Chapter 4

Conclusions and Limitations

All of the methods in this thesis have involved modeling and forecasting sales revenue. These studies have produced an analysis of the distribution and trend of sales revenue in Southern Thailand. They have also given us a clear idea of the factors associated with sales growth, key opportunity areas and issues to be addressed, and product preferences in different areas.

4.1 Research methodology

The objective of this thesis is to investigate the patterns of sales revenue by month, quarter, year, branch location, flavour and package type in Southern Thailand. The scope of this study is sales revenue from 2000-2006 in fourteen provinces in Southern Thailand. The pattern of sales revenue is useful in determining where sales revenue is high or low. The outcome variables are defined as the consumption rate and sales revenue in a cell indexed by branch location, flavour and period (monthly or quarterly or yearly). The determinant variables are defined as category variable as factors: branch, flavour and period factor (monthly, quarterly or yearly).

This study design is a cross-sectional survey distributed by time and area. The simplest model is based on linear regression with the outcome variable defined as the consumption rate and sales revenue in a cell indexed by branch location, flavour, and month, and calendar month or quarter (allowing for a seasonal effect) or year as categorical determinants. Data used in the current study are collected routinely by the sparkling beverage company in Southern Thailand. For each year after 1999, these

data are available in computer files with a record for each case and fields comprising characteristics of the flavour and the package type, including dates of sales and branch location. After cleaning to correct or impute data entry errors the records, we create sales revenue by branch location flavour, month, quarter and year. Consumption rate were computed as the number of cases per 1,000 residents in the branch location according to the 2000 Population and Housing Census of Thailand.

First of all, we try to fit log-normal multiple linear regression additive model for consumption rate by branch location, flavour and quarter. We then try to fit log-normal multiple linear regression models for consumption rate with branch-flavour interaction, quarter and year. Finally, we try to fit log-normal multiple linear regression models for consumption rate with branch-flavour interaction, branch-year interaction and quarter. We hope to be able to use these models to analyze the product preference in each area. Among the models fitted, the best are chosen based on residual deviance and r-squared. Other studies have also used linear regression analysis (McGartland et al 2003, Probart et al 2006, and Bureau 2007) but their studies did not take the location into account and did not include any analysis on per capita consumption rate. In our study, linear regression models were applied to both sales revenue and consumption rate analysis with application to a case study of sparkling soft drink products in southern Thailand.

For short-term sales forecast, we try to fit the log-normal observation driven multiple linear regression model for sales revenue with branch-flavour interaction, flavour, month and the lagged outcomes for the previous four months. We hope to be able to use the model to forecast the sales revenue for up to 12 future months in total,

including flavour and package type. For the forecasting errors analysis, we compare the forecasting results with the actual in year 2006.

For long-term sales forecast, we apply the Lee-Carter model for forecasting sales revenue for up to 24 future months. In order to find a least squares solution for the Lee-Carter equation we use a close approximation to the singular value decomposition (SVD) method. We then forecast the time trend index using the Holt-Winters method. We hope to be able to use the model to forecast the sales revenue by branch location. For the forecasting errors analysis, we compare the forecasting results with the actual in years 2005-2006.

4.2 Discussion

4.2.1 Sales analysis

The log-transformed quarterly sales revenue trends can be modeled by using linear regression. From this model, we found that quarterly effects and interactions associated with flavour-branch and branch-year are main factors that influencing the sparkling beverage sales in Southern Thailand. For 7 years period (2000-2006), the sparkling beverages annual per capita consumption value average rate in Southern Thailand was 297 Baht per population. The study also showed that the product preference in each area was different and the sales revenue have increased substantially in the last few years. The seasonal effects found in this study. The statistical model used in this study was suitable to answer our research questions and these findings are useful for managers to understand their performance, consumer needs in each branch location and opportunities to boot up the sales growth in each

area. Having the best model, managers can provide a useful basis for sales analysis, incorporating the results into their company plans and strategies.

4.2.2 Short-term sales forecast

The observation-driven multiple regression model containing year, month of year, location and beverage flavour as factors, as well as lagged observations for the preceding four months to log-transformed monthly revenue model was effective for forecasting total sales revenues and sales revenue grouped by flavour and package type for up to 12 future months. The model gave a r-squared of 0.95 and mean absolute percent error of predicted sales revenue was relatively small.

4.2.3 Long-term sales forecast

The classical Lee-Carter forecasting model and exponential smoothing Holt-Winters with additive seasonality method can produce excellent estimates in monthly sales revenue for up to 24 future months of 20 branches, compared with actual data in each branch during the years 2005-2006 and the separate forecast. The Lee-Carter method takes a simple extrapolative approach and produces sensible estimates in long-term sales forecasting for many branches in the same time whereas it is parsimonious in the number of parameters used. However, the model is well-fitted in case of the sales trend in each branch has a similar pattern. The Holt-Winters method contains both trend and seasonally factors that can give good forecasting results. However, the forecasting results always depend on the last period trend.

4.3 Conclusions

Multiple linear regression models can be applied to consumption rate analysis. The annual per capita consumption rate can be used to find market opportunities which lead to greater share and growth in each area. According to this study, branch, flavour and year have affect on sales revenue. Samui and Phuket branches, both tourist areas, had higher consumption rates than other branches. Nakhon Sri Thammarat (Nk) branch had the lowest consumption rate, thus this branch has an opportunity to increase their sales growth. This province also has the highest population in southern Thailand. A company would need to do the market development including more activities or promotions to drive volume and sales growth rate. The Muslims prefer cola products and colour flavours (orange, red, green) of sparkling beverage as well. This is very useful fact finding for manager to know where is the right place to push each product in and to understand how to create more sales into each area. The returnable package products have a negative trend and there is a slightly downward trend in sales revenues of all flavours, except the cola product. Red flavour has more value than orange in recent years. The non-returnable package product sales have a moderate growth of revenue and there is a slight growth trend with the cola flavour, while there is moderate growth with lime and colour flavours. The findings provide very important information for company plans and strategies. There is a significant sales growth in Yala branch during the forecasting periods. This is a good opportunity for the company to focus and do some more promotions or marketing strategies especially for this area.

4.4 Strengths of this study

This thesis is a unique in its strong orientation toward the application of statistical methods for business data analysis and forecasting. The results of this study provide the models that can produce useful sales analysis including short- and long-term forecasts of sales revenue in Southern Thailand. There is evidence of much higher consumption rates in tourist area. One main advantage of this study is that the model is able to separately consider data from each market segment, branch location, flavour and package type.

Using such models for forecasting sales revenue can assist for company managers to have more effectively strategic planning. Strategic planning has become popular in business as a guide to building profitable product portfolios. For this approach to be effective, management needs to look at the long run impact of alternative approaches and to be prepared with contingency plans. Thus, we expected that respondent firms would be interested in preparing alternative forecasts for different strategies and capabilities. For the implication of three studies, the models can be extended into other specific business data analysis and forecasting using the same methods.

4.5 Limitations and suggestions for further study

The methods used to estimate sales revenue provide a limitation guide in forecasting sales in any branch location because:

There were some missing data and some substantial interactions between the branch-flavour factor and the other factors existed could not be easily fitted using the available software because it would have increased the number of parameters.

The studies used to derive sales revenue grouped by branch location, flavour and time period were primarily conducted during 2000-2006. If a study was conducted for a period longer than seven years, the resulting model would be less prone to forecasting error.

The number of tourists generally seasonal change in each branch location so it is not easy to include in the models used.

For further study, sales data in recent year, still beverages data and new packages or new flavours data may be considered. Further study is also needed important factors such as advertising or marketing budget used or rainfall rate or socio-demographic factor may be included in the model for analyzes and forecasting the sales revenue. In addition, other business data such as competitor beverages, snack, ice-cream, etc. can also be compared using the same methods.