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Automotive captives
A risky business?

Supervisor:
Maria Gårdängen

Authors:
Karl Appelqvist Nolin
Richard Sundlöf
Daniel Wikström

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Authors: Karl Appelqvist Nolin, Richard Sundlöf, Daniel Wikström.

Advisor: Maria Gårdängen

Key words: Automotive industry, Automotive financing, Automotive Captives, Risk Management, Credit Default, Altman z-score, Merton, KMV, Credit Rating Agencies, Credit Risk Management

Purpose: The purpose of this thesis is to investigate to what extent an increased dependency on auto captives has affected the likelihood of bankruptcy for automotive manufacturing groups (AMGs). If so, we wish to critically examine whether this can be attributed to inadequate risk management practices. This will be done by studying the major AMGs during the years 2002-2008 both in a quantitative and qualitative manner.

Methodology: A quantitative approach using regression analysis has been used. Aspects not covered by the quantitative study are qualitatively examined.

Theoretical

perspectives: The theoretical perspective is derived from classical risk management theory. Altman z-score and credit rating agencies' methodology is used.

Empirical

foundation: The automotive manufacturer industry during 2002-2008 has empirically been studied to obtain the data needed.

Conclusions: This study quantitatively shows that an increased dependency on auto captives does increase the likelihood of bankruptcy for AMGs. Our study of qualitative aspects did also find several factors pointing out deficiencies risk management practices as an underlying cause.

Abstract

This thesis set out with the aim of answering the question to what extent an increased dependency on auto financing has affected the likelihood of bankruptcy. A regression analysis is used to statistically measure if risk is transferred from captives to automotive manufacturing groups during the years 2002 and 2008. Measurements of credit risk in both a quantitative and qualitative manner are evaluated. Altman's z-score is used as a quantitative measure of credit risk. A theoretical framework describing risk management and credit rating agencies approach to captives is discussed. The study suggests that observed changes in credit risk among automotive manufacturers can to a large extent be attributed to their captive activities. Based on this conclusion, the problems of consumer related auto financing in the automotive industry is discussed in the context of the current (spring 2009) financial crisis.

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1. Introduction

The first chapter of this thesis starts by introducing the importance of and the difficulties in the automotive industry. We then discuss the problems surrounding the auto financing industry, which leads us down to the purpose of this thesis. The chapter ends with delimitations of the purpose and an outline of the thesis.

1.1. Background

The global automotive industry has been severely impacted during the initial stages of the financial crisis. Car sales dried up the last quarter of 2008 when global demand dropped. The crisis is characterised as being systematic in nature leaving no one untouched. Leading brands such as BMW, Ford, Mercedes, Honda and Toyota have seen sales plummet by more than 20% during the last year (The Economist, 2009).

The cause is no mystery. First, the spike in oil prices caused a shift in demand from gasoline consuming trucks to smaller more environmentally friendly cars resulting in plummeting residual values¹. Second, contracting credit markets made it more difficult for customers to obtain loans to buy new cars (IHS Global Insight, 2009). To make matters worse automotive manufacturing groups (AMGs) are struggling with insupportable operational gearing from having made heavy investments in modernising factories and expanding production capacity. The automotive consultancy CSM estimated the global production capacity to be close to 94 million vehicles annually, while forecasted level of demand for 2009 is about 60 million (CSM Worldwide, 2009).

¹ Residual value risk is defined by Fitch (2006) as the risk that the residual value at the end of the financing agreement falls short of the initially assumed residual value.

Currently, auto manufacturers are desperately trying to scale back operations and adapt to new market conditions. However, because of the capital intensive and inflexible nature of vehicle production, progress is slow and cash burn severe. As a result, actors are forced to join the ferocious incentive battle in an effort to reduce the mounting stock of unsold cars weighing heavy on their financials (Schäfer, 2009). A fact accentuated by industry catch phrases such as “*put steel on the road*” or “*move the metal*” (Hener, 2005, p. 1).

Vehicle sales incentives have almost doubled over the last 6 years (see Exhibit A in appendix) and roughly 90 percent of new vehicles in the US and 60 percent in Europe are purchased with some type of financing (The Economist, 2009). Consequently, auto captives whose main purpose is to facilitate vehicle sales will play a key role as time progresses (Hener, 2005).

The major CRAs, Moody’s, Standard & Poor’s and Fitch classify a captive as a finance unit with the majority of its receivables originating from sales of the parent company’s goods or services and a strategic mission closely linked to the parent’s objectives (Standard & Poor’s, 2007) (Moody’s, 2007) (Fitch, 2006). A captive finance subsidiary can be considered as an extension of a firm’s marketing activities. It can be structured either as a legally separate entity or as a division of the company (Standard & Poor’s, 2008). The entity’s primary function is to facilitate sales of goods or services from its parent company by providing lease or debt financing to customers or/and dealers. It is also not uncommon for it to finance the inventory and receivables of its parent as well as selling insurance (Fitch, 2006).

1.2. Problem discussion

Early empirical research on the use of captives was made by Banner (1958). He evaluated potential risks as well as benefits arising from having a finance captive by examining non-financial US firms utilising captives for sales

financing. He concluded that consumer credit can be a more potent competitive instrument than an attractive product price and argued that captives have played a vital role in supporting high growth rates in several major industries, with the automotive industry used as an example. However, he also argued that the lack of independence of a captive may affect its credit policy by suggesting that the competitive advantages associated with offering consumer credit may cause the parent company to pressure its captive to continue with potentially unprofitable or risky lending (Banner, 1958).

Empirical research studying the potential benefits of having captives was made by Gradient (1966), Didriksen (1966) and Lavinat & Sondhi (1986). They found that captives can improve earnings management by separating the sales function from the receivables management function more effectively than its parent. Didriksen (1966) also concluded that large companies with substantial amounts of receivables and/or lease contracts extract the most benefits.

However, more recent studies have almost exclusively focused on captive credit policies and the risks involved. Boczar (1978), Remolona & Wulfekuhler (1992) and Carey *et al.* (1998) examined how lending practices differ between banks and finance companies. They did so by looking at risk segmentation of consumer loan markets and the presence of asymmetric information and concluded that finance companies generally service borrowers of higher risk levels than banks. Carey *et al.* (1998) also investigated the underlying causes as to why captives pursue more risky lending. They found evidence supporting Banner's (1958) argument, suggesting that the parent's commercial interests may outweigh restrictive credit policies. In addition, they found that the portfolio structures of banks differed substantially in that they hold significantly less lease and auto related financing, which is consistent with a lower risk profile since lessees are considered more risky than those that purchase assets outright. Sharpe &

Nguyen (1995) suggested that lenders pursuing more lease related activities are either more capable at managing the additional risk or are more willing to bear it compared to other lenders.

Garner *et al.* (1994) offered another explanation for differences in lending practices between banks and captives. They suggested that differences can be attributed to the use of different control and monitoring strategies. Banks are often characterised as “cash flow” lenders and captives as “asset-based” lenders. The typical cash flow oriented bank does not focus on the asset itself, but does a strict evaluation of historical and future projected cash flows of a borrower before granting a loan. In contrast, asset-based lenders focus less on cash flows and place a greater reliance on the collateral value of the asset after the loan is granted.

Studies specifically focusing on risks in auto finance industry were made by Hener (2005), Diekmann (2006) and Barron *et al.* (2008). Their results were consistent with earlier empirical research, concluding that captives employ more lenient credit policies than banks, which in turn reduces the likelihood of loan repayments. As an explanation they suggested that the sale proceeds from the vehicle subsidise any potential loss suffered on the lending side. Diekmann (2006) follows Banner’s (1958) argument by suggesting that competitive pressure from the vehicle market is likely to spread to the auto finance market, which in turn can encourage more risky behaviour in captives. Consequently, management will face an increasingly difficult task, which is to balance the need for supporting sales with incentivised customer financing and manage risk (Hener, 2005).

However, no study has to our knowledge been conducted, investigating how successful AMGs have been at managing the increased risk specifically caused by pursuing aggressive lending/leasing practices. The relevance of such a study is further enhanced by a study made by Fitch (2008), a leading

credit rating agency, which found a negative correlation between sales incentives and wholesale prices on vehicles. By reducing the purchase price, an artificial demand for new vehicles is created. They get more affordable, which in turn affects demand for used vehicles. As a consequence of using incentives, the residual value risk exposure of the captive will increase due to lower secondary market values of used vehicles (Fitch, 2006). If the captive also engages in leasing, its risk exposure will increase further due to rising turn-in rates² (Standard & Poor's, 2008). The risk will be even greater if technical achievements, e.g. in more environmentally friendly vehicles, become increasingly successful, causing the secondary market to get even more unstable.

As discussed, there are considerable risks involved with becoming too reliant on captives to support sales activities. With the industry in a dire condition and auto financing accounting for a growing share of the manufacturing groups' overall revenues, managing the risks involved becomes crucial. We therefore intend to investigate how the development of auto financing has affected the credit risk in AMGs.

1.3. Purpose

The purpose of this thesis is to investigate to what extent an increased dependency on auto captives has affected the likelihood of bankruptcy for AMGs. If so, we wish to critically examine whether this can be attributed to inadequate risk management practices. This will be done by studying the major AMGs during the years 2002-2008 both in a quantitative and qualitative manner.

² Turn-in rate is defined by Fitch Ratings (2008) as the number of vehicles returned to the lessor at lease termination as a percentage of the number of lease contracts that were scheduled to mature during the same period.

1.4. Delimitations

There are several additional factors, not included in this study, affecting the risk in captives e.g. access to capital markets, committed parental support, residual value setting policies and separation between operational and financial vehicle leases. However, in order for us to perform a quantitative investigation about the effects from these factors, we would require access to internal data. This has however not been feasible due to restrictive and varying disclosure standards from the auto captives. We will therefore not quantitatively study the specific methods used by auto manufacturers to manage its credit risks, in particular regarding the use of securitisation and derivatives. We also do not study Chinese and Indian actors, due to their limited disclosure of data relating to captives.

1.5. Outline

Chapter 2 gives an introduction of the automotive industry. A brief description of the global market is followed by a more detailed presentation of auto finance activities and the use of captives. In *Chapter 3* the theoretical framework is presented with the focus on risk management and models used to evaluate credit risk. Data collection and methodological approach is described in *Chapter 4*, including choice of dependent and independent variables. Methodological problems are also clarified. In *Chapter 5* empirical findings from the collected raw data are presented. Results from the regression are analysed based on our theoretical framework. *Chapter 6* serves two purposes. First, we conclude our study based on the regression analysis. Secondly, a discussion will be held regarding qualitative aspects not explicitly covered by the analysis. The chapter ends with suggestions for future research.

2. Automotive industry

It is essential to understand the underlying structures and main characteristics of the auto finance industry. In this chapter we describe the global automotive industry and the risks and services behind auto financing.

2.1. Role and relevance

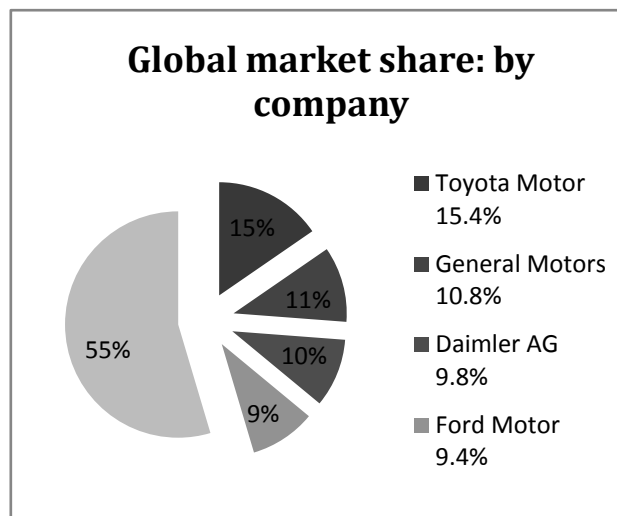
The global importance of the automotive industry can be attributed to its key role in modern society, both as an economic and transportation factor. According to a trade and development study made by the United Nations examining the world's largest economic entities, 7 out of 29 multinational companies studied were AMGs (Hener, 2005). The automotive supply chain represents a significant share of all global manufacturing jobs and is a major contributor to international trade (IHS Global Insight, 2009). The global automotive industry is divided into three major geographical markets. Their respective share of total value in 2008 is; Asia-pacific (35,9 percent), Americas (30,8 percent) and Europe (26,7 percent).

The industry generated total revenues of €1058bn in 2008 and have grown by a CAGR³ of 3,5 percent since 2004 (Datamonitor, 2008). The importance is further accentuated by including distribution and financing related activities as well as governmental income from vehicle taxes. Vehicle tax revenues in the EU for 2008 alone were in excess of €360bn (IHS Global Insight, 2009).

The industry has undergone considerable change during the last decades. Three major trends have been identified. First, a global pursuit of economies of scale created a wave of consolidation among AMGs, as shown by the steady decline of independent actors from 62 in 1960 down to 12 in 2004 (Becker, 2006). Forecasts predict that the number is likely to fall below 10 by 2015 (Diekmann, 2006). Already, the four largest actors account for almost

³ CAGR = Compounded annual growth rate

Figure 1 Major actors by share of total value.



Source: Datamonitor (2008)

half of the global market. The pursuit of economies of scale was also the reason behind the substantial build up of production capacity that occurred during the period. Second, product differentiation and shortening product life cycles, which according to Becker (2006) were caused by a rising consumer demand for distinct products spurred on by rapid advances in production technologies. Third, a focus on operational improvements, achieving a lean production, utilising Just-In-Time methods and outsourcing peripheral activities (Diekmann, 2006). The actual effect from these changes is a vehicle production process with high fixed costs and strained profit margins. The bank UBS estimated the average industry profit margin to be well below 3 percent over the last five years, which in turn have left AMGs badly equipped to respond to fluctuations in consumer demand (IHS Global Insight, 2009).

In addition, practically all manufacturers are facing significant capital expenditures over the coming years to develop new technologies needed to comply with future low emission requirements (Diekmann, 2006). A survey conducted by KPMG in 2006 unveiled that the top concerns among the key manufacturers were product quality, reducing cost and new technology. When the same survey was conducted 2 years later it restated previous results

but showed a dramatic increase in awareness concerning environmental issues, new products and product/pricing incentives (KPMG, 2009).

2.1.1. Auto finance and the use of captives

Studies show that the majority of profits generated during the lifetime of a vehicle originate from downstream activities (Volkswagen financial Services, 2004).

Table 1 Profit contributions in the automotive value chain.

Up-stream activities	38%
Manufacturer	16%
Modules suppliers	7%
Component specialists	8%
Standard parts suppliers	2%
Raw material providers	5%
Down-stream activities	62%
New car retailing	5%
Leasing & financing	9%
Insurance business	15%
Used car retailing	12%
Car rental business	4%
Service & parts business	17%

Source: Volkswagen financial Services (2004)

As can be seen in table 1, vehicle insurance, leasing and financing generates close to a quarter of all profits, making it highly attractive to AMGs, which in turn can explain the strong global growth in the use of captives (Diekmann, 2006). As a result, they are now considered key elements in vehicle sales strategies (IHS Global Insight, 2009). It should also be noted that auto captives are far from being the only suppliers of auto financing. Commercial banks and other finance institutions accounted for roughly two thirds of the total global auto finance market volume in 2008 (Diekmann, 2006).

Auto captives enjoy a number of advantages over its competitors. The close relationship with its parent generally gives them a better exposure at sales locations and lower distribution costs shielding them from competitive pressures from outside finance companies (Standard & Poor's, 2007).

However, their strategic focus may hinder diversification efforts as captives tend to have a greater degree of geographic and customer concentration than non-parent affiliated competitors (Standard & Poor's, 2008).

2.1.2. Auto finance incentives and products

Auto finance products can be divided into two main categories leasing and financing. Several variations exist. These include zero or low-rate financing, lease subvention programs, cash bonuses, insurance, extended loan terms, target marketing and pre-approved credit marketing. Their popularity has varied over time and between markets. Distinctions are not always clear cut, especially when considered on a global scale (International, 2005).

Financing

The terms and specifications of auto finance contracts vary. A typical contract is structured as a loan based on fixed monthly payments. However, contracts can be structured in a variety of ways and are often customised to meet consumer preferences, e.g. extended loan terms. Auto loans or financing is traditionally regarded as a relatively low risk activity mainly due to the collateralisation provided by the vehicle (Diekmann, 2006).

Leasing

A common definition of leasing is a contract granting utilisation of an object during a specified time period without ownership being transferred (Hener, 2005). The popularity of auto leasing comes from its positive effects on liquidity as well as enabling off-balance sheet financing. Despite being highly flexible in terms of duration and payment, literature describes two dominating lease structures. In one of the structures the customer returns the vehicle to the lessor at the end of the period, while other structure gives the customer an option to purchase the vehicle at residual value (Diekmann, 2006). The average duration of a lease contract ranges from 36 to 48 months (Fitch, 2006).

2.1.3. Captive specific risks explained in detail

The reason as to why the AMGs captives have been hit so exceptionally hard by the financial crisis can be explained by their portfolio structures (The Economist, 2009). As mentioned, captives are generally less diversified than other competing suppliers of auto finance (Standard & Poor's, 2008). Banks places less emphasis on collateral values by assuming that they move in sync with the overall state of the economy. This assumption holds given that their portfolio is well diversified causing fluctuations in collateral values to offset one another. Captives on the other hand are left exposed to shifts in the vehicle market, which does not necessarily need to move with the overall economy (Diekmann, 2006).

Fitch (2008) present key factors affecting default and recovery risk in auto loans. Captives have begun offering loans with extended-terms, which is in line with the growing trend of providing incentivised financing to consumers. The average maturity of new auto loans have increased from 52,7 to 63 months since 1999, which according to Fitch (2008) increases the likelihood of obligor credit migration⁴ as the lender remains exposed to a borrower for a longer time period. Loan delinquencies are therefore expected to increase significantly, since historical levels show a deteriorating performance for loans with maturities over 60 months. A possible explanation may be that extended term loans enable consumers to buy a car in a price range above what would be possible under terms offered in the past. Another trend in auto finance is the increase in Loan-To-Value ratios⁵ (LTV), which has jumped from 88 percent in 2005 to 93 percent in 2008. Consumers are now offered loans close to full value with down payments sometimes being waived altogether or incorporated into the monthly payments. As LTV increase so does the likelihood of default. (Fitch, 2008)

⁴ Credit migration is defined as a deterioration in the credit quality of an obligor

⁵ Loan-To-Value ratio is the relationship between the amount of the mortgage loan and the appraised value of the property expressed as a percentage

Assessing the riskiness of auto lease transactions is according to Diekmann (2006) even more complex, primarily due to its higher exposure to residual value risk. Residual value risk is defined as: *“The risk that the residual value at the end of the financing agreement falls short of the initially assumed residual value”* (Fitch, 2006, p.1). In contrast to auto loan transactions where the lender is exposed to residual value risk only in case of default, the lessor in a lease transaction is left exposed each time a lessee choose not to purchase the vehicle at the end of the contract period (Standard & Poor's, 2008). However, a study made by Schmit (2003) showed that leasing in the automotive industry is a relatively low risk activity. The study included the years from 1990 to 2000 and examined leasing of vehicles by financial institutions in Europe.

There are several factors affecting the residual value risk according to Fitch (2006). First, the residual value setting policy of the originator plays a critical role since it is the foundation on which interest and amortisation payments are based. Establishing the future market resale value of a vehicle is considered as fairly unpredictable and can be tailored to suit the overall business objectives (Diekmann, 2006). In effect, the captive can promote leasing by setting a higher residual value, thus lowering the required monthly payments, making the arrangement more attractive to consumers. Risk in lease transactions is also driven by typical supply and demand factors affecting price volatility in the used vehicle market as well as the turn-in rates. Such factors include the overall state of the economy as a proxy for consumer spending capacity, size and stability of the market as well as the likelihood of manufacturers leaving the market (Fitch, 2006).

Fahey (2003) identified another potential source of risk in the incentive structure used by AMGs. To shield their captives from competition manufacturers integrate incentives into lease or financing rates rather than giving direct cash discounts. The incentive can then either be treated as a

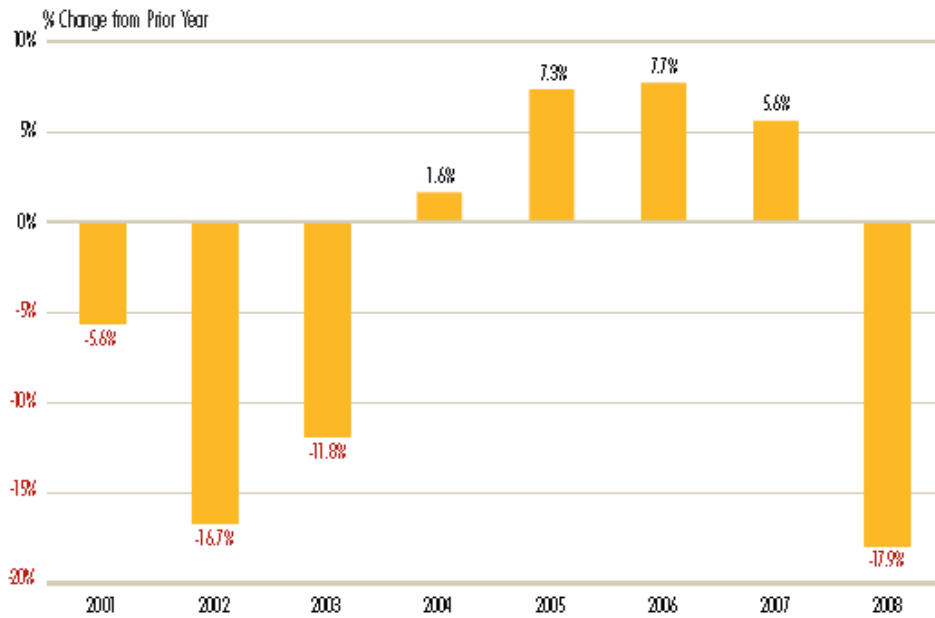
marketing cost or the parent can make an estimation of future resale value and make a reservation for a future loss. This may give rise to the risk of overstating sales, forcing the captive to realise significant losses in the event of a market downturn.

The risks associated with sales incentives and leasing was made evident in the beginning of 2001 when AMGs with their captives lost an estimated \$10,5bn after having significantly overestimated vehicle residual values. It began in 1996 to 1997 with declining demand for SUV⁶s. AMGs started offering cheap financing rates to counter this effect, causing lease volumes to rise sharply over the coming years. Attractive deals on new vehicles caused turn-in rates to rise, as consumers returned vehicles to the AMGs rather than using the option to purchase at lease termination (Fahey, 2003). The secondary market became oversupplied causing prices on used vehicles to fall, leaving the AMGs highly exposed to residual losses. The AMGs did however first not respond to indications of falling residual values. Consequently, the majority of lease contracts, initiated between 1997 and 2000, were based on inflated residual values (Adesa analytical services, 2008). The AMGs only started to pull back on leasing activities once lease contracts expired and residual value losses became a fact.

⁶ SUV=Sport utility vehicle

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Figure 2 Change (%) in lease volume from prior year.



Source: Adesa analytical services (2008)

Considering that the average lease contract ranges between 3 to 4 years, this failure to act were to affect their financial performance for years. Diekmann (2006) uses this episode as an example, showing deficiencies in the risk management practices of AMGs.

3. Theoretical and institutional framework

The third chapter describes the theoretical framework concerning risk and risk management. Quantitative measures of credit risk are presented, followed by a description of credit rating agencies' approach to evaluating qualitative aspects of risk in captives.

3.1. The nature of risk

Froot (2003) describes risk as variability in cash flows, which is a disturbing factor to both investment and financing activities. Risk is defined by Culp (2002) as; “any source of randomness that may have an adverse impact on the market value of a corporation’s assets net of liabilities, on its earnings, and/or on its raw cash flows” (Culp C. L., 2001, p.14).

3.2. Risk management

Management of corporate risk has been described through hedging models developed by Johnson (1960) and Stein (1961) and later Ederington (1979). They have all treated risk from the perspective of a single investor who is risk-averse. Corporate hedging has consequently been regarded as the same as an individual “trader hedging”, which is unsatisfactory according to Culp (2001), who builds his argument from the theory by Jensen & Meckling (1976), where a company is described not as a single investor, but as a “nexus of contracts”. Hence, a company does not have a single mind of its own but is an entity of individuals with different objectives. According to the findings of Modigliani & Miller (1958) and (1961), the capital structure has no relevant influence on a company who operates in a market without contracting costs or taxes. They stated that arbitrage profits cannot be made through managing risk by e.g. hedging. However, Culp (2001) argues that these criteria seldom reflect the reality and implies that risk management can be conducted to achieve value adding effects.

3.3. Core and non-core risk

Knight (1921) recognises that profits stem out from risk or uncertainty. He specifies risk as a situation of randomness that has an impact on a firm but is quantifiable. Since the risk is quantifiable it can also be managed. Uncertainty is described as randomness that is unquantifiable e.g. specific skills inherent to a specific company. Knight (1921) argues that with uncertainty eliminated, profits or losses would not exist. A company must carry this uncertainty but manage the risks. Studies made by Stultz (1996) confirmed that certain risks can add more value to specific firms if the management has a comparative advantage in estimating future prices. Such risks should therefore not be hedged. Schrand and Unal (1998) also acknowledge that firms' profit from bearing risk that is uniquely related to the business conducted. They refer to this type of risk as core-risk which supports Stultz (1996) argument that this type of risk should not be managed. All other risk should be hedged such as interest rate or currency risk. Culp (2002) concludes earlier arguments by suggesting that companies must recognise specific risks typical for their industry and keep this core risk within the company, while hedging the remaining non-core risk. He also discusses risk in terms of idiosyncratic and systematic risk. Idiosyncratic risk represents risk inherent to only a small number of assets and can be almost completely eliminated by diversification. Systematic risk, by comparison affects all existing cash flows on the market and cannot be diversified (Culp C. L., 2001).

3.4. Credit risk

Credit risk is defined as the probability that an actor on the market cannot meet its obligations towards its obligor (Basel Committee on Banking Supervision, 1997). Culp (2001) further defines credit risk by its source into direct and indirect risk. Direct credit risk, also known as default risk and downgrade risk. Default risk describes failure by another party to deliver

funds on time, whereas downgrade risk is the increased probability that this will occur. Indirect credit risk represents the effect that changes in credit worthiness of an unrelated third party can have on the present value of a bundle of cash flows (*Ibid*).

3.4.1. Credit risk management

The Basel Committee on Banking Supervision⁷ (1997) identified a set of key aspects to consider when analysing banks' (BIS, 2000) and financial institutions' (Hener, 2005) credit risk management practices. This was further elaborated in the report "Principles for the management of credit risk" published by the committee in 2000. The principles can be divided into five groups covering the different aspects of the credit risk management process including the;

- (i) Credit risk environment
- (ii) Credit granting process
- (iii) Credit measurement and monitoring process
- (iv) Controls over credit risk
- (v) The role of supervisors. (BIS, 2000)

The report also identified the most common indicators of poor credit risk management practices, highlighting concentration of credit exposures to a certain geographical market, sector or industry as being the most important. Moreover, problems arising from weaknesses in the credit granting process are common e.g. subjective decision-making by senior management, poor adherence to changes in collateral values as well as inability to evaluate business cycle effects on lending from relying on overly optimistic projections. Also, lacking a sound risk-sensitive pricing methodology tend to attract a disproportionately large share of under priced risks (*Ibid*).

⁷ The Basel Committee on Banking Supervision consists of central banks and supervisory authorities from members; Belgium, Canada, France, Germany, Italy, Japan, Luxembourg, the Netherlands, Sweden, Switzerland, the United Kingdom and the United States

3.5. Default risk from a Merton perspective

Another framework used to determine the risk of default is the Merton model, first published under the title “On the pricing of Corporate Debt: The Risk Structure of Interest Rates” in the Journal of Finance in 1974. It acknowledges three main determinants for the value of debt:

- (i) Required return on risk free debt (risk free in terms of default e.g. government bonds)
- (ii) Provisions and restrictions contained in the indenture
- (iii) The probability of default

These assumptions are then evaluated using the general equilibrium theory of option pricing developed by Black & Scholes (1973) which makes the following assumptions:

- (i) The market is perfect
- (ii) The Modigliani-Miller theorem holds, the value of the firm is invariant to which capital structure it obtains (1958)
- (iii) The market follows the “efficient market hypothesis” described by Fama (1970)

The probability of default is then calculated by viewing a firm’s equity and debt as contingent claims (European call option) issued against the firm’s underlying assets (Merton, 1974). Input variables needed to calculate distance to default through the Merton model are the following:

- Market value of the firm’s equity
- Market value of the firm’s assets
- Total amount of the firm’s debt (book value)
- Time to maturity of the firm’s debt

- Risk free interest rate
- Equity volatility

All variables are observable except for market value of the firm's assets and volatility of the firm's assets. These have to be calculated under assumptions made by Black & Scholes (1973).

The strength with the Merton model is the solid foundation of theories mentioned on which it is modelled. However, Byström & Kwon (2007) mentions some weaknesses in the model: it is e.g. based on accounting data and historical stock volatilities. This requires accurate and up to date balance sheet data and also makes the model sensitive to changes in the stock market (Byström & Kwon, 2007). Furthermore Culp (2001) argues that the capital structure of a firm is rarely as simple as the Merton model implies - based on equity plus zero coupon debt with a single maturity date using the volatility of equity as an approximation for asset volatility tends to be a source of error.

3.6. Default risk from a Altman's z-score perspective

The Altman z-score originates from Edward Altman who published his model in Journal of Finance in 1968. The model offers a quite simple but efficient way to calculate probability of default, using a multivariate, taking certain key ratios into consideration. Altman divided his sample of 66 firms into two equally large groups. One group contained the firms that had gone bankrupt during the years 1945-1965 and the other group contained the firms that still were in good financial health in 1966. Altman tested 22 financial ratios derived from the firms in the sample with multiple discriminate analysis to find which composition of the ratios that did the best job in predicting bankruptcy. (Altman E. , 1968)

The five ratios Altman found to give the best model are listed below:

X₁, Working capital/Total assets

X₂, Retained earnings/Total assets

X₃, EBIT/Total assets

X₄, Market value equity/Book value of debt

X₅, Sales / Total assets

X₁, Working capital/Total assets

Working capital is defined as the difference between current assets and current liabilities (Copeland, Koller, & Murrin, 2000). This ratio is frequently found in studies of corporate problems and is a measure of net liquid assets of the firm relative to total capitalisation. A firm that suffers from decreasing operating profits will be reflected by shrinking current assets in comparison to total assets. (Altman E. , 1968)

X₂, Retained earnings/Total assets

Retained earnings reflect the amount of reinvested earnings/losses of a firm. A hint of the leverage can also be given through this ratio since firms with a large amount of retained earnings relative to total assets imply that they have refinanced through retention of profits instead of debt. This measure can be subject to “manipulation” through stock reorganisations or stock dividends. Bias in this measure would also exist if the company has undertaken a substantial reorganisation. (*Ibid*)

X₃, EBIT/Total assets

Independent of any tax or leverage factors does this ratio contribute to the overall score with a true indicator of productivity of the company’s assets. This is one of the key indicators, since insolvency is measured when assets value is exceeded by the value of total liabilities. (*Ibid*)

X₄, Market value of equity/Book value of debt

This ratio adds market value dimension which according to Altman (1968) many other studies fail to consider. The ratio measures how much the company can decrease in value before the firm becomes insolvent. (*Ibid*)

X₅, Sales / Total assets

The sales generating ability of the firm's asset, also known as the capital-turnover ratio, gives a picture on how well the company survives competitive conditions. (*Ibid*)

The model developed by Altman:

$$z\text{-score} = 1,2 * X_1 + 1,4 * X_2 + 3,3 * X_3 + 0,6 * X_4 + 1 * X_5$$

The z-score subsequently describes how close a firm's financial position is to those companies in the sample that went bankrupt (*Ibid*).

When Altman tested his model on a new sample of firms the model correctly pointed out 95 percent of the firms that had gone bankrupt (*Ibid*). Every ratio in the model is multiplied with a constant that represents each ratio's relative contribution as concluded in Altman's study. In recent years studies have been made to investigate how well Altman's z-score has retained its accuracy over time. One study by Heine (2000) tests Altman's z-score over different time periods up to the year of 2000. He use samples of 86, 110 and 120 U.S. industrial firms respectively between the years 1969-1975, 1976-1995 and 1997-1999 and concludes that Altman's z-score still correctly identifies 82 to 94 percent of firms gone bankrupt. Some criticism concerning Altman's z-score is brought forward by Kyd (2008) where he points out that the input data is unadjusted accounting data. Furthermore, the first study made by Altman (1968) used relatively small firms and today the data used in the study is partially over 60 years old (Kyd, 2008).

3.7. Default risk from a credit rating agency perspective

3.7.1. Role and relevance

Credit rating agencies (CRAs) play a central role in modern capital markets. There are currently three major global actors providing credit ratings: Fitch, Standard and Poor's and Moody's. CRAs provide opinions of borrowers and issuers of fixed-income securities capacity to meet their financial obligations (IOSCO, 2008). Two main arguments are generally brought forward regarding the advantages of using credit ratings. First, CRAs enable economies of scale concerning data collection and analysis. Following the Modigliani & Miller (1961) assumption of symmetric information across market participants, credit ratings should, according to the International Committee of Securities Commissions (2003) improve market efficiency by reducing the existence of asymmetric information, a conclusion also reached by Thomas & Dale (1991). Economies of scale advantages can also help mitigate adverse selection problems between borrowers and issuers, which according to Cantor *et al.* (2007) can be explained by a sharp increase in the use of rating based loan or bond covenants. Secondly, CRAs' monitoring role can mitigate principal-agent problems in transactions where it is complicated to observe the other party's behaviour. The relevance of credit ratings can be attributed to its widespread use among governments, investment banks, suppliers, customers and other investors/stakeholders (IOSCO, 2008).

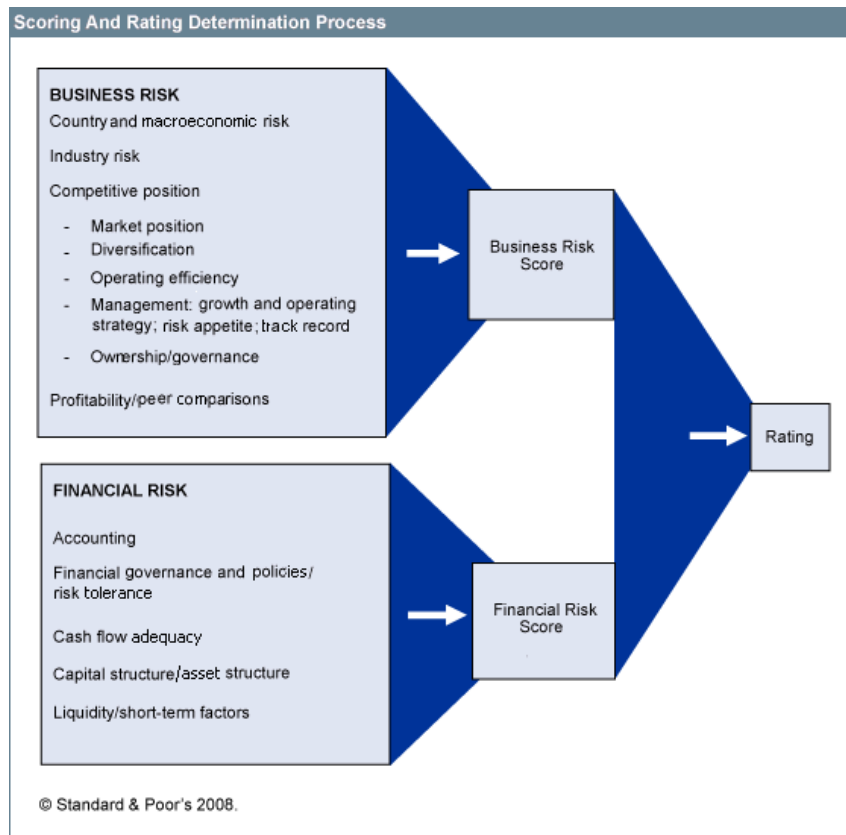
However, it should be noted that criticism has been raised regarding the market dependency and accuracy of credit ratings. Two studies made by the Association of Finance Professionals (2002, 2004) examine the timeliness and accuracy of credit ratings and was further studied by Cantor *et al.* (2007), which also summarise key concerns regarding the use of credit rating guidelines in the US and Europe. The issues raised were:

- (i) The hardwiring of market and regulatory rules, where credit ratings are incorporated into regulations and investment criteria.
- (ii) The problem of split ratings, where several CRA's disagree on the rating category of an issuer, who therefore has to decide on which to use as the preferred rating.
- (iii) The trade-off between rating accuracy and rating stability, as heterogeneous users of rating guidelines has different requirements. CRAs typically issue ratings intended to last more than one business-cycle, which is insufficient for active investors more concerned with short-term fluctuations in credit quality (Altman & Rijken, 2004).

3.7.2. Rating process

The analytical process and the methodology behind credit ratings are similar among the leading CRAs. Cantor & Packer (1994) examined the evolution and reliability of credit ratings. They concluded that credit ratings are a reliable relative risk measure and that the leading CRAs follow each other closely in terms of rating actions. The standard framework for assessing a company's ability to meet its financial obligations consists of two main parts and analyses both qualitative as well as quantitative aspects. The first part involves a fundamental business risk analysis, which evaluates relevant industry and business specific aspects. According to Standard & Poor's (2008), this part includes a substantial amount of subjective judgement and is intended to provide a foundation on which to base the next part, a detailed financial risk analysis of the company. This is done quantitatively by primarily focusing on analysis of financial ratios. The final part involves weighting the business risk and financial risk scores to arrive at the final credit score or rating. (Ganguin & Bilardello, 2005)

Figure 3 Standard & Poor's rating determination process.



Source: Standard & Poor's (2007)

3.7.3. Credit rating agencies' approach to captives

Rating process

When rating AMGs, CRAs assign the captive a weight of 5% in the overall credit score (Moody's, 2007). The CRAs generally rate a captive and its parent company as a single business unit, which derives from the close operational and financial ties between the two entities. As a consequence the credit rating between the two seldom differ more than one notch on the rating scale (Standard & Poor's, 2007) (Fitch, 2006) (Moody's, 2007). There are however exceptions. European captives are often protected by legal frameworks that restrict parental influence and prevent it from being included in a parent bankruptcy (Fitch, 2006). Their regulatory status also means that they are monitored more closely by authorities compared to US captives,

placing minimum requirements on risk management practices and internal controls. As a result, Standard & Poor's (2007) generally assign more confidence in the risk management of European captives.

Risk specific to captives

Business risk

Captives are according to Moody's (2007) generally highly exposed to shifts in competitive trends and technological changes affecting the parent company, which in turn will affect the business risks of the captive. Another factor is the captive's ability to support the business objectives of its parent, often measured as a percentage of the parent's total sales (Standard & Poor's, 2007).

Credit risk

Credit risk is typically regarded as the most important factor when rating a captive. The narrow focus of its operations increases consumer and geographical concentration, hindering diversification efforts, hence increasing credit risk (Fitch, 2006). Standard & Poor's (2007) highlights the importance of monitoring any indications that the captive is loosening credit standards in order to boost sales. Typical indicators of such actions are shifts in the residual value setting policy and extension of the duration of auto loans.

Liquidity risk

Captives typically have access to several sources of funding, including bank loans, commercial papers, unsecured debt as well as through the securitisation markets. The parent often acts as a guarantee in such transactions, which is why liquidity risk normally is evaluated on a consolidated basis (Moody's, 2006). Both Moody's (2007) and Standard & Poor's (2007) highlights the danger of a captive becoming too reliant on such market-sensitive transactions, where weakening performance of the parent will affect how the captive is viewed by the market, thus impairing its funding flexibility.

Profitability

Earnings fluctuations of captives do not always move in sync with those of its parent. E.g. if sales are dropping for the parent it may try to boost sales through incentivised financing at low interest rates, which in turn boost the captive's revenues, delaying the actual effects from weakening market conditions (Fitch, 2006).

Market risk

Market risk is generally considered a moderate risk factor and primarily concerns interest rate risk, which can be mitigated by matching customer receivables or offloading the balance sheet through securitisation (Standard & Poor's, 2007). However, should the captive's ability to perform these activities somehow be impaired, market risk becomes an important issue. This is because market factors have a large impact on the secondary vehicle market, which affects turn-in-rates (Fitch, 2006).

Leverage

When assessing the risks associated with increased leverage the key factor is the financial policy of the parent. Financial policy refers to funds moving upstream as well as the parent's willingness to support captive operations in terms of distress. This risk is significant, but can according to Moody's (2006) be difficult to analyse as the level of disclosure, varies greatly between different actors.

4. Methodology and data collection

In the fourth chapter of this thesis we present and motivate the methods we use in our study. We end the chapter by evaluating the validity and reliability of our research approach.

4.1. Research approach

This study aims to investigate to what extent an increased dependency on auto captives has affected the likelihood of bankruptcy for AMGs. This is done through a quantitative approach where we use regression analysis. Aspects not covered by the quantitative study are qualitatively examined.

The lack of previous research, specifically investigating the automotive industry, prevents us from solely relying on established theoretical frameworks to perform our analysis. We therefore use frameworks created by CRAs, the markets main authority on assessing default risk (likelihood of bankruptcy), and the Basel Committee on Banking Supervision. Findings by previous research studying captives, that had access to internal data, are used as reference when interpreting results. Hence, this is a deductive study (Bryman & Bell, 2003).

4.2. Data collection

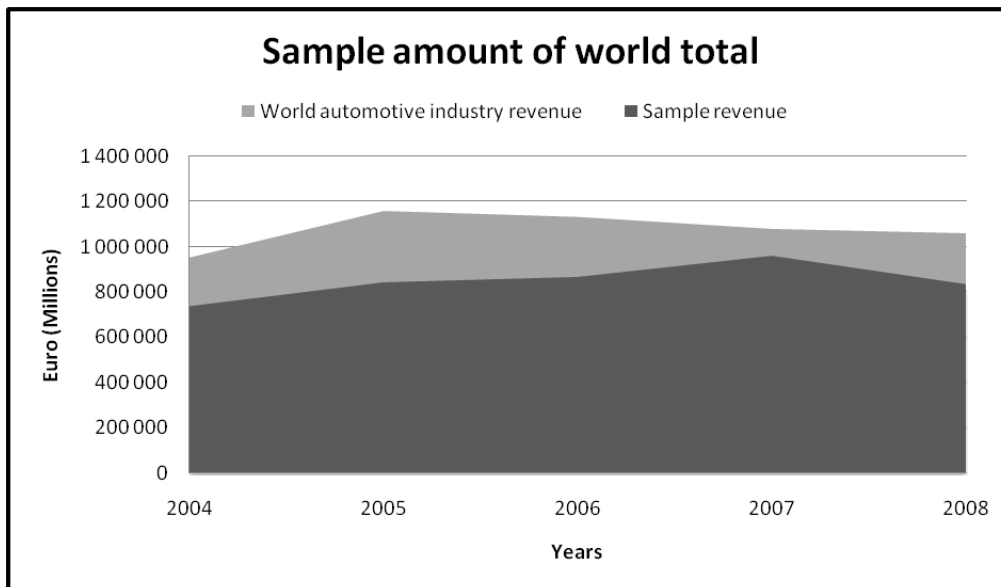
This study is based on secondary data reported from the companies. No primary data was available due to the restrictive disclosure policies in the automotive industry, especially regarding captive activities.

4.2.1. Sample

The sample of AMGs is selected through the use of the Global Industry Classification Standard (GICS) index for AMGs retrieved from the Thomson Reuters database. Each company is examined to determine if they use captives and how their ownership is structured.

The regulations for disclosure of financial information differ between countries. Thus, some regions are not represented in the study. For example, the AMGs in China and India are not included. We ended up with 12 companies and a total of 66 observations. Despite some shortfall, the sample in the study includes from 73 percent to 89 percent of the total automotive industry revenue in the years 2004 to 2008.

Figure 4 The study's sample of AMGs compared to total industry revenues



Sources: Datamonitor (2008), Thomson Reuters

4.2.2. Excluded observations

No observations are excluded from the study since the study aims to find how the captive affects the AMGs z-score. If negative z-scores are excluded there might be survival bias, which will affect the validity of the study. However, none of the companies in the sample has defaulted, even though some companies have very low or even negative z-score.

4.2.3. Company specific data

The AMGs income statement and balance sheet data is retrieved through Thomson Datastream, a database for financial information. A challenge in

this study is to retrieve financial information regarding the captives. This is done through annual reports downloaded from their respective websites.

4.3. Regression Analysis

Regression analysis is used to statistically establish any relations between collected data. Several decisions concerning models and variables have to be made and are discussed in this section.

4.3.1. Choice of regression model

When choosing among different regression models, the number of periods in time and number of observations are important factors to consider. Because of the small size and short time span of the observations, the selection of regression models is quite limited. Our data cover both a time-series and a cross-sectional aspect; consequently we need a model that covers both these factors. One solution is to use a cross-section data set that estimates the independent variables effect on the dependent variable at a particular point in time. Repeating this procedure for several years gives an indication of how the variables' effect changes over time. An approach to cross-section data sets is to use panel data sets, which are able to control individual heterogeneity that keeps the estimates from being biased (Baltagi, 2008). This is however not an issue in our study, since all our companies are from the same industry. Panel data sets may be better at identifying and estimating effects that cross-section data sets cannot handle, but when the time span is short a panel data set is not preferable (*Ibid.*). Hence, we use cross-sectional regressions for each of the years separately under the ordinary least squares (OLS) assumptions. This is carried out in Eviews, a software used for regression analysis.

OLS requires that certain assumptions are fulfilled. We therefore conduct tests to make sure that no heteroskedasticity, autocorrelation, multicollinearity or specification errors exist. Moreover, the distribution of the residuals is investigated to see if they are normally distributed. No

heteroskedasticity is present in our regressions according to the results from white's (1980) test. The Durbin-Watson statistics show no sign of autocorrelation and according to our correlation matrixes our regressions are free from multicollinearity. However, when looking at the distribution of the residuals using the Anderson-Darling test we can see that they are not normally distributed. We use the Anderson-Darling test since the more commonly used Jarque-Bera test is a large sample test and therefore is not appropriate for our study (Gujarati, 2006). According to Brooks (2008), exclusion of outliers may be a solution to the distribution problem. Adjusting for outliers did however not eliminate the distribution problem. Furthermore, since our sample size is very small, an exclusion of only a few observations would severely affect the strength of our quantitative model. According to Sprent & Smeeton (2001), an alternative way of performing regression analysis is using a non-parametric method, which is free from the assumption of normally distributed residuals. Non-parameteric regressions are suitable when the sample size is small (Sprent & Smeeton, 2001), which corresponds well with our data. For that reason we also perform cross-sectional regressions for each year using a non-parametric regression.

4.3.2. Dependent variable

Altman's z-score is used as the dependent variable in the regression analysis because of its widespread use and absence of unrealistic assumptions compared to the Merton (1974) model. It is important to note that the resulting values for each company each year in this study is not meant to be an absolute measure of bankruptcy probability, but a relative measure of development over time. The constant factors in the Altman's z-score equation can be altered to fit certain industries, however the general weights were used in this study as the z-score's only purpose, as mentioned before, is to compare among companies and through time. The general Altman z-score model is presented below:

$$z - score = 1,2 \times X_1 + 1,4 \times X_2 + 3,3 \times X_3 + 0,6 \times X_4 + 1,0 \times X_5$$

4.3.3. Independent variables

We aim to test to what extent the risk is transferred back to the parent, affecting the AMG's probability of default. This is done by using the asset to asset ratio, measured as the captive's total assets in relation to the group's total assets.

$$\text{Asset to asset ratio} = \frac{\text{Captive total assets}}{\text{Group total assets}}$$

We expect the asset to asset ratio to have a negative influence on the firm's z-score, which is consistent with empirical research showing that captives are more prone to take on risk than competitors e.g. commercial banks, by being less diversified and by employing more lenient credit policies (Carey, Post, & Sharpe, 1998).

Lease transactions are, according to Diekmann (2006), exposed to a more complex risk structure than other types of vehicle financing e.g. loans. Lease to asset ratio is therefore used to test whether the amount of lease contracts in relation to the captive's total assets will increase the AMG's probability of default.

$$\text{Lease to asset ratio} = \frac{\text{Captive assets consisting of lease contracts}}{\text{Captives total assets}}$$

Considering Moody's (2007) arguments regarding credit risk and vehicle residual values, we expect lease to asset ratio to be negatively correlated to probability of default. The equation used in the regression analysis is constructed as follows:

$$Z - \text{score} = \text{constant} + \text{lease ratio} \times \beta_1 + \text{asset ratio} \times \beta_2$$

Where the z-score is the dependent variable, lease ratio and asset ratio are the independent variables and the constant is the intercept.

4.4. Methodological Problems

It is important to scrutinise the method used in order to evaluate their relevance. This is crucial to the contribution the study has to offer. This is done by confirming the validity and reliability (Golafshani, 2003). Assessing the validity of a study means questioning if the results generated are justifiable when compared to what the study was meant to measure (Bryman & Bell, 2003). Ryan *et al.* (2002) separates validity into internal and external validity, which we use as a framework for discussing the validity of our study. In order to clarify if the study is reliable, the relevance of measures used must be assessed. A study that is conducted in the same way multiple times and concludes the same answers is to be considered to have a strong reliability (Bryman & Bell, 2003).

4.4.1. Validity

Internal validity

A high internal validity is characterised by changes in the dependent variable being described by the independent variables to large extent (Ryan, Scapens, & Theobald, 2002).

Although our regression analysis identifies a strong connection between our independent and dependent variables, we must consider that macroeconomic and other industry specific factors also have an influence on our dependent variable. The regression method used is well known and commonly used for this type of study and does not inflict on our results.

External validity

External validity is described as the possibility for the results to be generalised to other settings (*Ibid*). Our sample represents the majority of the

automotive industry. In addition we have analysed the captives in general, which implies that our study can be generalised to the whole automotive industry as well as captive activities in general.

4.4.2. Reliability

Data used when calculating Altman z-score are retrieved from Datastream and Reuters, both deemed to be reliable sources of information. Captive data are collected from annual reports, which can be subjected to manipulation. However, external reporting from firms in our sample is regulated through frameworks such as IFRS and GAAP. Annual reports are also the main source of information used by external investors. Accounting data from firms are therefore considered to be reliable. Furthermore, the disclosure of information varies greatly over time and between captives. It is therefore not possible to make adjustments compensating for changes in accounting policies e.g. IFRS and GAAP. Following the CRAs methodology regarding adjustments is not possible, since they to a certain degree rely on internal information (Standard & Poor's, 2008). This will inflict on our reliability, but in order to maintain the integrity of our sample, no observations are excluded because of accounting policies.

5. Empirical findings and analysis

In the fifth chapter empirical findings from the collected raw data are presented. Results from our regression are then analysed based on our theoretical framework.

5.1. Empirical findings

Table 2 This table summarises the final sample and observations used in the study.

Company	years	Lease ratio		Asset ratio		Altman's Z-score	
		Mean	Median	Mean	Median	Mean	Median
General Motors	2002-2008	0,104	0,097	0,796	0,707	0,511	0,583
Peugeot	2002-2008	0,223	0,213	0,397	0,389	1,442	1,367
Honda	2002-2008	0,406	0,443	0,582	0,572	1,871	1,845
Toyota	2003-2008	0,208	0,212	0,226	0,225	1,607	1,605
Ford	2002-2008	0,151	0,150	0,615	0,608	0,791	0,808
Volkswagen	2002-2008	0,290	0,290	0,315	0,329	1,168	1,168
Fiat	2005-2008	0,095	0,086	0,253	0,28	1,207	1,243
BMW	2002-2008	0,299	0,320	0,608	0,597	1,114	1,139
Daimler	2007-2008	0,177	0,177	0,494	0,494	1,206	1,206
Renault	2002-2007	0,241	0,238	0,401	0,402	0,798	0,779
Nissan	2006-2007	0,302	0,302	0,479	0,479	1,440	1,440
Hyundai	2002-2005	0,094	0,100	0,181	0,169	1,192	1,190
Mean		0,216	0,219	0,446	0,438	1,196	1,198
Median		0,216	0,212	0,440	0,441	1,199	1,198
Standard deviation		0,097	0,107	0,185	0,167	0,375	0,355

Lease to assets ratio

To capture the effect of the captive portfolio the captive lease to assets ratio is used in the regression analyses. The standard deviation indicates that the ratio is quite stable between the companies. The extreme values in this variable are represented by Hyundai and Fiat with a mean of 0.094 and 0.095 respectively and Honda with a mean of 0.443 whilst the mean of the total sample is 0.216.

Captive assets to group assets ratio

As a measure of size relationship between the captive and the group, captive assets to group assets is used. Ford and General Motors have the most extreme values, indicating that the American market deviates from the rest of the world. This is most likely because the American AMGs have been under

Automotive captives
A risky business?

particular pressure and therefore been more aggressive in their effort to keep demands high through their captives. For the total sample the mean is 0.446 which we think is surprisingly high.

Altman z-score

Altman's z-score is used as a measure of credit risk in this study. The mean of the sample is 1.196 where especially General Motors stand out with a mean of 0.511. The other American AMG in the sample, Ford, also has a relatively low z-score of 0.791 which is only beaten by General Motors. It is apparent that the current crisis has hit the American market the hardest. Omitting the American manufacturers would of course lead to a higher mean but not a more correct mean. Our sample represents from 73 to 89 percent of the population which means that the observed is most likely the actual.

5.2. Analysis

Table 3. Results from the non-parametric regression analysis.

Variable	2008	2007	2006	2005	2004	2003	2002
Constant	1,863	1,488	1,018	0,958	1,006	1,041	1,047
<i>p-value</i>	0,014 **	0,002 ***	0,083 *	0,085 *	0,092 *	0,079 *	0,260
Lease ratio	1,745	1,084	1,147	2,381	3,038	3,075	2,167
<i>t-statistic</i>	0,928	1,013	0,895	1,488	2,011	2,527	1,059
<i>Stand error</i>	1,881	1,070	1,281	1,600	1,510	1,217	2,046
<i>p-value</i>	0,389	0,341	0,400	0,180	0,091 *	0,045 **	0,338
Asset ratio	-2,372	-1,102	0,185	-0,970	-1,054	-1,099	-0,787
<i>t-statistic</i>	-4,201	-2,322	0,268	-1,108	-1,178	-1,304	-0,494
<i>Stand error</i>	0,565	0,475	0,690	0,875	0,895	0,843	1,594
<i>p-value</i>	0,006 ***	0,049 **	0,796	0,304	0,283	0,240	0,642
R2(robust)	0,718	0,441	0,155	0,358	0,549	0,556	0,343
Prob(F-statistic)	0,022 **	0,098 *	0,556	0,212	0,092 *	0,087 *	0,349
No. Observations	9	11	10	10	9	9	8

*** significant at 1 percent level. **significant at 5 percent level. *significant at 10 percent level.

In table 3 it can be seen that the estimates of the independent variables remain steady in terms of size and of sign through the observed period. The number of observations is few, which make the regression results less reliable. It is however important to remember that the results should be seen

as the observed trend for the whole population. Moreover, our regression analysis under the OLS assumptions generates results, which are very close to the non-parametric model (see Exhibit C in appendix) indicating that our results are reliable.

The fact that the constant is significant for almost every year is interesting. This indicates that if the independent variables were zero the average z-score of the companies would be higher in the years 2007 and 2008 than the calculated average z-score for the sample. This is most likely due to the increasing financial difficulties in the automotive industry especially in the U.S. However, in the preceding 5 years this would mean that a captive contributes to a higher z-score.

The regression analysis shows that the lease ratio, in contrast to what we expected, have a positive influence on the group's z-score suggesting that the more of a captive's assets that consists of leasing assets the higher the z-score. Significance can be found in the lease ratio in 2 out of 7 years. These findings are inconsistent with research made by Sharpe & Nguyen (1995), Carey *et al.* (1998), Diekmann (2006) and Fitch (2006). It can be argued that this may be due to the captives' ability to realise gains from their leasing operations, which exceeds the risk they are taking, which is in line with the studies made by Knight (1921), Stultz (1996) and Shrand & Unal (1998). We have to consider the possibility that our time period does not include any of the years when low residual values hit the market such as the year 2001 and most likely the years 2009-2010, due to the financial crisis.

The asset ratio variable, used as a proxy for captive size in relation to the group as a whole, shows that the more of the auto group's assets that consists of captive assets, the more the z-score declines. The asset ratio shows significance in the years 2007 and 2008. The value of the coefficient determines that if the asset ratio moves up by one unit the z-score drops by

2.4 units in 2008 and approximately 1 the rest of the years except for 2006 when the coefficient is positive. The economic significance of this is hard to evaluate, for most of the years a 10 percentage point rise in the asset ratio would mean a 0.1 drop in the z-score, what effects that would give on loan costs and investment restraints varies of course between the companies and in what state they already are in.

The regression as a whole shows significance in 4 of the 7 years. Our results suggest that the risk within auto manufacturers can be explained to a large extent by the activities conducted within captives. This is risk that according Froot (2003) and Culp (2001), may inflict on finance and investment activities as well as the market value of the parent company. A failure in risk management is considered by Culp (2001) as an effect of lack in diversification of non-core risk. This would then imply that the captives do not succeed in managing the risk that they obtain.

Furthermore, since Moody's (2007) only assign captive activities a 5 percent weight of AMGs total credit rating, our results are intriguing. Our study cannot prove the rating agencies wrong, but our regression analysis suggests that the captives have a larger influence on the credit rating than rating agencies assume. This argument also finds some support in criticism brought forward by Cantor *et al.* (2007) and Altman & Rijken (2004) against the accuracy of CRAs.

6. Conclusion

The sixth chapter will serve two purposes. First, we conclude our analysis from the previous chapter. Secondly, a discussion will be held regarding important qualitative aspects not explicitly covered by the analysis. We end the chapter with suggestions for future research.

6.1. Conclusion

This thesis set out with the aim of answering the question, to what extent an increased dependency on auto captives has affected the likelihood of bankruptcy for AMGs.

Our study quantitatively shows that captives are not successful in managing their risk. The asset ratio has a negative effect on average approximately 1 unit on the AMGs z-score over the 7 year period. This is most likely due to lack of diversification in the captives operations. The asset ratio is however only statistically significant in 2 years.

Leasing on the other hand has an average positive effect of 2 on the AMGs z-score. This supports Schmit's (2003) study which concludes that leasing is a relatively low risk activity. Support can be found in the risk management theories regarding comparative advantages by Stultz (1996) and Culp (2002).

6.2. Discussion

Looking at the profit distribution along the vehicle value chain (Table 1), auto financing does indeed seem like an attractive opportunity for AMGs to widen stressed profit margins. This is in line with theory, which suggests that automotive finance can, if properly managed, be a relatively low-risk activity

due to the collateral offered by the vehicle itself (Diekmann, 2006). However, as incentive levels increase, the situation changes and auto groups are running the risk of undermining their business model (Fitch, 2008), while at the same time increasing the exposure towards residual value risk (Fahey, 2003).

As mentioned, the regression result for the asset ratio is consistent with our initial belief. By analysing our results, using the frameworks established by the Basel Committee on Banking Supervision (2000) and CRAs, we find additional signs of possible flaws in the risk management practices of captives.

Standard & Poor's (2008) indicated that a captive's association to its parent company hinders it from being fully diversified, which according to BIS (2000) is one of the main contributors to credit risk. However, it should be noted that captives may hold advantage over e.g. commercial banks in terms of superior knowledge and experience from the automotive industry following the argument by Sharpe & Nguyen (1998).

Another factor hindering sound credit risk management practices is the existence of subjective decision-making by management. A possible source of conflict of interests in AMGs was first identified by Banner (1958) and more thoroughly discussed by Hener (2005) who highlighted the importance of management's ability to balance revenue growth against risk concerns. Our quantitative study was not able to show that the credit decision in auto captives has been corrupted by sales considerations. However, referring to the losses incurred due to aggressive leasing policies during the late 1990s, when sales considerations clearly took precedence over risk monitoring (Fahey, 2003), we find reason to believe that auto financing activities pursued during market downturns may expose them to more residual value risk. Especially since any potential difference between vehicles values in the

secondary market and estimated residual values only become evident in case of default or at lease termination.

This corresponds well to another source of looming credit problems identified by BIS (2000), which is an insufficient adherence to business cycle effects on risk exposure. Evidence supporting this argument can be found from the above mentioned episode. There are also a number of parallels to the current development in the automotive industry, referring to the substantial build up of production capacity prior to a downward shift in demand (CSM Worldwide, 2009) and the failure to anticipate the shift toward more environmentally friendly vehicles (KPMG, 2009).

The significance of having sound credit risk management practices is further highlighted by the CRAs, who may, if they deem the effects to be long-term, penalize an AMG with a lower credit rating. This can have severe economic implications for the AMGs, since a lower credit rating is viewed by the market as an indication of deteriorating performance, which in turn may impair its financial flexibility (Thomas & Dale, 1991).

In contrast to what we believed prior to the study, the lease ratio was positively correlated with the z-score which we think might be because of the parent's option to use incentivised leasing through the captive when sales are dropping, which is consistent with the increasing level of sales incentives (see Figure 5 in appendix). However, this argument only holds as long as residual values remain unaffected. Once residual values starts to decline the captives' risk exposure increases. Losses on the other hand might not be realised for a number of years since the average lease contract is between 36 to 48 months. Consequently, we find reason to believe that during periods with significant drops in residual values, the lease ratio might be negatively correlated with the z-score. Unfortunately our time period does not include

such periods e.g. 1996 to 2000 when the residual values declined sharply and the undermining of the AMG's own business model was more apparent.

Captives can be seen as a necessary source of competitiveness considering the dire condition of the automotive industry. Auto finance is in itself not a particularly risky activity. However, if sales incentives are used without taking proper care and consideration, captives can quickly become a significant source of risk for automotive manufacturing groups.

6.3. Future research

AMGs have deeply rooted ties with modern society, its importance certified by the current governmental efforts to keep them from bankruptcy. Future research regarding the use of captives, credit risk management and especially the automotive industry is therefore of great importance.

Although we have been able to statistically establish the relationship between auto captives and their effect on the risk structure of the AMG we have, as often with economic and statistical research, been restricted by data shortcomings. Additional research would ideally be performed with access to more detailed information such as contract specific residual values and industry default rates, which would enable a more accurate estimation of risks and loss rates. To fully capture the impact that recent leasing and financing activities will have upon maturity, it would be interesting to extend this study in 3 to 4 years time. Since little academic research has been conducted about credit risk management in financial captives the possibilities for new discoveries should be vast.

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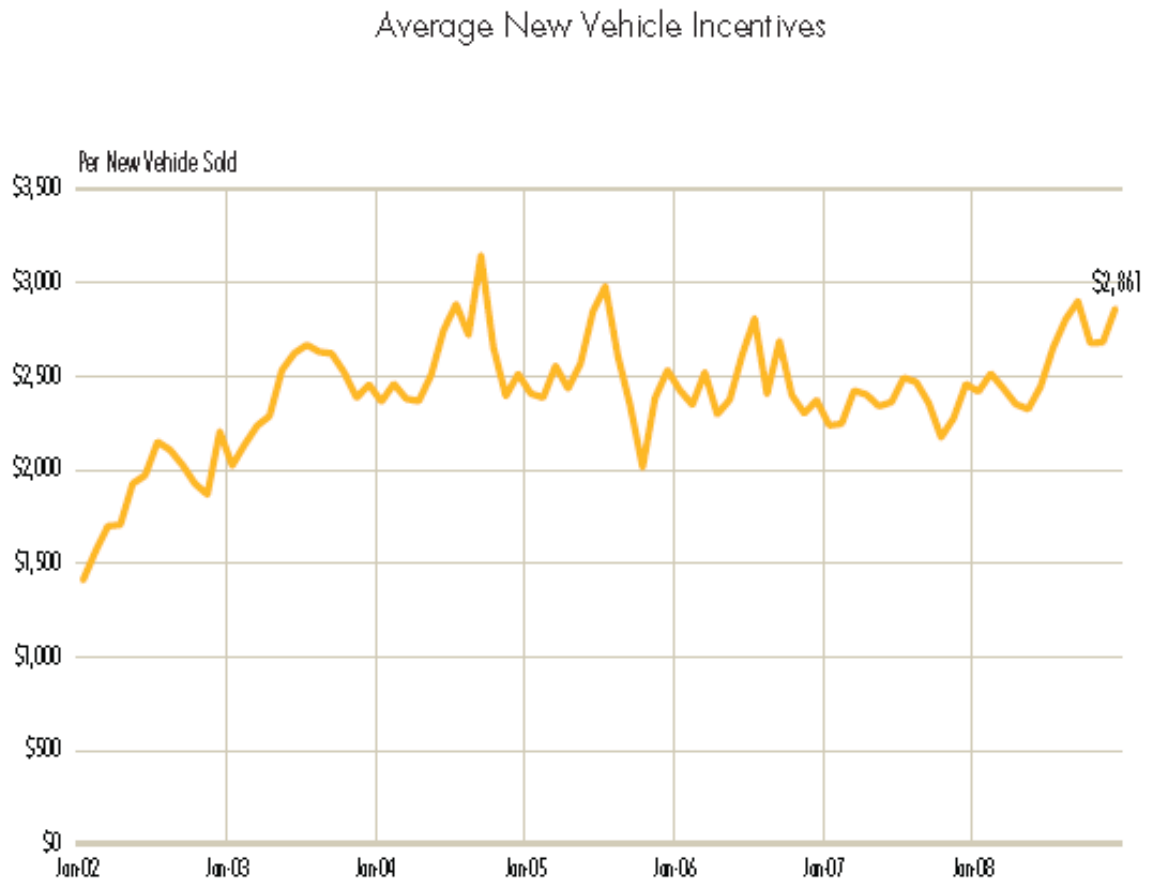
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8. Appendix

8.1. Exhibit A

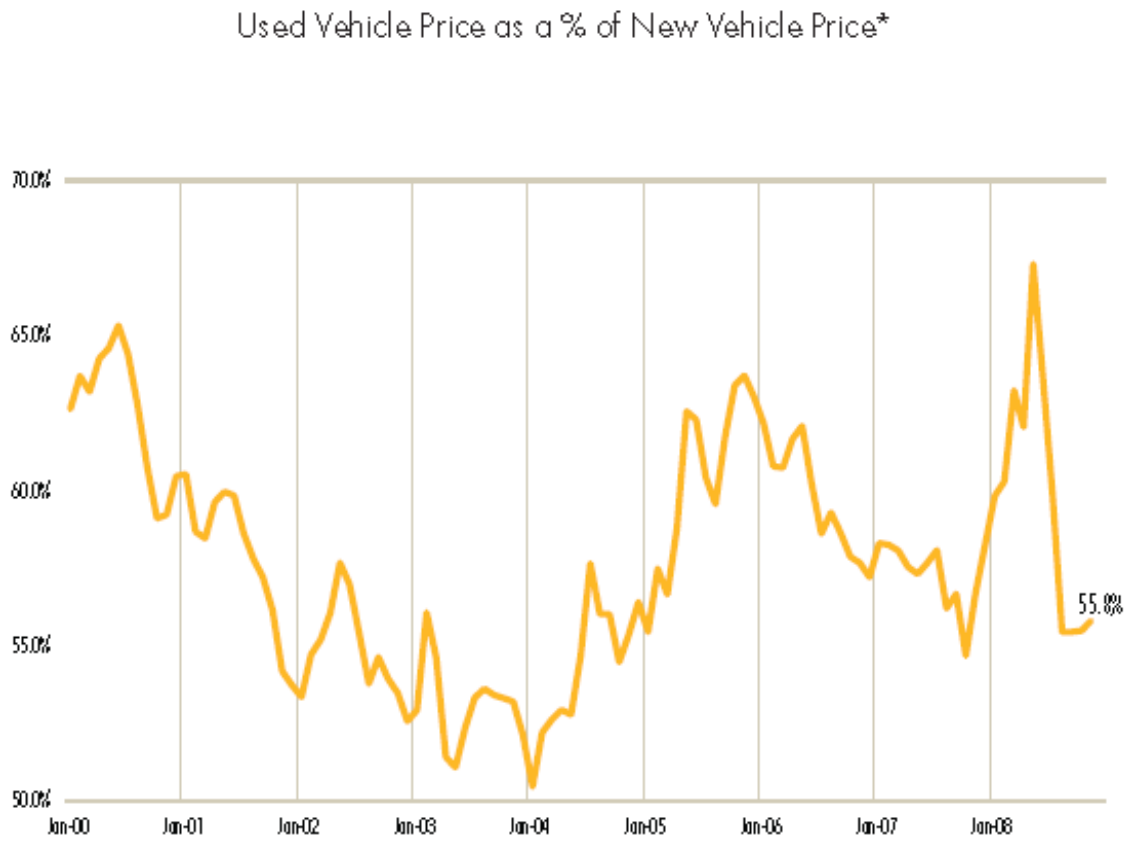
Figure 5 Global incentives per new vehicles sold.



Source: Adesa analytical services (2008)

8.2. Exhibit B

Figure 6 Global price difference between used and new vehicles



* Based on vehicles financed by domestic captive finance companies.

Source: Adesa analytical services (2008)

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8.3. Exhibit C

Table 4 Results from the OLS regression analysis.

Variable	2008	2007	2006	2005	2004	2003	2002
Constant	1,902	1,213	0,848	0,942	1,075	1,115	1,096
<i>p-value</i>	0,020 **	0,022 **	0,089 *	0,026 **	0,012 **	0,021 **	0,039 **
Lease ratio	1,827	1,525	1,238	2,403	2,994	2,601	2,154
<i>t-statistic</i>	0,867	1,136	1,083	2,173	3,260	2,673	2,217
<i>Standard error</i>	2,108	1,342	1,143	1,106	0,918	0,973	0,971
<i>p-value</i>	0,419	0,289	0,315	0,066 *	0,017 **	0,037 **	0,077 *
Asset ratio	-2,388	-0,755	0,202	-0,860	-1,114	-1,077	-0,795
<i>t-statistic</i>	-3,775	-1,268	0,329	-1,421	-2,048	-1,597	-1,051
<i>Stand error</i>	0,633	0,595	0,615	0,605	0,544	0,674	0,757
<i>p-value</i>	0,009 ***	0,241	0,752	0,198	0,087 *	0,161	0,341
R2	0,728	0,262	0,152	0,455	0,686	0,600	0,510
R2 adjusted	0,638	0,078	-0,090	0,300	0,582	0,467	0,313
Prob(F-statistic)	0,020 **	0,297	0,561	0,119	0,031 **	0,064 *	0,168
No. Observations	9	11	10	10	9	9	8

*** significant at 1 percent level. **significant at 5 percent level. *significant at 10 percent level.