

DECREASE IN MARKET VALUE OF A MOTOR VEHICLE

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Introduction

Whereas in previous years the repair of accidental damages used to be connected with a remainder of accident traces, nowadays it is possible to repair even complicated accidental damages virtually without any trace or at least without defects by using today's conventional repair methods. However, it has to be noted that a vehicle with a repaired accidental damage realizes an inferior value on the market compared to an undamaged comparable vehicle. This decrease in market value can basically be explained by a change in purchase behavior influenced by possible doubts about the professional and proper repair or the apprehension of possible consequences of the accident. This change in vehicle value is therefore not so much caused by technical reasons but can be seen as a result of the purchase behavior and a changed market situation of the vehicle.

Over the past few years a number of calculation methods have been introduced. As a rule, the calculation methods by Ruhkopf/Sahm, the Hamburg method, by Halbgewachs or by BVSK are common practice. In this connection it has to be noted that all calculation methods are subject to specific preconditions and lead only in certain cases to a realistic result. In general, it is necessary that the assessor evaluates the decrease in market value at his discretion as an expert. Knowledge of the market situation as well as a rough estimate of the decrease is, of course, a precondition.

Previously, it was assumed - in particular by jurisdiction - that a vehicle only up to certain age or kilometrage (a maximum of 5 years, a maximum of 100,000 km) is subject to a corresponding decrease in market value. With regard to the usual life of vehicles today (average age of today's fleet of cars in Germany is approx. 7-8 years) and with regard to the reachable kilometrage of the vehicles (kilometrage of 350,000 km and more are quite possible) such limitations are in principle subjected to a critical discussion.

The most important characteristic of a vehicle even if older than 8 years is nowadays always the lack of any accident history so that from the assessor's point of view a decrease in market value has always to be taken into consideration - also for vehicles with more than 100,000 km and older than 5 years.

The corresponding decrease in market value can be estimated by assessors at their discretion having regard to all factors that influence value, in particular the scope of repair and the repair solution. Accurate calculation methods can only be used in few cases.

Legislative Bases

The claim for compensation of the decrease in value after an accident arises from the general bases of claim obliging compensation such as §§ 823 cont. BGB (German Civil Code), 7,18 StVG (Road Traffic Act) and not directly from §§ 249 cont. BGB (German Civil Code) which only determines the way and the scope of compensation.

According to the principle of restitution in kind the person obliged to pay compensation under § 249 para. 1 BGB (German Civil Code) has to restore the condition which would exist if the circumstance leading to the compensation would not have happened.

As far as the restoration is "not possible or inadequate for compensation" the compensation has to be made "in money" according to § 251 para. 1 BGB (German Civil Code).

The claim resulting from the decrease in market value is based in this respect on the partly impossibility or inadequateness of restitution in kind. The reduced market value according to legal classification has to be distinguished from the actual restitution in kind because the reduced market value exceeds restitution in kind and does not constitute a substitute of benefit (see § 252 BGB [German Civil Code]) or an immaterial compensation (see § 253 para. 1 BGB [German Civil Code]).

Calculation Methods for Reduced Market Value

None of the so far existing methods to determine the reduced market value tries to only determine the actual decrease in value on the second-hand car market; in this respect it is at best only a matter of approximate values. Depending on the method different assessment factors are incorporated in the calculation. Vital factors for determining the reduced market value are current replacement value, age, kilometrage and amount of repair costs. In addition, other factors (type, marketability, previous owner, condition, color, previous use etc.) play a role on the second-hand car market. The determination of approximate values corresponds to the desire to handle claim settlement in a practical way as an empiric determination of the actual loss cannot be accomplished for every single vehicle. In order to avoid damage due to a lower market value which will not be compensated the methods must be reviewed critically and on an individual basis and market research must be done for the vehicle, if need be.

Calculation Method by Ruhkopf/Sahm

The method according to Ruhkopf/Sahm dates from an essay written in 1962. The authors recommended an across-the-board compensation of the reduced value dependent on the sales value (current replacement value, repair costs and year of registration) in consideration of the market action at that time, which should apply for the primary types of passenger cars, motorcycles, multi-purpose vehicles and vans and are listed in the table below.

The decrease in market value according to Ruhkopf/Sahm is calculated from the repair costs and the current replacement value.

Calculation Factors	Abbreviation
Original price (MSRP)	NP
Current replacement value incl. kilometrage	WBW
Age of vehicle in months	M
Repair cost in total	RK
Repair cost ratio	K
Depreciation	W

Table 1: Calculation factors/abbreviation Ruhkopf/Sahm

For the calculation according to the method by Ruhkopf/Sahm it is necessary to calculate so-called ratios first. These are:

1. Value ratio = $\frac{WBW}{NP} \times 100$
2. Cost ratio = $\frac{RK}{NP} \times 100$
3. Effort ratio = $\frac{RK}{WBW} \times 100$

If the ratio of the current replacement value with respect to the original price (NP) is below 40% the car is depreciated by age or used in such a way that a decrease in market value based on an accident is no longer justified.

$$W (\%) = \frac{WBW}{NP \text{ net}} * 100$$

Formula 1: Depreciation [W%] Ruhkopf/Sahm

$$W (\%) = < 40 \% = \text{no further depreciation}$$

Formula 2: Depreciation question Ruhkopf/Sahm

If the ratio of repair costs to current replacement value is below 10 % a minor damage occurred that does not justify any decrease in market value.

$$K \% < 10 \% = \text{minor damage}$$

Formula 3: Minor damage question Ruhkopf/Sahm

$$\text{Effort Ratio [K \%]} = \frac{RK \text{ net}}{WPW \text{ net}} * 100$$

Formula 4: Effort ratio [K%] Ruhkopf/Sahm

With the help of the table above a factor can be determined using the age of the vehicle (year of registration). The method by Ruhkopf/Sahm requires that the vehicle at the time of the accident was not older than 5 years and that the kilometrage did not exceed 100,000 km. Decrease in market value according to the method by Ruhkopf/Sahm is justified if the value ratio is higher than 40% and the cost ratio higher than 10%. In this case the decrease in market value is calculated according to the following equation:

$$\text{Decrease in value} = \frac{(WBW \text{ net} + \text{rep. cost net}) * \text{factor from table}}{100}$$

Formula 5: Decrease in market value [EUR] Ruhkopf/Sahm

Repair Cost Ratio (K%) to Current Replacement Value	10-30 %	30-60 %	60-90 %
1st year after registration	5	6	7
2nd year after registration	4	5	6
as of 3rd year after registration	3	4	5

Table 2: Repair cost ratio [K%] Ruhkopf/Sahm

Example of Calculation of the Decrease in Market Value according to the Method by Ruhkopf/Sahm

Calculation Factors	Values
Original price (MSRP)	= 30,000 EUR net
Current replacement value (WBW)	= 18,000 EUR gross
Age	= 26 months = 3rd year after registration
Repair costs	= 6,800 EUR net

Table 3: Example values for calculation according to Ruhkopf/Sahm

The determination of the decrease in market value according to the calculation model by Ruhkopf/Sahm is divided into 5 calculation steps:

$$\begin{aligned} \text{➤ Repair cost ratio [K \%]} &= \frac{\text{rep. cost net}}{WBW \text{ net}} * 100 \\ &= \frac{6,800}{18,000} * 100 = 37.8 \% \end{aligned}$$

$$\text{➤ } K \% < 10 \% \neq \text{minor damage}$$

$$\text{➤ } W (\%) = \frac{18,000}{30,000} * 100 = 60 \%$$

$$\text{➤ } W (\%) \neq < 40 \% = \text{no further depreciation}$$

$$\begin{aligned} \text{➤ Decrease in value [Wm]} &= \frac{(WBW \text{ net} + \text{rep. cost net}) * \text{factor from table}}{100} \\ &= \frac{(18,000 + 6,800) * 4}{100} = 992 \text{ EUR} \end{aligned}$$

= 1,000 EUR rounded

If the almost 50-year-old assessment method, in particular its limitations, is still up to the current situation on the second-hand car market may be questioned and rightly so. However, the essential factors - also on today's second-hand car market - are taken into consideration. Moreover, the method by Ruhkopf/Sahm is until now the only method designated as "useful assessment basis" by the German Federal Court of Justice (BGH).

Ruhkopf/Sahm explain their calculation method in more detail in the insurance law magazine VersR 1962, page 593 cont.

Calculation Method Hamburg Model

The so-called "Swiss formula" is the basis of this calculation method, globally assuming 20% of the repairs costs (net) as decrease in market value. The courts of Hamburg and the Local Court of Bremen developed their own methods out of this, focusing either on kilometrage (Hamburg model) or age of vehicle (Bremen model). The Hamburg model excludes a decrease in market value for a kilometrage of more than 100,000 km.

Kilometrage	Decrease in Market Value in % of Gross Repair Costs
Up to 20,000 km	30 %
Up to 50,000 km	20 %
Up to 75,000 km	15 %
Up to 100,000 km	10 %
More than 100,000 km	0 %

Table 4: Table of correlation Hamburg model

Example of Calculation of the Decrease in Market Value according to the Hamburg Model

Calculation Factors	Values
Original price (MSRP)	= 30,000 EUR net
Current replacement value (WBW)	= 18,000 EUR gross
Age	= 26 months = 3rd year after registration
Repair costs	= 6,800 EUR net
Considerable repair costs	= 4,000 EUR gross
Kilometrage	= 45,000 km

Table 5: Example values for calculation according to Hamburg model

$$Decrease\ in\ value\ [Wm] = 20\% * \frac{4,000\ EUR}{100\ \%} = 800\ EUR$$

Calculation Method Bremen Model

The Bremen model relates the age of the vehicle at the time of the accident to the repair costs caused by the accident. Accordingly, the decrease in market value within the first 6 months amounts to 30 %.

Age of the Vehicle	Decrease in Market Value in Relation to the Repair Costs
Up to 6 months	30 %
Up to 12 months	25 %
Up to 24 months	20 %
Up to 36 months	15 %
Up to 60 months	10 %

Table 6: Table of correlation Bremen model

If a vehicle was older than 60 months then depreciation was no longer justified according to the perception at that time. Background of this perception was then inexistent

corrosion protection of vehicles so that a 5-year-old vehicle already had considerable corrosion damages which were not caused by any accidents.

Calculation Method by Halbgewachs

The method by Halbgewachs to determine the upper assessment threshold of the decrease in market value dates from a brochure published by DEKRA in 1964 which was updated until 2003.

It relates the manufacturer's suggested retail price (MSRP) to the age of the vehicle and the repair costs, dividing the repair costs into wages and spare parts. Moreover, the total repair costs shall be corrected to an average local charge rate of working hours. Furthermore, previous damages and change of owners are taken into consideration.

For calculation according to Halbgewachs also so-called ratios need to be calculated but the effort ratio (compared to the method by Ruhkopf/Sahm) is defined differently.

1. Value ratios = $\frac{WBW}{NP} \times 100$
2. Cost ratio = $\frac{RK}{NP} \times 100$
3. Effort ratio = $\frac{Wage\ costs}{Spare\ part\ costs} \times 100$

Decrease in market value according to the method by Halbgewachs is justified if the value ratio is higher than 40% and the cost ratio higher than 10%, calculated according to the following formula:

$$Decrease\ in\ value\ [Wm] = \frac{WBW + RK(net)}{100} * X$$

Formula 6: Decrease in market value according to Halbgewachs

Original Price (Manufacturer's Suggested Retail Price MSRP)

The original net price including extra equipment at the time of the first registration is used as calculation basis.

Current Replacement Value (WBW)

For the calculation the current replacement value on the day of the damage has to be determined and entered into the corresponding formula.

Age of the Vehicle

The age of the vehicle is indicated in full months. Consequently, already on the first day after the first registration one month has to be inserted into the calculation formula. If the vehicle is older than 72 months only in special justified cases a decrease in market value should be calculated.

Costs of Repair, Wages and Spare Parts

All costs without statutory value-added tax are taken as basis for the calculation of the decrease in market value. Additionally, the costs for wages are corrected to an average local charge rate of working hours.

The decrease in market value should not depend on the level of the hourly wage. Otherwise it would lead to the strange result that a higher decrease in market value would be determined if the repair was carried out in an expensive "branded garage" which is regarded as being the better choice by the typical buyer of second-hand vehicles than in a "inexpensive" garage.

This objectively better repair will lower the reduced market value. Without correction the decrease in market value would be higher therefore the costs of wages have to be corrected to the average local charge rate of working hours.

Ratios

Value Ratio (W)

The value ratio corresponds to the ratio of the current replacement value (WBW) to the original price (NP) at that time in percent. This ratio sheds light on the fact if a decrease in market value is still justified. If the ratio is below 35% then the precondition for decrease in market value is missing. The vehicle is already depreciated to the extent that a proper repair does not have any additional negative effects.

$$W (\%) = \frac{WBW}{NP} * 100$$

Formula 7: Value ratio; Halbgewachs

Cost Ratio (Value K or A)

K corresponds to the ratio of repair costs (RK) to the current replacement value (WBW) in percent. This ratio indicates if on the one hand a minor damage has occurred or on the other hand a total economic loss.

$$K (\%) = \frac{RK}{WBW} * 100$$

Formula 8: Cost ratio; Halbgewachs

In general, a minor damage has occurred if the repair costs amount up to approx. 750 € not leading to a claim for a decrease in market value.

A cost ratio < 10% signalizes to the assessor to look individually at the decrease in market value. It should not be ruled out categorically. The absolute amount of the repair costs have to be taken into consideration. If in case of a very high realization value a damage below K = 10 % has occurred it may still be a considerable damage to well-equipped vehicles and may result in a decrease in market value.

As a car can be repaired up to the threshold of total loss, meaning the ratio of the sum of repair costs (RK) and the decrease in market value (WM) to the current replacement value (WBW) is < 130%, then the reduced market value up to the total amount of damage has to be determined.

Effort ratio (Value A or B)

The effort ratio (A) corresponds to the ratio of wage costs (LK) to the material costs (MK) in percent. This ratio indicates to which extent parts are changed and repairs have to be made. In case of a value of A < 40% the share in material costs is high or the repair work carried out is low, therefore the risk of latent defects is also very low. In such a case it must be examined in detail if there is a claim for a decrease in market value.

1. Effort ratio = $\frac{Wage\ costs}{Spare\ part\ costs} * 100$

Factor X in the Table

Factor X can either be read directly from the table via the cost ratio and the effort ratio.

A-Wert Kostenverhältnis	I 10-20 %					II 21-33 %					III 34-45 %					IV 46-65 %					V 66-90 %					
B-Wert Aufwandsverhältnis	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	a	b	c	d	e	
	130 ^	130-100 v	100-70 v	70-50 v	50-40 v	130 ^	130-100 v	100-70 v	70-50 v	50-40 v	130 ^	130-100 v	100-70 v	70-50 v	50-40 v	130 ^	130-100 v	100-70 v	70-50 v	50-40 v	130 ^	130-100 v	100-70 v	70-50 v	50-40 v	
Alter bis 2 Monate	5,0	4,5	4,0	3,5	3,0	5,25	4,75	4,25	3,75	3,25	5,5	5,0	4,5	4,0	3,5	5,75	5,25	4,75	4,25	3,75	6,0	5,5	5,0	4,5	4,0	4,0
Alter bis 6 Monate	4,5	4,0	3,5	3,0	2,5	4,75	4,25	3,75	3,25	2,75	5,0	4,5	4,0	3,5	3,0	5,25	4,75	4,25	3,75	3,25	5,5	5,0	4,5	4,0	3,5	3,5
Alter bis 12 Monate	4,0	3,5	3,0	2,5	2,0	4,25	3,75	3,25	2,75	2,25	4,5	4,0	3,5	3,0	2,5	4,75	4,25	3,75	3,25	2,75	5,0	4,5	4,0	3,5	3,0	3,0
Alter bis 24 Monate	3,5	3,0	2,5	2,0	1,5	3,75	3,25	2,75	2,25	1,75	4,0	3,5	3,0	2,5	2,0	4,25	3,75	3,25	2,75	2,25	4,5	4,0	3,5	3,0	2,5	2,5
Alter bis 36 Monate	3,0	2,5	2,0	1,5	1,0	3,25	2,75	2,25	1,75	1,25	3,5	3,0	2,5	2,0	1,5	3,75	3,25	2,75	2,25	1,75	4,0	3,5	3,0	2,5	2,0	2,0
Alter bis 48 Monate	2,5	2,0	1,5	1,0	0,5	2,75	2,25	1,75	1,25	0,75	3,0	2,5	2,0	1,5	1,0	3,25	2,75	2,25	1,75	1,25	3,5	3,0	2,5	2,0	1,5	1,5
Alter bis 60 Monate	2,0	1,5	1,0	0,5		2,25	1,75	1,25	0,75	0,25	2,5	2,0	1,5	1,0	0,5	2,75	2,25	1,75	1,25	0,75	3,0	2,5	2,0	1,5	1,0	1,0

The factor X can be calculated using the following formulas.

X is the sum of 3 values (X= Xm + Xk + Xa). The values represent the age of the vehicle (Xm), the ratio of the repair costs to the current replacement value (Xk) and the ratio of the wage costs to the material costs (Xa).

Calculation of the Individual X Factors

The factor Xm is calculated from the age of the vehicle. x is the age of the vehicle in months (formula for x = 0 to 72 months).

$$Xm = \frac{0.0008 * x^4 - 0.3 * x^3 + 25 * x^2}{10,000} - 0.1136 * x + 3.2$$

The factor Xk is calculated from cost ratio K.

$$Xk = \frac{-0.002 * K^3 - 0.4 * K^2 + 192 * K}{10,000} - 0.082$$

The factor Xa is calculated from the effort ratio A.

$$Xa = 1.5392 * Ln(A) - 5.5773$$

Factor X is the sum of all individual factors.

$$X = Xm + Xk + Xa$$

Examples of the Decrease in Market Value according to the Model by Halbgewachs

Calculation Factors	Values
Original price (MSRP)	= 30,000 EUR net
Current replacement value (WBW)	= 18,000 EUR gross
Age	= 26 months = 3rd year after registration
Repair costs	= 6,800 EUR net
Wage costs	= 2,800 EUR gross
Material costs	= 3,100 km

Table 7: Example values for calculation according to Halbgewachs model

$$W (\%) = \frac{WBW}{NP} * 100 = \frac{18.000 \text{ €}}{30.000 \text{ €}} * 100 = 60\% \rightarrow \text{O.K. as } > 35\%$$

$$K (\%) = \frac{RK}{WBW} * 100 = \frac{6.800 \text{ €}}{18.000 \text{ €}} * 100 = 37,8\% \rightarrow \text{O.K. as } > 10\% \text{ and } > 130\%$$

$$A = \frac{LK}{MK} * 100 = \frac{2.800 \text{ €}}{3.100 \text{ €}} * 100 = 90\% \rightarrow \text{O.K. as } > 40\%$$

Factor X in the Table = 2.5

$$WM = \frac{(WBW+RK(net))}{100} * X = \frac{(18.000 \text{ €}+6.800 \text{ €})}{100} * 2.5 = 620 \text{ €}$$

Calculation Method by BVSK

Essential reference values for determining the decrease in market value are the current replacement value and the extent of repairs; these factors have a decisive influence over the purchase pattern. Regarding the other factors it is necessary to distinguish between factors

influencing the decrease in market value and factors with little or no influence on purchase behavior.

The amount of a decrease in market value is influenced by the following factors. These factors are taken into consideration due to the current replacement value of the vehicle at the time of the accident.

- Vehicle owner
- Kilometrage
- Number of owners
- Condition
- Marketability
- Special equipment.

These factors are consolidated in the classification of damages:

- Extent of the damage
- Repair solution
- Repair costs.

In classifying the extent of damage, influencing variables such as different charge rates, extra charges on spare part prices and transport costs are eliminated. The classification of damage only constitutes the factor including the actual damage of a vehicle. This factor is only to be determined by the assessor on the basis of the actual damage.

Therefore, the amount of a decrease in market value is essentially determined by the influencing variables of current of replacement value and classification.

To avoid double impact of the influencing variables of marketability already included in the current replacement value, a rule in form of a value M must be introduced. Without introduction of such a factor a higher reduced value would be the result for a marketable vehicle with the same claims rating category than for a vehicle with inferior marketability. For a vehicle that already has inferior marketability without previous accidental damage a higher reduced value has to be applied than for a vehicle with good marketability and previous accidental damage.

Determination of the Claims Rating Categories (% - category)

The damage (%-category) is classified according the following list:

Category	Description	% - values - category
1	Minor damages with replacement of attached parts (e.g. bumpers) and paintwork without straightening	0 to 0.5%
2	Minor damages with replacement of attached parts and screwed body parts without straightening	0.5 to 1.5%
3	Replacement of attached parts and screwed body parts and straightening of welded body parts	1.5 to 2.5%
4	Replacement of attached parts and screwed body parts, replacement of welded body parts and straightening of such parts, replacement of axle parts	2.5 to 3.5%
5	As category 4, but considerable straightening	3.5 to 4.5%
6	Replacement of attached parts, screwed and welded body parts, straightening of such parts as well as frame and floor pans, use of straightening bench, replacement of axle parts	4.5 to 6.0%
7	As 6, but additionally also use of frame parts and floor pans, use of straightening bench, damages front and rear	6.0 to 8.0%

Table 8: Claims rating category for calculation according to BVSK

Determination of Value M

Market dependency (factor M) is defined according to the list below:

Description	Value M
Good marketability	-0.5 %
Medium marketability	0.0 %
Inferior marketability	+1.0 %
Very long standstill periods, rare exotic vehicles	+2.0 %

Table 9: Value M for calculation according to BVSK

Determination of Factor K

When determining the decrease in market value of light commercial vehicles their special market situation has to be taken into consideration using another correction factor K.

The approach of the correction factor K should likewise be examined regarding vehicles with an already repaired previous damage.

Factor K is a sensitive value to be evaluated at assessor's discretion. The following values are suggested for factor K:

Description	Factor K
Light commercial vehicles	0.8
Repaired previous damage exists	0.8-0,5

Table 10 Factor K for calculation according to BVSK

BVSK Calculation Formulas

$$WM = WBW * \left(\frac{\% -category + value M}{100} \right) * \text{Factor K}$$

Evaluation

As the explanation above shows there are several calculation models for determining the decrease in market value. In this connection it has to be noted that all calculation methods are subject to a specific precondition and lead only in certain cases to a realistic result. In general, it is necessary that the assessor evaluates the reduced market value at his discretion as an expert. Knowledge of the market situation as well as a rough estimate of the decrease is, of course, a precondition.

Previously, it was assumed, in particular by jurisdiction, that a vehicle only up to certain age or kilometrage is subject to a corresponding reduced market value.

Concerning the service life of vehicles (average age of today's passenger car fleet in Germany is approx. 8-9 years) and with regard to the possible kilometrage of vehicles (kilometrage of far more than 250,000 km) such limitations are in principle subjected to a critical discussion.

The most important characteristic even for vehicles older than 8 years is nowadays always the lack of an accident history. The corresponding decrease in market value can be estimated by assessors at their discretion having regard to all factors that influence value, in particular the scope of repair and the repair solution. More accurate calculation methods can only be used in a few cases.