GAP Insurance—Techniques and Challenges

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Abstract: GAP (Guaranteed Asset Protection) insurance is an insurance product that insures the difference (if any) between the loan balance and the actual value of the underlying asset. Typically, this insurance is sold in conjunction with a traditional insurance product and guarantees that an insurable event will be sufficient to satisfy any lien upon the asset. While this type of insurance is used to cover a variety of exposures, the largest asset class is private passenger vehicles.

1. WHAT IS GAP INSURANCE?

The origins of GAP insurance are a little murky—the product has existed for about 25 years and originally may have been underwritten by car dealers as a sort of "quasi-insurance" product.

GAP is similar to credit life and credit A&H because it pays the vehicle loan in the event of certain contingencies, namely the car being deemed a "total loss" by the physical damage insurer. GAP will cover the shortfall between the loan payoff and the insurance recovery (typically book value less the deductible.)

While the term for gap coverage matches the term of the loan, the possibility of a claim is zero once the book value (less the deductible) of the vehicle exceeds the loan payoff. Also, there can be only one claim on a GAP policy—once a claim has been made the policy is expired and any remaining unearned premium is fully earned.

The regulatory framework for GAP differs from state to state. In some states it is not technically considered insurance. Other states may require that an insurance policy ultimately back the liabilities of a program (contractual liability), while others may consider the full premium insurance. Regardless of the regulatory framework, the techniques developed in this paper would be applicable since the consideration for pricing applications should be the ultimate projection of the underlying losses.

GAP products are structurally different from most other property/casualty products and an understanding of the structure and terminology may be helpful for the actuary who is unfamiliar with the business.

GAP is generally sold for a single payment for the entire term of the underlying loan and the sale is made at the time that the covered vehicle is purchased. A GAP policy can be cancelled and a refund processed. This will happen if the vehicle is sold or the policyholder requests a cancellation.

The refund method varies by state, with most using a Rule of 78s amortization due to the declining value of the coverage, but some, notably Texas, requiring pro rata for the return of premium. In addition, some lienholders may specifically require pro rata refunds in order to finance the GAP policy with the auto loan.

In addition to GAP, the consumer may encounter several other ancillary products during the inevitable visit to the dealer's finance and insurance department. These products include pre-paid maintenance, a vehicle service contract, VIN etch, etc. All of these products are almost always financed with the vehicle.

In states where GAP is not regulated as an insurance product, the price charged by the dealer is made up of three components: (1) GAP reserve, (2) administrative fees, and (3) dealer markup. It's also important to note that component (1) is the only portion that is paid to the insurer. Components (2) and (3) are not paid to the insurer, nor are they included in premium for purposes of calculating premium tax or risk-based capital. The portion of the price remitted to the insurance company may be the entire GAP reserve (1) or the GAP reserve may be placed in trust and a contractual liability policy can be issued to guarantee the performance of the trust.

An administrator typically will perform all the processing and servicing of the GAP contract. An agent will represent the administrator to the dealer clients. The GAP reserve may be remitted to an insurance company, or it may not be considered insurance in a regulatory sense. For the actuary, there are two items of note:

The terminology of reserve is misleading because "reserve" in GAP typically refers to all funds used to pay claims, not just the outstanding portion, and is more analogous to written premium. For our purposes, we will use the term *premium*.

Since the majority of expenses are paid prior to the remittance of funds to the insurance company, the expected loss ratio on net of expense premium on a book is higher than other property/casualty products. Often, a book will be priced at an expected loss ratio of 80 to 90 percent.

One should also note that GAP insurance represents a "moral hazard" since, after a loss, the insured will be in a better financial position than before since the negative equity on the vehicle has been removed. Of course, this is not different than replacement cost on homeowners insurance. Based on reviews of proprietary data, there is evidence of this hazard by the noticeable rise in frequency of GAP claims during the recession of 2008/2009.

2. CONSIDERATIONS WHEN PRICING GAP

GAP claims are dependent on two criteria: the occurrence of a total loss by the contract holder and the loan balance at the time of loss exceeding the book value of the vehicle.

Since the underlying product is private passenger insurance, we would expect that the same rating variables that are prevalent in private passenger pricing would also be predictive for the GAP pricing.

However, one must remember that a claim is only generated by a total loss, which would indicate that the frequency of more expensive or higher symbol vehicles might be lower than budget-priced vehicles, since they may be less likely to be declared a total loss by the insurance company. Even a state insurance department may not fully understand this difference. Texas, for example, mandates GAP rates by the amount of the loan, which has little correlation with loss.

GAP losses on vehicles will be driven more by the depreciation of the vehicle, which historically has been faster for American-made sedans and slower for some of the European and Japanese makes. Depreciation rates can fluctuate and are often a function of consumer preference. So the current depreciation rate for a vehicle may be subject to change in the future.

The severity of the loss will, of course, depend on the loan balance and the book value at the time of loss. Since the loan will amortize more slowly on a longer-term loan (and provide a greater length of coverage), the length of the loan is a factor in the severity. It also may affect the frequency because, once the value of the vehicle exceeds the loan, the claim would not be compensated.

Another major factor is the book value of the vehicle at the time of the purchase. While one might assume that the price of the vehicle would be equal to its underlying value, this is not necessarily true.

In many sales, the purchasers will owe more on their existing vehicles than the trade-in values. In the industry, this is known as "negative equity" or being "upside down." These customers are typically offered more for their trade than the vehicle is worth and the difference is reflected in the retail price. This inflated purchase price creates an immediate GAP exposure at the inception of the policy.

For example, suppose that a customer's current vehicle is worth $8,000 but the customer owes $12,000 on the vehicle. The new vehicle can be purchased for $25,000, which is the book value of the vehicle. In this case, a dealer may increase the price of the new vehicle to $29,000 and the value of the trade to $12,000. This will allow the existing note to be settled and a new loan for $29,000 will be originated. Therefore, the negative equity is "rolled" into the new loan. If a total loss occurred immediately on this new vehicle, the purchaser would face a shortfall of $4,000.

While these types of transactions may not be the majority of overall vehicle purchases, they will be a substantial part of a GAP portfolio, because these purchasers recognize their negative equity situations and will seek to insure the exposures.

In general, used vehicles will show fewer propensities for initial negative equity than new vehicles, and the frequency and the severity will be lower.

Unfortunately, many GAP insurance writers do not capture both the loan amount and the vehicle value at the time of purchase, which makes the analysis difficult. If loan amount and terms are captured, one can model the potential GAP severities on the book by examining the difference between the amortized value of the loan and the book value of the vehicle less the deductible.

While the typical automobile liability rating variables (such as age, credit score, marital status, driving record, garaging zip code, etc.) would likely be predictive for GAP coverage, in reality the rating plans for GAP coverage are currently very simple, with the vast majority only varying on the term of the loan.

Finally, the actuary must consider the catastrophe exposure for this line, which would include the typical catastrophe perils that affect the automobile physical damage coverage. Hail, wind and flood would by typical causation factors—the largest exposure is likely flood as most other catastrophes would not result in total losses to the vehicle and because most states require a vehicle that has been flooded to be declared a total loss. There was a significant amount of GAP catastrophe loss associated with Hurricane Katrina, although this was mitigated by insureds driving their vehicles out of the flood zones prior to the hurricane. Since vehicles with significant GAP exposure are also likely newer vehicles, they may be more prone to be removed from a potential catastrophe exposure.

3. THE LEVERAGED IMPACT OF USED VEHICLE PRICING

The biggest uncertainty with the analysis of a GAP program is the future direction of used vehicle pricing. Used vehicle prices are subject to volatile shifts. This occurs because of economic shifts that can impact the market value of used vehicles.

It is important to note that for GAP pricing, late-model used vehicle prices are more important, as the sale prices of older vehicles (more than three years from the current model year) will not be subject to significant GAP claims.

Since GAP will cover the difference between the book value and the loan balance, the difference between book value and loan amount acts like a very high deductible in a traditional automobile physical damage insurance policy. As the Table 1 below shows, changes in used vehicle values are significantly leveraged up into changes in the GAP severity.
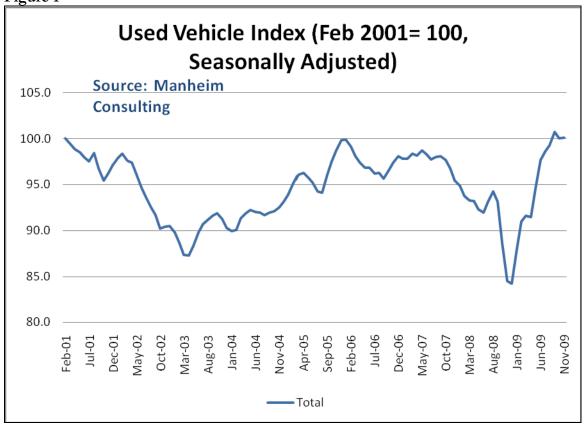
Table 1

	(1)	(2)	(3)	(4)	(5)	(6)
	Loan Amount	Book Value	GAP Deductible	GAP Coverage	Change in Book Value	Change in GAP Coverage
Base	16,000	13,000	500	3,500		
Increase in Book Value	16,000	14,300	500	2,200	10%	-37%
Decrease in Book Value	16,000	11,700	500	4,800	-10%	37%

(4)   (1) - (2) + (3)
(5)   (2) / Base (2)
(6)   (4) / Base (4)

Another issue is shifting vehicle preference among types of vehicles, such as the definite relationship between small vehicle prices and gasoline prices. Alternatively, there is an inverse relationship between large trucks prices and gasoline prices. Dramatic shifts in consumer preferences will cause GAP claims to increase, even if overall prices remain stable. This is because increases in underlying asset prices are capped by the amount of the loan while decreases remain uncapped.

Figure 1

Used Vehicle Index (Feb 2001= 100, Seasonally Adjusted)
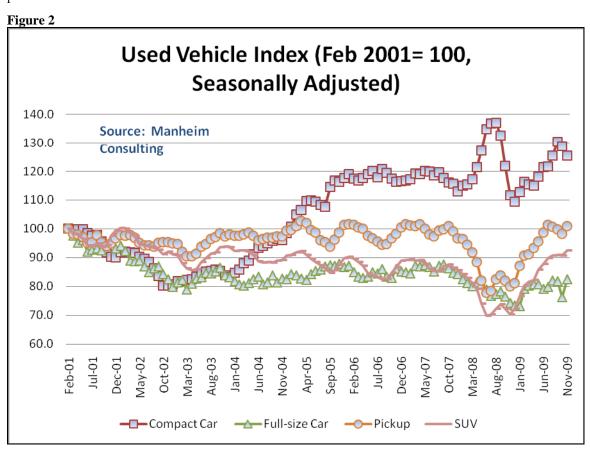Source: Manheim Consulting

As Figure 1 above shows, the index of used vehicle prices is subject to significant variation. Vehicles in the index are compiled from auction sales which focus mostly on late model used vehicles.

For example, in the aftermath of 9/11, vehicle manufacturers began to heavily incentivize the purchase of new vehicles through "zero percent financing" and other enticements. The result was a strong decline in the value of used vehicles, as these prices adjusted to the corresponding new vehicle price.

The "great recession" officially began in December 2007, which is the beginning of a decrease in the price of used vehicles.

In late 2008, used vehicle prices showed a dramatic improvement. There is some evidence that this increase may be more due to a lower supply of late model used vehicles in the marketplace rather than an increase in demand. This supply constraint may be due to decreased new vehicle sales in the prior years, as well as less leasing of vehicles (which generates a sale when the lease terminates). In addition, rental car fleets (who are a major source of late-model used vehicles) purchased fewer vehicles.

Figure 2

The chart in Figure 2 shows the same data, but is broken out by popular vehicle segments. For example, compact cars have shown significant price appreciation since 2001.

In conclusion, GAP is a leverage product in which small changes in the underlying book value of the asset will cause large swings in projected results. In addition, private passenger vehicles are subject to dramatic and somewhat unpredictable changes in price due to economic forces, petroleum prices, and consumer preferences. Furthermore, future regulatory requirements such as increased mileage standards may affect asset prices. Forecasting future GAP claims is subject to significant variation.

4. EARNINGS PATTERNS

GAP is a multi-year policy for which premium is earned through the use of earnings factors or earnings curves. These earnings are subject to actuarial review during evaluation before issuing a loss reserve opinion.

Typically, earnings are done on a "Rule-of-78s"-basis, which implies a quicker earnings pattern than a pro rata or even earnings typical for most property casualty products. The Rule-of-78s will earn premium as a function of the sum of the digits of the remaining term with the sum of digits of all term values.

Earnings for Rule-of-78s

N = Term in months.

M = Evaluated month.

Earnings factor to apply to written premium for this contract:

$$\text{Earnings Factor} = \sum_{M \equiv 1}^{N} \frac{2(N+1-M)}{(N)(N+1)}.$$

As the Table 2 below shows, this pattern closely resembles the balance of a loan. Research indicates that this pattern is slower than the actual emerging experience.[1] A more accurate earnings pattern can be obtained by assuming a reduction in the term of the loan by 25% (Term Elimination Factor) and using the Rule-of-78s pattern on these numbers).

Abbreviating the term for GAP insurance also makes sense when determining earned premium. GAP insurance does not cover the loan balance; it covers the difference between the loan balance and the book value. Once the loan amortizes to the point which the loan balance plus the

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[1] The 25% reduction is suggested by industry data in the 2009 CCIA GAP Study which was based on approximately 489,000 exposures and 5,800 claims. Several methods were employed, with the 25% reduction having the best fit if one refunds based on Rule-of78s. Mature books may also be analyzed directly for the underlying claim distribution pattern.

deductible is less than the book value of the vehicle, there is no severity associated with a claim. Therefore, we would expect that the severity of a GAP policy to reach zero more quickly than the loan balance.

Earnings for Abbreviated Rule-of-78s

N = Term in months.

M = Evaluated month.

A = Term Elimination Factor (0 < A <= 1).

Earnings factor to apply to written premium for this contract:

Z = (N x (1 - A).

For M < Z.

Earnings Factor = $\sum_{M=1}^{Z} \dfrac{2(Z+1-M)}{(Z)(Z+1)}$.

Else 1.

Table 2 illustrates these calculations for a 60-month loan.

Table 2

Month	(1) Balance	(2) Balance Earnings	(3) Rule of 78s	(4) Abbreviated Rule of 78s	(5) Example Book Value	(6) Deduct	(7) GAP Severity	(8) Example Book Value Earnings
1	10,000	3.1%	3.3%	4.3%	8,000	500	2,500	3.0%
2	9,860	3.1%	3.2%	4.3%	7,840	500	2,520	3.0%
3	9,720	3.0%	3.2%	4.2%	7,683	500	2,537	3.0%
4	9,579	3.0%	3.1%	4.1%	7,530	500	2,549	3.1%
5	9,436	2.9%	3.1%	4.0%	7,379	500	2,557	3.1%
6	9,293	2.9%	3.0%	3.9%	7,231	500	2,562	3.1%
7	9,150	2.8%	3.0%	3.8%	7,087	500	2,563	3.1%
8	9,005	2.8%	2.9%	3.7%	6,945	500	2,560	3.1%
9	8,859	2.7%	2.8%	3.6%	6,806	500	2,553	3.1%
10	8,713	2.7%	2.8%	3.5%	6,670	500	2,543	3.1%
11	8,566	2.7%	2.7%	3.4%	6,537	500	2,529	3.0%
12	8,418	2.6%	2.7%	3.3%	6,406	500	2,512	3.0%

Month	(1) Balance	(2) Balance Earnings	(3) Rule of 78s	(4) Abbreviated Rule of 78s	(5) Example Book Value	(6) Deduct	(7) GAP Severity	(8) Example Book Value Earnings
13	8,269	2.6%	2.6%	3.2%	6,278	500	2,491	3.0%
14	8,119	2.5%	2.6%	3.1%	6,152	500	2,467	3.0%
15	7,969	2.5%	2.5%	3.0%	6,029	500	2,439	2.9%
16	7,817	2.4%	2.5%	2.9%	5,909	500	2,409	2.9%
17	7,665	2.4%	2.4%	2.8%	5,790	500	2,374	2.9%
18	7,511	2.3%	2.3%	2.7%	5,675	500	2,337	2.8%
19	7,357	2.3%	2.3%	2.6%	5,561	500	2,296	2.8%
20	7,202	2.2%	2.2%	2.5%	5,450	500	2,252	2.7%
21	7,046	2.2%	2.2%	2.4%	5,341	500	2,205	2.7%
22	6,889	2.1%	2.1%	2.3%	5,234	500	2,155	2.6%
23	6,731	2.1%	2.1%	2.2%	5,129	500	2,102	2.5%
24	6,573	2.0%	2.0%	2.1%	5,027	500	2,046	2.5%
25	6,413	2.0%	2.0%	2.0%	4,926	500	1,987	2.4%
26	6,252	1.9%	1.9%	1.9%	4,828	500	1,925	2.3%
27	6,091	1.9%	1.9%	1.8%	4,731	500	1,860	2.2%
28	5,928	1.8%	1.8%	1.7%	4,637	500	1,792	2.2%
29	5,765	1.8%	1.7%	1.6%	4,544	500	1,721	2.1%
30	5,600	1.7%	1.7%	1.5%	4,453	500	1,648	2.0%
31	5,435	1.7%	1.6%	1.4%	4,364	500	1,571	1.9%
32	5,269	1.6%	1.6%	1.4%	4,277	500	1,492	1.8%
33	5,102	1.6%	1.5%	1.3%	4,191	500	1,410	1.7%
34	4,933	1.5%	1.5%	1.2%	4,107	500	1,326	1.6%
35	4,764	1.5%	1.4%	1.1%	4,025	500	1,239	1.5%
36	4,594	1.4%	1.4%	1.0%	3,945	500	1,149	1.4%
37	4,423	1.4%	1.3%	0.9%	3,866	500	1,057	1.3%
38	4,250	1.3%	1.3%	0.8%	3,788	500	962	1.2%
39	4,077	1.3%	1.2%	0.7%	3,713	500	865	1.0%

Month	(1) Balance	(2) Balance Earnings	(3) Rule of 78s	(4) Abbreviated Rule of 78s	(5) Example Book Value	(6) Deduct	(7) GAP Severity	(8) Example Book Value Earnings
40	3,903	1.2%	1.1%	0.6%	3,638	500	765	0.9%
41	3,728	1.2%	1.1%	0.5%	3,566	500	662	0.8%
42	3,551	1.1%	1.0%	0.4%	3,494	500	557	0.7%
43	3,374	1.0%	1.0%	0.3%	3,424	500	450	0.5%
44	3,196	1.0%	0.9%	0.2%	3,356	500	340	0.4%
45	3,016	0.9%	0.9%	0.1%	3,289	500	228	0.3%
46	2,836	0.9%	0.8%	0.0%	3,223	500	113	0.1%
47	2,655	0.8%	0.8%	0.0%	3,159	500	–	0.0%
48	2,472	0.8%	0.7%	0.0%	3,095	500	–	0.0%
49	2,288	0.7%	0.7%	0.0%	3,033	500	–	0.0%
50	2,104	0.7%	0.6%	0.0%	2,973	500	–	0.0%
51	1,918	0.6%	0.5%	0.0%	2,913	500	–	0.0%
52	1,731	0.5%	0.5%	0.0%	2,855	500	–	0.0%
53	1,543	0.5%	0.4%	0.0%	2,798	500	–	0.0%
54	1,354	0.4%	0.4%	0.0%	2,742	500	–	0.0%
55	1,164	0.4%	0.3%	0.0%	2,687	500	–	0.0%
56	973	0.3%	0.3%	0.0%	2,633	500	–	0.0%
57	781	0.2%	0.2%	0.0%	2,581	500	–	0.0%
58	587	0.2%	0.2%	0.0%	2,529	500	–	0.0%
59	393	0.1%	0.1%	0.0%	2,479	500	–	0.0%
60	197	0.1%	0.1%	0.0%	2,429	500	–	0.0%

(1) Loan Balance for 60-month loan, 7% interest rate
(2) Earnings based on (1)
(3) Traditional Rule of 78s
(4) Rule of 78s reducing term to 45 months from 60 months

(5) Book value assuming monthly 2% depreciation
(7) Maximum of (1) - (5) + (6) and 0
(8) Using (7) to form earnings curve.

A mature book of business can be analyzed to see the indicated underlying earnings patterns without relying on formulaic earnings patterns, but results should be reasonably close to an abbreviated Rule of 78s.

5. PROJECTING THE RESULTS

Once an appropriate earned premium has been calculated using either the Rule of 78s, the Abbreviated Rule of 78s, or actual historical data, the actuary should project the losses. It would be incorrect to merely assume that the current loss ratio will continue into the future; explicit assumptions should be made about future frequencies and severities. In addition, the book should be analyzed separately by credible class, such as term, initial GAP (if available), vehicle type and other relevant private passenger rating variables.

Of course, one should be careful because GAP is subject to volatile results due to fluctuations in the financing and used-vehicle market. GAP pure premiums will increase when financing standards become more lax because lenders will allow more negative equity (as described above) to be rolled into new loans. In addition, changes in used vehicle pricing will affect future loss rates.

Ideally, the book would contain loan amounts, terms, and book values (both historical and current). With this information, every current GAP could be modeled and the future GAP could be forecasted using different economic scenarios. On a more practical level, it is easier to calculate the earned contracts (using the same earnings factors described above) for different policy years and compare the results under different economic conditions.

A generalized linear model can be utilized to forecast the frequency and severity by class. For frequency, a logistic regression model is appropriate (since there can be only either zero or one claim.)

A logistic model would be specified by the claims divided by the earned contracts—with the earned factor calculated above applied to the contract. Contracts that have incurred a claim could be considered fully earned.

Logistic regression uses the natural logs of the frequencies of claims.

$$\text{logit}(p_i) = \ln\left(\frac{p_i}{1 - p_i}\right) = \beta_0 + \beta_1 x_{1,i} + \cdots + \beta_k x_{k,i}.$$

Where p = observed frequency and B = parameters and x = observed values for significant rating variables.

For severity, a gamma model provides a decent fit since there is not a significant tail on the severity amounts.

Unless the data set contains a long time period with periods of inflation and deflation in used-vehicle pricing, it is not possible through statistical models to capture all the variability associated with GAP claims.

Therefore, one could explicitly model various used vehicle pricing scenarios to better understand the potential variability of the results.

Profit provisions for GAP should recognize the variability of results due to economic conditions. This may imply a larger profit and contingencies provision than for more stable lines of insurance. Analyzing the proper profit and contingencies provision for GAP is beyond the scope of this paper, but would be a good topic for further research.

6. ENHANCEMENTS TO GAP

Recently, companies have introduced enhancements or added features to GAP products that offer down payment assistance or additional consideration when an insured files a claim. For example, a product might offer an additional $1,000 for any total loss during the policy period. In this case, the earnings curve would substantially be reversed, since it is more likely that a vehicle would be declared a total loss at the end of the contract.

These cases must be analyzed independently. Ideally, one could forecast the expected pure premium at each month in the contact for the additional coverage. This could be combined with the expected pure premium for the traditional GAP coverage and a new earnings curve would be formed.

7. SIMILAR PRODUCTS

Other asset classes that may have GAP policies are boats, recreational vehicles, and commercial equipment. In addition, financial institutions such as banks may purchase a GAP policy to cover their entire portfolio of loans when the borrower is unable to satisfy the lien after a total loss.

Another type of insurance similar to GAP is called Residual Value Insurance (RVI). RVI is often purchased in situations where an owner is leasing some type of property to another party. Examples of property that may be covered by RVI are rental real estate, leased automobiles, rolling stock of railroads (i.e., train cars), and leased airplanes. RVI will cover the difference between actual book value of the property at the end of the lease and the residual value specified in the lease. The specified residual value will be a forecast of the book value at the time of the purchase of the property.

In the past, RVI products have incurred significant underwriting losses and may not currently be available for all types of property. This is likely due to the difficulty of forecasting future residual values.

These products may be analyzed in similar fashion, though the terms may differ by product since

they can be customized. In addition, less data will typically be available for asset classes other than private passenger vehicles.

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