

# การประมาณอุปสงค์รถยนต์

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มหาวิทยาลัยราชภัฏอุบลราชธานี

## บทคัดย่อ

การศึกษาวิจัยครั้งนี้มีวัตถุประสงค์สองประการคือ เพื่อหาปัจจัยที่เป็นตัวกำหนดฟังก์ชันอุปสงค์ของรถยนต์นั่งส่วนบุคคลในประเทศไทย และเพื่อศึกษาลักษณะและภาวะการกระจุกตัวของตลาดรถยนต์นั่งส่วนบุคคลในประเทศไทย

กำหนดขอบเขตของการวิจัยจากการวิเคราะห์โดยพิจารณาเฉพาะกรณีรถยนต์ใหม่หรือรถยนต์ที่จดทะเบียนเป็นครั้งแรก ในช่วงปี พ.ศ. 2541-2549 ตั้งแต่ไตรมาสที่ 1 ปี พ.ศ.2541 ถึงไตรมาสที่ 4 ปี พ.ศ. 2549 รวม 36 ไตรมาสซึ่งผู้ประกอบธุรกิจรถยนต์นั่งส่วนบุคคล ในการวิเคราะห์ครั้งนี้ คือ ยี่ห้อรถยนต์นั่งส่วนบุคคลที่มีจำหน่ายในประเทศ โดยพิจารณาเฉพาะผู้ประกอบการรถยนต์นั่งส่วนบุคคลที่มีส่วนแบ่งตลาดสูงสุด 10 อันดับแรก ในปี 2549 ได้แก่ ผู้ประกอบการรถยนต์นั่งส่วนบุคคลยี่ห้อ โตโยต้า ฮอนด้า เชฟโรเลต มิตซูบิชิ นิสสัน มาสด้า เบนซ์ บีเอ็มดับเบิลยู ฟอर्ड และวอลโว่ โดยใช้ชื่อยี่ห้อเป็นตัวแทนของผู้ประกอบการ การศึกษาครั้งนี้ได้แบ่งการศึกษาออกเป็นสองส่วนคือ

ส่วนที่ 1 ศึกษาปัจจัยที่เป็นตัวกำหนดฟังก์ชันอุปสงค์ของรถยนต์นั่งส่วนบุคคลในประเทศไทย ทำการวิเคราะห์ปัจจัยต่าง ๆ ที่เป็นตัวกำหนดฟังก์ชันอุปสงค์รถยนต์นั่งส่วนบุคคลโดยวิเคราะห์ความสัมพันธ์ระหว่างปริมาณอุปสงค์ของรถยนต์นั่งส่วนบุคคลซึ่งเป็นตัวแปรตามกับตัวแปรอิสระคือ ปัจจัยต่าง ๆ ที่คาดว่าจะมีผลกระทบ ได้แก่ ราคาของรถยนต์นั่งส่วนบุคคล รายได้เฉลี่ยต่อหัวของประชากร ราคาถดถอย ราคาน้ำมัน เบนซินขายปลีก ค่าใช้จ่ายในการโฆษณา จำนวนประชากร และอัตราดอกเบี้ยเงินกู้ โดยวิธีการวิเคราะห์ทางเศรษฐมิติ ที่เรียกว่าการวิเคราะห์ถดถอยพหุคูณ (Multiple Regression Analysis) รูปแบบของสมการที่ใช้อยู่ในรูปของสมการถดถอยเส้นตรงพหุคูณ (Multiple Linear Regression) ค่าต่าง ๆ ที่ใช้ในการวิเคราะห์จะคำนวณออกมาโดยใช้โปรแกรมสำเร็จรูปของคอมพิวเตอร์ และใช้ข้อมูลทุติยภูมิรายไตรมาสที่เก็บรวบรวมตั้งแต่ปี 2541-2549 ซึ่งค่าต่าง ๆ ได้แก่ ค่าสัมประสิทธิ์สหสัมพันธ์ ( $R^2$ ) ค่าสัมประสิทธิ์สหสัมพันธ์ที่ปรับค่าแล้ว (Adjusted  $R^2$ ) การทดสอบค่าที (t-test) การทดสอบค่าเอฟ (F-test) ค่าเดอบิน-วัตสันเทส (Durbin-Watson test) ค่าสัมประสิทธิ์ของตัวแปรอิสระ (Variable Coefficient)

ส่วนที่ 2 ศึกษาลักษณะและภาวะการณ์กระจุกตัวของตลาดรถยนต์นั่งส่วนบุคคลในประเทศไทย เป็นการวิเคราะห์เชิงปริมาณ โดยนำข้อมูลitudinal ที่ได้รวบรวมไว้มาทำการศึกษาและทำการวิเคราะห์ โดยใช้ปัจจัยที่เป็นตัวชี้วัดได้แก่อัตราการกระจุกตัว (Concentration Ratio : CR) ดัชนีเฮอริฟินดัล (Herfindahl Index)

ผลการวิจัยพบว่า

ส่วนที่ 1 ศึกษาปัจจัยที่เป็นตัวกำหนดฟังก์ชันอุปสงค์ของรถยนต์นั่งส่วนบุคคลในประเทศไทย ใช้วิธีการวิเคราะห์ถดถอยพหุคูณ ด้วยวิธีกำลังสองน้อยที่สุดทั่วไป (Ordinary Least Square : OLS) สรุปได้ว่า อุปสงค์รถยนต์นั่งส่วนบุคคลในประเทศไทย พบว่า ปัจจัยที่มีผลกระทบได้แก่ ราคาเครื่องยนต์นั่งส่วนบุคคล ราคา รถปิคอัพ ราคาน้ำมันเบนซินขายปลีก ค่าใช้จ่ายในการโฆษณา จำนวนประชากร และอัตราดอกเบี้ยเงินกู้ โดยที่ราคาเครื่องยนต์นั่งส่วนบุคคล ราคา รถปิคอัพ ค่าใช้จ่ายในการโฆษณา จำนวนประชากร และอัตราดอกเบี้ยเงินกู้ มีความสัมพันธ์ในทิศทางเดียวกันกับอุปสงค์รถยนต์นั่งส่วนบุคคล ซึ่งราคาเครื่องยนต์นั่งส่วนบุคคลมีความสัมพันธ์ไปในทิศทางเดียวกับปริมาณอุปสงค์รถยนต์นั่งส่วนบุคคล ที่ระดับความเชื่อมั่นร้อยละ 82.83 ราคา รถปิคอัพ มีความสัมพันธ์ไปในทิศทางเดียวกับปริมาณอุปสงค์รถยนต์นั่งส่วนบุคคล ที่ระดับความเชื่อมั่นร้อยละ 64.75 ค่าใช้จ่ายในการโฆษณามีความสัมพันธ์ไปในทิศทางเดียวกับปริมาณอุปสงค์รถยนต์นั่งส่วนบุคคล ที่ระดับความเชื่อมั่นร้อยละ 85.27 จำนวนประชากรมีความสัมพันธ์ไปในทิศทางเดียวกับปริมาณอุปสงค์รถยนต์นั่งส่วนบุคคล ที่ระดับความเชื่อมั่นร้อยละ 99.82 และอัตราดอกเบี้ยเงินกู้มีความสัมพันธ์ไปในทิศทางเดียวกับปริมาณอุปสงค์รถยนต์นั่งส่วนบุคคล ที่ระดับความเชื่อมั่นร้อยละ 69.71 ส่วนราคาน้ำมันเบนซินขายปลีกมีความสัมพันธ์ไปในทิศทางตรงกันข้ามกับปริมาณอุปสงค์รถยนต์นั่งส่วนบุคคล ที่ระดับความเชื่อมั่นร้อยละ 96.12

ส่วนที่ 2 ศึกษาลักษณะและภาวะการณ์กระจุกตัวของตลาดรถยนต์นั่งส่วนบุคคลในประเทศไทย โดยการศึกษาถึงอุตสาหกรรมรถยนต์ในประเทศไทย ด้วยวิธีการพรรณนาร่วมกับสถิติอย่างง่าย สำหรับลักษณะ และภาวะการณ์กระจุกตัวใช้ปัจจัยที่เป็นตัวชี้วัด คือ อัตราการกระจุกตัว (Concentration Ratio : CR) และ ดัชนีเฮอริฟินดัล (Herfindahl Index) ผลการศึกษาพบว่าโครงสร้างของอุตสาหกรรมรถยนต์ในประเทศไทย มีแนวโน้มการกระจุกตัวของส่วนแบ่งตลาดเพิ่มขึ้น จากการกระจุกตัวของส่วนแบ่งตลาด 2 ราย (CR2) ร้อยละ 78.25 ในปี 2548 เพิ่มขึ้นเป็นร้อยละ 82.05 ในปี 2549 และค่าการกระจุกตัวของส่วนแบ่งการตลาด 4 ราย (CR4) เพิ่มขึ้นจากร้อยละ 86.23 ในปี 2548 เป็นร้อยละ 89.60 ในปี 2549 รวมทั้งการที่ค่าดัชนีเฮอริฟินดัลมีแนวโน้มเพิ่มขึ้นจากปี 2548 ที่มีค่าเท่ากับ 0.33 เป็น 0.35 ในปี 2549 แสดงโครงสร้างของอุตสาหกรรมรถยนต์มีการแข่งขันลดลง โดยผู้ประกอบการรถยนต์นั่งส่วนบุคคลรายใหญ่อยังคงครองส่วนแบ่งตลาดได้เป็นส่วนใหญ่ ทั้งนี้เนื่องจากผู้ประกอบการรถยนต์นั่งส่วนบุคคลรายใหญ่จะเป็นผู้นำเข้ารายใหญ่ด้วย ดังนั้นส่วนแบ่งตลาดรถยนต์นั่งส่วนบุคคลในประเทศไทยจะถูกครอบครองโดยรถยนต์นั่งส่วนบุคคลเพียง 4-5 ยี่ห้อเท่านั้น

# Thai Passenger Car Demand Estimation

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## ABSTRACT

The aim of this research is two-fold: to identify the major determinants for the Thai passenger car demand function and to quantify the market concentration of the Thai passenger car market. The new car sale and registration between 1998-2006 data sets from the top ten car manufacturers in 2006 were used for the study. The observation is 36 quarters range for the first quarter of 1998 to the fourth quarter of 2006. These top ten car producers were Toyota, Honda, Chevrolet, Mitsubishi, Nissan, Mazda, Mercedes-Benz, BMW, Ford and Volvo.

The paper was divided into two parts. In the first part, the major demand determinants for the Thai passenger car were presented using the multiple regression analysis. The dependent variable, the quantity of the private passenger car sale, was regressed against the independent variables including the passenger car price, the income per capita, the pickup truck price, the retailed gasoline price, the advertising expense, the population, and the loan interest rate. The quarterly data sets between 1998-2006 was used in the multiple linear regression model to identify several statistics such as  $R^2$ , Adjusted  $R^2$ , t-statistic, F-statistic, Durbin-Watson test, and coefficients of the independent variables in order to justify the model. Finally, the market concentration was quantified using two indicators: the concentration ratio (CR) and the Herfindahl Index.

The results of the study are concluded that the major determinants for the Thai passenger car demand are the passenger car price, the pickup truck price, the retailed gasoline price, the advertising expense, the population, and the loan interest rate. All determinants are positively correlated with the quantity of the car sale except the retailed gasoline price that has a negative correlation. The car price is positively correlated at 82.83% confidence level while the pickup truck price, the advertising expense, the population, and the loan interest rate are also positively correlated at the confidence level of 64.75%, 85.27%, 99.82%, and 69.71% respectively. On the other hand, the retailed gasoline price is negatively correlated at the confidence level of 96.12%.

In the later part, the results showed that the Thai passenger car industry experienced higher market concentration. The concentration ratio of the top two producers (CR2) was increased from 78.25% in 2005 to 82.05% in 2006. The concentration ratio of the top four producers (CR4) was also increased from 86.23% in 2005 to 89.60% in 2006. In addition, the Herfindahl Index was also increased from 0.33 in 2005 to 0.35 in 2006. These indicators suggested that the Thai passenger car competition was declined due to the increasing market share of the top producers. Since the top car producers are also the top car importers, the Thai passenger car market are dominated by 4-5 top producers.

## Introduction

Automobile industry is one of the most important industries in the Thai economy. The value added and foreign exchange from this industry is significant. According to Thai automobile producers, there were 538,000 cars exports equal to the value of 240,764.09 million bahts in 2006 (Automotive Institute, 2006). The highest export volume was the one-ton pickup truck, followed by the passenger car. In addition, the automobile industry is the major employer in the industrial sector at the employment ratio around 8-9% of all industry. The automobile industry also creates many linkages between many supporting industries and the other raw material industries such as the steel industry, and the plastic industry. However, the major demand for the passenger car is the domestic market.

The Thai automobile industry is relatively small compared to the other Asian countries. There are some idle capacities left and ready to produce to meet the surge in demand. According to Sasin Business Administration Institution of Chulalongkorn University, Thai automobile industry has an advantage for the development of the industry competitiveness. (Sasin, 2003: p.126).

There were approximately 100,000 passenger cars in Thailand in 2006, increased from around 20,000 in 1998. Currently, the Thai automobile industry is dominated by the major car manufacturers from Japan with relatively high capacity. However, the Thai automobile market is limited due to several factors such as high excise tax rate for the passenger car which make the car retail price very high relative to the consumer purchasing power. Even the population

is increasing most of them is low income and therefore have not sufficient purchasing power. This makes the passenger car, the market for medium to high income consumers. While the major Thai manufacturing capacity and major automobile part industry is mainly for the pickup truck, the passenger car has the highest market share in the global automobile market. However, the Thai automobile manufacturing capacity follow the pickup truck is the passenger car, this creates a good opportunities for the Thai car manufacturers to produce both the pickup truck and the passenger car for the domestic and international market.

From the reason explained previously, the major demand determinants for the Thai passenger car are quite interesting. This study was expected to provide the basic information for Thai car manufacturers in order to understand the consumer needs for the product development in the near future. The main objectives of the research are to identify the major demand determinants for the passenger car in Thailand and to quantify the market concentration of the Thai passenger car market.

## Concept and Theory

### Law of Demand

Demand is the quantity demanded of goods and services that the consumers are willing to pay at a specific time for a different price level. The word "willing to pay" is a consumer need together with a purchasing power which means that the consumers must have enough money and the willingness to pay for the goods and services.

The law of demand states the inverse relationship between the quantity demanded for goods and services and the price of such goods and services. This implies that the higher the price of goods and services, the lower the quantity demanded. On the other hand, the lower the price of goods and services, the higher the quantity demanded.

The demand estimation is the estimation of the coefficients of the independent variables in the demand model. The managers can expect the effect of the changes in any variables to the quantity demanded of their products and sale revenue. Hence, they can improve their planning and make their decision more efficient. The demand estimation supports the producers for their marketing planning, production planning, and the pricing policy to response for the changes in the demand as a result of the changes in any determinants (Tangkrajang, 2003 : pp. 87-88).

The first step in the demand estimation is to identify the value of the coefficient for each independent variable. The major demand determinants is using as the independent variables in the model can be divided into the controllable variables such as the sale price, the sale promotion, the product design, and the marketing channel, and the uncontrollable variables such as the consumer income, the consumer preferences and their expectation, and the policy of the competitors (Chutiwong, 2004: pp.64-65).

The demand function used to identify the direction of the changes in demand with respect to the changes in the determinants. However, the qualitative analysis from the demand function may not be sufficient for the management planning, the

quantitative analysis is needed. The demand estimation is used to quantify the percentage change in demand as a result of the percentage change in the determinant. For example, the manager may need to know that how much they need to reduce the price of the product in order to increase the sale volume by 5% or what is the effect on the sale volume if the competitors reduce their price by 10%. The quantitative analysis makes the business more confident in their decision making process (Meenapan, 2003: p.206).

In addition, Ivan Png explained the data sets using in the demand estimation in his Managerial Economics book. He mentioned that the data sets can be divided into two groups: the time series data and the cross sectional data. The time series data are the published statistical records and private records which collected from the research survey and the market research in the focus group to identify the consumer preferences which may reflect the actual consumption with respect to the change in the specific determinant. The cross sectional is the collection of the data sets of the sale volume from the different market at the specific point in time (Png, 2005: p.86).

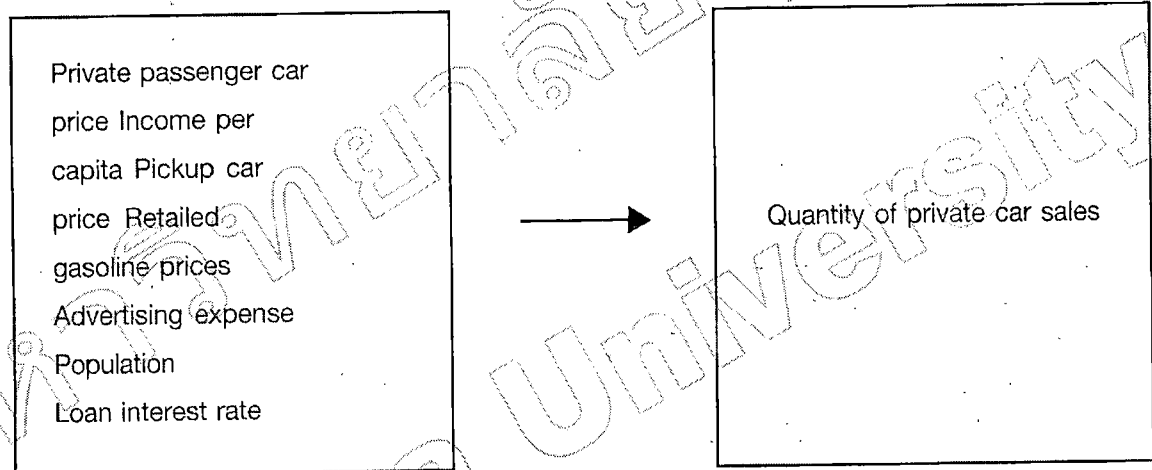
In summary, the demand estimation is the identification of the relationships of the demand and its determinants from the coefficients in the demand model and their explaining power. This provides the information on the direction of the demand change with respect to the change in the determinant. If there is the inverse relationship between the demand and the determinant, the coefficient will show the negative sign. On the other hand, if there is a direct relationship, the sign of the coefficient will be positive. In addition, the value of the coefficient also informs the size of such relationship.

There are two types of the demand estimation: a direct estimation and an indirect estimation. The direct estimation can be performed by the market survey using the questionnaire, the market test, the consumer clinic, the Delphi, the direct marketing, and the estimation from the grass-root. The indirect estimation is using the regression technique.

## Market Concentration

### Independent variables

### Dependent variable



The conceptual framework of the demand estimation.

### 1. Major factors for market concentration

In the calculation of the market concentration, four economics numbers are mainly used namely the sale revenue, the value-added value, the employment level, and the asset value. The sale revenue is the revenue from the sales of the products, while the value-added value is the different between the sale revenue and the cost of production. The value-added value is more appropriate because it reflects the efficiency of the resource usage in the production process even there are the same amount of the percentage of the sale revenue to the total sale value of the industry. In the industries that have different production process, the economic efficiency from the resource usage can be identified by the employment level and the asset value.

However, these two figures have some limitations in practice from the different time frame due to the information disclosure of the business.

## 2. Market Concentration Measures

There are several measures for the market concentration such as Concentration Ratio (CR), Size Ratio (W), Comprehensive Concentration Index (CCI), Entropy Index, Lorenze Curve and Gini Coefficient and Herfindahl Index (HI). However, this study used two measures, Concentration Ratio and Herfindahl Index, to quantify the market concentration since these two indicators are the indices used for the monopolistic competitive market. Robin Bade & Michael Parkin explained the indices used for the monopolistic competitive market in the Foundations of Microeconomics books. They mentioned the measures of the market concentration as the following:

2.1 The Concentration Ratio is the measurement of the market share of the top producers sorted by the size of the market share as the percentage of the whole market.

2.2 The Herfindahl Index is the measurement of the market concentration to quantify the market characteristics and the degree of competition from every producer in the industry. The index uses the sum of the square of the market share of the individual firm over the total market size. (Bade & Parkin, 2005: pp. 422-423)

## Related Researches

Kachin Sukumoljun (1999: abstract) The aim of this research is to analyze the Thai passenger car demand between 1988-1998. The passenger car was grouped by size : less than 1500 cc, 1501-1600 cc, 1800-2000 cc and more than 2000 cc. The research methodology was multiple regression analysis by logarithmic linear equation. The results of the study are concluded that the major determinants for car less than 1500 cc are price and real income, 1501-1600 cc are price and real income, 1800-2000 cc are real income and short term loan and more than 2000 cc are real income.

Kulachai Wongnararatchakit (2002: abstract) The aim of this research are to study concentration of automobile industry and to analyze SWOT between 1981-2000. The automobile industry was divided in passenger car, commercial car and total car. The research indices were concentration ratio, Herfindahl index and industry concentration curve. The results of the study are concluded that the market concentration of passenger car, commercial car and total car were 4 producers which were market leader

## Research Methodology

### Definition

**The passenger car industry** means the assembly of the passenger car using the automotive parts and the engine including the chassis, the engine, suspension, and transmission for the under body, and the wheels, the interior components and decorations, and the electrical and electronics parts. There are two types of passenger cars in Thailand: the private passenger car and the commercial passenger car.

**The private passenger car** means the seven-seated passenger car including both two-door and four-door using for the convenience of the owner.

**The commercial passenger car** means the passenger car that used for commercial purposes including transportation of goods or passengers from one place to the others in order to receive the return either in the form of money or not.

**The pickup truck** means a light truck with carrying capacity of one ton including two-door, two-door with cab, four-door, and four-wheel drive pickup truck.

**Demand function** is the relationship between the quantity that the consumers are willing to pay and the determinants of the demand, *ceteris paribus*.

**Demand determinants** are all major factors that affect the quantity demanded such as the own price, the price of other goods including the

price of the complementary and the substitute, the consumer preferences, the average household income, the season, the population, and the income distribution.

### Data and data collection

The secondary data used in the study are the data related to the automobile industry in Thailand including the marketing, the production, the import, and the export. These data sets were collected from the books, the journals, the newspaper, and the documents and statistical records from the government agencies and private companies such as the Ministry of Industry, the Bank of Thailand, the Thailand Automotive Institute, the Council of Industry of Thailand, the Media Spending Co., Ltd., the Grand Prix International Co., Ltd., and the 10 major car manufacturers' website. The data sets were collected in 36 quarters range from 1998-2006 including:

1. The sale volume, the production, the import and the export of the automobile in Thailand sorted by the individual manufacturer from the Automotive Institute, Thai Council of Industry, the Department of Customs, and the Department of Land Transportation

2. The average price of the private passenger car, the pickup truck classified by the individual manufacturer and driving mechanism using the weighted average price by the ratio of the monthly sale volume from each manufacturer adjusted by the Consumer Price Index (CPI) at the 2000 base year collected by the Grand Prix International Co., Ltd.



3. The income per capita collect from the GNP Per Capita at the 1998 base year which is the most reliable data from the Bank of Thailand

4. The quarterly advertising expense classified by the individual car manufacturer adjusted by the CPI at the 2000 base year from the Media Spending Co.,Ltd.

5. The population from the National Statistical Office

6. The retailed gasoline price adjusted by the CPI at the 2000 base year from the Bank of Thailand

7. The loan interest rate using the Minimum Loan Rate (MLR) which is the benchmark interest rate for the car financing interest rate adjusted by the CPI at the 2000 base year from the Bank of Thailand.

## Data Analysis

### Part 1

The econometric model was set up in order to identify the relationship between demand and its major determinants for the first objective. The data set explained earlier was used to perform the multiple regression analysis using the Eview statistical software.

### Econometric Model

The Thai passenger car demand estimation model was developed in order to explain the effect of the major determinants on the quantity demanded. These demand determinants include the price of the passenger car, the income per capita, the price of the pickup truck, the retailed gasoline price, the advertising expense, the population, the loan interest rate, and time. The study assumes that the consumer preferences and price expectation are constant. The model functional form is the following:

$$Q_t = f(P_t, Y_t, P_{Rt}, O_t, A_t, Pop_t, R_t)$$

where

$Q_t$	=	Quantity of private car sales
$P_t$	=	Private passenger car price (bahts)
$Y_t$	=	Income per capita (bahts)
$P_{Rt}$	=	Pickup car price (bahts)
$O_t$	=	Retailed gasoline prices (bahts)
$A_t$	=	Advertising expense (bahts)
$Pop_t$	=	Population
$R_t$	=	Loan interest rate (%)

### Hypothesis

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According to the law of demand, the hypothesis on the sign of each determinant for the demand of the passenger car is the following:

1. The price of the passenger car has a negative correlation with the quantity of the passenger car sale. This implies that when the price increases, the car sale volume decreases. So the coefficient of the price of the passenger car should be negative.

2. The income per capita of the population has a positive correlation with the quantity of the passenger car sale. This implies that when the income per capita increases, the car sale volume also increases. So the coefficient of the income per capita should be positive.

3. The price of the pickup truck has a positive correlation with the quantity of the passenger car

sale. This implies that when the price of the pickup truck increases, the car sale volume also increases. So the coefficient of the price of the pick up truck should be positive.

4. The retailed price of gasoline has a negative correlation with the quantity of the passenger car sale. This implies that when the retailed price of gasoline increases, the car sale volume decreases. So the coefficient of the retailed gasoline price should be negative.

5. The advertising expense has a positive correlation with the quantity of the passenger car sale. This implies that when the advertising expense increases, the car sale volume also increases. So the coefficient of the advertising expense should be positive.

6. The population has a positive correlation with the quantity of the passenger car sale. This implies

that when the population increases, the car sale volume also increases. So the coefficient of the population should be positive.

7. The loan interest rate has a negative correlation with the quantity of the passenger car sale. This implies that when the loan interest rate

decreases, the car sale volume also increases. So the coefficient of the loan interest rate should be negative.

The relationship between the demand of the passenger car and the major determinants can be identified using the quantitative analysis. The multiple regression analysis is performed using the following model specification:

$$Q_p = \beta_0 + \beta_1 P + \beta_2 Y + \beta_3 P_R + \beta_4 O + \beta_5 A + \beta_6 Pop + \beta_7 R + \beta_8 T$$

where

$Q_p$	=	Quantity of private car sales
$P$	=	Private passenger car price (bahts)
$Y$	=	Income per capita (bahts)
$P_R$	=	Pickup car price (bahts)
$O$	=	Retailed gasoline prices (bahts)
$A$	=	Advertising expense (bahts)
$Pop$	=	Population
$R$	=	Loan interest rate (%)
$T$	=	Time
$B_j$	=	Coefficient for independent variable, where $j = 0$ to $9$
$E$	=	Error term

From the above model, the coefficient of each independent variable reflects the effect of such variable on the passenger car demand. If the coefficient has a positive sign, then there is a positive correlation between the passenger car demand and the specific independent variable. On the other hand, if the coefficient has a negative sign, then there is a negative correlation between the passenger car

demand and the specific independent variable. The value of the coefficient also reflects the explaining power of such coefficient on the value of the passenger demand. The statistics using to justify the appropriate model specification are  $R^2$ , T-Statistic F-Statistic.

## Part 2

The study in this part on the passenger market concentration was report as the following:

1. The study of the Thai automotive industry are performed by descriptive statistics using the tables and charts including the production, the sale, the export, the import and the government policy.

2. The level of the market concentration in the Thai passenger car industry is performed using the quantitative analysis on the secondary data sets mentioned earlier. Two indicators, the Concentration Ratio (CR) and the Herfindahl Index (HI), are calculated.

## Research Results

### Part 1

The major demand determinants for Thai passenger car were determined by the quantitative analysis, using the multiple regression analysis, in order to identify the relationship between the quantity of the passenger car sale that is dependent variable and the independent variables. Seven independent variables in the model were the average price of the passenger car, the average price of the pickup truck, the advertising expense, the average retailed gasoline price, the population, and the loan interest rate. The results from the multiple regression analysis are the following:

$$Q_t = -756733.3 + 0.015737 P_t - 1.273919 Y_t^{NS} + 0.042683 P_{RT} - 1802.462 O_t^* + 3.69E-05 A_t + 12.21018 Pop_t^{**} + 1100.159 R_t \quad (1)$$

(1.145)                      (-0.502)                      (0.864)                      (-2195)  
(1.543)                      (1.022)                      (-0.725)

$$R^2 = 0.8600, \text{ Adjusted-} R^2 = 0.82506 \quad F \text{ statistic} = 24.572$$

$$\text{Value in blanket} = t\text{-statistic} \quad \text{Durbin-Watson} = 2.533$$

\* Coefficient is statistically significant at 95% confidence level

\*\* Coefficient is statistically significant at 99% confidence level

The result from the regression shown the  $R^2$  of 0.860 , F Statistic of 24.572 and Prob. of 0.00000 implied that the model specifications and independent variables have the explaining power of 86% with statistically significant. The Durbin- Watson of 2.533 is not much different from 2. This implied that the

error terms are good distributed, so there is no autocorrelation in the model.

The previous results can be concluded that the major determinants which shown as independent variables with statistically significant are the passenger

car price, the pickup truck price, the retailed gasoline price, the advertising expense, the population, and the loan interest rate. This left the income per capita from the model since it did not show any statistically

significant. So the model was revised by drop the insignificant independent variable out by performing the multiple regression using 6 independent variables. The results are as the following:

$$Q_t = -745426.1 + 0.014492 P_t + 0.045709 P_{Rt} - 1709.131 O_t^* + 3.17E-05 A_t + 11.64407 Pop_t^{**} + 1113.341 R_t \quad \dots\dots\dots(2)$$

(1.391)                      (0.944)                      (-2.164)                      (1.488)  
(3.431)                      (1.048)

$R^2 = 0.8587$       Adjusted  $R^2 = 0.8295$       F statistic = 29.3825  
Value in Blanket = t statistic      Durbin-Watson = 2.5168

\* Coefficient is statistically significant at 95% confidence level

\*\* Coefficient is statistically significant at 99% confidence level

The study from both models can be concluded that the second model is more appropriate due to several statistics such as F statistic which show the explaining power of all independent variables in the model with statistically significant at 99% confidence level. In addition, the t-statistic for individual independent variables is also statistically significant. For a small sample, it is a better measure for goodness-of-fit than  $R^2$ . It is also used as a criterion to add or remove an explanatory variable from the model if it does not contradict theories.

The results from the second regression model suggest that the passenger car price, the pickup truck price, the advertising expense, the population, and the loan interest rate are positive correlated with the passenger car sale. The car price is positively correlated at 82.83% confidence level while the pickup truck price, the advertising expenses, the population,

and the loan interest rate are also positively correlated with the confidence level of 64.75%, 85.27%, 99.82%, and 69.71% respectively. On the other hand, the retailed gasoline price is negatively correlated with the confidence level of 96.12%.

The sign of the independent variables also shown that the pickup truck price, the retailed gasoline price, the advertising expense, and the population are the same as hypothesized while the passenger car price and the loan interest rate are not the same as expected. For the passenger car price, the consumer preference may affect their decision that did not concern on price due to the major consumer group are medium to high income consumer. While the loan interest rate may not be as important as the loan installment, the ratio of down payment to the price of the car, loan period, and the sale promotion from the dealers. In addition, the consumer may have ability to

buy the car in cash so the loan interest may not affect their decision.

## **Part 2**

### **1. The automobile industry in Thailand**

The Thai automobile industry was started in 1961 when the Board of Investment (BOI) first promoted automobile assembly led to the establishment of the first Thai automobile assembly factory namely the Thai Motors Industry Co., Ltd. In the earlier period, the domestic automobile parts using in the assembly factory are only the wheel, the battery, and the stud for the driving mechanism. The plant assembly mainly the American and European car, until 1962 the Japanese car assembly was set up. The car production line increases from 525 cars in 1961 to 13,988 cars in 1968. However, the assembly parts was mainly import from the headquarter. (Sasin, 2003: p.94)

In 1991 the Ministry of Industry announced the market liberalization policy for many industries including the automobile industry. The import restrictions on the new and used car were abandoned. In 1993, the restriction on the establishment of the new car assembly plant was also dropped out. This encourages the foreign car manufacturers, particularly the Western companies, to invest in the car assembly plants in Thailand in order to produce car for export in the Asian region. In 1996, the American car manufacturers increase their investment in the automobile parts to supply for the assembly plant in Thailand. In 1999, the forces from the free trade wave set up by the World Trade Organization (WTO) were

increasing. At the same time the Thai automobile industry was suffered from the financial crisis in 1997, the government removed the legislation the Thai-source content requirement for vehicle assembly. In 2002, the tax policy for car was revised to the new tax regime in order to reduce the unfair and double tax system. The new tax regime expected to improve technology and the competitiveness of the domestic car manufacturers. In 2003, the Ministry of Finance set up the new customs system that base on the three phases of the manufacturing process: the raw materials, the intermediate products and the finished products. In 2006 the new investment promotion measures for production of energy-saving cars under the world class standard, so that Thailand can be a car assembly base for energy-saving vehicles.

The car assembly line in Thailand use many supplied parts and components that import through CKD (completely knock down) to assemble with some local content required by the regulations. The assembly process start with the car body component to which a multitude of panel and braces was subsequently be either welded or bolted using Jig and Fixture. As it moves down the assembly line, held in place by clamping fixtures, the shell of the vehicle is built. As the body moves from the isolated weld area of the assembly line, subsequent body components including fully assembled doors, deck lids, hood panel, fenders, trunk lid, and bumper reinforcements are installed. Prior to painting, the body must pass through a rigorous inspection process, the body in white operation. After the shell has been fully inspected and repaired, the assembly conveyor carries it through a cleaning station where it is immersed and cleaned of all residual oil, dirt, and contaminants. As the shell exits the cleaning station it goes through a drying booth and then through

an undercoat dip with primer. This coat acts as a substrate surface to which the top coat of colored paint adheres. After the undercoat bath, it proceeds on to the final paint operation. The painted shell proceeds through the interior assembly area where workers assemble all of the instrumentation and wiring systems, dash panels, interior lights, seats, door and trim panels, headliners, radios, speakers, all glass and the automobile windshield, steering column and wheel, brake and gas pedals, carpeting, and front and rear bumper fascias. The vehicle can now be started. From here it is driven to a checkpoint off the line, where its engine is audited, its lights and horn checked, its tires balanced, and its charging system examined. When the vehicle passes final audit it is given a price label and driven to a staging lot where it will await shipment to its destination.

The Thai automotive industry had seen some sign of export since 1995 due to the excess production capacity and the slow down of domestic market, but the export quantity was only 7,208 cars which mainly were Mitsubishi and Toyota. In 1997, however, things changed abruptly in the wake of Thailand's economic crisis that immediately cut domestic demand for cars. Under these circumstances, automotive manufacturers had to solve the problem of excess production capacity. As a solution, they opted to export their products to other countries with some additional quotas from their headquarters. At the same time there are some benefits from the devaluation of Thai baht. The auto export increase from 2 companies in 1995 to 5 companies and increasing in the near future.

On the import side Thailand has also imported the automobiles from many countries. The Japanese exporter was the highest value of around 65%,

followed by Korea and European cars around 15%, the rest and the U.S. around 5%. The auto import value tends to increase continuously due to the economic growth and bilateral free-trade agreement.

Government policy on the development of Thai automobile industry since the start until present as mentioned previously providing incentives for foreign car manufacturers and parts-makers to invest in Thailand. The Thai government took several measures aimed at regulating and establishment of new assembly facilities, including a ban on CBU (completely built up) imports in favor of local production, local content requirements, import tariff barriers and investment promotion. (Automobile Institute, 2005, p.44)

## **2. The study on the market concentration of the Thai passenger car market using the CR and HI**

The results of the market concentration study from 1998-2006 concluded that the passenger car sales are concentrated among several car manufacturers particularly the first and the second top producers. In 1998 Toyota and Honda are the top 2 producers with the market share of 32.65% and 31.74% respectively. The CR2 was 64.39% which was more than half of the total market. This was also true for the following year. The CR2 was 58.18%, 63.43%, 67.23 and 64.76% from 1999-2002 respectively. More recently, during the last 4 years from 2003-2006, the top 2 producers had the market share more than 70%. The CR2 was 75.97%, 83.03%, 78.25%, and 82.05% from 2003-2006 respectively.

If consider HI, the average value of 0.28 from 1998-2006. There are some years more than 0.28 such as 2003, 2004, 2005, and 2006 with the value range from 0.21 to 0.36. These implied that there was an increasing in the automobile industry due to the entry of the new competitors such as the car import from the new foreign manufacturers with lower prices. This reduces the market share of the current competitors in the auto market. The lower HI implied that the competition in the industry was increased even the high CR means the high market power of the top producer. Since the low HI may be the result of many car manufacturers other than the top 5 producers which are control high market share. For example, in 2006, there were only 2 car makers that have the market share more than 10% which is Toyota and Honda while the other car makers (more than 8 producers) had market share below 5%. Thus, the HI calculation was low.

interest rate are increased, the consumers are still willing to pay for the car. For the market implications, the higher price may be not important as the quality, the efficiency, or the car design which encourage the consumer to purchase and enhance the demand and sales volume.

2. The government policy should enhance the local content requirements especially the engine parts and the electronics parts in order to develop the local part-producers the ability to improve the product quality.

3. The research and development on some passenger car models to set up the assembly base in Thailand for both domestic and export market by relocation from the headquarters.

## Suggestion

The results of the study lead to the policy recommendations for the development of the Thai passenger car industry for the competitive advantages and create the opportunities and new alternatives to expand the production not only the pickup truck to the domestic market.

1. The price of the passenger car, the price of the pickup truck, the advertising expense, the population, and the loan interest rate are the determinants that have the positive correlation with the demand for the passenger car. This means that even the price of the passenger car and the loan

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