Residual Value Analysis

Andreas Jost
DaimlerChrysler Research and Technology
IT for Engineering and Processes - Digital Engineering Competence Center
Wilhelm-Runge-Strasse 11 - 89013 Ulm - Germany
phone: + 49 731 505 2364 - fax: + 49 731 505 4400
mail: andreas.jost@daimlerchrysler.com

Alexander Franke
Collège des Ingénieurs (CDI)
49 rue de l'Université - 75007 Paris - France
phone: +49 179 964 1081
mail: afranke@cdi.fr

ABSTRACT
Residual values are considered of major importance for an automotive product/brand in various aspects. They are believed to have a major influence on attributes such as: new car sales, pricing options, buyback risk, and image perception. The presented paper refers to a work in progress model developed for the analysis of residual values in the automotive industry. It is designed to analyze how an automotive company can support and take advantage of residual values. Among others, the following questions are addressed:

- Which leverages/policies effect residual values?
- Which leverages/policies are particularly effective/sensitive?
- What effects/consequences regarding the new car business are to expect by changes in residual values?

Although the model is designed and developed for practical use in the automotive industry and can not be revealed in detail, it provides important aspects that are worthy of discussion with experts in the field of System Dynamics. It represents a new approach to the subject of residual values and connects to previous work such as Sterman (2002). The developed model reproduces the course of residual values in relation to specified market cycles as well as the given exogenous factors realistically and has proven valuable for important questions of the automotive industry regarding effective leverages and policies to residual values.

INTRODUCTION

Residual values are considered of major importance for an automotive product/brand in many aspects. They are believed to support new car sales, to influence pricing options and reduce buyback risks. Furthermore residual values significantly influence brand image.
Classical approaches to the subject of residual values include statistical regression analysis and maximum likelihood estimates based on available market data. Automotive market analysts also offer product oriented multipoint checklists and various forecast models. Nevertheless the identified, classical approaches did not provide sufficient support to address the aforementioned questions (see abstract) and to develop strategic policies accordingly. Therefore a System Dynamics approach was taken in order to explore leverages and effects to residual values from a perspective of an automotive manufacturer. Also the System Dynamic modeling process was considered to be of remarkable value for the formulation of a common perspective and the generation of additional insights to the subject.

LITERATURE REVIEW

Little previous work was found focusing on the analysis of residual values. Most related publications concentrate on more general questions associated with the market of used cars. A milestone towards a better understanding of the relevant market mechanisms was introduced by Akerloff (1970). According to this model a potential buyer has disadvantages as he cannot access the quality of a used car individually. This leads to decisions purely based on price and the association of lower prices with lower qualities accordingly. A reinforcing cycle may therefore lead to a reduction in the average quality of goods and result in a "market of lemons". Akerloff´s hypothesis were repeatedly tested (more recently by Emons/Sheldon (2002)) but have not been empirically confirmed. Nevertheless they are considered to be highly significant and believed to have led to higher transparency in market of used cars.

With focus on the car market in Germany Dudenhöffer/Borscheid (2004) describe available forecast models for residual values and highlight the advantages of explicative time series. Also with regard to the German market Beyer (1997) proposes the introduction of a *used car price index* as a basis to reduce car lessor's risks in the instability of residual values through the utilization of options and derivatives.

Applying System Dynamics as a method in the context of used car markets Barraba/Pudar (1997) analyze long-term effects of leasing strategies with General Motors. Along this System Dynamic initiative GM's Dialogue Decision Process was developed and introduced. An important aspect for the work presented in this paper is the connection to the physical vehicle flow model presented by Sterman (2002). Its model section simulates volume flows of cars on the automotive market. Sterman related his analysis to the interaction of the new and used car market and investigated the impact of a substitute market (of younger used cars) as an option for new cars triggered by leasing. Whereas **Sterman (2002) focuses on the physical flow of cars form production to today's recycling phase within the presented model. This flow is extended to include orders and most importantly buyback volumes.**

MODEL STRUCTURE AND ASPECTS

In the following an overview of the model structure is provided and selected model sections are briefly introduced.

MODEL OVERVIEW

In the developed model four sections can be distinguished: *Vehicle Flow and Buyback Volume*, *Model Cycles and Vehicle Attractiveness, Residual Value Formation* and *Exogenous Factors* (see Figure 1). The last sector is concerned with the integration of exogenous factors and basic demand volumes and will not be described in detail.

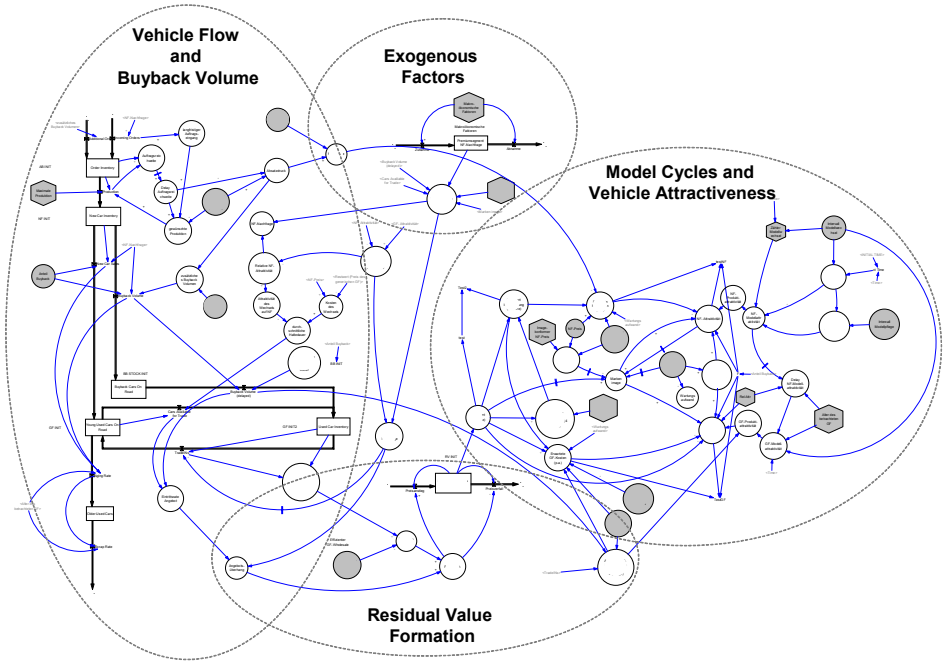

Fig 1: Overview model structure

VEHICLE FLOW AND BUYBACK VOLUME

The vehicle flow is modeled similar to Sterman (2002). It simulates volume flows of vehicles from production to today's recycling phase. Compared to the model introduced by Sterman the vehicle flow was extended to include orders and most importantly buyback volumes (see Figure 2).

Orders are distinguished between base orders and additional orders generated by short-term initiatives (including market initiatives as well as production oriented activities).

Buyback volumes explicate the number of buyback cars on the road and introduce a virtual used car inventory generated by the commitments to buybacks and the available number of younger used cars on the road.

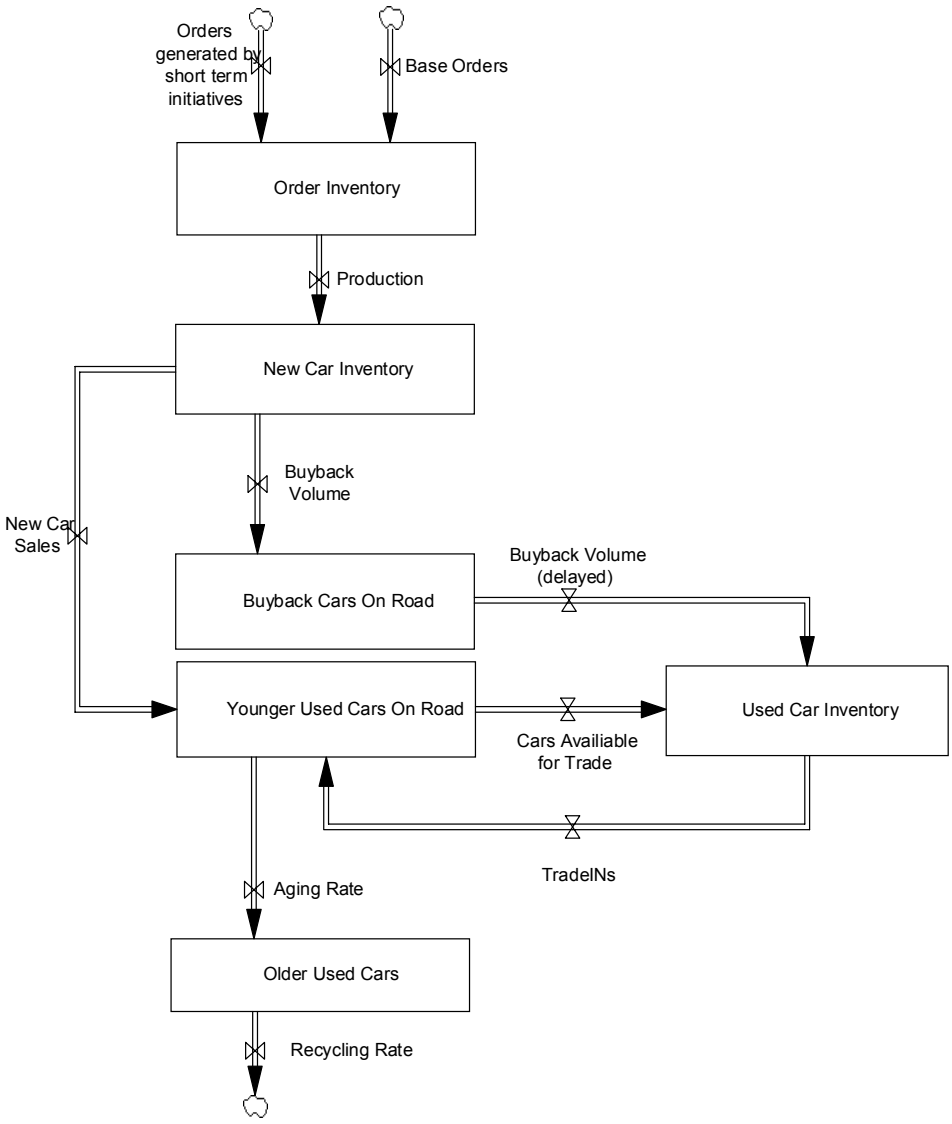

Fig 2: Vehicle Flow and Buyback Volume

MODEL CYCLES AND VEHICLE ATTRACTIVENESS

The Vehicle Attractiveness distinguishes between new and used car attractiveness. Both parameters counteract in relation to the model cycles. New product launches frequently start a new model cycle and significantly influence the respective residual values. The

effects of model upgrades are less sensitive in their influence on the formation of residual values. Central parameters are intervals between model cycles and age (time since production) of a respective model.

RESIDUAL VALUE FORMATION

The residual value is formed through a competing approach between the demand for younger used cars and the respective supply combined with the identified dynamics (derivatives). Supply pressure is believed to be a major factor in the formation of residual values. The strategies employed by car manufacturers can have significant effects on the supply side as well as on the demand side. The model takes different strategic levers into account that are directly and indirectly controlled by OEMs. Examples are product life cycles, leasing strategies and market initiatives.

MODEL CHARACTERISTICS

Figure 3 shows the qualitative course of the residual value in relation to a given model cycle. The attractiveness of new and used vehicles is shown in parallel in order to emphasize significant points within a model. The graph is not shown in scale and with no hierarchical order on the vertical axis.

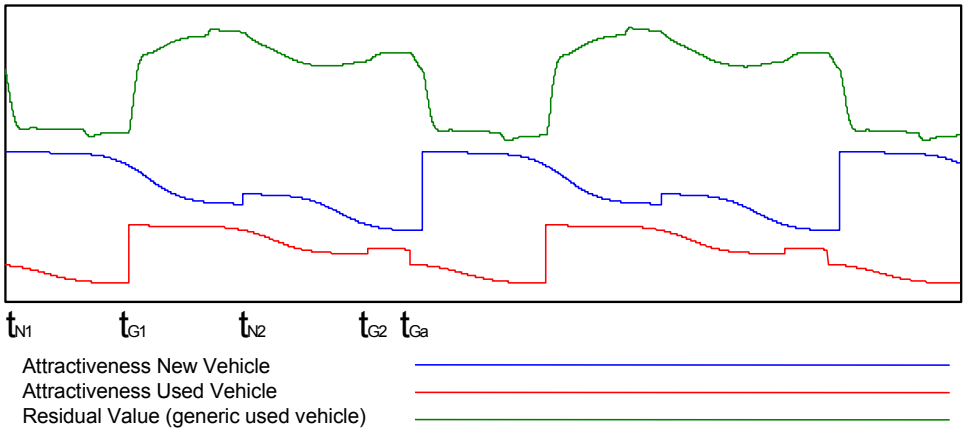

Fig 3: Residual Value and Model Attractiveness

At t_{N1} a new car model enters the marked for new vehicles. In the used car market its respective predecessor car model is in a mature life cycle phase. The residual value of a given car model is low. At t_{G1} a new car model becomes available in the market for used cars and the residual value rises significantly. At t_{N2} the highest level of the residual value is reached. Further on residual values decrease until at t_{G2} an upgrade of the current car model becomes available on the used car market. t_{Ga} marks the presentation of the new (successor) car model in advance to the planned market introduction (t_{N1}).

CONCLUSIONS AND FURTHER RESEARCH

The developed model is able to address important questions of the automotive industry regarding effective leverages and policies to residual values. It is able to realistically reproduce the course of residual values in relation to specified market cycles and the given exogenous factors.

Nevertheless, certain effects have been left out in the first step which are worthy of consideration in a second step. All above, the model is designed to support the decision of an automotive company and focuses on leverages that are in direct or indirect control of that company. In the first step the market cycles of competing car models (of other manufactures) have been omitted. The integration of competitor model cycles is believed to be a significant factor which can further improve the value of the developed model.

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