tourism is more involved in the local retailing business and other activities.

Table 4 shows foreign same-day tourist consumption by region and shares of nationalities. The total foreign same-day tourist consumption is estimated to 12.8 billion DKK in 1995 fixed price (about 1.9 billion USD), accounting for about 60 percent of total foreign tourist consumption in Denmark. The distribution of foreign same-day tourism is concentrated in the border regions. The county of Sønderjylland received 44.5 percent of total foreign same-day tourist expenditure in Denmark, while the county of Frederiksborg received 23 percent and the county of Nordjylland accounted for 16 percent. In the regions of Sønderjylland, Storstrøm and Fyn, the same-day visitors are Germans. In the regions of Frederiksborg, Århus, the Greater Copenhagen and Bornholm, the same-day visitors are mainly from Sweden. In the region of Viborg the same-day visitors come from Norway, while in the region of Nordjylland, one half of the visitors are from Sweden and another half from Norway.

We have to mention here that tourism revenue from international airlines has not been included in the tourism consumption data. Adding this to what has been mentioned earlier that the Danish same-day tourist consumption has not been included in the tourism data, the tourism economic consequence by using such data must be underestimated.

## **5. Regional Consequences of Tourism**

Tourism impact analysis is set up based on different scenarios. The tourism consumption is divided into three types: 1) foreign same-day tourist consumption in Denmark 2) foreign ordinary tourist consumption in Denmark, and 3) domestic tourist consumption. If we set all three types of tourism consumption into zero, then run the model, the results will be obtained, which show the overall tourism impact in Denmark. The different scenarios can also be analyzed separately by setting only one type of tourism consumption into zero each time to get the economic consequences from the model.

As mentioned above, the LINE model can give a large number of regional economic indicators for analyses. We try to present in this paper the key economic indicators following the real circle, i.e. from place of production by sector, then to place of residence by group and household, then further to place of demand by component and by commodity. The key economic indicators are reflected by the changes in regional output, income, employment, disposable income, taxes and income transfers, private consumption, trade margins, and interregional trade flows, etc.

Table 5 shows the overall tourism impact on gross output by sector by place of production. There is no doubt that tourism has a larger impact on hotel and restaurant sectors. The hotel sector will reduce about one third of its production, and the restaurant sector will reduce about 12 percent of the production in case of no tourism in Denmark. The retailing sector gets also quite a large consequence from tourism. Sector of recreation and sector of processing production for food and beverage will also have a comparatively large impact from tourism. Table 6 and 7 show the overall tourism impact on income and employment respectively, by sector at place of production. The impact is seen to be the same on sectors as showed by Table 5. The overall tourism impact on gross output in Denmark is 1.75. The overall tourism impact on income in Denmark is 1.74. The overall tourism impact on employment in Denmark is 2.03.

Table 8 shows the tourism impact on employment by region. The employment consequences caused by tourism are shown separately by the three scenarios, i.e. foreign same-day tourist consumption, foreign overnight tourist consumption, and domestic tourism consumption. The numbers of absolute changes in employment, as well as percentage changes of employment in the regions for the three scenarios are presented in the table. The percentage changes are calculated by absolute changes in number of employment divided by the numbers of employment in the baseline. In order to show more clearly the picture of tourism impact on employment, two graphs are produced based on the data from this table.

Figure 5 shows the tourism impact on employment by region with absolute changes in number of employment. It is seen from the figure that foreign same-day tourism has larger impact on the counties of Sønderjylland, Frederiksborg, Nordjylland and the Greater Copenhagen than other regions. Foreign overnight tourism is comparatively more important in the Greater Copenhagen, Ringkøbing and Ribe than other regions. Domestic tourism has a larger impact on the regions of Århus, Fyn, Størstrøm and Viborg than the other two types of tourism. The figure gives us a picture of the absolute tourism impact on employment in the regions. For example, in the large regions like in the Greater Copenhagen, tourism generates more than 11,500 jobs. In the regions of Århus, Nordjylland and Fyn, domestic tourism generates more than 2,000 jobs for each region. Foreign same-day tourism generates around 6,500 full-time equivalent jobs in the county of Sønderjylland, 3,500 jobs in the Greater Copenhagen and 3,000 jobs in each of the counties of Frederiksborg and Nordjylland.

Figure 6 shows the tourism impact on employment by region with percentage changes in employment. The percentage change in employment measures the importance of tourism to the regional economy. For example, the absolute number of changes in employment is tiny in the region of Bornholm, but the percentage changes in employment show that both foreign overnight tourism and domestic tourism are more important on Bornholm than in most of the other regions. On the other hand, the absolute changes in employment are great in the Greater Copenhagen (refers to Figure 5), but the percentage changes in employment in the Copenhagen area are smaller. The foreign same-day tourism is shown to have greater impact on the counties of Sønderjylland, Frederiksborg and Nordjylland than on other regions.

The above results show the economic consequences of tourism by sector or by regions. However, tourism impact on employment can be found by other dimensions, such as with different qualification group at place of residence. Table 9 shows tourism impact on employment by qualification group. In the absolute changes of employment, the group with

full stage university education has got the greatest impact, accounting for 41% of the total employment impact. The group with vocational education took the second place, accounting for 33.5% of the total. From the column of “percentage changes in employment”, it can be found that the groups with lower education get higher impact than other groups.

Table 10 shows the tourism impact on disposable income of household at place of residence. It seems that tourism will affect the household type of “children (under age of 18) not living with their parents” the most. This group is not actually a representative group, as its disposable income accounts for only 0.02 percent of the total disposable income. Concentrating on the large groups, it is found that tourism will affect the household’s disposable income the most on the household type “married couples with children”. The percentage change is found to be 1.15 for this type of household and the type “single with children” is 0.72, also higher than the average level.

Table 11 shows the tourism impact on income tax by region. The income tax here is defined as an aggregated income tax covering all types of income taxes. The model can show different types of income taxes in Denmark, including state, county and municipality taxes, as well as the top, medium and bottom income taxes and wealth tax. The change in aggregate income tax by region means the regional effect of tourism on taxation in general. From Table 11 it is found that the counties of Sønderjylland and Bornholm have got greater impact on taxation than other regions. The tax impact on the county of Frederiksborg is also above the average level.

Table 12 shows the tourism impact on income transfers by region. One can find that the county of Sønderjylland stands at top of the list. That is because tourism creates a large number of jobs in the region. The income transfers will be increased in case of closing down (or reducing) tourism in the region. The counties of Bornholm, Frederiksborg and Nordjylland have also received greater impact on income transfers than other regions.

Finally, Table 13 shows the tourism impact on retailing margins by region. Again it can be found that tourism has great impact on the counties of Sønderjylland, Frederiksborg, Bornholm and Nordjylland regarding retailing margins. The impact on retailing margins is the greatest on Sønderjylland, which means that the foreign same-day tourism and the border shopping play a much more important role than normal overnight tourism in the border regions. Tourism does not only affect hotels, restaurants and other tourism sectors, but it has also great impact on the retailing business in some border regions.

As mentioned earlier, many variables and indicators can be shown from the model. Apart from the results given in these tables, other variables, such as inter-regional imports and exports, private consumption, wholesaling margins, VAT and commodity tax, and external imports and exports, etc. can also be obtained from the model. The results have shown the tourism economic consequences on the Danish regions, however, more than that, the results also give us a picture of tourism’s impact on sector, qualification group and household, etc.

## 6. Conclusion

The Danish interregional macroeconomic model, LINE is applied for analyzing the economic consequences of tourism on Danish regions. The LINE model is a computable general equilibrium model with the data construction based on a SAM framework. The model is seen as a combined one containing both Keynesian demand model and Leontief's input-output model. The advantage of this model is that the model is more flexible and complete than the other previous regional models in Denmark. Moreover, the model has much more to offer to the economists who are involved with regional analysis.

The tourism sub-model is fully integrated in the model, which makes domestic tourism demand endogenously determined. The foreign tourist consumption in Denmark is still exogenous to the model. Tourism data applied in the model are based on a large tourism survey in Denmark, i.e. TØBBE. However, in order to make consistence with the statistical data, in the present version of the model, the TØBBE data have been scaled down according to the Statistics data. Therefore, the results from this analysis will incline to underestimate the tourism impact. An alternative model based on the TØBBE data is also possible to be constructed.

The tourism impact analysis presented in this paper gives us a demonstration of how regional analysis can be carried out by using the model. The purpose of any well-specified model is to offer decision-makers and regional analysts a useful tool for a wide variety of policy-oriented issues. The LINE model is going to be applied in several other policy-oriented projects, such as agriculture, transport, taxation policy and all kinds of regional analyses.

**Table 1. Tourism consumption by region in Denmark, 1999**  
(In million DKK)

Regions	TØBBE data <sup>1)</sup>				Data applied in the model <sup>1)</sup>			
	Danes	Foreigners	Total	%	Danes	Foreigner	Total	%
Greater Copenhagen <sup>2)</sup>	2520	6326	8846	21.2	1490	3962	5453	17.2
Frederiksborg	729	3411	4139	9.9	532	3173	3704	11.7
Roskilde	306	288	594	1.4	286	277	563	1.8
Vestsjælland	672	272	944	2.3	533	177	709	2.2
Storstrøm	765	713	1478	3.5	630	448	1078	3.4
Bornholm	322	504	825	2.0	193	296	489	1.5
Fyn	1279	753	2032	4.9	1045	495	1540	4.9
Sønderjylland	855	6386	7241	17.3	706	6094	6799	21.5
Ribe	752	1391	2143	5.1	508	677	1185	3.7
Vejle	907	753	1659	4.0	556	506	1062	3.4
Ringkøbing	650	1154	1804	4.3	481	687	1167	3.7
Århus	1662	1606	3268	7.8	1252	1199	2451	7.7
Viborg	664	464	1127	2.7	553	295	847	2.7
Nordjylland	1816	3868	5684	13.6	1283	3316	4598	14.5
Denmark	13896	27889	41785	100	10046	21600	31646	100

Source: TØBBE data from the Danish Tourist Council and AKF, also referring to report from Danish Tourist Council: "Turismens økonomiske og beskæftigelsesmæssige betydning nationalt og regionalt – Opdatering 1999". Other data are obtained from the LINE model and own calculations.

Note: <sup>1)</sup> TØBBE data are in current price, while data applied in the model are transformed into 1995 fixed price. <sup>2)</sup>

Greater Copenhagen covers Copenhagen Municipality, Frederiksberg Municipality and the County of Copenhagen.

**Table 2. Tourism consumption compared with GDP at factor cost by region, 1999**

(Values in billion DKK in current price)

Region	Tourism revenue	GDP at factor cost	Share (%)
Greater Copenhagen	8.846	336.4	2.6
Frederiksborg	4.139	53.7	7.7
Roskilde	0.594	30.5	1.9
Vestsjælland	0.944	47.0	2.0
Storstrøm	1.478	34.6	4.3
Bornholm	0.825	6.5	12.7
Fyn	2.032	75.7	2.7
Sønderjylland	7.241	43.1	16.8
Ribe	2.143	40.4	5.3
Vejle	1.659	59.0	2.8
Ringkøbing	1.804	49.8	3.6
Århus	3.268	107.2	3.0
Viborg	1.127	39.0	2.9
Nordjylland	5.684	82.2	6.9
Denmark	41.785	1005.0	4.2

Source: Statistics Denmark and the LINE model, AKF.



**Table 3. Employment in tourism sectors by region, 1999**

(In full time equivalent jobs)

Region	Hotel	Restaurant	Recreation	Tourism: (1)+(2)+(3)=	Employment in region	Share of (4) in (5)=
	(1)	(2)	(3)	(4)	(5)	(6)
Greater Copenhagen	4232	20433	20895	45559	744554	6.1
Frederiksborg	1008	3053	2116	6177	148610	4.2
Roskilde	502	1750	1254	3505	91852	3.8
Vestsjælland	1162	2361	1157	4680	131668	3.6
Storstrøm	1057	2585	1311	4953	104789	4.7
Bornholm	401	430	321	1152	20449	5.6
Fyn	2826	3981	3604	10411	221468	4.7
Sønderjylland	1225	1815	1188	4228	122170	3.5
Ribe	1054	2489	1562	5106	116729	4.4
Vejle	1958	2862	2028	6848	177335	3.9
Ringkøbing	1069	2213	1560	4843	144277	3.4
Århus	2602	6086	4875	13563	314853	4.3
Viborg	679	1627	1234	3540	117836	3.0
Nordjylland	2880	4974	3141	10995	241062	4.6
Denmark	22655	56660	46244	125559	2697652	4.7

Source: Statistics Denmark and own calculation.

**Table 4. Foreign same-day tourist consumption by region and nationality, 1999**

(Values in million DKK in 1995 fixed price)

Region	Tourist consumption	Share in national total	Share by foreign nationalities (%):		
			German	Swedish	Norwegian
Greater Copenhagen	1512.4	11.8		87	12
Frederiksborg	2943.9	22.9		100	
Roskilde					
Vestsjælland					
Storstrøm	157.4	1.2	100		
Bornholm	70.5	0.5	11	89	
Fyn	21.5	0.2	100		
Sønderjylland	5709.3	44.5	100		
Ribe	7.4	0.1			
Vejle					
Ringkøbing					
Århus	265.4	2.1		100	
Viborg	107.6	0.8			100
Nordjylland	2047.6	15.9		49	51
Denmark	12842.9	100	46	43	10

Source: TØBBE data and the LINE model.

**Table 5. Tourism impact on gross output by sector**

(In million DKK)

Sector	Gross output in baseline	Changes in gross output	Percentage changes in gross output
Agriculture	83936	1723	2.05
Food, beverage, tobacco	109635	2842	2.59
Other industries	380953	3387	0.89
Construction	125887	451	0.36
Wholesale	131258	3046	2.32
Retail	81208	4680	5.76
Hotel	7365	2425	32.93
Restaurant	25483	3075	12.07
Transport	178873	3206	1.79
Finance and insurance	79953	1389	1.74
Other private service	292350	3755	1.28
Public service	320354	1473	0.46
Recreation and cultural activities	29642	887	2.99
All sectors	1846896	32339	1.75

**Table 6. Tourism impact on income by sector**

(In million DKK)

Sector	Primary income in baseline	Changes in primary income	Percentage changes in income
Agriculture	45353	919	2.03
Food, beverage, tobacco	24665	664	2.69
Other industries	152376	1362	0.89
Construction	44410	159	0.36
Wholesale	78371	1814	2.31
Retail	53724	3105	5.78
Hotel	3303	1080	32.70
Restaurant	12690	1518	11.96
Transport	82258	1572	1.91
Finance and insurance	49370	867	1.76
Other private service	170079	2176	1.28
Public service	229526	1057	0.46
Recreation and cultural activities	17450	520	2.98
All sectors	963575	16813	1.74

**Table 7. Tourism impact on employment by sector**

(In number of full time equivalent jobs)

Sector	Employment in baseline	Changes in employment	Percentage changes in employment
Agriculture	105103	2199	2.09
Food, beverage, tobacco	81568	2149	2.63
Other industries	395759	3562	0.90
Construction	166476	599	0.36
Wholesale	175432	3914	2.23
Retail	223731	13088	5.85
Hotel	22655	7621	33.64
Restaurant	56660	7045	12.43
Transport	190494	3948	2.07
Finance and insurance	82681	1451	1.75
Other private service	319539	4065	1.27
Public service	835026	3928	0.47
Recreation and cultural activities	46244	1339	2.90
All sectors	2701366	54907	2.03

**Table 8. Tourism impact on employment by region in three scenarios**

(In number of full-time equivalent jobs, percentage changes in parentheses)

	Employment in baseline	Foreign same-day tourist consumption		Foreign overnight tourist consumption		Domestic tourist consumption	
Greater Copenhagen	744554	3530	(0.47)	4562	(0.61)	3386	(0.45)
Frederiksborg	148610	3138	(2.11)	473	(0.32)	825	(0.55)
Roskilde	91852	132	(0.14)	465	(0.51)	464	(0.51)
Vestsjælland	131668	244	(0.19)	409	(0.31)	860	(0.65)
Storstrøm	104789	476	(0.45)	682	(0.65)	1121	(1.07)
Bornholm	20449	116	(0.57)	361	(1.77)	280	(1.37)
Fyn	221468	444	(0.20)	1113	(0.50)	2035	(0.92)
Sønderjylland	122170	6563	(5.37)	680	(0.56)	1025	(0.84)
Ribe	116729	287	(0.25)	1158	(0.99)	870	(0.75)
Vejle	177335	446	(0.25)	1111	(0.63)	1247	(0.70)
Ringkøbing	144277	266	(0.18)	1124	(0.78)	850	(0.59)
Århus	314853	915	(0.29)	1841	(0.58)	2287	(0.73)
Viborg	117836	372	(0.32)	410	(0.35)	826	(0.70)
Nordjylland	241062	2956	(1.23)	2307	(0.96)	2284	(0.95)
Denmark	2701366	19892	(0.74)	16704	(0.62)	18366	(0.68)

**Table 9. Tourism impact on employment by qualification group**

(In number of full-time equivalent jobs)

Qualification groups	Employment in baseline	Changes in employment	Percentage changes in employment
Basic education:	96956	2447	2.52
Secondary education	197008	5054	2.57
Vocational education	978721	18979	1.94
Higher vocational education	170201	2047	1.20
First stage university	253998	3073	1.21
Second stage university	140960	1769	1.25
Full stage university	967308	23292	2.41
All groups	2805153	56661	2.02

**Table 10. Tourism impact on disposable income of household at place of residence**

(Value in million DKK)

Household types	Disposable income in baseline	Changes in disposable income	Percentage changes in disposable income
Single without children	142746	41	0.03
Single with children	17071	123	0.72
Married couples without children	132888	538	0.40
Married couples with children	111658	1282	1.15
Registered same sex couples without children	314	1	0.39
Registered same sex couples with children	20	0	0.19
Other couples without children	924	1	0.14
Other couples with children	22842	25	0.11
Unmarried couples (different sex with age difference less than 15 years) without children	34737	106	0.31
Unmarried couples (different sex with age difference less than 15 years) with children	5224	12	0.22
Children not living with parents	116	2	1.36
All households	468542	1804	0.39



**Table 11. Tourism impact on income tax by region**

(Value in million DKK)

<b>Region</b>	<b>Income tax in baseline</b>	<b>Changes in income tax</b>	<b>Percentage changes in income tax</b>
Greater Copenhagen	73763	576	0,78
Frederiksborg	24182	234	0,97
Roskilde	14473	111	0,76
Vestsjælland	15271	70	0,46
Storstrøm	12641	85	0,67
Bornholm	2059	30	1,44
Fyn	24125	136	0,56
Sønderjylland	12672	376	2,97
Ribe	11325	81	0,71
Vejle	17294	108	0,63
Ringkøbing	13617	70	0,51
Århus	32940	167	0,51
Viborg	10959	54	0,50
Nordjylland	23997	192	0,80
Denmark	289319	2289	0,79

**Table 12. Tourism impact on income transfers by region**

(Value in million DKK)

<b>Region</b>	<b>Income transfers in baseline</b>	<b>Changes in income transfers</b>	<b>Percentage changes in income transfers</b>
Greater Copenhagen	37670	1013	2,69
Frederiksborg	9416	525	5,57
Roskilde	5148	185	3,59
Vestsjælland	9053	199	2,20
Storstrøm	9035	276	3,05
Bornholm	1431	87	6,10
Fyn	15084	407	2,70
Sønderjylland	7750	954	12,31
Ribe	6195	271	4,38
Vejle	9673	334	3,46
Ringkøbing	7328	274	3,74
Århus	18773	631	3,36
Viborg	6849	190	2,77
Nordjylland	15406	854	5,54
Denmark	158811	6200	3,90

**Table 13. Tourism impact on retailing margins by region**

(Value in million DKK)

<b>Region</b>	<b>Retailing margins in baseline</b>	<b>Changes in retailing margins</b>	<b>Percentage changes in retailing margins</b>
Greater Copenhagen	18258	782	4.28
Frederiksborg	4650	594	12.78
Roskilde	2756	84	3.05
Vestsjælland	3229	91	2.80
Storstrøm	3053	143	4.67
Bornholm	549	59	10.70
Fyn	5396	190	3.51
Sønderjylland	3007	690	22.96
Ribe	2626	138	5.24
Vejle	4601	142	3.09
Ringkøbing	3360	145	4.32
Århus	8033	332	4.13
Viborg	2358	96	4.06
Nordjylland	5876	582	9.90
Denmark	67753	4065	6.00

**Figure 1. The Structure of the LINE Model**

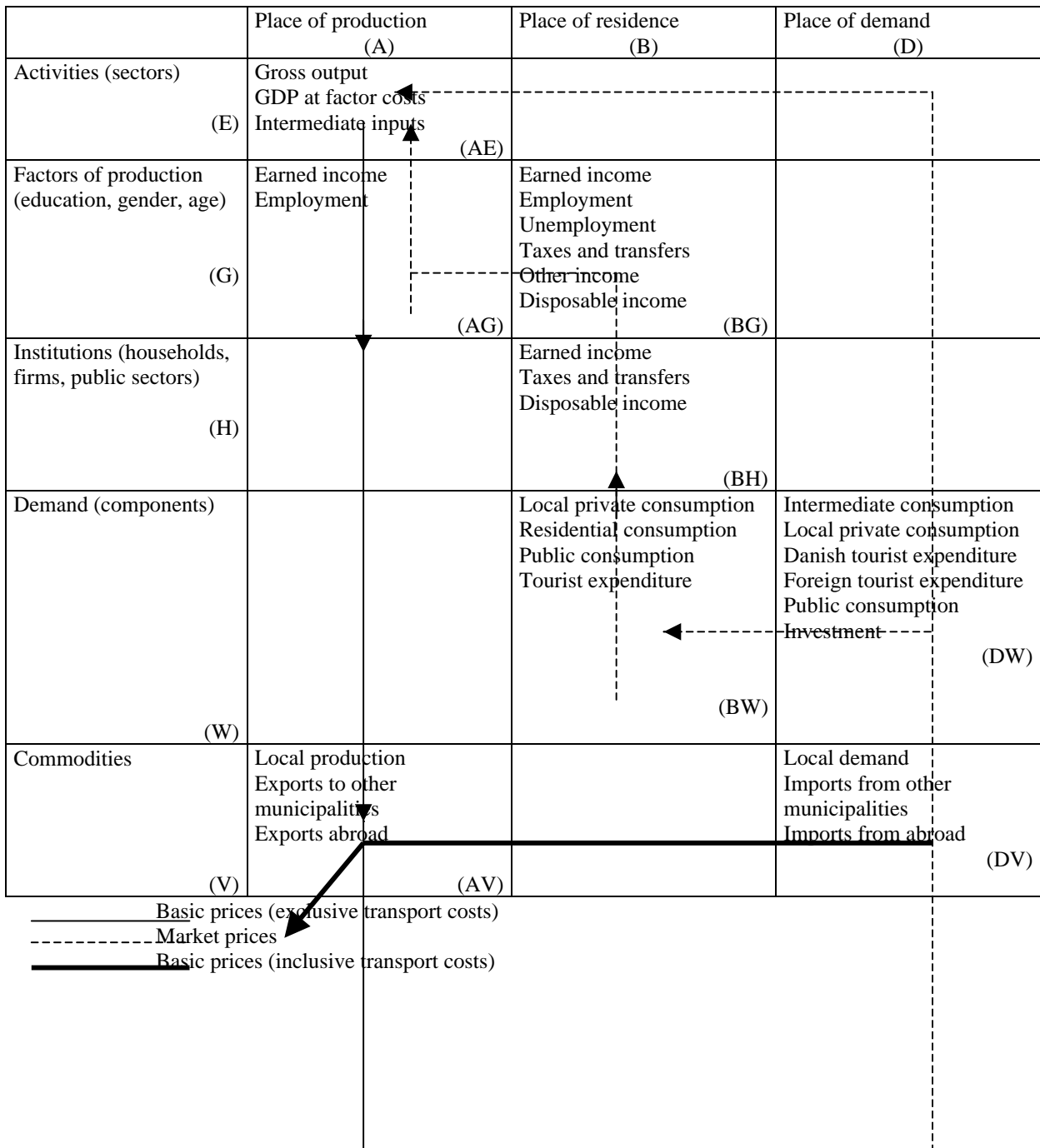
<u>Place of production</u>	<u>Place of residence</u>	<u>Place of demand</u>	
<u>Gross output</u> Intermediate consumption Productivity GDP at factor cost Earned income Employment			<u>Activity (sectors)</u>
Earned income Employment	Population Labor force Earned income Employment Unemployment Disposable income Taxes Income transfers Other income		<u>Factors (qualifications etc.)</u>
	Earned income Other income Income transfers Disposable income Taxes Local private consumption		<u>Institutions (households, firms and government)</u>
	<u>Danish tourist consumption</u> Local private consumption Public consumption	<u>Danish tourist consumption</u> Foreign tourist expenditure <u>Local private consumption</u> Private consumption <u>Public consumption</u> Intermediate consumption Investment	<u>Wants (components)</u>
<u>Gross output</u> Sale to the regions itself Exports to other regions Exports to abroad		<u>Local demand</u> Indirect taxes and subsidies Imports from other regions Imports from abroad	<u>Commodities</u>

**Figure 2. Simplified version of LINE: The real circuit**

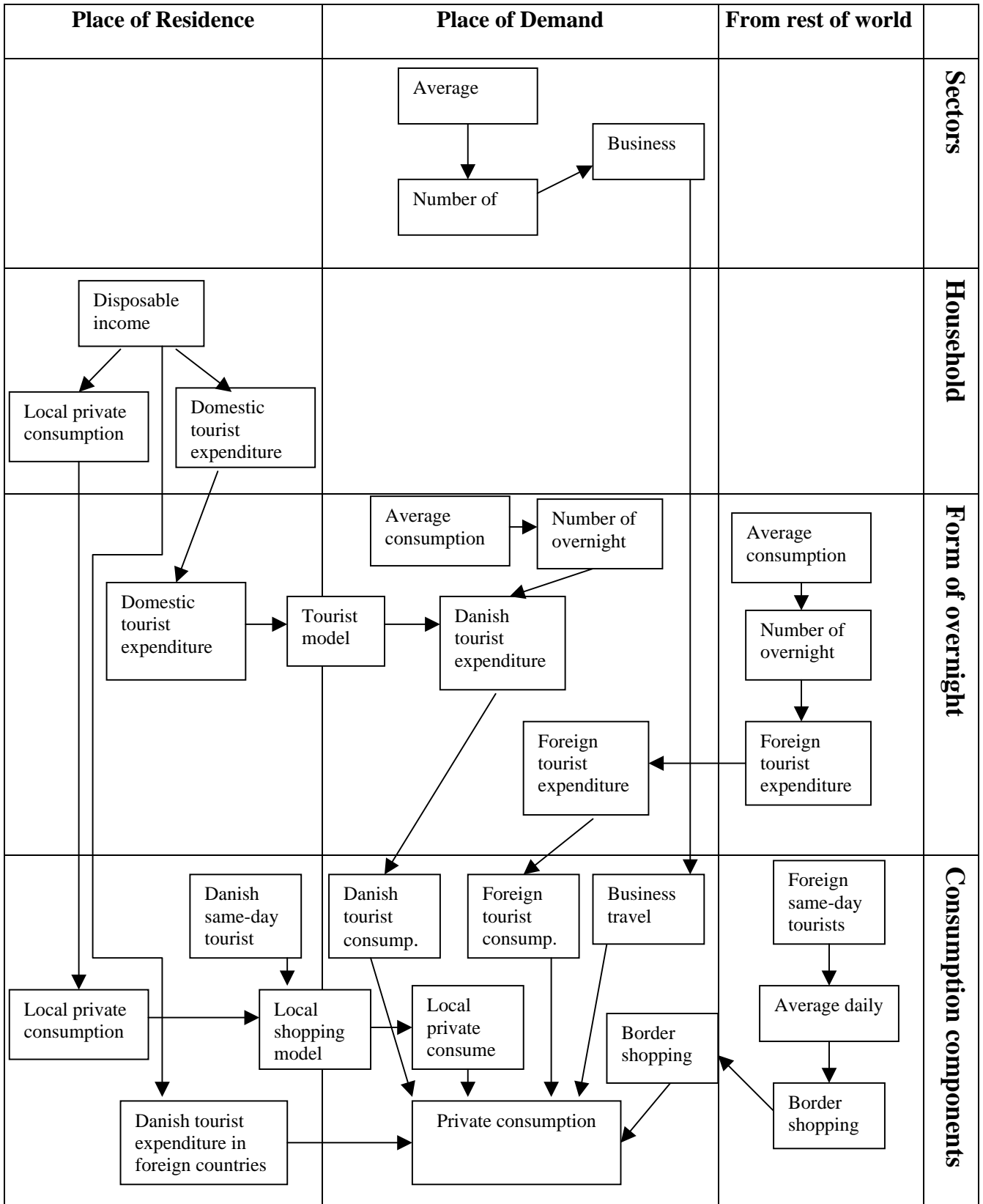
	Place of production (A)	Place of residence (B)	Place of demand (D)
Activities (sectors) (E)	Gross output GDP at factor costs Intermediate inputs		
Factors of production (education, gender, age) (G)	Earned income Employment	Earned income Employment Unemployment Taxes and transfers Other income Disposable income	
Institutions (households, firms, public sectors) (H)		Earned income Taxes and transfers Disposable income	
Demand (components) (W)		Local private consumption Residential consumption Public consumption Tourist expenditure	Intermediate consumption Local private consumption Danish tourist expenditure Foreign tourist expenditure Public consumption Investment
Commodities (V)	Local production Exports to other municipalities Exports abroad		Local demand Imports from other municipalities Imports from abroad

\_\_\_\_\_ Constant prices  
 ----- Current prices

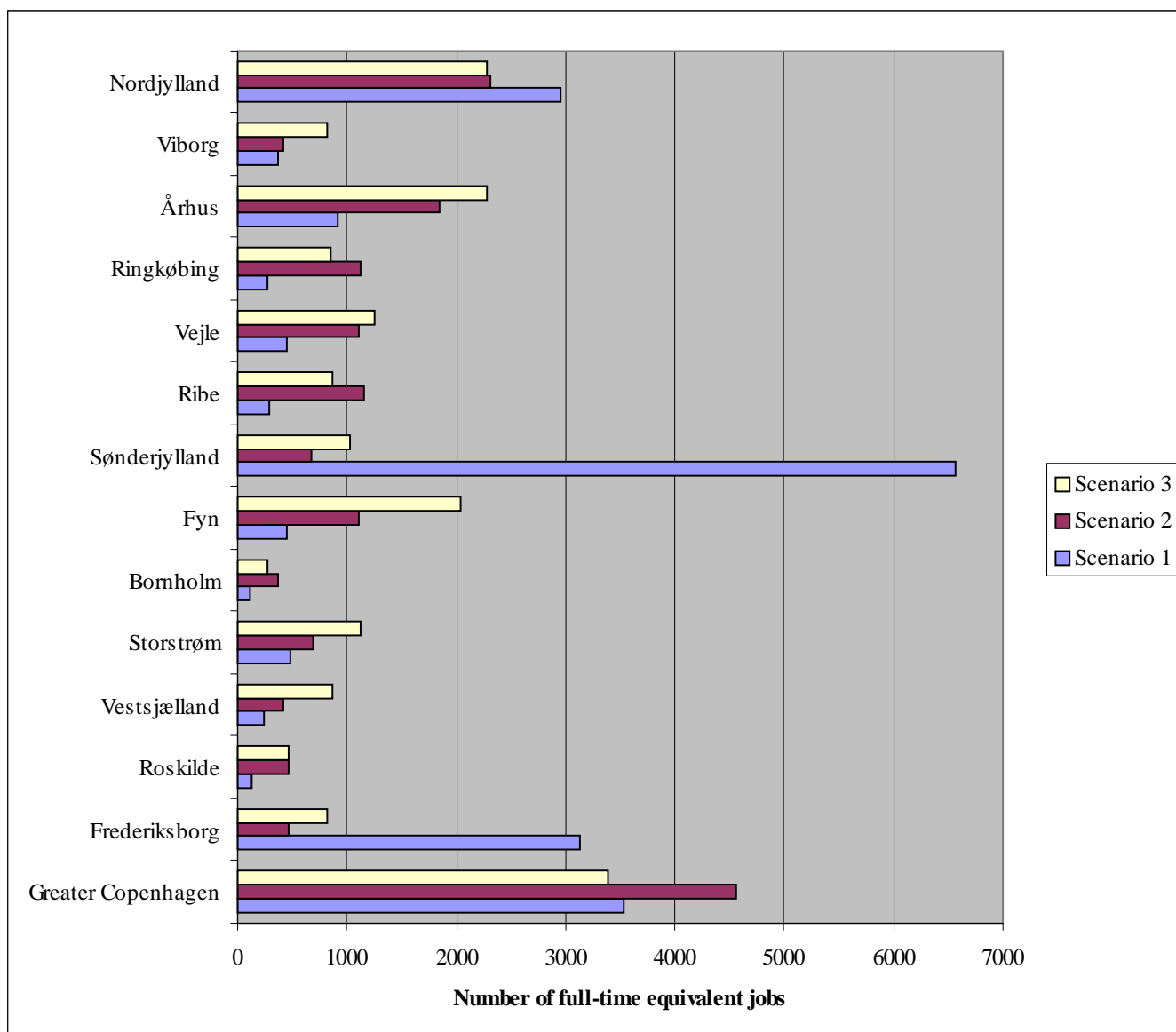
**Figure 3. Simplified version of LINE: The Price circuit**



**Figure 4. Diagram for Tourism Sub-Model in LINE**



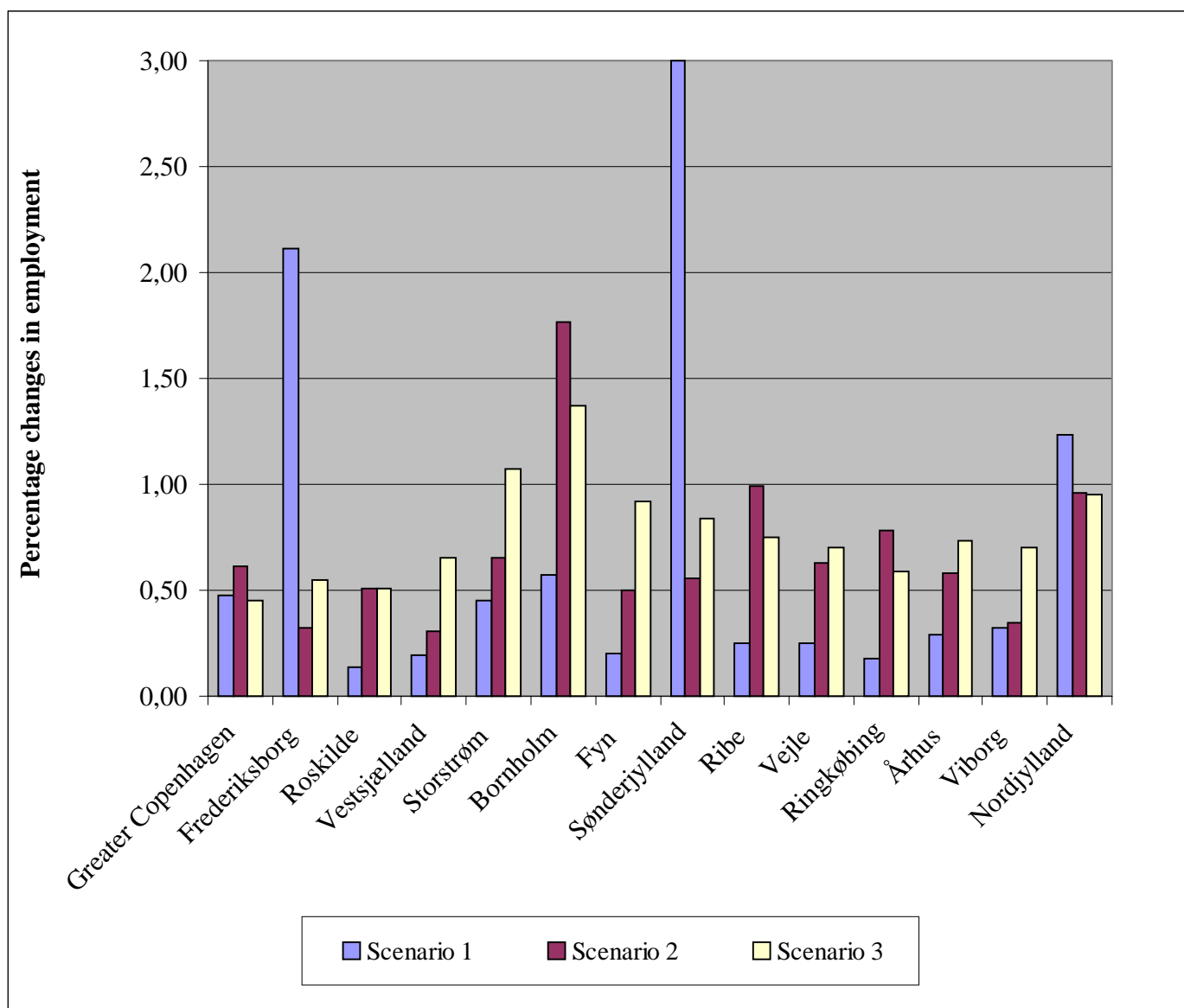
**Figure 5. Tourism impact on employment by region – Absolute changes in number of employment**



Note: Scenario 1 is foreign same-day tourism; Scenario 2 is foreign overnight tourism; Scenario 3 is domestic tourism.



**Figure 6. Tourism impact on employment by region – percentage changes in employment**



**Note:** 1) Scenario 1, 2 and 3 are defined the same as in figure 5.

2) The percentage change of the foreign same-day tourist consumption in Sønderjylland is 5.37. In order to show clearly for other data, the value 3 is given here.

## Notes:

<sup>1</sup> WTTC: Travel and Tourism – The 1998 WTTC Report – Research Edition, World Travel and Tourism Council.

<sup>2</sup> Fretcher J. E. (1989) “Input-output analysis and tourism impact studies”, *Annals of Tourism Research*, 16, 514-529.

<sup>3</sup> Archer B. and J. Fletcher, (1996) “The economic impact of tourism in the Seychelles”, *Annals of Tourism Research*, 23 (1), 32-47.

<sup>4</sup> Freeman D. and E. Sultan, (1997) “The economic impact of tourism in Israel: a multi-regional input-output analysis”, *Tourism Economic*, 1997, 3 (4), 341-359.

<sup>5</sup> Frechtling D. C. and E. Horvath, (1999) “Estimating the multiplier effects of tourism expenditures on a local economy through a regional input-output model”, *Journal of Travel Research*, 37 (4), 324-332.

<sup>6</sup> Wagner, J. E. (1997) “Estimating the economic impact of tourism”, *Annals of Tourism Research*, Vol. 24, No. 3, 592-608.

<sup>7</sup> Zhou, D., J.F. Yanagida, U. Chakravorty, and P. Leung (1997) “Estimating economic impacts from tourism”, *Annals of Tourism Research*, Vol. 24, pp. 76-89.

<sup>8</sup> Hansen, R., (1970) *General Equilibrium System*, McGraw-Hill, New York.

<sup>9</sup> Miller, R. E. and P. D. Blair, (1985) *Input-Output Analysis: Foundations and Extensions*, Prentice – Hall Inc.

<sup>10</sup> Fletcher, J. E. and B. H. Archer (1991) “The development and application of multiplier analysis”. In the book: *Progress in Tourism, Recreation and Hospitality Management*.

<sup>11</sup> Briguglio, L., (1993) “Tourism multipliers in the Maltese economy”, in Johnson and Thomas *et al.* (ed.) *Perspectives on Tourism Policy*, Mansell Publishing Limited.

<sup>12</sup> See note 7.

<sup>13</sup> See note 6.

<sup>14</sup> Madsen, B, C. Jensen-Butler, P. U. Dam and H. Johnson (2001) *The LINE-model*. AKF, Denmark.

<sup>15</sup> Madsen, B, C. Jensen-Butler and P. U. Dam (2001) *A Social Accounting Matrix for Danish Municipalities*. AKF, Denmark.

<sup>16</sup> Briassoulis, H. (1991) “Methodological issues: Tourism input-output analysis”, *Annals of Tourism Research*, Vol. 18, pp. 485-495.

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<sup>17</sup> Zhang, J and B. Madsen (2001) “Private consumption and interregional modelling – data construction”, paper presented at Nordic Regional Science Association conference, Vänersborg, Sweden, June 2001.

<sup>18</sup> Several publications referred to TØBBE, see 1) Ahmt, T. and L. Eriksen (1997), *Opbygning af turismedatabank og regionaløkonomisk modellering af turisme – AKF memo*. 2) Eriksen, L. and T. Ahmt (1999), “Measuring and modelling the regional impact of tourism in Denmark”. *International Journal of Tourism Research*, 1, 313-327. 3) Danish Tourist Council (1996, 1998 and 1999), *Turismens økonomiske betydning nationalt og regionalt*.

<sup>19</sup> Hansen C. and S. Jensen, (1996) “The impact of tourism on employment in Denmark: different definitions, different results”, *Tourism Economics*, 1996, 2(4), 283-302.

<sup>20</sup> The exchange rate in 1995 was approximately USD 1 = 6.5 DKK, or DKK 1 = 0.15 USD.

<sup>21</sup> See Zhang, J and C. R. Rassing, (2000) *Tourism Impact Studies – The case of Bornholm*, Research Centre of Bornholm, Denmark.