Modelling the linkage between tourism and multiple dimensions of poverty in Thailand

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ABSTRACT

This study aimed at modelling the quantitative linkage between tourism and the whole boundaries of poverty, economic, social, and environmental perspectives, at the provincial level in Thailand. There were both positive and negative effects from tourism to dimensions of poverty. Tourism helped decreasing absolute poverty via tourism income. It also tended to raise nutrition and healthcare indicators. More people accessed to cleaner, safer, and better quality of food and drinking water. People were also more capable in accessing to better healthcare services and in taking care of household sanitations. The environmental indicator was also improved by the environmental concern of crafts and arts production villages which aimed to sell their products to tourists. However, there was a trading-off effect. It weakened locally social and political strength when tourism income distribution was uneven between members of the community. It was proven that poverty eradication (absolute poverty) in the poorest province of Thailand was almost impossible by relying on only tourism income.

Key words: Tourism, Poverty alleviation, Income poverty, Non-income poverty, Interdisciplinary modeling

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1. Introduction

Modelling interdisciplinary concepts of poverty was a challenge to an economist. The efforts of Desai and Shah (1988), and Untong (2006) could be good examples because they were closer to the interdisciplinary concepts of poverty. However, there were rooms for an improvement that could provide more scientific information for the issue. In modelling the linkage between tourism and poverty especially in Thailand, first, the whole boundaries between economic, social, and environmental perspectives of poverty were not captured by any quantitative model. Second, there was no modelling using provincial data. Lastly, the trading-off effects between income-poverty and other aspects of poverty were still not presented in any quantitative model.

This paper was aimed to provide marginal effects and trading-off effects from tourism to multiple dimensions of poverty at the provincial level in Thailand. The central research questions were whether tourism was a cure-for-all solution for poverty alleviation in Thailand. Moreover, it was a survey what would be obstacles to modelling the issue interdisciplinarily. Hopefully, it might be able to provide the discussion how to overcome the obstacles.

In the paper, firstly multiple dimensions of poverty and tourism will be discussed. Then, conceptual framework will be presented. After that, methodology will be explained following by the modelling results. The discussion of the results will be also provided. Lastly, the obstacles to the modelling along with ideas how to overcome the obstacles will be discussed.

2. Multiple Dimensions of the issue

This section will discuss multiple dimensions of poverty and tourism.

a) Dimensions of poverty

Poverty is a multiple dimensional issue. There are at least 3 dimensions seen from different perspectives. First, economic perspective focuses at the absolute poverty, the percentage of people under the poverty line. Another economic concept, the relative poverty, is concerned when a person feels that his or her income is much less than the average income of the society even though he or she is above the poverty line. However, the concepts of absolute and relative poverty are limited to income poverty. There are also non-income poverty such as lacking of nutrition, education and healthcare concerned in modern literatures (Klasen, 2005; Grosse, Harttgen, and Klasen, 2005; Guenther and Klasen, 2007).

Second, social perspective of poverty can be seen in terms of poor living, lacking of freedom and social solidarity (Sen, 1987; Sen, 1988; Sen, 1998; Sen 2000). If people are rich but jailed, they are seen as the poor. Lacking of political freedom for choosing their leaders and representatives to the parliament, lacking of freedom from hunger and malnutrition, lacking of freedom from famine are aspects that were mentioned for being poor. Social exclusion is another aspect to make a person poor.

Third, environmental perspective of poverty focuses at the sustainability between the livelihood of human and the environmental service (Lehtonen, 2004; Sen, 2006). Pollution is one of the concerns. If a free rich man lives in a polluted area, he or she is poor in this sense. It is also accepted by economists, especially ecological economists, that the environmental factor is crucial to the sustainable development.

The three perspectives of poverty were listed in table 1.

Table 1: Perspectives of poverty

Economic perspective	Social perspective	Environmental perspective
• Absolute poverty: income under poverty line • Relative poverty: income less than average or other people • Non-income poverty: lacking of necessities for living such as nutrition, education and healthcare	• Lacking of freedom from hunger, malnutrition, famine and democracy. • Social exclusion	• Pollution: living in polluted area. • Degraded environment

Poverty reduction, therefore, has at least three dimensions. First, the poverty reduction in the economic perspective can be targeted to the reduction of the amount of people under the poverty line, the more even income distribution to alleviate the relative poverty, and the provision of basic needs related to nutrition, education and healthcare.

Second, the provision of political freedom, the strengthening of solidarity in societies and the protection of human rights are at hearts of the poverty reduction in the social perspective.

Lastly, the provision of non-polluted habitats and the prevention of degraded environmental services are major concerns of the poverty reduction in the environmental perspective.

b) Dimension of tourism

There are also multiple dimensions of tourism. Tourism can be seen in at least 3 dimensions. First, conventional tourism is the major part of today's tourism activities and supply chains. It is under the heavy capitalism (Weiermair, 2007). Second, community-based tourism (CBT) is a small and locally self-organized tourism service. Usually, CBT takes place in remote area where natural, social and cultural resources have not been modified by globalization. Lastly, tourism related production is a production of souvenirs such as crafts and arts. Shopping cannot be excluded from tourism industry in Thailand. For the Thai tourists, it can be said that traveling is for shopping. The Thai tourists like to buy things along the way they travel. For foreign tourists, shopping accounted around 28 percent of

their total spending in Thailand (Suriya and Srichoochart, 2007). The value was around 110,000 Million Baht for the whole country. Eight Upper-Northern provinces (so called Lanna provinces) shared the value around 8,900 Million Baht.

3. Conceptual framework

The conceptual framework of the model is shown in figure 1.

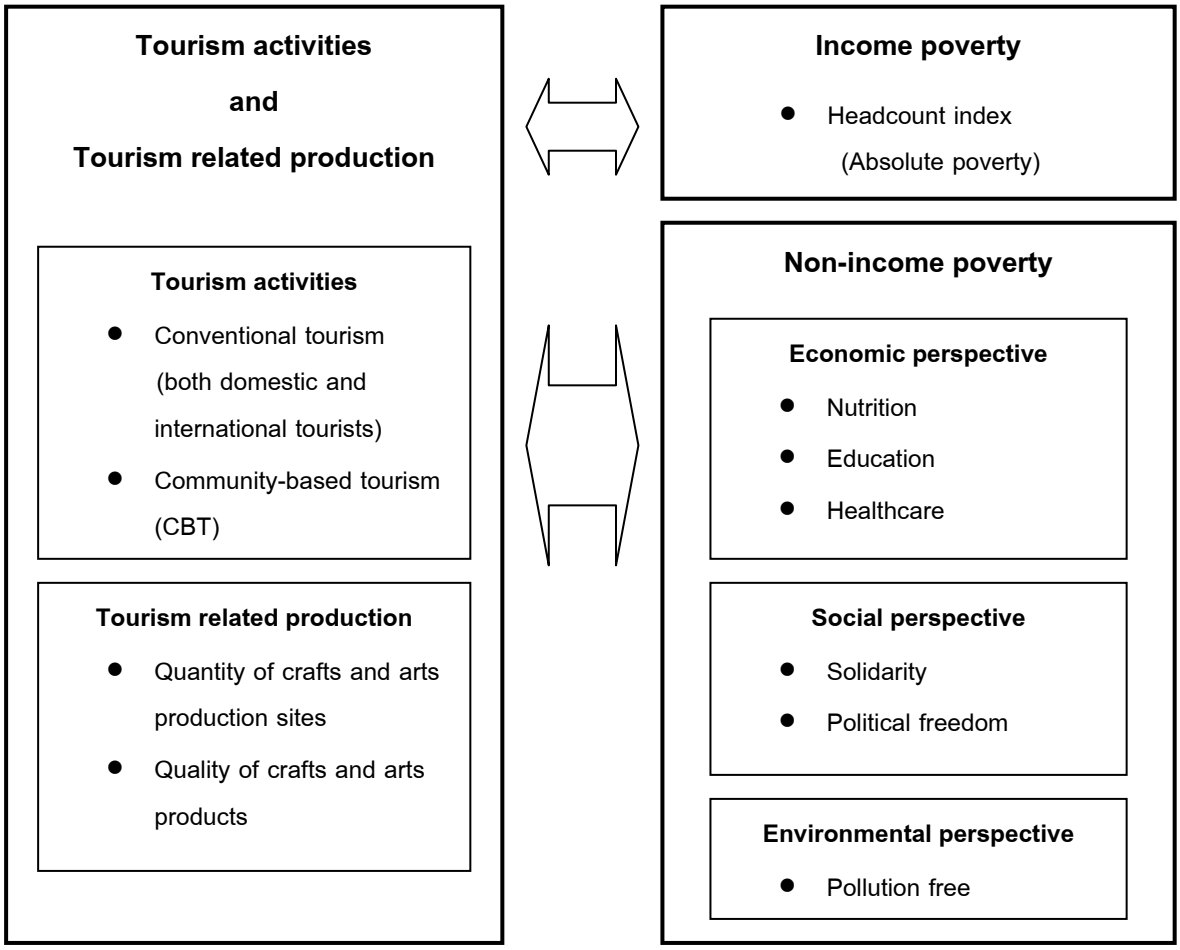

Figure 1: Conceptual framework of the model

Although the modelling issue contains complex dimensions of poverty and tourism, the conceptual framework is clearly simple. Apart of tourism, other factors that are crucial for economic development such as education, industrialization, and improvement of agricultural production are kept constant. On the tourism side, all three dimensions of tourism are included. Moreover, the tourism related production is extended to two parts, the quantity and quality of arts and crafts products. On the poverty side, the whole three dimensions of poverty are included.

The framework emphasizes on the direct causation from tourism to poverty. It is believed that tourism income can reduce poverty. However, the reverse causation from poverty to tourism is also possible and should not be ignored. The reason is that tourism is capitalism (Weiermair, 2007). Then, when poverty is reduced in a province, people can accumulate capitals to participate more in

tourism activities. Thus, the rising tourism income in a province is probably caused by the reduction of poverty.

4. Methodology

To construct this paper, first, literatures related to perspectives of poverty and modelling of the issue were searched by using the internet. Second, secondary data was collected. Basic Needs Indicators provided online by Ministry of Interior of Thailand, and the poverty map provided online by the National Statistical Office of Thailand (NSO) were downloaded. To transform the poverty map into quantitative data, Photoshop was used to identify colors in the map. The percentage of poverty in a province was an average value of its districts. Third, a program called Lisrel (student version) along with its instructions and examples were downloaded from the provider's website. The purpose of using this software was to estimate the Structural Equation Model (SEM). Fourth, Seemingly Unrelated Regression (SURE) was used together with SEM to tackle the technical problem in the estimation process.

Estimation strategy was shown in Table 2. Details of dependent variables, independent variables and sample size can be seen in section 5(c) and annex 3.

Table 2: Steps for the estimation of the model

Step	Objectives of the process	Detail of the process	Program
1	Grouping basic needs indicators into poverty indicators	Test whether basic needs indicators can be grouped together for the reduction of the number of indicators to capture major dimensions of poverty.	Lisrel 8.80 (student version)
2	Testing the relationship between income and non-income poverty indicators to ensure the validity of the conceptual framework	To test whether the income and non-income poverty indicators are exclusively independent. If a relationship between them was found, the conceptual framework might have to be modified. Structural Equation Model (SEM) will be used in this step because it can avoid multicollinearity problem when treating non-income poverty indicators as	Lisrel 8.80 (student version)

Step	Objectives of the process	Detail of the process	Program
		independent variables and an income poverty indicator as a dependent variable.	
3	Modelling the forward causation from tourism to poverty	To test whether tourism affects poverty. Both Structural Equation Model (SEM) and Seemingly Unrelated Regression (SURE) were used in this step.	Lisrel 8.80 (student version) and Eviews 3.0
4	Modelling the reverse causation from poverty to tourism	To test whether poverty affects tourism. Only Structural Equation Model (SEM) was used in this step because poverty indicators were highly correlated and would cause the multicollinearity problem in Seemingly Unrelated Regression (SURE).	Lisrel 8.80 (student version)

5. Modelling results

The modelling results consist of four parts following the four steps of the estimation strategy.

a) Grouping poverty indicators

Basic needs indicators could be grouped by Structural Equation Model (SEM) into 4 groups representing different perspectives of poverty (Figure 2). Three groups, labeled as **Nutrition**, **Education** and **Healthcare,** represented economically non-income poverty. Another group, labeled as **Politics**, represented solidarity and political freedom which are social perspective of poverty. The labeled **Pollution-free** indicator, representing the environmental perspective, was assigned by the estimation into the healthcare group. However, the **Pollution-free** indicator was also introduced as a stand-alone indicator and a dependent variable when applying SURE to capture the environmental perspective of poverty explicitly in section 5(c). The explanations of the basic needs indicators in each group are available in table A-1 in annex 1.

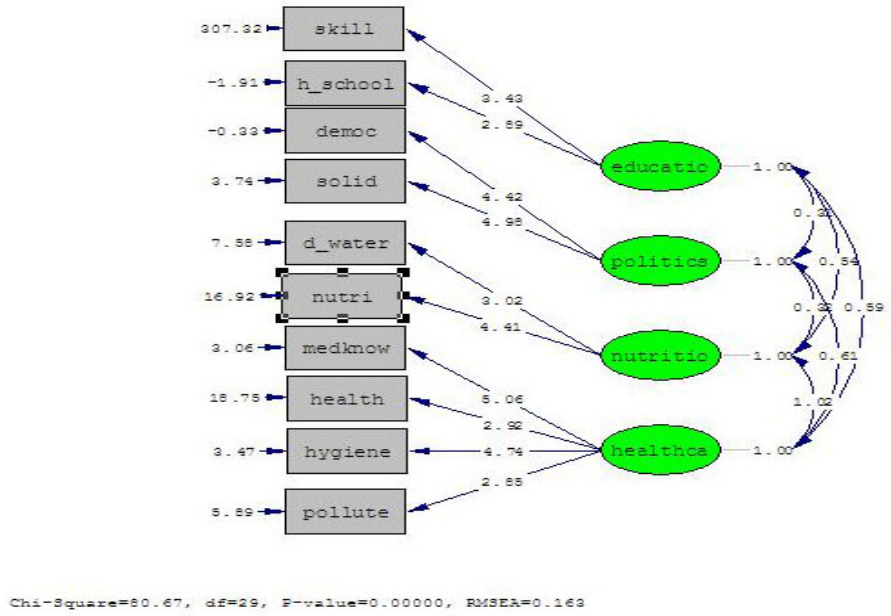

Figure 2: Basic Needs Indicators could be grouped into 4 groups

b) The relationship between income and non-income poverty

The result from Structural Equation Model (SEM) showed that there was no significant relationship between income poverty (the headcount index) and non-income poverty (four groups of indicators obtained from section 5(a)). The result of the testing was shown in figure 3 where numbers in the diagram presented t-statistics.

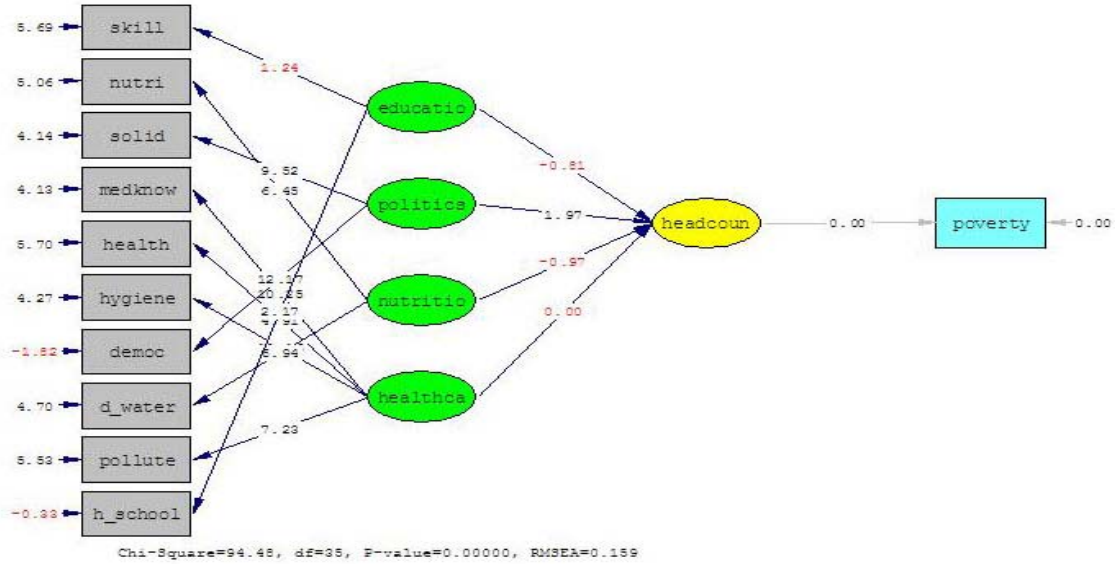

Figure 3: There was no relationship between income and non-income poverty indicators

c) Modelling forward causation from tourism to poverty

It was technically obstructed in using Structural Equation Model (SEM) to model the forward causation. The model was not converged (see figure A-1 in annex 2). The reason was that SEM is good in working with indicators and latent variables. When applying other types of data to the model, it always appears to be malfunctioned. Papers which run SEM in Lisrel successfully used only indicators and latent variables such as Untong (2006).

To overcome this problem, Seemingly Unrelated Regression (SURE) was used instead of SEM for this purpose. SURE is good in dealing with equation system with correlated error terms. Error terms of the four groups of non-income poverty indicators could be seen from SEM that they were highly correlated (Figure 2 in section 5(a)).

Independent variables represented multiple dimensions of tourism. There were 4 independent variables listed below. The detail of variables and sources of data were mentioned in table A-2 in annex 3.

(1) **"Tourism income per capita (Baht/person-year)"** represented the income from conventional tourism in a province.

(2) **"Tourism villages per 100,000 population"** represented the size of community-based tourism in a province.

(3) **"Production villages per 100,000 population"** represented the quantity of tourism related production in a province.

(4) **"Product champions per 10 production villages"** represented the quality of tourism related production in a province. Product champions are awards given to high quality products in One Tambon One Product (OTOP) program supported by the Thai government.

Dependent variables were multiple dimensions of poverty. The detail of variables and sources of data were mentioned in table A-3 in annex 3. In the first model, **headcount index** represented income poverty (negative sign of relationship was expected). Second to fourth, **nutrition**, **healthcare** and **education** which were groups of indicators represented non-income poverty in the economic perspective (positive signs of relationship were expected). Fifth, **politics** which was a group of indicators represented social perspective of poverty (positive sign of relationship was expected). Sixth, **pollution free** which was a stand-alone indicator represented environmental perspective of poverty (positive sign of relationship was also expected because the greater value of the indicator indicated less pollution problem in a province). It should be noted that, according to the original description of the indicator, the meaning of **pollution free** is that "a household was not suffered from pollutions" which covers all types of pollutions.

The estimation results obtained from SURE were presented in table 3. It was clearly significant that tourism income reduced income poverty. The headcount index dropped when tourism income per capita was increased (model 1). The larger numbers of production villages in a province raised greater well-beings of people in terms of nutritional intake (model 2), healthcare (model 3), and pollution-free environment (model 6). However, tourism income, both from conventional tourism and community-based tourism, lessened social solidarity and political strength in provincial level (model 5). However, the significance of the relationship between tourism and education was not found (Model 4).

Table 3: Estimation results of SURE

System: **Tourism and Multiple Dimensions of Poverty**

Estimation Method: **Seemingly Unrelated Regression**

Observation: 68 provinces

	Coefficient	Std. Error	t-Statistic	Prob.
Model 1: Headcount index				
(expected sign: negative)				
Constant	22.05272	2.285852	9.647487	0.0000
Tourism income per capita	**-0.000236**	**9.55E-05**	**-2.472986**	**0.0138**
Tourism villages per 100,000 population	0.105207	0.724545	0.145204	0.8846
Production villages per 100,000 population	-0.139806	0.090644	-1.542363	0.1238
Product champions per 10 production villages	-0.914076	0.860845	-1.061836	0.2890

Model 2: Nutrition (expected sign: positive)				
Constant	88.91475	1.358623	65.44474	0.0000
Tourism income per capita	-1.38E-05	5.68E-05	-0.242687	0.8084
Tourism villages per 100,000 population	-0.487486	0.430642	-1.131998	0.2584
Production villages per 100,000 population	**0.098432**	**0.053875**	**1.827026**	**0.0685**
Product champions per 10 production villages	0.240208	0.511654	0.469475	0.6390

Model 3: Healthcare (expected sign: positive)				
Constant	89.19359	1.252901	71.18968	0.0000
Tourism income per capita	-1.37E-06	5.23E-05	-0.026143	0.9792
Tourism villages per 100,000 population	**-0.769584**	**0.397131**	**-1.937859**	**0.0534**
Production villages per 100,000 population	**0.103971**	**0.049683**	**2.092682**	**0.0370**
Product champions per 10 production villages	-0.380698	0.471839	-0.806839	0.4203

Table 3: Estimation results of SURE (cont.)

	Coefficient	Std. Error	t-Statistic	Prob.
Model 4: Education (expected sign: positive)				
Constant	82.86587	2.905858	28.51684	0.0000
Tourism income per capita	-5.97E-05	0.000121	-0.491836	0.6231
Tourism villages per 100,000 population	-0.652458	0.921068	-0.708371	0.4792
Production villages per 100,000 population	-0.007366	0.115230	-0.063927	0.9491
Product champions per 10 production villages	-0.536351	1.094337	-0.490115	0.6243
Model 5: Politics (expected sign: positive)				
Constant	91.46088	1.418485	64.47786	0.0000
Tourism income per capita	**-0.000120**	**5.93E-05**	**-2.028483**	**0.0432**
Tourism villages per 100,000 population	**-0.783568**	**0.449616**	**-1.742748**	**0.0822**
Production villages per 100,000 population	0.055585	0.056249	0.988194	0.3237
Product champions per 10 production villages	-0.545944	0.534197	-1.021989	0.3074
Model 6: Pollution free (expected sign: positive)				
Constant	89.29757	1.152430	77.48630	0.0000
Tourism income per capita	-9.70E-06	4.81E-05	-0.201405	0.8405
Tourism villages per 100,000 population	0.057102	0.365285	0.156323	0.8759
Production villages per 100,000 population	**0.077654**	**0.045699**	**1.699253**	**0.0901**
Product champions per 10 production villages	-0.137218	0.434002	-0.316170	0.7520

Source: Calculation using Eviews 3.0

d) Modelling reverse causation from poverty indicators to tourism

In this estimation, poverty indicators were turned into independent variables while tourism activities were treated as dependent variables. Unfortunately, the estimation using SURE was not valid because of the multicollinearity problem among poverty indicators. In this case, SEM was capable to model the relationship instead because the assumption of multicollinearity could be relaxed by the method. The result was shown in figure 4 where numbers in the diagram were t-statistics.

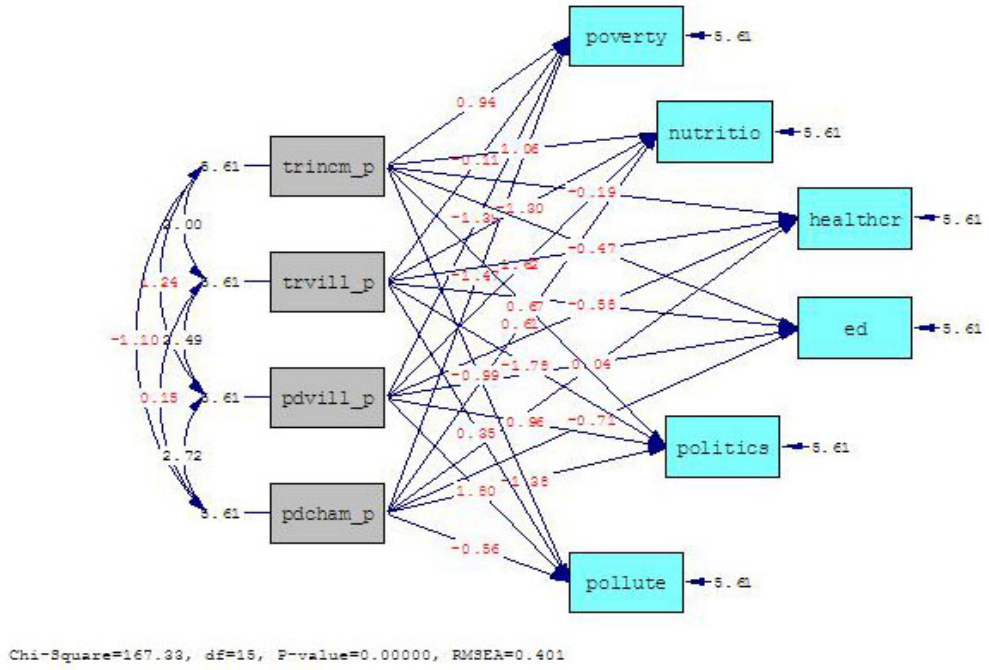

Figure 4: There was no reverse causation from poverty indicators to tourism

The estimation result from SEM in figure 4 showed that there was no reverse causation from poverty indicators to tourism activities.

6. Discussion of modelling results

From SURE, there were linkages between tourism activities to poverty situation. A major finding was that tourism income tended to reduce headcount index. The effect to the headcount index was not different from Suriya (2007) in the direction of the linkage but different in the coefficients.

From the result, only tourism income could not eradicate the poverty from the poorest province. According to the marginal effect from SURE, one additional Baht acquired from tourism for every person in a province in a year would reduce the headcount index 0.000236 percentage point. Thus, it required around 4,237 Baht per person per year to reduce the index down 1 percentage point. For Nakorn Panom in Northeastern Thailand, the poorest province with 36 percent of population under poverty line, around 152,542 Baht per person per year should be added to reduce the whole poverty. With its 695,351 citizens in 2004, it required around 106,000 Million Baht per year more for this province, additional to 793 Million Baht of its current tourism income, to achieve the poverty-free target. The amount was more than annual tourism income of Phuket (see table 4). It was also around one-third of Bangkok's tourism income. Nakorn Panom had to develop 133 times more of its current tourism industry to achieve that target. Even though the province could double its tourism income, the headcount index would be reduced less than 1 percentage point. It required 3.7 times of improvement in the tourism sector to achieve 1 percentage point reduction of the index.

Table 4: Tourism income of major tourism cities in Thailand in 2004

Number	Province	Tourism income (Million Baht per year)
1	Bangkok	306,873
Nakorn Panom would be here if the province could earn 106,793 Million Baht of tourism income per year. Then the whole poverty in the province would be eradicated.		
2	Phuket	85,670
3	Chonburi (Pattaya)	50,282
4	Chiang Mai	45,066
5	Krabi	19,325

Source: Tourism Authority of Thailand, 2004.

Only 5 provinces might be able to eradicate its absolute poverty if doubled their tourism income. They were Bangkok, Phuket, Phang Nga, Chonburi and Krabi. However, it was hard to think about Bangkok to double its size or even 20 percent. Another province, Rayong, might be able to achieve the ideal target if doubled its tourism income. Even Chiang Mai might have to develop 2.43 times more of its tourism income to meet the whole eradication of absolute poverty (see table 5).

The trade-off between income poverty and social poverty when raising tourism income was found but apparently small. For example, if Nakorn Panom could achieve 1 percentage point reduction of headcount index, the political indicator would drop 0.51 percentage point. With this ratio, if all absolute poverty of the province was eradicated, 36 percent, the political indicator would drop from 96.05 percent to 77.74 percent.

Table 5: The requirements of tourism income acquisition to eradicate the whole poverty (absolute poverty) in the province

No.	Province	Headcount index (%)	Population in 2004	Tourism income in 2004 (Mill. Baht)	Size of the improvement needed (times)
1	Phuket	2.50	300,737	85,670	0.04
2	Bangkok	2.45	5,695,956	306,873	0.19
3	Phang-Nga	2.50	245,394	9,773	0.27
4	Chonburi	5.22	1,209,290	50,282	0.53
5	Krabi	8.30	403,363	19,325	0.73
6	Rayong	6.60	573,785	8,728	1.84
7	Phetchaburi	9.10	456,681	7,624	2.31

No.	Province	Headcount index (%)	Population in 2004	Tourism income in 2004 (Mill. Baht)	Size of the improvement needed (times)
8	Chiang Mai	15.57	1,658,298	45,066	2.43
9	Prachuab Kirikhan	12.30	494,416	8,469	3.04
10	Trang	4.06	607,450	3,216	3.25
11	Nakorn Panom	36.00	695,351	793	133

Source: Calculation by the marginal effect obtained from SURE.

The trade-off between tourism income and social solidarity could be explained by the uneven distribution of tourism income. Wattanakuljarus (2007), using CGE, reported that the poor got less benefits from tourism than the rich. Kaosa-ard (2006) discussed that while tourism was accepted by the majority of the Thai people, it tended to exploit cultural and natural resources which led to more unacceptability. Untong (2006), using SEM, showed that people in Chiang Mai and Chiang Rai, major tourism cities in Northern Thailand, began to reveal their dissatisfactions to tourism after more negative effects were dumped to them after the income reached its limit of growth. However, tourism agents who enjoyed benefits kept doing aggressive marketing especially to Taiwanese and Chinese.

The second finding was that tourism village tended to reduce social poverty indicators. It could be explained by the findings from Kaosa-ard (2006) and Untong et al (2006) that while tourism yielded more income to a village, it tended to decrease income distribution in the village. Consequently, solidarities in tourism villages were usually weakened.

The leading group who brought tourism into the village usually benefited more than other members of the village who were supposed to be affiliates or tourism workers. The uneven income distribution usually led to conflicts between who benefited more and less. Kantamaturapoj (2005) reported that, in Plai Pong Pang village in Thailand, people who benefited less cut trees where fire flyers lived. Fire flyers were the most valuable tourism resource for the village where tourists came to see them at night. Moreover, Kaosa-ard et al (2008) reported the breaking of cartel in the same village causing by unfair income allocation between tourism center and owners of home stays who were members of the cartel.

The third finding was that tourism village surprisingly reduced healthcare indicators. It was because most of tourism villages were in remote areas, more than half were hill tribal villages. Thus, healthcare was less concerned in the area. In this sense, tourism was not leading to less healthcare indicators but rather highly correlated to less healthy areas.

The fourth finding was that production village helped increasing nutrition, healthcare and pollution-free indicators. Production villages were the gathering place of efficient people. Apart of selling in tourism market, they exported to international markets such as U.S.A., Europe and Japan. So, the living standards, especially the healthcare and nutrition in these production villages were

higher than in tourism villages. For the environmental issue, the production villages produced crafts and arts which released less pollution than industrial production. Moreover, wastes from a factory could be recycled to be materials for other factories. Pollution was also prevented by the villagers since the villages were frequently visited by tourists. Unless the villages were kept clean, they would not be attractive to tourists and buyers from around the world.

Even though production villages were positively influential to poverty reduction in the non-income and environmental perspectives, the promotion of the production villages took longer time than other tourism activities. Tawai village, the biggest and most successful production village in Thailand located in Chiang Mai where almost every household produced own products, took 50 years with two generations of craftsmanship to develop itself fully for tourism and export. San Kao Kaeb Klang village, the home of a big and successful wood-carving factory named Arun Colourware, took 25 years of its development but the spillover effect from the factory to the whole village was still limited.

The modelling in this study could show what perspectives of poverty would be affected and how much they would be affected by tourism income and activities. But the aspect of the delivery mechanism of the effect to the poor was not explicitly presented by the model. Works of Jonathan Mitchell and Calorine Ashley from Overseas Development Institute (ODI) who have done a lot of field researches especially in Africa and Asia (Ashley et al, 2006; ODI, 2007; Mitchell and Ashley, 2007) can fulfill this gap for readers.

7. The obstacles to modelling and how to overcome the obstacles

From the modelling experiment in this paper, two obstacles were found. They were data obstacle and technical obstacle. In this section, these obstacles will be discussed with some ideas how to overcome them.

a) Data obstacle

Modelling could not be done without quantitative data. A data obstacle was probably occurred because there was no effort to quantify related quality issues. Many leading literatures in the area, such as papers from Overseas Development Institute (ODI), ignored modelling because sufficient quantitative data was not available in most cases especially in Africa. Therefore, ODI has rather focused on “how-to” questions than modelling.

In Thailand, the National Statistical Office (NSO) has provided good quantitative data in the Socio-economic survey (SES). However, in SES, there was nothing related to tourism income or tourism activities which usable for modelling the issue. Moreover, SES was not a panel data. In this case, the data obstacle appeared to be at the quality of data which might not match researcher’s interest.

The access to the data online was another data obstacle. According to the Public Information Act in Thailand, free access to any data collected by government agencies is mandatory. However, there was a capacity limit of officers to upload data to the internet.

The creditability of data was the last obstacle. Although the Basic Needs Indicators served perfectly in capturing multiple dimensions of poverty, it was less popular than Computable General Equilibrium (CGE) and socio-economic survey (SES) among Thai economists.

There were several disadvantages of Basic Needs Indicators compared to SES and CGE. First, they were just indicators providing nothing about cause and effect while SES contained characteristics of households and could be modelled for causality. Second, most indicators reached around 90 percent of their values. That meant basic needs were almost successfully provided through out the country. Only some remote areas needed to be focused. Therefore, it was a matter of spatial mapping and tackling of poverty rather than the national policy aspect. Third, the definition of each indicator was broad. It could be understood in many ways without an accurate standard of measurement i.e. “good and safe food”. Last, the indicators were produced annually as a routine job. Thus, their statistical inferences might be less credible compared to SES which was a national survey capturing higher level of interests from both bureaucrats and scholars. Therefore, the data obstacle was appeared at the lacking of creditability of the data even though it was provided perfectly online and fitted for modelling.

b) Technical obstacle

Structural Equation Model (SEM) is a powerful tool for modelling multiple dimensions of poverty, especially social and environmental dimensions. However, it is ignored by mainstream economists because it relaxes most Gaussian assumptions. It is always questionable when running a linear model in SEM with highly correlated exogenous variables. SEM explains that it can extract the correlations among exogenous variables and present them as relationships between error terms of each variable instead. By the way, even SEM has sensible explanations of its estimation method, economists are likely to rely more on econometrics.

However, when dealing with interdisciplinary modelling, a question arose how to include quality issues into quantitative data. USAID (2004) shed light that the World Bank has introduced the Living Standards Measurement Survey (LSMS) since 1985. Basic Needs Indicators of Thailand was constructed following this idea. Although this was a way to overcome the data obstacle, the technical obstacle occurred instead. Among tools for analyzing indicators, factor analysis and cluster analysis tended to find patterns from data rather than present the causality. Structural Equation Model, therefore, came to be one of the brightest alternatives. However, the technical obstacle of SEM was observed in this paper that it could not handle the presence of various types of variables in a model altogether, i.e. indicators, latent variables and tourism income.

To overcome the technical obstacle, this paper showed that “team work” between Structural Equation Model and an econometric method, SURE, was workable. While SURE provided major

finding of the forward causation, SEM could provide the testing of reverse causation which SURE could not do because of multicollinearity problem.

8. Conclusion

It was possible to capture the whole boundaries between economic, social, and environmental perspectives of poverty at the provincial level in a quantitative modelling. In economic dimension, the headcount index representing absolute poverty was used. Non-income factors such as nutrition, education and healthcare could be assessed in the form of indicators and used as dependent variables in the model. Social dimensions such as political freedom could also be included in the model as another indicator. Moreover, environmental dimension such as the concern of pollution could be added as an indicator as well.

For the modelling result, there were both positive and negative effects from tourism to dimensions of poverty. Tourism helped decreasing absolute poverty via tourism income. It also tended to raise nutrition, healthcare and environmental indicators via the presence of crafts and arts production villages. However, there was a trading-off effect. It weakened local political strength when tourism income distribution was uneven between members of the community, especially in villages operating community-base tourism.

From the marginal effect analysis, tourism itself was not the cure-for-all solution for poverty alleviation. It was proven that poverty eradication (absolute poverty) was almost impossible in the poorest province of Thailand by relying on only tourism income.

Although the modelling showed that conventional tourism and production villages were major keys for poverty alleviation, the answers how the mechanisms worked in the linkages were not explicitly explained by the model. It required the field research to observe what were really happening in villages and how tourism could carry additional income to the poor.

Obstacles in interdisciplinary modelling of the issue appeared in two terms, the data obstacle and technical obstacle. For the data obstacle, efforts to quantify related qualitative issues, efforts of provision the data online, matching quality of data with researchers' interests, and creditability of indicators data were the obstacles.

For the technical obstacles, dealing with many types of data in a model caused technical problem that only one method could not handle the model. In this paper, the "team work" between Structural Equation Model (SEM) and Seemingly Unrelated Regression (SURE) was proven that it yielded sensible results of estimation. Therefore, the technical obstacle could be overcome by using multiple methods of analysis.

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Annex

Annex 1: Details of Basic Needs Indicators

The detail of Basic Needs Indicators were presented in table A-1 below.

Table A-1: Basic Needs Indicators

No.	Issues	Mean among provinces (%)	s.d. among provinces	Grouping and name of the group
1	Everyone in the household had good and safe food. (NUTRI)	89.26	6.27	Nutrition
2	The household has enough safe drinking water for the whole year. (D_WATER)	93.46	4.25	
3	Students who did not attend high school were trained vocational skills. (SKILL)	69.77	17.47	Education
4	Students after 9 years of mandatory education attended high schools. (H_SCHOOL)	91.88	2.63	
5	The household knows how to use medicines correctly. (MEDHOW)	89.82	5.31	Healthcare
6	Citizen over 35 years old attended an annual health check. (HEALTH)	90.34	5.24	
7	The household was clean and safe from deceases and accidents. (HYGIENE)	91.59	5.10	
8	The household was not suffered from pollutions.	91.00	3.69	
9	At least one member of the household was a member of an organization at village or sub-district level. (DEMOC)	89.57	6.19	Politics
10	The household took part in sharing ideas for mutual benefits at village or local level. (SOLID)	90.34	5.00	

Note: The complete set of the Basic Needs Indicators in Thailand contains 37 indicators. However, the standard deviations of 17 indicators among provinces were less than 2. Therefore, they were not suitable for the modelling and were excluded. Three indicators were related to income poverty, so they were ignored. Among the rest indicators, only 10 were selected for the modelling because of the capacity limit in Lisrel program (student version). The selection criterion was that they went along better with the concept of multiple dimensions of poverty.

Annex 2: The estimation result of forward relationship using SEM

This figure showed that the estimation of the forward relationship from tourism to poverty was not possible using Structural Equation Model (SEM). The model was not converged. The reason was the presence of many types of variables in the model altogether. It was found in this study that the method could not handle the case.

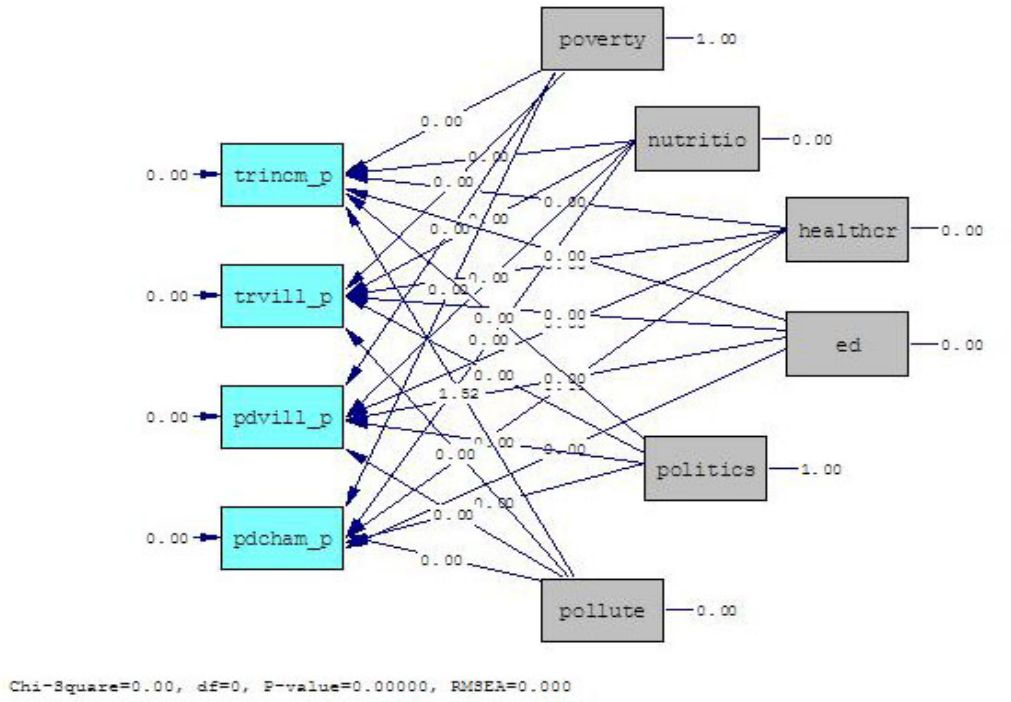

Figure A-1: Modelling the forward relationship from tourism sectors to poverty indicators was not possible in Lisrel because the model was not converged.

Annex 3: Details of independent and dependent variables in the forward causation model

a) Independent variables in the forward causation model

The independent variables are listed in table A-2.

Table A-2: Details of independent variables

Independent variables	Dimension of tourism	Source
Tourism income per capita	Income from both domestic and international tourists	Tourism Authority of Thailand
Traveling villages per 100,000 population	Community-based tourism (CBT)	www.thaitambon.com
Production villages per 100,000 population	Community production of crafts and arts for both tourism and export markets	
Product champion per 10 production villages	Quality of products produced by community production villages	

b) Dependent variables in the reverse causation model

The dependent variables are listed in table A-3.

Table A-3: Details of dependent variables

Dependent variables	Dimension of poverty	Source
Headcount index	Economic dimension (absolute income poverty)	Poverty map provided online by National Statistical Office of Thailand (NSO)
Nutrition (group of indicators)	Economic dimension (non-income poverty)	Basic Needs Indicators provided online by Ministry of Interior, Thailand
Education (group of indicators)	Economic dimension (non-income poverty)	
Healthcare (group of indicators)	Economic dimension (non-income poverty)	
Politics (group of indicators)	Social dimension	
Pollution free (group of indicators)	Environmental dimension	

c) Sample size

There are 76 provinces in Thailand. However, only 68 provinces were included in the model. The reason why a particular province was excluded from the model was listed in table A-4.

Table A-4: Excluded provinces and the reason of the exclusion

Group	Number of provinces	Reasons	Provinces
1	2	Outlier	Bangkok and Phuket
2	2	Incomplete poverty map	Lamphun, Ranong
3	4	Time inconsistency in tourism income	Nonthaburi, Samut Prakarn, Samut Sakorn, Prathum Thani