

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

Orin M. Linden, PhD, FCAS, MAAA, ARM

James B. Kahn, FCAS, MAAA

Brian Ko

Abstract

Motivation. Non-insurance companies are offering ever greater enhancements to their warranty programs, many times as a competitive tool to strengthen market position. Yet, oftentimes very little analysis is performed to understand the cost of these changes. This paper discusses how warranties are accrued for on a manufacturer's balance sheet and offers examples of methods to estimate these costs.

Method. Most of the paper's discussion centers around projecting actual payments over time using an approach similar to an incremental loss development triangle approach, properly adjusted for exposure and inflation changes. Other methods discussed include Bornhuetter-Ferguson, Average Age of Warranty Claim Times Annual Spend, Active Life, and Calendar Year Payments to Revenue Approaches.

Results. The most appropriate projection method may depend on factors such as available data or the nature of the company's product.

Conclusions. Actuarial projections of warranty costs rooted in common actuarial reserving and pricing techniques are appropriate for estimating the future liabilities for the warranty liabilities.

Keywords. Warranty/Service Contracts; Parts and Labor Cost; Reserving; Pricing.

1. INTRODUCTION

Quite simply put, if a company has a product, it will likely be offering warranties associated with it. While warranty coverage for automobile mechanical breakdown has become more commonplace over the years, the latest technological explosions have led to more and more customers being offered a bewildering array of warranties for products ranging from most personal and home appliances to highly specific products such as jet engines.

For the most part, history and the various state laws that deal with the appropriateness of items for their intended use have dictated that a manufacturer's basic warranty would be in place for no additional charge to the customer. However, many companies offer the consumer an opportunity to purchase an 'extended' warranty or service agreement, which would provide for some combination of (1) additional years of coverage, and/or (2) coverage of additional costs. In addition, a manufacturer may offer a maintenance agreement that provides for maintaining a product according to a recommended

maintenance schedule. Some manufacturers will guarantee coverage over the entire 'lifetime' of a given product under the terms of their 'lifetime' warranties.

2. WHY WORRY?

Warranties come in all types and shapes. They may be implied (i.e. an expectation of fitness for the use intended) or expressed (actually stated orally or in writing). They may cover a short period of time such as 30 days or the lifetime of a product, however defined. They may cover all or part of a product (e.g., a five year bumper to bumper vs. a 10 year drivetrain auto warranty). Some will cover parts only; others, labor as well. Specific warranties may cover related costs such as a roofing tile company covering the cost of removal and dumping of the defective product.

Some companies offer a basic warranty and nothing else. The basic warranty may be simple (e.g., one year parts and labor) or quite complicated (e.g., auto warranties that have different life spans and coverages for different parts and may require servicing from other companies for purchased parts such as tires or radios). Indeed, many companies offer a dazzling assortment of both products and warranty options. Customers may receive a basic warranty automatically but the terms may vary by product. When a manufacturer offers greater coverage through an extended warranty or service contract, these additional warranties are sold for a variety of purposes; as profit items, to differentiate a product, or to underscore the inherent quality of a product. The terms of an extending warranty can be just as puzzling as the standard or basic warranty. They also may cover replacement parts, labor and peripheral costs for differing time periods.

To make matters more interesting, depending on the product and economic situation, warranties can often be used as competitive tools. In such cases manufacturers may decide to extend the coverage offered by their basic or extended warranties for several purposes:

- Showing a company's belief in the inherent quality of their product;
- Adding a differentiator where consumers view products as inherently similar;
- Changing warranties to be similar to changes adopted by competitors;

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

- Encouraging product buyers to also purchase maintenance services from the manufacturer;
- Encouraging sales of an existing product or a new product where the manufacturer may have had quality issues in the past; and
- Encouraging sales from a new manufacturer or a new product without a history of product quality.

The costs of providing warranties vary by manufacturer but are large overall. One source we are familiar with put the industry reserve level at \$39 billion for the third quarter of 2006¹. Others sources estimate the total cost of warranty reserves as greater than 2% of revenue for manufacturers. Such costs rival those paid by manufacturers for insuring their fortuitous risk exposure. Because most manufacturer warranties are short term, this likely approximates manufacturers' annual spend for this exposure. By contrast, the Insurance Information Institute puts the United States annual spend for Workers Compensation premium at approximately \$42 billion, a similar amount.

Funding for warranty accruals is required to be disclosed according to FASB Interpretation 45² which states that, among other things, a manufacturer is required to disclose the approximate terms of warranties, the accounting policy and methodology for funding, and the carried reserves for product warranties. By their nature, warranty claims tend to have a very high frequency/low severity exposure and the law of large numbers generally works well. These costs are generally able to be estimated by actuarial methods.

The principal obstacles in performing such analyses tend to be data issues. Simply put, many companies do not seem to code warranty claims in the level of detail that insurers code losses. As a result, in performing the analysis of warranty claim costs, the greatest amount of time is usually spent scurrying around looking for data sources that could, with some preparation, be coded and thus be much more readily available to an analyst. While such improvements in coding would be beneficial to manufacturers for accrual purposes, the

¹ "Warranty Reserve Levels." *Warranty Week*, 30 January 2007.
<http://www.warrantyweek.com/archive/ww20070130.html>. Accessed 30 January 2008.

² Financial Accounting Standards Board Interpretation No. 45 – Guarantor's Accounting and Disclosure Requirements for Guarantees, Including Indirect Guarantees of Indebtedness of Others.
<http://www.fasb.org/pdf/fin%2045.pdf>

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

authors believe that far greater benefits of better coding would appear in both the control of costs and in costing changes in the basic or extended warranties that companies consider routinely for competitive and cost control purposes. Like insurance claims, a single calendar year brings in claims from sales in all prior revenue years in which warranties are still live. However, unlike insurance claims, the amounts are generally relatively small, paid quickly, and do not take a great deal of time to develop. Thus, changes in coding will begin providing useful data almost immediately for all lengths of warranties. In the cases of relatively inexpensive items sold in great bulk, such as tools, useful information may be available in as little as a week.

While some warranties are sold by third parties who sell them as a business model, we will be focusing on the ultimate warranty cost associated with product manufacturers' warranty programs. Although warranty costs are not technically insurance costs, many of the same characteristics can apply to the warranty programs in explaining yearly cost emergence. The CAS Literature has a number of articles dealing with the insurance aspect of mechanical breakdown insurance. There are much fewer publications dealing with the non-insurance sector and general product warranty accruals.

Generally speaking, warranty programs among industries and companies are rarely identical. As such, it is important to be able to determine what general steps to take in modifying an existing warranty program. Equally important, a manufacturer should consider carefully how to code their internal claims and information systems to be able to handle any changes for the warranty program in the future.

3. WARRANTY BACKGROUND

3.1 Warranty Characteristics

As mentioned previously, specifics of company warranties are rarely identical to each other. Some characteristics of warranty programs observed and worth noting are listed below:

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

- Mechanical breakdown coverage has historically been the most prevalent type of warranty with actuarial involvement. Several companies have offered extended warranty coverage for automobiles for several decades.
- Automobile mechanical breakdown losses are generally 'back-end loaded' as manufacturer warranties often inure to the benefit of extended warranty coverages. Normal wear and tear of a vehicle usually results in mechanical breakdown after a period of several years.
- Because of the propensity for mechanical breakdown losses to increase over the course of time, many companies earn their premium accordingly, often using methodologies like the reverse rule of 78's or something similar to approximate the true payment patterns over time and match the premium earnings accordingly. The NAIC's Statement of Actuarial Opinion requirement requires opining actuaries to mention the Unearned Premium Reserve component associated with "Long Duration Contracts". Many of these long duration contracts are warranty contracts.³ Companies should be aware of profitability considerations to determine if any premium deficiency issues would need to be separately handled.
- Many manufacturers have drags on earnings as a result of their warranty liabilities. Many of these difficulties have arisen from misestimation of ultimate liabilities involving the long tails of "back-end loaded" types of products.
- Some types of warranties are offered for products that rarely have warranty events, whereas others are offered for products that companies expect to pay losses routinely. In the latter case, an extended warranty is often bundled with a service contract to maintain the product. Estimation of costs would obviously be quite different amongst the various products and types of warranties.
- Companies offering 'lifetime' warranties generally have a long tail of claims emergence. It is also possible for products with lifetime warranties that historical cost emergence patterns may not be indicative of costs seen in the future. There are

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

many reasons why this may be so. For instance, product specifications may have been changed over time. Secondly, distribution channels or locations may have been changing over the course of time, and may be distorting companies' historical data. Additionally, a company's data may only include a limited number of years. It is certainly possible that expected lifetimes may be longer than the historical timeframe, but well within the bounds of time as specified in revised extended warranty periods. In such cases, it is important to try to identify external sources of data or internal company experts to help assess cost emergence for periods outside of the experience period.

- Generally speaking, ALAE costs for warranty programs are either minimal or non-existent. Companies may want to consider ULAE costs involved with an internal claims department that handles their warranty claims.
- There is usually a very short lag period between the reporting of a loss and the actual payment of loss by the company issuing the warranty. As such, reserving for known claims is typically not a major issue. Case reserves are not generally set up and funding may be part of the overall warranty accrual process.
- It is not uncommon for companies issuing warranties to pay for losses that are outside the scope of coverage (either for cause of loss or time) as a 'goodwill' measure especially in the first 12 months after sale. Such payments may be made often enough to be routine and may be considerably larger than the true costs covered by the warranty. Other times, they may be rare. An understanding of how often an entity pays goodwill losses is necessary to fully understand the cost impact involved in the expansion of a company's warranty program. However, it is our experience that many companies do not keep track of these payments. Nor do they have guidelines as to when they should be paid. As a result, large costs may be incurred without the benefits anticipated.

³ National Association of Insurance Commissioners – Instructions to the Annual Statement for Property/Casualty. www.naic.org.

3.2 Competitive Environment of Warranties

Most companies consider what their competitors offer in the marketplace in establishing their warranties. Many companies that issue extended warranties routinely revise their existing programs based upon what their competitors have been offering. Many times, salespeople are adamant that not providing warranties with as much coverage as the competitors (both in terms of covered perils as well as years of coverage) places the company at a competitive disadvantage. The perception in the marketplace is that the company in question does not 'stand behind the quality of its product'. The result is that companies, for fear of losing market share, are often proactive in either making revisions to their current program to be more in line with their competition, or offering their own broader warranty coverage before their competitors do. The result of the competitive environment is that even in the cases where a company may offer a broader coverage than their competition in an attempt to gain market share, there is often a limited time period before their competitors begin to provide their own similar product essentially 'leveling the playing field' despite the company's best efforts to differentiate themselves.

Often revisions to existing warranty programs are made without adequate studies as to the immediate impact such revisions could have on a company's financial statement. Yet analysis can often be done to better understand the financial costs of such changes. The techniques discussed here in this paper are designed to estimate the additional costs associated with the broadening of coverage.

3.3 External Regulation and Distribution of Warranties

A recent example involving a warranty company (not a manufacturer) illustrates what can potentially go wrong given the current regulatory environment. A warranty company, the majority of whose business pertained to used-car extended warranty business, recently ran into such high financial problems, that its reinsurer also runs the risk of becoming insolvent. By the time the State Insurance Department became involved, the company's insurer, backing a portion of the warranties, was itself on the brink of insolvency. According to one source, in the overall long list of creditors in such a case, it is fair to assume that the warranty policyholders themselves would be very low on the list of those who can make claims on the insurance company's assets. As it turned out, even though some State Departments of Commerce had denied the warranty company a license in their states, and had even issued a "cease and desist" order against selling these warranties in their state, thousands of warranty

policies continued to be issued, by auto dealers whose commissions exceeded as much as 50% of the overall premium.⁴

Thus, even in this situations where state commerce departments have banned companies from doing business in a state, the many third party agents selling warranty policies have made it difficult to effectively carry out such a ban. It is easy to speculate that this phenomenon may become more and more prevalent especially as an increasing number of people begin to purchase personal electronics from some of the larger appliance stores. In many of these cases warranty may not be issued by the manufacturer or the store, but rather by a third party company whose performances may not be tied to the results of the warranty company itself. These instances could lead to similar situations as the warranty companies may have exorbitant potential liabilities on the books without fully grasping the magnitude of their aggregate exposures to liability.

4. DATA ISSUES

As mentioned earlier, a company may choose to address expansion of their warranty in either a proactive or reactive manner in an attempt to differentiate themselves from their competition and increase sales. It is possible, if not likely, that extensions of years of coverage may be made without immediately performing a formal actuarial cost analysis. However, some companies have had several extended warranty type products in the marketplace through many different attempts at broadening the options available for the consumer. As such, with proper data coding of historical claims, there would be an opportunity to use this actual historical company cost emergence information to formally project the proposed cost changes to an existing warranty.

4.1 Loss Coding

As with any pricing or reserving project, costing and reserving for warranty exposures generally starts with historical information. The following list of issues should be considered in establishing a warranty database or refining an existing database. The items below should be considered, though the list should not be limited to those noted:

⁴ Cummins, H.J., "Worthless Warranty", Minneapolis Star Tribune, December 12, 2007, pages D1, D3.

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

- **Type of Product** – As historical loss information may be different by type of product, and as terms and conditions of warranties may have varied historically by type of product, this information should be properly coded within a company's historical claims database. To the extent that products are sold internationally, the warranty costs should be segregated both by geographic area and by currency so that differing geographical usage patterns and currency exchange rate fluctuations can be addressed. Similar considerations will apply to revenue coding as well.
- **Date of Purchase, Shipment or Installation** – The date for when a product is purchased, shipped or installed (whichever is the key date to start the beginning of the warranty) should be captured in the company's claims database.
- **Date of Claim Occurrence** – The date of claims occurrence, as defined by the company for the purposes of providing coverage, should be captured in the company's claims database.
- **Date of Claim Report** – The date a claim is first reported to the company or recorded on the company's records, as defined by the company, should be captured in the company's claims database. As mentioned previously, the lag period for warranty coverage is usually not significantly long from the date of occurrence to the date of claim report.
- **Date of Claim Payment** – The date or dates a claim is paid by the company should be recorded in the claims database. Warranty costs are usually paid quickly after the claim is reported to the company.
- **Repair Type and cost** – The type of repair made, as defined by the company, should be captured in the company's claims database. In its simplest form, this may be a split between materials and labor costs. This may be further sub-divided, sometimes significantly, at the company's discretion. The amount paid for each type of claim category associated with a

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

given claim should also be captured in the company's claims database. If payment is made for costs that, in theory, should not have been paid for, these figures should also be tracked. Companies should consider the level of detail in the coding of repair types and costs very carefully. Generally, more detailed coding of these items should be encouraged as future changes in product design and production or changes to warranty programs may consider the explicit addition or deletion of various costs.

- ***Location of Claim*** – The location of incident or repair for each type of claim should be captured in the company's claims database. This category could be important for several reasons. For instance, it may be necessary to understand and segregate payments made as a result of catastrophes that led to claims being submitted under warranties. For, example, a building product warranty may be tapped to cover damage in a hurricane. Additionally, frequency of claims, costs of repairs, or legal environment could vary significantly by location due to local weather and economic conditions. Potentially, a company may ultimately decide for exclusions, pricing differences, or distributions of products in certain states depending upon the results of the observed history of claims emergence.
- ***Basic vs. Extended Warranty*** – For losses that are coded by the Company in their claims database, a distinction should be made as to which losses are associated with a historical basic warranty type, and which losses are associated with an extended warranty. Warranties change from time to time. The exact warranty that was purchased should be coded along with the date of warranty purchase so that the exact terms of warranties can be analyzed.
- ***Length of Warranty or Service Agreement*** – The term length of the warranty associated with a given claim should be captured by the company.
- ***Cost of Labor by Geographical Area*** – To the extent that labor is a covered cost, and the associated rates vary by geographical area, the historical costs of labor and the associated repairs should be tracked. If this

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

information is not immediately available, a reasonable approximation might be calculated for some procedures by using outside sources including the internet.

- **Historical Pro Rata Percentages** – Some warranties contain a provision where, for a certain number of initial years, warranty costs are covered at full cost. Following this period, many cover some costs at a prorated percentage of the warranty policy. Furthermore, some may cover some types of losses at a prorated percentage, but entirely exclude other types of coverage after this initial period. To the extent that losses are coded, the company should also code the detail in their claims database as to the pro rata percentage that was historically paid for a given claim amount. This would be valuable information to have, should the ‘full coverage’ time allowance be amended in the future.

4.2 Exposure and Revenue Coding

Additionally, the following list of items should be monitored, but not necessarily in the same database as which contains the claims information. There should, however, be an appropriate way to group these figures to those captured in the claims database:

- **Number of Units Sold** – The company should consider the number of units sold historically including an appropriate way to group these to track historical sales. They should further track this information, if possible, as to what types of warranties were sold (or provided at sale) for each unit. If possible, the company should consider coding the type of warranty purchased or provided by serial number so as to make matching warranty type to sales possible.
- **Revenue** – The company should track the historical sales volume including an appropriate way to group this for appropriate tracking of exposure volume. They should further track this information, if possible, as to what types of warranties were sold (or not sold) for each unit. Revenue should

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

clearly delineate cost of product and cost of extended warranty by type of warranty and product.

- **Cost of Warranty Type Sold** – The company should track the prices that all their different types of warranties have cost the consumer historically.
- **Commissions** – The company should track the commission paid and who sold the warranties historically.
- **Rejection Database** – The company should track claims that have been historically rejected, and the reasons as to why they were rejected. This could perhaps be tracked in conjunction with those that were paid ‘outside the scope’ of the warranty policy. A database such as this is a good way to track claims information should the company one day expand the terms of its warranty program to include types of loss that had not been covered historically. It should be noted that, in such a situation, the company should be aware that the frequency of these types of losses may be understated from what they should expect to see with a broadening of coverage as the consumer may understand that these costs would not be covered under their warranty and as such not report the incident to the company.

Unfortunately, the above mentioned items may not come from the same source or department from within a company. In other cases, different users of data may carry it in varying levels of detail, causing reconciliation to be difficult. Companies may even have third-parties handle certain data items. As a result, the task of matching revenue, product and warranty is not always a straightforward exercise. Having a designated person from the company that can help in coordinating and providing the necessary data in a usable format in these situations can be vital.

Database systems may vary widely from company to company but the actual data can usually be exported in a universally-recognized format and imported into other platforms. Examples include commonly used database formats such as comma-delimited files (.csv) or text files (.txt). However, conversions may cause a loss of information regarding data field types. For example, fields that were originally formatted as a ‘date’ value may be imported as

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

generic 'text' by default, unless the user manually specifies otherwise. Without such care, any subsequent operation that relies on the field being a 'date' value would lead to difficulties.

Data types are also important because of space considerations. Designating a field that could suffice with an 'integer' value (2 bytes) to be a 'double-precision' value (8 bytes) results in using four times more space than is necessary. Over multiple fields and millions of records, the volume of misallocated space can become quite large. The size of the data file is an important factor in determining how smoothly the project proceeds. While many data manipulation tasks may seem simple enough in theory, working with large files can require lengthy computer run-times, in addition to causing issues with software constraints. For example, if the user does not have access to specialized data analysis software such as SAS, and elects instead to use a database management program with say a 2GB limit, the file can quickly reach the limit. This, in turn, can cause the file to become corrupt and unusable or cause important information to be lost in conversion. Taking the extra effort to correctly define data fields at the onset of a large undertaking is highly recommended as it will generally save great amounts of time throughout the rest of the project.

In addition to the above, companies should consider whether other sources of payment may be available to the purchaser of a product and consider whether the warranty acquired or purchased is primary or secondary. For example, a building owner may have property insurance that covers the failure of a building materials product such as siding in a windstorm. The company needs to consider whether the warranty coverage will be primary or secondary to the other sources and state this explicitly.

5. TECHNIQUES OF COST PROJECTION

5.1 General Considerations

Warranty cost projection can be viewed in a manner similar to pricing if it is prospective and similar to loss reserving for accrual purposes, with bodies of data grouped appropriately by year and with historical "warranty year" costs being observed and projected to ultimate. Although many exposure bases can be considered, such as number of units sold, methodologies can often be most easily applied by reviewing historical loss cost emergence as a percentage of sales figures where it can preliminarily be assumed that, with both costs and revenue being inflation-sensitive, the overall ratio should not need to be significantly

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

adjusted for changes in inflation over a reasonable time period. Of course, it is highly recommended that yearly ratios be observed to see if an increasing annual trend is observed, signifying that overall costs may be increasing at a greater rate than revenue. Adjustments should be considered in such a situation.

As previously mentioned, report and payment lags for warranty policies are usually relatively short. As such, future cost emergence of existing basic and extended warranties in-force can be generally viewed as occurrences that have not yet happened but will ultimately give rise to warranty claims, as pipeline claims are usually small in total costs compared to the total warranty exposures.. Whoever performs a warranty analysis may consider performing further breakdowns of cost emergence between labor, parts, or any other type of cost payments, depending on the purpose of the analysis and the available data.

Many warranty policies specify that no losses should be paid for any of the periods beyond the terms of the warranty agreement. Any warranty costs paid beyond these periods should be quantified and properly denoted as either 'goodwill' payments or some other appropriate notation. A company should understand how often these types of payments are made, how much they cost, and adjust for this in any pricing or accrual exercises.

For the purposes of a company establishing a warranty accrual on their balance sheet for future costs, a company may want to factor in the time value of money by establishing a discounting procedure, depending on their accounting requirements. One assumption to consider would be an after-tax risk-free discount rate based on something appropriate such as the latest year's average Treasury bill rates. A similar consideration exists for costing and pricing new warranties or making changes to existing programs.

Depending on data availability and scope of analysis, it is sometimes better to perform an analysis on all the data of a particular product group, rather than on an individual type of product or model basis or any other classification deemed appropriate by the manufacturer or warranty issuer. Such an analysis increases the volume of the data. In such cases, if there is to be any further analysis by individual sub-line of products, loss costs should ultimately balance back to the overall total loss cost figures based on the latest year's exposure distributions. A normalization procedure should be incorporated not unlike off-balance factor calculations that are utilized in territorial rate filings for insurance companies.

Some companies allow warranties to be extended at any time, not just at product

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

purchase. In such cases, the analyst needs to consider whether there is an adverse selection process going on such that these buyers can be expected to have higher costs. If so, the pricing of the warranty needs to consider this. Similarly, some companies offer service contracts designed to maintain products in addition to extended or basic warranties. In such cases, the analyst should attempt to understand whether the warranty costs are likely to be lower as the products are well maintained and/or that part failure may be prevented by replacement under the maintenance contract. Such analyses are only possible if the company has implemented coding procedures that allow such issues to be tracked.

Finally, we note that many times warranty coverage allows some sort of continuation of the warranty coverage as transfer of ownership or title takes place for a covered product. While warranties differ in terms of how they handle the transfer of ownership (either disallowing transfer entirely, allowing transfer in all cases, or allowing transfer for a limited number of times), any changes to the existing structure going forward should be reflected in the future analyses.

5.2 A Costing Example: Expansion of Number of Years

5.2.1 Yearly Emergence

Perhaps the most common type of warranty expansion is allowing for coverage for an additional number of years. In our example, we will assume that a company will be expanding the current basic program from 3 years of coverage to 5 years of coverage. The new basic warranty will cover the costs of parts and labor in the 4th and 5th years. In this case, we will consider that the company has offered extended warranties historically, and thus has their own claims experience for the 4th and 5th year after installation for the customers who have purchased extended warranties historically. (We note that without actual data, one could consider other techniques such as curve fits or loss experience for similar products). To complicate matters a little bit, we will also assume that historically the extended warranties upon which we are basing our cost estimates had labor costs covered only through year 3. Additionally, the old program had covered parts/material costs at 100% through year 3 and at a prorated percentage thereafter. The new proposal will cover parts/material at 100% for years 4 and 5. As such, historical data would show the cost in years 4 and 5 without the impact of labor and 100% part replacement in these time periods. Calculations would thus need to quantify the amounts of labor cost and non-prorated part

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

cost for these years in the determination of the new projections.

To determine an estimate of additional cost emergence for all the changes, one can review the company's database and group the cost emergence in subsequent 12 month intervals for each year of product sale. This type of grouping and corresponding emergence will look like a policy year loss development triangle but will consider at each evaluation warranty claims that occurred within successive 12 month periods from the date of sale of each item. Each corresponding policy year (year of sale) will not be fully "developed" for the first 12 months of emergence until the policy (sale) year is 24 months old (as policies sold on the last day of the 12th month of a calendar year will be 12 months old when the policy/sale year is 24 months old). There will also be some (usually) short time period in which the newest warranty claims are evaluated and settled.

The data will now need to be adjusted to consider the impact of extending the non-prorated period. This will consist of two adjustments: adjusting the claim value to 100% for calendar years 4 and 5 (after the end of the historical non-prorated periods), and putting in a provision for additional labor costs for years 4 and 5. Adjustments can be made fairly easily by reading the company's historical warranty policy to estimate the prorated percentage to apply to years 4 and 5. They can be adjusted to 100% simply by dividing historical payments by these percentages.

To estimate the provision for additional labor costs, we multiply the number of historical units repaired or replaced under warranty claims by the average cost of labor per unit. If coding is available, such costs can be directly calculated based on historical payments. Otherwise, an estimate of these labor costs can be estimated by appropriate company personnel by geographical location, or an overall national basis. It is possible of course that the overall national labor average may vary going forward if the company's mix of geographical location changes over the course of time (or may have historical distortions if the mix has changed over time). We note that in performing these calculations the average cost of labor utilized will generally vary by year due to inflation.

The impact of extending the non-prorated period from 3 to 5 years would be estimated by subtracting the unadjusted calendar year payments (as a percentage of revenue) for years 4 and 5 from the newly adjusted calendar year payments (as a percentage of revenue) for years 4 and 5. It is possible that prorated percentages after year 5 may change as well. Adjustments for such changes in percentage will need to be contemplated in such a

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

situation. The calculations will be similar to the adjustments already considered (excluding the cost of labor).

If no pro rata percentage of losses existed in the old extended warranty program, and no additional charges for new coverages would be applied, this calculation would be nothing more than a simple addition of the estimated costs for years 4 and 5 (as a percentage of revenue).

If projections are based on ratios of units sold, not as percentages of revenue, appropriate adjustments for inflation should be made as unit sales do not reflect inflation.

As a final note, it may be necessary to consider the impact of yearly cost projections for periods where no data exists. For example, if a company is interested in expanding the warranty coverage period to 40 years but had no data beyond 10 years, one could estimate an annual decay percentage through year 10, and then project the yearly decline in coverage to year 40. Alternatively, other curve fits should be considered. In such cases, the analyst should identify company engineers or product experts and discuss the results to determine whether such a pattern would truly make sense so many years into the future, or if the expected product lifetime is likely to alter yearly emergence after a given point in time. Any additional information as to the characteristics of the product should be reflected appropriately.

5.2.2 Percentage of First Year Costs

Many companies cannot segregate their product sales revenue by type of warranty (basic or extended). However, most companies can expect that basic warranty costs can be related to annual revenue as extended warranties almost surely contain terms at least as good as the basic warranty. Thus, if we are estimating the cost of adding more years to a basic warranty, another way to project future cost emergence involves making an overall determination of the ratio of the costs of the basic warranty in the first 12 months to total annual sales. Estimations can then be made as to relationships of future years' emergence to emergence in the first year warranty costs for the basic warranty only by using the historical ratio from actual data.

5.3 Expansion of Covered Costs and Introduction of New Covered Perils A Costing Example: Expansion of Number of Years

A company may look to expand the types of losses being covered by an extended warranty rather than solely the number of years. Many different variations of this expansion may be considered: (1) a company may consider paying for certain types of warranty costs during the same time that the basic warranty is in place, effectively providing broader coverage, (2) a company may consider providing for a coverage, which is currently being provided at full or pro rated value for some years, but not during a proposed expanded time period – for example, some companies include things like labor cost initially, but then only costs for materials after a certain point in time, and (3) a company may be considering adding coverage for a type of warranty cost that is not being provided in any current form.

Depending on the type of data available for a company, one may wish to calculate expansion of covered costs either directly (by multiplying the expected number of incidents of coverage by an appropriate expected cost) or by taking differences of costs based on existing programs.

In the first situation, one may be able to properly estimate frequency of incidence that would require the new type of coverage (or determining estimation during the appropriate future time period). Such a frequency might be approximated in many ways. Historical frequency of similar claims might be useful. Alternatively, sampling or surveying the users of the product or internal personnel might be useful. Finally, the rejection database might also give some indication of future frequency.

The severity to apply to the expected incidents could be based on the average value of a claim observed historically, or based on some external proxy such as the average cost of repair. With any inflation sensitive component such as labor rates, it is important to factor yearly cost of living adjustments into the appropriate calculations either by trending historical costs or by detrending the most recent information available. Adding broader coverage during the basic warranty timeframe could consider using this approach as well.

In the second situation involving differences in cost estimations, a company may have existing information for a program that includes the new coverage (even for a longer period of time than what is being proposed with the expansion). Historical yearly cost emergence as a percentage of revenue including the new covered peril as well as the historical yearly cost emergence excluding the new peril might be tracked for each selected time period. In

such a case, a simple subtraction of the two data sets can be performed, with the difference being the new additional cost. Any differences in the overall emergence between the two data segments should be accounted for and adjusted if necessary.

6. METHODS FOR RESERVING

Accounting guidance for warranties that are a part of a product purchase is provided by FASB Interpretation No. 45⁵ which clarifies that a liability for expected costs of a warranty must be recognized at the inception of the warranty. Accounting guidance for extended warranties appears in FASB Technical Bulletin No. 90-1, Accounting for Separately Priced Extended Warranty and Product Maintenance Contracts⁶. The situation is a bit different as it deals with revenue recognition and not expected costs. The guidance notes:

“3. Revenue from separately priced extended warranty and product maintenance contracts should be deferred and recognized in income on a straight-line basis over the contract period except in those circumstances in which sufficient historical evidence indicates that the costs of performing services under the contract are incurred on other than a straight-line basis. In those circumstances, revenue should be recognized over the contract period in proportion to the costs expected to be incurred in performing services under the contract.

4. Costs that are directly related to the acquisition of a contract and that would have not been incurred but for the acquisition of that contract (incremental direct acquisition costs) should be deferred and charged to expense in proportion to the revenue recognized. All other costs, such as costs of services performed under the contract, general and administrative expenses, advertising expenses, and costs associated with the negotiation of a contract that is not consummated, should be charged to expense as incurred.

5. A loss should be recognized on extended warranty or product maintenance contracts if the sum of expected costs of providing services under the contracts and unamortized acquisition costs exceeds related unearned revenue. Extended warranty or product maintenance contracts should be grouped in a consistent manner to determine if a loss exists. A loss should be recognized first by charging any unamortized acquisition costs to

5 Financial Accounting Standards Board Interpretation No. 45 – Guarantor’s Accounting and Disclosure Requirements for Guarantees, Including Indirect Guarantees of Indebtedness of Others. <http://www.fasb.org/pdf/fin%2045.pdf>.

6 Financial Accounting Standards Board Technical Bulletin No. 90-1 – Accounting for Separately Priced Extended Warranty and Product Maintenance Contracts. <http://www.fasb.org/pdf/ftb%2090-1.pdf>.

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

expense. If the loss is greater than the unamortized acquisition costs, a liability should be recognized for the excess.”⁷

We note that the reader should check with their accountants or other accounting experts for the exact treatment of warranty accruals.

The methodologies above are mainly utilized for estimating the cost of warranty covers. Following the accounting guidance above, the methodology for reserving may be based on these calculations or a simpler method can often be utilized so long as the revenue recognition for extended warranties follows expected costs. In the following we will discuss the recognition of the loss cost portion itself. This relates directly to establishing the reserve and runoff pattern of basic warranties included with the sale at no extra cost. Some additional work may be required for extended warranties to insure that the revenue recognition follows these expected loss costs and that expenses and any loss in excess of revenues are appropriately recognized. In the particular case of extended warranties the analyst should also consider whether the costs of claims in the settlement process are significant enough to establish a separate reserve for pipeline claims in-transit.

6.1 Bornhuetter-Ferguson Test A Priori

Monitoring results, especially for the first time, is an important measure to be taken with a warranty program. The methodologies listed previously contemplate expected emergence in a given calendar year. Year to year fluctuations among actual results can be handled through a Bornhuetter-Ferguson methodology by using this expected cost emergence in a given year as an a priori together with the expected unpaid percentage of cost emergence. With this method, the calculations made to cost or price the existing coverages can be unwound as to year of expected costs as a percentage of revenue. These percentages, for the unexpired portion of the warranties in place can then be applied (often on a discounted basis) to revenue for the year of sale to create a reserve. Revisions to yearly cost estimates can be made or, at the very least, differences between actual and expected cost emergence can be observed and studied. A series of refinements to selected yearly costs can be made

⁷ Accounting guidance for extended warranties appears in FASB Technical Bulletin No. 90-1, Accounting for Separately Priced Extended Warranty and Product Maintenance Contracts, Copyright © 1990, Financial Accounting Standards Board, Page 4

appropriately going forward at least annually, if not quarterly.⁸

6.2 Average Age of Warranty Claim Times Annual Spend

This is likely the simplest of all warranty accrual methods. In this method one computes the average age of warranty claims in a given period of time. This figure is then applied to the average annual expenditure on warranties (appropriately adjusted for inflation) to determine the increase in warranty reserve. For example, if the average age of warranty claim is 5 years past the date of sale or installation and the average spend is \$1 million per year, then for a period of five years of emergence, a reserve of \$5 million (plus any adjustments for inflation) would be established.

This methodology appears to work best where the volume and mix of product is similar year to year, the annual average cost of each specific warranty incident is not very variable and the average annual outlay for warranty claims is fairly constant. Products such as tools and small electronics may often utilize this method successfully.

6.3 Active Life Approach

This methodology utilizes methods similar to those discussed in costing to come up with probabilities of a claim by report year under each type of warranty issued or sold. These probabilities are multiplied by the number of products sold by warranty type, in a given time period, to arrive at an expected frequency by report year. These are in turn multiplied by an expected cost (inflation adjusted) to arrive at a warranty reserve.

This method is well suited for warranties of particularly long duration where probability of defects is fairly constant.

6.4 Calendar Year Payments to Revenue Approach

This method is similar to the active life approach but much simpler to apply in practice. Actual warranty costs by year of product sale are accumulated for at least one and usually two or more years. These costs are divided by either revenue or number of products sold in each year of sale. Ratios of claim costs by age as a percentage of revenue (or average cost per product sold) are selected and the unexpired warranty year fundings are computed as the

⁸ Bornhuetter, Ronald L. and Ronald E. Ferguson., "The Actuary and IBNR", *PCAS LIX*, 1972, pp. 181-195.

ratios by age times the revenue sold by year. This method works well where warranty costs are fairly static as a percentage of revenue but the product line volume varies significantly by year.

7. BUSINESS CONSIDERATIONS

7.1 Warranty Language

Many of the basics of standard insurance contracts are often overlooked in producing a warranty. Unlike insurance, there is no industry-wide organization writing standardized warranty wording for companies to adopt or rewrite. Warranties often vary greatly by type of product being serviced; oftentimes being in completely different types of industries. Moreover, warranty language may vary company to company for similar products and may even vary across similar warranties in the same company. Because of this, it is often difficult to have universal, standard types of warranties in place. As a result, companies could conceivably find themselves paying more claim dollars than they otherwise would with universal, standard contracts.

For instance, warranty language often does not include wording that would make their policy secondary to other sources of recovery such as homeowners insurance or any other sources of recovery. As a result, the warranty writer may in effect pay for claims either instead of other recoveries, or even worse, in addition to other sources of recovery. In contrast, it is common for other types of guarantees such as credit card companies to cover the collision damage to a rental vehicle. In such cases, card issuers routinely make this coverage secondary to the renters own insurance policy.

Finally, warranty policies many times omit language that would limit payment to some specified amount such as the value of a completely new replacement item that may very well be less than replacing individual parts for outdated products. Some sort of limitation language would potentially be advantageous to both the warranty companies (that may pay fewer dollars of claims) as well as the customer (who may choose to get a cheaper, but more state of the art model of product should they choose).

7.2 Internal Operations

Major companies who issue warranties often do not have staff fully dedicated to

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

monitoring the results of the warranty program. It is likely that in the overall costs of such companies, warranty costs are a small (but meaningful) fraction of the overall cost measures of a company. As such, devoting full time staff for such tasks as fully estimating the cost of warranty policy revisions, or estimating the quarterly accruals is often neglected (even though warranty policies involve many different segments such as marketing, claims, accounting, and other financial departments, to name a few).

An interesting example mentioned previously concerns the potential payment of many claims as 'goodwill' measures even though the warranty language may not allow for such coverage. With poor internal communication as to how often goodwill claims are paid, and poor monitoring as to the actual dollars of payments by year that are effectively true goodwill claims, it will be difficult, if not impossible, to understand the true warranty costs and ultimately, the liability for balance sheet accruals. As such, goodwill payments tend to be made without the benefit of a strategic plan and it is not always clear that these non-required payments have a benefit equal to their costs. Further, companies do not always track the amount or payment detail of such payments and cannot always analyze whether these payments are actually undermining the company's attempt to sell for-profit extended warranties.

While many companies may want to focus their efforts solely on the external marketing of their extended warranty product, it is well worth the effort to monitor the amount of goodwill claims that have been routinely paid in the marketplace on their basic warranties. Those with a historically large preponderance of goodwill type claims that might be covered under extended warranties offered by the company may find it difficult to find purchasers of the extended warranty product. Such loose standards may effectively dictate that consumers have been receiving extended warranty coverage for basic warranty cost. While this is not necessarily a terrible result, a company should be thoughtful in its use of such payments and integrate them into its strategic marketing plan for both basic and extended warranties.

7.3 External Sales Force

As mentioned earlier, products with corresponding warranties, many times have a third party agency force whose results are not dependent on the overall results of the warranty program. Often, the third party sales force finds themselves with commissions that may very well be in excess of half the warranty price itself.

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

In such circumstances, it is not difficult to imagine where conflicts of interest could exist between sales forces and the results of the warranty company. As an example, let us look at the case where a salesperson may be allowed, if not encouraged, to sell a one year service agreement several years after the one year basic manufacturers warranty has expired. Should the consumer, based on their own observed experience, see that each of their last few years of experience has cost them more in repairs than the upcoming cost of the warranty, they would not be hesitant to purchase the policy. This adverse selection practice may go on for several years if a company issuing the warranty does not adequately monitor the activity and subsequently change their contract wording, their pricing scheme, their agency force, or some combination of all.

8. CONCLUSIONS

Although there seems to be a growing market for extended warranties as competitive pressures continue to exist and new and complex products are brought to the market, it is fair to say that companies oftentimes do not devote enough resources to studying the financial impact brought on by either the introduction of a new warranty or the modification of an existing warranty.

Interestingly, many companies have complex data systems already set up for monitoring historical warranty claims, and may need relatively few changes to internal coding to better monitor their perpetually changing programs. Such changes are very likely to pay for themselves many times over in terms of providing data to make cost-effective decisions. In today's competitive marketplace, information is crucial and those companies who can access their data in detail have a clear competitive edge.

Historically, many companies have found that their warranty accruals have been understated, sometimes resulting in large balance sheet corrections that catch the eye of financial analysts. It is becoming increasingly important for companies to monitor their warranty results going forward both with revision of internal data coding as well as with actuarial type analyses involving cost projections. Once projections have been contemplated, it is important that information continue to be monitored appropriately given all the potential sources of adverse selection ('goodwill' claims, third party agency force, etc.).

Even the simplest of actuarial loss projection methods can prove invaluable in a

Estimating the Ultimate Liability for a Non-Insurance Company's Revised Warranty Product

company's understanding of historical cost emergence, or more significantly, their future cost emergence. In the competitive marketplace, the ability to quantify the potential impact competitors' warranty changes on a company's own book will allow for more informed business decisions and most importantly, more profitable financial results.

Appendix A

- Cost of Adding Widget Repair from 6 to 25 Years – EXHIBIT 1
- Cost of Extending Full Value Warranty Period from 4 to 6 Years – EXHIBIT 2
- Warranty Cost for First 5 Years Based on Percentage of Year 1 (Basic Warranty) Costs – EXHIBIT 3

XYZ Warranty Company
Cost of Adding Widget Repair from 6 to 25 Years

EXHIBIT 1

(1)	(2)	(3)	(4)	(5)
Years from Sale Date	Selected Widget Payment Percentage for Period (A)	Discount Factor (B)	Discounted Widget Payment Percentage for Period = (2)*(3) (C)	Year N Costs as a percentage of Year N-1 Costs (D)
1	0.044%	98.058%	0.043%	
2	0.040%	94.287%	0.037%	90.6%
3	0.038%	90.660%	0.035%	96.9%
4	0.036%	87.173%	0.032%	94.5%
5	0.034%	83.820%	0.029%	95.1%

(6) Selected Percentage of Year N Incremental Costs as a Percentage of Year N-1 Incremental Costs: 95.0%

(7)	(8)	(9)	(10)
Years from Sale Date	Projected Widget Payment Percentage for Period (C)	Discount Factor (D)	Discounted Widget Payment Percentage for Period = (8)*(9) (E)
6	0.033%	80.597%	0.026%
7	0.031%	77.497%	0.024%
8	0.030%	74.516%	0.022%
9	0.028%	71.650%	0.020%
10	0.027%	68.894%	0.018%
11	0.025%	66.245%	0.017%
12	0.024%	63.697%	0.015%
13	0.023%	61.247%	0.014%
14	0.022%	58.891%	0.013%
15	0.021%	56.626%	0.012%
16	0.020%	54.448%	0.011%
17	0.019%	52.354%	0.010%
18	0.018%	50.340%	0.009%
19	0.017%	48.404%	0.008%
20	0.016%	46.543%	0.007%
21	0.015%	44.752%	0.007%
22	0.014%	43.031%	0.006%
23	0.014%	41.376%	0.006%
24	0.013%	39.785%	0.005%
25	0.012%	38.255%	0.005%

TOTAL	0.420%	0.255%
--------------	---------------	---------------

Notes: OLD PRODUCT DESCRIPTION - Repair cost for broken Widgets only covered for the first 5 years after sale date (at 100% cost).

NEW PRODUCT DESCRIPTION - Repair cost for broken Widgets will be covered for the first 25 years after sale date (at 100% cost).

(A) Based on actual historical widget cost emergence pattern as a percentage of historical fiscal year revenue.

(B) = $(1.04)^{-((1)-0.5)}$

(C) = Selected Incremental Costs for Year N = Selected Incremental Costs for Year N-1*(6)

(D) = $(1.04)^{-((7)-0.5)}$

XYZ Warranty Company
Cost of Extending Full Value Warranty Period from 4 to 6 Years

EXHIBIT 2

(1)	(2)	(3)	(4)
<u>Years from Sale Date</u>	<u>Additional Incremental Payment for Increased Period</u> (A)	<u>Discount Factor</u> (B)	<u>Discounted Additional Incremental Payment for Increased Full Value Period</u> =(2)*(3)
5	0.250%	83.820%	0.210%
6	0.200%	80.597%	0.161%
TOTAL	0.450%		0.371%

Notes: OLD PRODUCT DESCRIPTION - Labor and Materials were covered 100% from years 1-4 after sale.

NEW PRODUCT DESCRIPTION - Labor and Materials to be covered 100% from years 1-6 after sale.

(A) Based on actual historical warranty cost emergence pattern as a percentage of historical fiscal year revenue with adjustments to remove historical pro rated percentages and include estimated additional labor costs.

(B) Based on actual historical warranty cost emergence pattern as a percentage of historical fiscal year revenue.

(B) = $(1.04)^{-((1)-0.5)}$

Figures Shown are for Illustrative Purpsoses Only

XYZ Warranty Company

EXHIBIT 3

Warranty Cost for First 5 Years Based on Percentage of Year 1 (Basic Warranty) Costs

(1)	(2)	(3)	(4)
Year of Sale	Revenue	First Year Warranty Cost	Percentage of Revenue =(3)/(2)
2001	1,663,031	16,753	1.007%
2002	1,741,968	18,247	1.047%
2003	1,854,439	18,359	0.990%
2004	1,991,913	19,853	0.997%
2005	2,119,722	21,587	1.018%
(5) Selected Percentage of Revenue:			1.010%

(6)	(7)	(8)	(9)	(10)
Years from Sale Date	Selected Percentage of Year 1 Costs	Selected Costs as a Percentage of Revenue (A)	Discount Factor (B)	Discounted Selected Costs as a Percentage of Revenue =(8)*(9)
1	100.00%	1.010%	98.058%	0.990%
2	62.50%	0.631%	94.287%	0.595%
3	57.00%	0.576%	90.660%	0.522%
4	57.00%	0.576%	87.173%	0.502%
5	55.00%	0.556%	83.820%	0.466%
TOTAL		3.348%		3.075%

Notes: OLD PRODUCT DESCRIPTION - Coverage for only the First Year after Sale Date.

NEW PRODUCT DESCRIPTION - Coverage for First 5 Years after Sale Date.

(A) = (5)*(7)

(B) = (1.04)^-((1)-0.5)

Figures Shown are for Illustrative Purposes Only

9. REFERENCES

- [1] Bornhuetter, Ronald L. and Ronald E. Ferguson., "The Actuary and IBNR", PCAS LIX, 1972, pp. 181-195.
- [2] Cummins, H.J., "Worthless Warranty", Minneapolis Star Tribune, December 12, 2007, pages D1, D3.
- [3] Financial Accounting Standards Board Interpretation No. 45 – Guarantor's Accounting and Disclosure Requirements for Guarantees, Including Indirect Guarantees of Indebtedness of Others. <http://www.fasb.org/pdf/fin%2045.pdf...>
- [4] Financial Accounting Standards Board Technical Bulletin No. 90-1 – Accounting for Separately Priced Extended Warranty and Product Maintenance Contracts. <http://www.fasb.org/pdf/ftb%2090-1.pdf>
- [5] National Association of Insurance Commissioners – Instructions to the Annual Statement for Property/Casualty. www.naic.org.
- [6] "Warranty Reserve Levels." Warranty Week, 30 January 2007. <http://www.warrantyweek.com/archive/ww20070130.html>. Accessed 30 January 2008.

Abbreviations and notations

ALAE, allocated loss adjustment expense
FASB, Financial Accounting Standards Board
NAIC, National Association of Insurance Commissioners
ULAE, unallocated loss adjustment expense

Biography(ies) of the Author(s)

Orin M. Linden is the Practice Leader for Insurance & Financial Services for Watson Wyatt in New York, NY. . He is a Fellow of the Casualty Actuarial Society, a Member of the American Academy of Actuaries and holds an Associate in Risk Management. He received his B.A. degree in Mathematics (with Honors) from Queens College of the City University of New York, and holds Masters and PhD degrees from the Belfer Graduate School of Science at Yeshiva University. Mr. Linden has over 30 years of actuarial experience, having held positions at two insurance companies, and has been a partner at two of the Big 4 accounting firms prior to joining Watson Wyatt. He has made numerous speeches at CAS and other functions and published numerous papers and reviews in the Proceedings and other publications. His paper, Estimating Satellite Liabilities, co-written with Alan Gould, was awarded the 2000 Ronald Bornhuetter Loss Reserve Prize.

James B. Kahn is a Senior Consultant with Watson Wyatt in New York, NY. He is a Fellow of the Casualty Actuarial Society and a Member of the American Academy of Actuaries. He received his B.A. degree in Mathematics (with an application in Probability and Statistics) from the Johns Hopkins University in Baltimore, MD. Mr. Kahn has over 18 years of actuarial experience, having held various positions at a primary insurance company, a reinsurance company, and consulting firms prior to coming to Watson Wyatt.

Brian Ko is a Consultant with Watson Wyatt in New York, NY. He received his B.A. degree in Mathematics and International Studies from the University of Pennsylvania's School of Arts and Sciences in Philadelphia, PA and his B.S. degree in Finance from the University of Pennsylvania's Wharton School. Mr. Ko has 4 years of actuarial experience, having held various positions at the Insurance Services Office prior to coming to Watson Wyatt.