JÖNKÖPING INTERNATIONAL BUSINESS SCHOOL
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Investment Performance of the World Automotive Industry between 1999 and 2004

A Marginal q Analysis

MASTER THESIS in ECONOMICS

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Abstract

The paper examines the investment performance of the world automotive industry using a sample of 21 original equipment manufacturers (OEMs) based in three major continents, North America, Europe and Asia between the years 1999 and 2004. The empirical findings suggest that there exists persistent overinvestment not only in the global level but also in the major automotive production regions analyzed. Proving that none of the 3 regions gain returns on investment at least as large as their costs of capital, shareholder wealth is not maximized in the world automotive industry. Europe, among these regions, proves to gain the highest return on investment of its cost of capital. The empirical results also show that the return on investment financed by debt is high around the world and close to 100% of its cost of capital.

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1 Introduction

The automotive industry is referred to "the industry of industries" around the world due both to its notable share in national economies and its multi-dimensional complexity such as advanced product design and manufacturing technologies, supply chain size and network, involvement of government and labor relations. According to a report, published in 2004, of the International Organization for Motor Vehicles Manufacturers, known as OICA, the global turnover of the automotive industry was €1.6 trillion, which would be the 6th largest economy in the world. The industry invested over €66 billion in research and development and production worldwide. Besides, contributions to government revenues exceeded €400 billion merely in 26 countries (OICA, 2004). Regarding the complexity it involves, the industry, although it is regarded as "mature", has been continuously experiencing substantial changes in core issues such as consolidation, production regions, technology and market leadership for the last two decades (Fine, Clair, Lafrance and Hillebrand, 1996).

The investment intensive industry was estimated to have global overcapacity equivalent to 40 automotive manufacturing assembly plants in the year 2003 (Site Selection, 2005 and European Competitiveness Report, 2004). Currently, the automotive industry produces at a level of global overcapacity of around 25%. The overcapacity seems to be an issue not only in North America and in Europe, but also even surprisingly in China (Brahat Book Bureau, 2006).

The efforts of automotive manufacturers to increase customer demand for vehicles have not been compensated in terms of increase in sales and increase in rates of returns on investments yet. Taking the intensifying competition into account, the incumbents take measures establishing strategic mergers and acquisitions in order to attain desired economies of scales and scope, and boost returns for their shareholders.

1.1 Definition of the Problem

The automotive industry has a voracious need for growth. The shareholders of many automotive companies invested substantial resources to emerging Eastern European markets in mid-1990s. In result, this led to a remarkable, 10%, drop in capacity utilization rate (European Competitiveness Report, 2004). Today, almost all automotive companies invest billions of dollars of shareholders' capital in China, add more capacity, in expectation of high returns and profitability in future. The world automotive industry is expected to build at least 2m units of new capacity in China by 2006 and plan extra additions by 2010. The industry is still expanding very fast due to substantial capital flows, of almost all automotive manufacturers, running into the Chinese market (Hayes, Warburton et.al, 2003). That being said, high returns on investments in automotive industry cannot be reaped easily unless demand for vehicles boost.

Previous performance studies were built on explaining return on capital mainly by using Tobin's q, which was then found to be a less than ideal method for hypothesis testing due to some inefficiencies such as omitted variable problems and its being an average statistic (Gugler and Yurtoglu, 2002). In order to built a complete method that can explain the marginal return on investment, marginal q, ratio of firm's marginal returns on investment to its cost of capital, will be utilized in this paper.

1.2 Purpose of the Thesis

The purpose of the paper is to examine the investment performance of the world automotive industry utilizing the marginal q method during the sample period 1999 - 2004. The paper merely presents the results, while empirical analysis of possible factors effecting the results are not in the scope of the paper.

Although this paper is technically built on previous researches, it is a first attempt to investigate the investment performance of the world automotive industry by utilizing marginal q method.

Table 1.2 Companies under review

North America	Ford, General Motors, Paccar
Europe	Volkswagen, Volvo, Daimler Chrysler, Renault, BMW, MAN, Scania, Peugeot, Fiat
Asia	Daihatsu, Isuzu, Mitsubishi, Mazda, Nissan, Honda, Toyota, Kia, Hyundai

Source: Own construction

In this paper, 21 listed automotive manufacturers operating in car, bus and truck sectors will be analyzed. The companies are grouped according to the regions, in which they are based, as depicted in Table 1.2 above. The data for the companies under review are mainly extracted from the Bureau Van Dijk's major database of OSIRIS and several company annual reports.

1.3 Outline of the Thesis

In chapter 2 of the paper, detailed information on industrial developments such as consolidation and overcapacity in the three pioneering regions of the world is presented. Subsequently, in chapter 3, the shareholder model and free cash-flow are introduced, hypotheses are asserted, and previous researches are reviewed. The method of marginal q, definitions of variables and the data sources will be introduced in chapter 4. Also in this chapter, the results of the marginal q analyses are given. Finally, chapter 5 gives a brief summary and concludes the paper.

2 World Automotive Industry

2.1 American Automotive Industry

The American automotive industry is the largest manufacturing industry in the US. The Big-3, Ford, DaimlerChrysler and GM, are ranked among the world's largest corporations. These corporations contribute to the economy more than $260 billion every year and maintain employment to approximately 700,000 people. In numerical terms, 1 out of 10 jobs in the US and 1 out of 7 in Canada are reckoned as related to automotive industry. Furthermore, the R&D carried out in the American automotive industry exceeds that of the pharmaceutical, electronics or computer industries and accounts for 12% of the nation's corporate R&D expenditure. A remarkable share of R&D investment is devoted to new technology development to alleviate the environmental issues. For instance; Ford Scientific Laboratory's allocate more than 50% of its research budget to advance the environmental technologies. Additionally, the greatest product market for automotive manufacturers is the domestic market (Brahat Book Bureau, 2006).

2.2 European Automotive Industry

Europe is the world's largest motor vehicle production region with its 40% share. The industry employs approximately 12m people directly and indirectly. Moreover, the automotive industry produces around 7% of the total manufacturing output in Europe (European Automotive Industry Report, 2005). Within Europe, despite its economy in recession, Germany continues to dominate the European single market in the automotive industry. However, compared to the US and Japan, the productivity is low and the labor costs are high due to rigid labor markets in the EU (European Competitiveness Report, 2004). Due to these reasons, 45 % of German cars are produced abroad and the share of Asian countries are rapidly increasing (Brahat Book Bureau, 2006).

Regarding increasing global competition, a series of intercontinental consolidation has been experienced throughout the years. As to give a couple of examples, Daimler-Benz has acquired Chrysler to increase its market share in the US, Renault has strengthened its operations with Nissan. However, some European brands have chosen other European brands such as acquisition of Skoda and Seat by Volkswagen Group, merger between Citroen and Peugeot. From this point of view, within the continent or out of the continent, unpartnered European automotive manufacturers may not handle the intensifying competition and live in future (Brahat Book Bureau, 2006).

The highly mature European automotive industry has sought potential growth opportunities in South America and Eastern Europe. The hope of extracting high profit in these fast developing regions has generated substantial amount of capital investments. Although these investments response to growth opportunities in mid-1990s resulted in at around 13% decline in capacity utilization, it has recovered back to a level between 85% - 90% levels since 2003 (European Competitiveness Report (ECR), 2004).

The role of regulations in the European automotive industry is substantial. These regulations mainly consist of environmental protection and competition policies. The companies invest substaintial resources to maintain the requirements strictly enforced by European Commission (ECR, 2004).

2.3 Asian Automotive Industry

The Asian market will likely be the main source of growth fostering global demand for vehicles over the next five years (KPMG, 2006). In particular, the Chinese market, the largest potential market of all with 1.3 bn customers, is estimated to expand in double-digit growth rates (Volkswagen Annual Report, 2005). In five years, Chinese market is expected to embody more than one third of global volume growth (BNP Paribas, 2005).

The government regulation preserves Chinese automotive industry by means of JVs (joint ventures) with international automotive manufacturers, and keeps the industry unconsolidated due to long-term industrial policies. Within the last two decades, almost all international automotive companies have established JVs with Chinese companies. For the time being, the structure of Chinese automotive industry is highly disintegrated with more than 100 companies. Most of these manufacturers produce relatively outmoded models in primitive plants (Hayes, Warburton et.al, 2003). Therefore, in general, the industry is said to have low utilization rates. The already low utilization rate of 77%, as presented in Table 1 below, is estimated to decrease further to 59% with the realization of planned capacity increases in global OEMs.

Table 2.3 Chinese Car Production Capacity of Global OEMs in 2002 and 2006

Company	2002 capacity	2006E capacity	Details
VW	550,000	1,000,000	VW statement
GM	140,000	350,000?	Estimate
PSA	150,000	300,000?	Estimate
Honda	150,000	400,000?	Aim: 240,000 by 2004
Toyota	50,000	200,000?	Aim: 400,000 by 2010
Nissan	0,000	220,000	Nissan statement
Hyundai	50,000	250,000	Aim: 500,000 by 2010
Ford	30,000	200,000?	Estimate
BMW	0,000	30,000?	Estimate
Kia	50,000	250,000	
Other	400,000	400,000	No increase assumed
Total capacity	1,570,000	3,600,000	
Total sales	1,221,123	2,136,000	Projected with an annual growth of 15%
Capacity utilization of global OEMs in China	Estimated 77%	Estimated 59%	

Source: Goldman Sachs Research estimates (Hayes, Warburton, Lapidus, Shiohara, Chang and McKenna, 2003).
Note: 2006E represents the estimated car production capacities for the respective OEMs.

The Korean automotive industry is also extremely fragmented consisting of more than 4000 companies. However, the fragmented Korean automotive industry is expected to experience restructuring and consolidation in the years to come (BNP Paribas, 2005). On the other hand, Japanese automotive market is mature and forecasted to expand about 2.3% in 2006 (Volkswagen Annual Report, 2005).

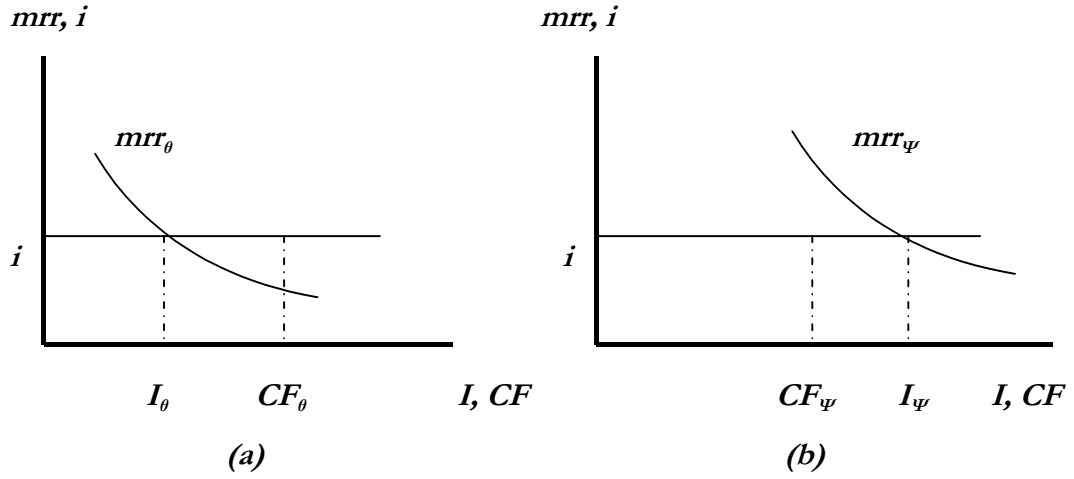
3 Theoretical Framework

3.1 The Shareholder Model

The shareholder model, by definition, justifies how a firm maximizes the profits to maximize shareholder wealth. The Figure 3.1 below helps to display the mechanism for two firms having different marginal rate of returns but same cost of capital. The horizontal axis shows the level of investment, *I*, and cash flow, *CF*, whereas vertical axis indicates marginal rate of return, *mrr*, and cost of capital, *i*. Accordingly, each firm trying to maximize the shareholder wealth must invest at maximum until the level, at which marginal rate of return of the investment, *mrr*, and the firm's cost of capital, *i*, curves intersect each other, giving a marginal return greater than 1, $q_m > 1$. As plotted in Figure 3.1, these particular points corresponds to I_θ and I_Ψ, where rates of returns of the investments, *mrr*'s, and the firms' cost of capital, *i*, are equal to each other for the respective two firms in review. The firm with mrr_θ maximizes shareholder wealth by investing I_θ and distributing $(CF - I_\theta)$ as dividends, whereas the other firm with mrr_Ψ satisfies the level of shareholder value maximization by investing I_Ψ and raising $(I_\Psi - CF)$ via issuing new equity or borrowing new debt externally from capital markets (Gugler, Mueller and Yurtoglu, 2001 and 2004).

In Figure 3.1 (a), the level of marginal rate of return, mrr_θ, is higher than the firm's cost of capital, *i*, until the investment level, I_θ. That is why, the shareholder value maximizing firm invests until the level I_θ, where the marginal rate of return equals the firm's cost of capital, $mrr_\theta = i$. If the level I_θ is exceeded, the marginal rate of return falls short of the firm's cost of capital, *i*. Any investment level between I_θ and *CF* corresponds to a lower marginal rate of return on investment than the firm's cost of capital and, thus, impedes maximization of shareholder wealth (Gugler, Mueller and Yurtoglu, 2004). In Figure 3.1 (b), the shareholder wealth maximizing level of investment, I_Ψ, can easily be detected employing the $mrr_\Psi = i$ rule on the graph.

Figure 3.1.i Investment Consistent with Shareholder Value Maximization



Source: "Corporate Governance and the Returns on Investment" (Gugler, Mueller and Yurtoglu, 2004).

People having capital can establish big companies; however they may not have specific skills to take the right decisions in necessary circumstances. That is why, companies are run by professional managers hired to run the organization in favor of shareholders (Becht, Bolton and Roell, 2002). Regarding this relation within the companies, Berle and Means

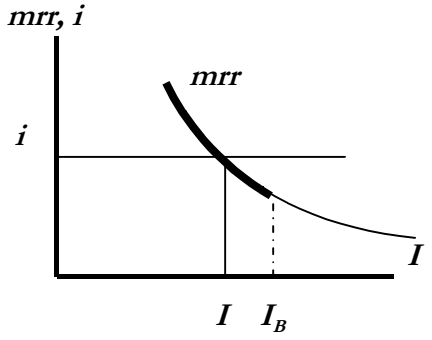
(1932) assert that separation of ownership and control may lead managers to become less accountable to shareholders. Grabowski and Mueller (1972) have taken the first step and mentioned that separation gives to managerial discretion. Large companies generally have large number of shareholders due to a number of reasons such as mitigating risk through diversification and high cost of holding large shares (Demsetz and Lehn, 1985). That mentioned, most of the shareholders hold few shares and have less chance to put pressure on managers to stick to their way. In such organizations, professional managers may find enough leeway and pursue their own objectives such as increasing market share, attaining high growth rate, maximizing their salary or tendency to undertaking particular investment projects (Maher and Andersson, 1999).

Knowing that managers may well behave discretionary by striving to attain personal interests and objectives other than that of shareholders, principal-agent problems may arise due to the separation, mentioned by Jensen and Meckling (1976). According to Coase (1937), Jensen and Meckling (1976), and Fama and Jensen (1983a,b) managers behave discretionary by taking advantage of the residual claims in favor of own pursuits provided that there is a sort of residual claim to be done, although behaving in parallel to shareholders' interests is the main reason of their being hired. Any kind of discretionary decision given by managers leads to low returns on investments and, hence, hinders maximization of shareholder wealth. Grossman and Hart (1986) state that the abuse of residual claim brings forth some drawbacks such as discouragement of potential investors and decline in their willingness to provide the company with capital in future investment projects undertaken.

3.1.1 Using Marginal q rather than Tobin's q

The shareholder model is also helpful to grasp why using marginal q is more appropriate than using Tobin's q. The intuitive is that any investment level higher than *I* leads to a smaller *mrr* than *i*. Therefore, Tobin's q, already an average performance measure, is the average of marginal q's up to that particular point.

Figure 3.1.ii Marginal q and Tobin's q



Source: Own construction based on the shareholder model.

Let the firm invest at I_B. However, corresponding marginal rate of return for this investments is less than its cost of capital. In result, the firm keeps investing despite the fact that the marginal rate of return falls short of its cost of capital. Given the subtlety, using marginal q instead of Tobin's q is therefore not a preference but a necessity to obtain accurate results on investment performance.

3.2 Hypothesis Formulation

Having equipped with requisite theoretical knowledge about investment performance and its relations with shareholder value maximization, it is easy to associate this with the ongoing developments in the world automotive industry. The industry outlook signifies overcapacity as a common issue. Overcapacity can be a result of overinvestment stemming from managerial discretion or failure. In this regard, whether the overcapacity is driven by overinvestment, or not, can be analyzed emprically. If the automotive industry has overinvested, then the corresponding level of investment should match with a point where marginal rate of return, *mrr*, falls below *i*, yielding a lower return on investment than its cost of capital. In other words, in a more systematized way, the first hypothesis to be analyzed can be formulated as follows;

Hypothesis 1: *The overcapacity in the world automotive industry is resulted from overinvestment, which leads to having* $mrr < i$.

Moving from the world level to the regional level, the differences in the structure of the regional automotive industries should in turn have effects on returns on investments. As it has already been mentioned in chapter 2, the European automotive industry is relatively mature and consolidated, whereas the Asian automotive market is relatively young and unconsolidated. The capacity utilization level in Europe was between 85% and 90% in 2003. However, due to capacity building in Asia, especially in China, the utilization level has been continuously declining, from 77% in 2002 to 59% in 2006. The low utilization level can be attributed to building too much overcapacity. This in turn means that the European automotive manufacturers have less overcapacity than that Asian automotive manufacturers have. In this case, the high level of overcapacity in Asia can be driven by a higher overinvestment level than that in Europe. Therefore, the second hypothesis investigating the regional differences in investment performances can be stated as in the following;

Hypothesis 2: *Since the overcapacity in Asia is higher than that in Europe, the overinvestment in Asia is expected to be higher than the overinvestment in Europe.*

3.3 Free Cash Flow

Managers in large companies can increase the dividend rate and, thus, shareholders can gain some amount that may otherwise well be put in low return investment projects or misused. Although managers can agree to increase dividend rate, such statements are reversible. However, the capital markets response to every bit of information, indication of low return, with sharp drops in stock price. Similar to paying dividends, managers are bounded to give away some portion of future cash flows to debt holders. However, paying debt is more bonding than distributing dividends, because debt holders go to court in case the principal and interest payments are not fulfilled properly. Associating this with the previous information, investment financed by debt decreases the cash flow available for discretionary decisions of managers pursuing private benefits (Jensen, 1986). In this regard, returns on investment financed by debt should be as high as its cost. Accordingly, a third hypothesis can be proposed as the following;

Hypothesis 3: *Returns on investment financed by debt is expected to be at least as high as its cost of capital, namely* $mrr_D \geq i$.

3.4 Previous Researches

Throughout the years, several researches have been carried out about firm performance, corporate governance and marginal q. The predecessors of this field are Berle and Means who first presented the separation of ownership and control of companies in 1932. Their concern has been on managers and shareholders. They asserted that when the shareholders cannot actively monitor a company, managers may take advantage of lax control and pursue their private interests using corporate assets.

Throughout the years many researches have been conducted on investigating the relation between investment performances and several other variables that are possibly influential on investment performance. Gugler, Mueller and Yurtoglu (2001 and 2004) have researched the impact of institutions, ownership structures and capital markets on investment performances, mainly returns on investments, of companies. Their empirical results have signified that legal system of a country has a greater effect than ownership structures on returns on investments of a company. They have also concluded that strong capital markets advance the returns on investments. Gugler and Yurtoglu (2002) have proposed that marginal q is a superior performance measure than Tobin's q. Furthermore, Gugler, Mueller and Yurtoglu (2003) have sought the reasons of different returns across different sources of finance and of greater of use external equity capital in developing countries than in developed countries. Their paper proves that managers are inclined to finance low return projects internally in countries where strong corporate governance systems prevail. On the other hand, in developing countries where weak corporate governance systems are in practice, managers take advantage of less control and raise equity capital to finance low return investments. In another study, Gugler, Mueller and Yurtoglu (2004) have claimed that agency problems pulling down the returns on investment of companies exist in all countries. In line with their previous studies, they also state that country's legal system has been found to be the most influential on investment performance, and legal institutions bolstering shareholder rights improve investment performance. Similar to findings of studies of Gugler, Mueller and Yurtoglu; La Porta, Lopez-de-Silanes, Shleifer and Vishny (1999) have found that better legal protection of minority shareholders leads to higher valuation of companies.

Mueller and Reardon (1993) have first introduced the marginal q, the ratio of marginal returns on investment to firm's cost of capital. Subsequently, Gugler, Mueller and Yurtoglu (2004) have employed the marginal q method utilizing a different calculation technique to examine the cash constraints and discretionary behavior of managers for Continental Europe and Anglo-Saxon countries. This paper is built on a third version of marginal q applied in Gugler and Yurtoglu (2002), and this method will be presented in the next chapter.

Having brought in the major studies pursued in investment performances, this paper combines the marginal q method and automotive industry to analyze the global investment performance in this specific industry.

4 Methodology, Data and Empirical Analysis

4.1 Marginal q Methodolody

The methodology of marginal q, developed by Mueller and Reardon (1993), utilizes the changes in the market value of a firm to estimate its returns on investment[1]. Market value of a firm is affected by the market's evaluation and expectation regarding the firm's future profits, losses in each term. In this aspect, the present value of the investments are considered as fundamental in calculation of return on investment.

The present value of future cash flows of a firm can be calculated by adding up each periods' cash flows discounted by *(1 + i)* to the power of that particular year, *j*. The present value formula below is built under the assumption that the discount rate, i, and the cash flow, *CF,* vary for different time periods.

$$PV_t = \sum_{j=1}^{\infty} \frac{CF_{t+j}}{(1+i_t)^j} \qquad \text{Eq. (1)}$$

where *PV* stands for the present value of the investment project at time-t, *CF* stands for the cash flow investment generates, *i* stands for the discount rate of the firm.

We can calculate the PV_t of the investment I_t made with a rate of return of r_t on the discount rate of the firm i_t as follows;

$$PV_t = \frac{I_t r_t}{i_t} = q_{mt} I_t \qquad \text{Eq. (2)}$$

According to the equation above, a firm can gain a present value equal to the amount of investment, I_t, made, if and only if the rate of return, r_t, of a project equals to the discount rate of the firm, i_t. Here, the ratio of r_t to i_t is defined as the marginal q, q_m, the main statistic on which all the analyses will be based in the sections to come. As we have examined the shareholder model in detail, a shareholder wealth maximizing firm is expected to accept investment projects having marginal q greater than 1, $q_m > 1$ (Gugler, Mueller and Yurtoglu, 2001).

The market value of the firm at time-t is defined as the addition of market value of previous term, *PV* of the investment project undertaken, the market's error term, and less of depreciation realized previous term, and formulated as;

$$M_t = M_{t-1} + PV_t - \delta_t M_{t-1} + \mu_t \qquad \text{Eq. (3)}$$

where M_t denotes the market value, δ is the depreciation rate for the firm's total capital, and μ is the market's error term incorporated in the market value function.

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[1] The derivation of marginal q was first presented by Mueller and Reardon (1993).

Substituting PV_t with $q_m I_t$ and subtracting M_{t-1} from both sides of the Eq. (3), we obtain

$$M_t - M_{t-1} = q_m I_t - \delta_t M_{t-1} + \mu_t \qquad \text{Eq. (4)}$$

Eq. (2) and Eq. (4) bring up the distinction between the average performance measure Tobin's q and investment performance measure marginal q. Tobin's q gives an average return on capital by dividing the market value of the firm by its capital stock, whereas marginal q is the change in market value of a firm divided by the change in its capital stock, namely the investment that generated it (Gugler and Yurtoglu, 2002).

For a better understanding of the meachanism, consider a firm with $\delta = 0$ and $I = 1000$ given that the $r_t < i_t$ meaning that the $q_m < 1$ for that investment. Accordingly, Eq. (4) in turn spells that the increase in market value of the firm will be less than the level of investment, 1000. Technically, it is explained as managers have overinvested (Gugler and Yurtoglu, 2002).

We shall employ the assumption of capital market efficiency, which suggest that the capital markets make an unbiased estimate of the present value of any investment. Any unbiased estimation requires that the expected value of error term, μ_t, must be zero (Gugler, Mueller, and Yurtoglu, 2004).

Dividing both sides by M_{t-1} to eliminate heteroscedasticity and plugging $\mu_t = 0$ in the Eq. (4) gives

$$\frac{M_t - M_{t-1}}{M_{t-1}} = -\delta + q_m \frac{I_t}{M_{t-1}} \qquad \text{(Eq. 5)}$$

Eq. (5) allows us to estimate both δ and q_{mt} under the assumption that δ and q_{mt} are either constant over time across all firms or over time by using the data set constructed without knowing the rate of return on investments and discount rates of each firms. Market value is calculated by adding up the market value of outstanding shares and the value of outstanding debt (Gugler, Mueller and Yurtoglu, 2001).

As observed in the Eq. (5), investment figures are also needed in order to pin down this equation. Hence, a comprehensive investment function is defined as the following;

$$I = \pi + Depr - Div + \Delta D + \Delta E + R\&D + ADV \qquad \text{(Eq. 7)}$$

where π is after tax profits, *Depr* is depreciation, *Div* is dividends, ΔD and ΔE are funds raised through new debt and issuing new equity (Gugler, Mueller and Yurtoglu, 2003). *R&D* and *ADV*, which refers to research and development, and advertising expenses respectively, are also forms of investment that can generate large intangible assets such as know-how, patents, brand names and goodwill in general, which all together are expected to result in increase in the market value of the firm in future.

4.2 Variables and Data

As defined in the Eq. (5), the main analyzes incorporates the market value and the investment data for each company reviewed. Below in Table 4.2, the definitions of all the related variables are given.

Table 4.2 Definitions of Variables

M_t	Market value of the firm is calculated by taking the sum of the market value of firm's common stock outstanding and the value of firm's total debt. Market value of the firm's common stock outstanding is known as market capitalization. It is computed by multiplication of the year end number of outstanding shares with the year end price per share.
I	Investment
π	After Tax Profits is the P/L after tax or earnings after tax items.
$Depr$	Depreciation is the accounting depreciation.
Div	Dividends are ordinary dividends.
ΔD	Change in Debt is calculated by taking the difference between the total debt items of current and previous years. Total debt is the summation of short-term and long-term debt. Short-term debt is the remanining portion of Total Current Liabilities after current portion of bonds, accrued expenses, accrued income taxes, deposits received, deferred tax liabilities-current portion and other current liabilities are deducted. Long-term debt is noted as it is.
ΔE	Change in equity is the net proceeds from sale/issue of common and preferred stock item under the financing activities section of the cash flow statement.
$R\&D$	Research and Development Expenses
ADV	Advertising Expenses.
SGA	Selling, General and Administrative expenses. It mainly includes sales promotion, salaries, warranties, advertising, research, distribution costs.

Source: Own Construction

One thing to note is that the differences in accounting methods in different countries hinder better utilization of resources and extraction of accurate data. As to give examples, Japanese automotive manufacturers, in general, do not disclose *R&D* expenditures explicitly as the European manufacturers do. Also, in Korean companies, related *R&D* and *ADV* are included in Selling, Administrative and General Expenses item. The large deviations of *ADV* in Selling and Administrative Expenses or Gross Sales have also been restrictive in approximating an average *ADV* expenditure. As the last best possible resort, missing values of *R&D* expenses and depreciation items are approximated using interpolations by utilizing average *R&D/Gross Sales* and *Depreciation/Fixed Assets* ratios of available years.

The data for the 21 listed automotive companies are retrieved from the database OSIRIS, which contains detailed data on financial statements starting from mid-1980s and stock data starting from 1999 for 38000 listed companies worldwide. The availability of stock data has been influential in choosing the sample period of the study for 6 years, between 1999 and 2004.

4.3 The Results of the Empirical Analysis

Referring back to the section 4.2, the differences in accounting principles in different regions complicates extraction of precise data. Considering the unavailability of finding relevant *ADV* data for each company, results are given in intervals. Technically, one end of the interval shows the marginal q calculated for an investment function excluding *ADV* item, and the other end indicates the q_m computed for an investment function including Selling, General and Administrative Expenses *(SGA)* as a proxy for *ADV* item. In general, *SGA* includes much more than *ADV* as mentioned in the definitions of variables (see Table 4.2). Given the constraints, the former case gives us the maximum q_m that could be achieved in the sample period, whereas the latter yields an underestimated q_m. Since neither *ADV* is 0, nor is it as large as *SGA*, the real q_m will eventually fall somewhere in the interval. As a second way of interpreting data, the investment function is broken into its elements. Throughout the analyses, cash flow ($\pi + Depr - Div$), ΔD, ΔE, *R&D*, *SGA* are the elements investigated. After the presentation of regression results examining regional differences in marginal rate of returns on investments, a comprehensive comparison analyses with explanations will be given in the following subsections.

4.3.1 Regional Investment Performances

Regarding the regions that the companies under review originate, dividing the empirical results into categories will draw a clear map of the investment performance in the automotive industry all around the world. The results indicate that in every continent there is a severe overinvestment problem. In addition to this common issue, there are remarkable differences in returns on investments from one continent to another.

4.3.1.1 World Automotive Industry (OEMs)

To begin with, this first analysis is conducted to find out the investment performance of 21 global OEMs, using the proposed interval method, of the world automotive industry. The q_m is statistically significant and found to change in the interval of (0.655, 0.415). This in turn means that managers of global OEMs have overinvested and exceeded shareholder wealth maximization level of investment between 1999 and 2004. In result, the global OEMs have earned a return on investment between 65% and 41% of its cost of capital. Effectively, the world automotive industry has an overinvestment problem, $q_m < 1$, which verifies the hypothesis 1 asserting that the industry is expected to have a $mrr < i$.

The regression can also be ran using the elements of the investment function. R1.1 and R2.1 are ran to examine how much marginal return from different sources of investment companies have gained in this period. The intercepts indicate that the depreciation rate is in the interval of (8.7, 11.2) when SGA is excluded and included, in two respective cases. Reminding that Mueller and Reardon (1993) have used depreciation rate of 10% in their studies, the results are quite plausible.

One of the important result is that, among other variables, return on investment financed by debt is always higher than and very close to 1 in both regressions. Moreover, the respective t-values are significant at around 11.5 in both regressions.

Table 4.3.1.1 Estimated q_ms for the World Automotive Industry (OEMs)

	Excluding SGA		Including SGA	
Variables	**R1**	**R1.1**	**R2**	**R2.1**
Intercept	-0.087	-0.038	-0.112	-0.045
	(-4.071)	(-1.179)	(-3.946)	(-1.360)
$I_t/M_{(t-1)}$	0.655		0.415	
	(7.916)		(6.145)	
$CF/M_{(t-1)}$		0.033		-0.001
		(0.262)		(-0.007)
$\Delta D/M_{(t-1)}$		1.061		1.054
		(11.521)		(11.405)
$\Delta E/M_{(t-1)}$		0.261		0.169
		(0.390)		(0.249)
$R\&D/M_{(t-1)}$		0.386		0.216
		(0.572)		(0.309)
$SGA/M_{(t-1)}$				0.114
				(0.950)
R^2	0.378	0.576	0.268	0.580
$Adj\ R^2$	0.372	0.559	0.261	0.559
F	62.668	34.014	37.765	27.364
Observations	105	105	105	105

Source: Own computations
Note: t-values are given in parentheses.

4.3.1.2 Asian Automotive Industry

Table 4.3.1.2 Estimated q_ms for the Asian Companies

	Excluding SGA		Including SGA	
Variables	**R3**	**R3.1**	**R4**	**R4.1**
Intercept	-0.114	-0.052	-0.183	-0.071
	(-0.37)	(-1.029)	(-3.666)	(-1.282)
$I_t/M_{(t-1)}$	0.597		0.422	
	(4.651)		(4.344)	
$CF/M_{(t-1)}$		-0.006		-0.028
		(0.039)		(-0.193)
$\Delta D/M_{(t-1)}$		1.237		1.194
		(8.869)		(8.016)
$\Delta E/M_{(t-1)}$		0.243		0.237
		((0.314)		(0.306)
$R\&D/M_{(t-1)}$		0.385		-0.093
		(0.367)		(-0.078)
$SGA/M_{(t-1)}$				0.154
				(0.850)
R^2	0.335	0.679	0.305	0.685
$Adj\ R^2$	0.319	0.647	0.289	0.644
F	21.629	21.177	18.871	16.969
Observations	45	45	45	45

Source: Own computations
Note: t-values are given in parentheses.

The Asian automotive industry is found to have a q_m in the interval (0.597, 0.422) meaning that managers have overinvested, and Asian companies have realized a return on investment approximately between 60% and 42% of their cost of capital, when SGA is excluded and included respectively. The q_ms found in R3 and R4 are observed to be significant in both regressions. Moreover, as seen in R3 and R4, the depreciation rate is in the interval (11.4, 18.3), both more than global average and the estimates of Mueller and Reardon (1993). Regarding R3.1 and R4.1, again the marginal returns on investment financed by debt is more than 1, (1.237, 1194), and statistically significant, whereas returns of *CF*, Δ*E*, *R&D* and *SGA* are very low and insignificant.

4.3.1.3 Asian and North American Automotive Industry

Due to having few observations, only North American data is not presented. To pinpoint the difference in returns on investment between Europe and the remaining two major automotive production regions, North American data is analyzed together with Asian data. The joint q_m of Asian and North American OEMs is in the interval (0.571, 0.344). The regions taken together again have merited a return on investment between 57% and 34%. The decline in q_m, compared to that of Asian brands only, can be regarded as an indication of low investment performance for North American automotive manufacturers. R5 and R6 show that the q_m laying in this interval is significant. The intercepts obtained for Asian and North American brands are between 8.8% and 11.7%, much better than sole values ontained for Asia and close to global level of OEMs. Looking at the R5.1 and R6.1, as it has been the case in global and Asian level, debt yields the highest marginal returns among other sources of investment in Asian and American companies, in a statistically significant value interval of (1.155, 1.121).

Table 4.3.1.3 Estimated q_ms for the Asian and American Companies

	Excluding SGA		Including SGA	
Variables	**R5**	**R5.1**	**R6**	**R6.1**
Intercept	-0.088	-0.018	-0.117	-0.026
	(-2.815)	(-0.442)	(-2.905)	(-0.598)
$I_t/M_{(t-1)}$	0.571		0.344	
	(4.788)		(3.886)	
$CF/M_{(t-1)}$		0.039		0.013
		(0.270)		(0.086)
$\Delta D/M_{(t-1)}$		1.155		1.121
		(8.574)		(7.929)
$\Delta E/M_{(t-1)}$		0.404		0.348
		(0.528)		(0.451)
$R\&D/M_{(t-1)}$		-0.459		-0.848
		(-0.481)		(-0.797)
$SGA/M_{(t-1)}$				0.135
				(0.837)
R^2	0.283	0.601	0.206	0.606
Adj R^2	0.271	0.572	0.192	0.570
F	22.925	20683	15.102	16.597
Observations	60	60	60	60

Source: Own computations
Note: t-values are given in parentheses.

4.3.1.4 European Automotive Industry

The interval for q_m of European automotive manufacturers is found as (0.803, 0683), based on the results of regressions R7 and R8. The European companies, despite having overinvested, have demonstrated the highest return on investments approximately between 8/10 and 7/10 of their cost of capital among other regions of the world during the sample period. The q_m is significant in both cases, excluding and including SGA, is significant concluding that all possible values of q_m in the interval are significant. As to comment on results of R7.1 and R8.1, the marginal rate of return on debt financing for European automotive manufacturers are in the interval of (0.811, 0.840). The depreciation rate is in the interval (9.7, 15.4) in the European automotive industry.

Table 4.3.1.4 Estimated q_ms for the European Companies

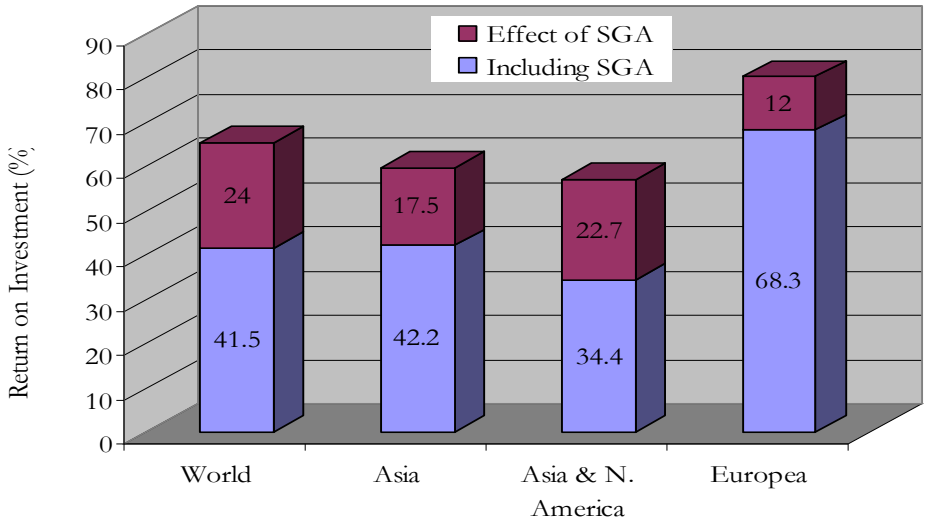
	Excluding SGA		Including SGA	
Variables	**R7**	**R7.1**	**R8**	**R8.1**
Intercept	-0.097	-0.118	-0.154	-0.122
	(-3.857)	(-2.263)	(-4.633)	(-2.320)
$I_t/M_{(t-1)}$	0.803		0.683	
	(8.148)		(7.474)	
$CF/M_{(t-1)}$		0.606		0.447
		(1.390)		(0.955)
$\Delta D/M_{(t-1)}$		0.811		0.840
		(6.602)		(6.630)
$\Delta E/M_{(t-1)}$		1.350		1.307
		(0.562)		(0.542)
$R\&D/M_{(t-1)}$		1.530		1.206
		(1.390)		(1.045)
$SGA/M_{(t-1)}$				0.267
				(0.944)
R^2	0.607	0.612	0.565	0.620
$Adj\ R^2$	0.598	0.573	0.555	0.572
F	66.394	15.758	55.861	0.115
Observations	45	45	45	45

Source: Own computations
Note: t-values are given in parentheses.

4.3.2 The Inter-Regional Comparison of Investment Performances

The results presented in subsection 4.3.1 and the proceeding ones up to this subsection have proved that there is overinvestment not only in the global level but also in the regional level. The true value of return on investment in the world industry lies between 65% and 37% of its cost of capital between the years 1999 and 2004. The empirical findings point out that, even in the best case, it is not likely that managers maximize shareholder wealth properly. Relating the findings to the shareholder model, overinvestment can be attributed to the discretionary behavior of managers. Otherwise, overinvestment may have to be an indispensable burden, borne by shareholders, to shield their company against upcoming threats in order to maintain future success of the company.

Figure 4.3.2 Returns on Investment for Different Regions



Source: Own computations.

4.3.2.1 Europe and Asia

Looking at the empirical findings in regional basis, there is notable differences in returns on investments, especially in Asia and Europe. The European automotive industry has reaped a return on investment between 80% and 68% of its cost of capital as depicted in Figure 4.3.2. However, the Asian automotive industry has gained a return on investment between 60% and 42%, a lower range of values, of its cost of capital. In this case, given the data and results obtained for the sample composition, it is clear-cut to assert that even, in the best case, the return on investments in the Asian automotive industry has been lower than the return on investment in the European automotive industry, that is to say $q_m^E > q_m^A$, between 1999 and 2004. Thus, the hypothesis 2 arguing that the Asian automotive industry has overinvested more than the European automotive industry has done is verified.

As to explain the findings in more elaborate terms; firstly, Asian automotive market is immature and unsaturated. The Chinese economy is currently developing very fast, and companies invest substantial amounts to meet possible future needs of the market. Particularly the two main drivers of the region, South Korea and China, have a highly fragmented automotive industry consisting of too many producers (see section 2.3 for details). This partly stems from the fact that local governments aim to build national technology and brands in future. For this reason, local authorities support all producers to establish Sino-foreign joint ventures, a form of JV established between Chinese and foreign business partners (Hayes, Warburton et.al, 2003). Secondly, Asian automotive industry is very much likely to go through consolidation in further stages to come as competition intensifies and prices increase.

The European automotive industry has experienced a number of mergers and acquisition, which has led incumbents to attain large scale and scope throughout the last two decades. At present, the industry is highly mature and saturated compared to the Asian automotive industry. To fix ideas, the car per capita density was 492 cars/1000 inhabitants in Europe in the year 2003 (European Automobile Manufacturers Associaton (ACEA), 2005). This ratio clearly states that every household consisting of two people have approximately one car on average.

Taking all these differences into account, Asian managers essentially have higher incentives for growth than European managers. The difference in market structures gives leeway to professional managers to overinvest in order to accomplish their future sales targets, at the expense of shareholder wealth maximization. In relation to this, the statement of Jensen (1986) saying that growth in sales is positively related to manager's compensation may help to clarify the possible discretion of managers more clearly.

Looking from the stock markets' perpective, building overcapacity to gain higher returns, maybe not now but in future, can be interpreted as a reasonably good move by stock markets. This positive outlook is then reflected on stock price and yields a higher valuation of the company, and so a higher q_m depending on the investment level. However, if the investment do not satisfy its expected return, then this may also lead to low q_m. In this case, investments made in the Asian automotive industry should have yielded lower returns on investment than required.

As Gugler, Mueller and Yurtoglu (2004) have stressed, countries with strong legal systems protecting shareholder rights exhibit higher returns on investment than countries with weaker legal systems. In relation to this, Claessens, Djankov and Lang (1999) have found that, in Asia, merely Japan has a good shareholder protection. Therefore, inefficient protection of shareholders in the rest of Asia may lead to low investment performance.

Chinese government has put some restrictions on cash flow movements. Consequently, capital controls make it difficult for shareholders to receive shares of cash flows (Hayes, Warburton et.al, 2003). The controls also lead to using more profits than necessary for new investments. This in turn shows that investors have been financing extra investments promising low returns.

4.3.2.2 Asia and North America

When Asian data are worked out, with and without SGA, the return on investment is found to be greater than the returns on investment obtained for Asian and North American data worked out together. To justify this decline, the first thing to note is that whatever the number of observations for the two groups, the result will be any value between their individual return on investments. In this case, it can be concluded that the return on investment in the North American automotive industry has been lower than the return on investment in the Asian automotive industry between 1999 and 2004.

Having conducted the analyses examining the returns on different sources of investment, q_m for investment financed by debt is higher than 1 in both cases indicating strong monitoring and control on investment made by utilizing debt. There is still some room to increase the share of investment financed by debt for both of them, since having q_m higher than 1 is an indication of underinvestment financed by debt.

4.3.3 Debt Financing

The world average, (1.061, 1.054), indicate that the return on investment, financed by debt, of its cost of capital is very close to 100%, almost at the shareholder value maximization level. Therefore, the hypothesis 3 asserting that the return on investment financed by debt is almost equal to, or higher than, its cost of capital around the world between the sample period of 1999 – 2004 using the data set under review is verified.

After having informed about the world statistics, analyzing the returns on investment financed by debt in regional basis can assist to distinguish them easily. In the regional level, the returns for investment financed by debt are statistically significant, and are in the interval (1.237, 1.194) in Asia, (1.155, 1.121) in Asia and North America taken together, and finally (0.811, 0.840) in Europe.

As seen, the interval of values change from one region to another. The results for q_m for debt indicate that Asian companies are strict on debt financing, which in turn results in a high return on investment financed by debt between 123% and 119% of its cost of capital. Meanwhile, the European companies have a return on investment financed by debt between 81% and 84% of its cost of capital. In fact, low return for debt is an indication of overinvestment funded by debt, which leads to a greater scope for monitoring of the debt holders on management. Because, managers and debt holders have a contractual relationship, whereas managers and equity holders have a sort of implicit contract between each other. As the pressure on management increases, room for discretionary behavior shrinks, and this yields higher returns on investment out of debt financing. However, the relatively low returns on investment financed by debt in Europe may be due to the fact that most of the European automotive companies have international investment banks offering large capital resources as large shareholders, which primarily seeks for growth and development instead of profitability as the shareholder model suggests. The underlying intuition is that these banks grow as their clients grow (Gugler, Mueller and Yurtoglu, 2004).

5 Conclusion

In line with the purpose of the paper, investment performance of the automotive industry has been examined in the global level. In broad terms, overinvestment is actually a structural and persistent issue not only in the world average, but also in major automotive manufacturing regions. The empirical results have proved that returns on investment in Asia, Europe and North America have fallen below their cost of capital, $q_m < 1$, meaning that automotive industries in these regions have overinvested between 1999 and 2004.

Due to constraints on obtaining the accurate value of advertising expenses, an interval in which the true value of return on investment falls is constructed by including the selling, general and administrative expenses to or excluding it from the analyses. The return on investment has found to be between 65% and 41% of its cost of capital for the world automotive industry. In the regional level, the Asian automotive industry has shown a return on investment between 60% and 42% of its cost of capital, whereas the return on investment for the Asian and North American automotive industries, taken together, is between 57% and 34%, and finally the return on investment for the European automotive industry is between 80% and 68% of its cost of capital.

The large amount of investment into the fast developing Asian countries, particularly to China, results in overcapacity and in turn low returns on investment. The incentive to do so is that building overcapacity let OEMs take one step forward, because when the markets mature and demand soars, they will have cheap and quick access to utilize already built-in capacity. Since building extra capacity in the beginning - or today - is cheaper than building it in future, manufacturers minimize costs to some extent. Taking this into account, the respective stock markets in OEMs' home countries can interpret overcapacity not as a burden of today, but as a premium for future payoffs. However, the estimated low returns on investment may be due to strong government influence on capital controls in China, weak legal systems protecting shareholder rights or low return promising investment project, which may also partly stem from capital controls or management failure. Accordingly, although OEMs already know the constraints stated, they also know that not investing in China in this case, may be more hazardous than investing in China.

Comparing the relatively young Asian automotive industry with the mature European automotive industry that has already attained enough scale and scope through mergers, acquisitions and consolidations, the difference in returns on investment between the two is plausible. Regarding these, the Asian automotive industry is to experience strategic mergers and consolidation, cut costs, and then will be able to pull out extra money for their shareholders in the years to come. On the other hand, adding the data for North America worsens the returns on investment for Asia, signifying that the return on investment for North American automotive industry is already lower than Asians'.

Another remark is that although the Continental Europe has been losing its leadership in being the greatest production base of automotive industry against Asia gradually, it still stands in the first place with regard to returns on investment and shareholder wealth maximization in the world automotive industry.

The research can be extended including subcontractors in addition to increasing the number of OEMs under review. Furthermore, capital market constraints such as country specific legal systems, investor and creditor rights and accounting standards can be considered to explain possible reasons of low returns on investment in the automotive industry.

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