Warranty Reserve: Contingent Liability, Informational Signal, or Earnings Management Tool?*

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Abstract

Utilizing a database that became available due to the requirements of FIN 45, we examine the informational role of accounting disclosures on warranties. First, since firms use warranty policies as a business strategy to promote their products, a warranty reserve may serve two roles: an informational signal regarding product quality as well as a contingent liability. Consistent with this view, we find that the stock market recognizes that: (1) the warranty reserve contains information about firms' future performance, and (2) the reserve is a liability. Second, since warranty accruals require estimation of future claims, they can also be used as a tool of earnings management. Our evidence indicates that managers use warranty accruals to manage earnings opportunistically to meet their earnings targets. Finally, we find that the stock market recognizes that warranty liabilities of firms that managed earnings are underestimated.

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1. Introduction

Most durable products are sold with warranties.[1] A warranty provided by a manufacturer/vendor guarantees its customers that a product will provide expected service; in the event of failure, the warranty provider would rectify the product according to the terms of the warranty policy, which can vary in duration and scope (full or limited, labor and/or parts, repair vs. refund, etc.). A warranty is an effective means for reducing uncertainty about the product's future performance. Warranties' role in resolving information-based problems has been studied extensively in the economics (e.g., Spence, 1977, Grossman, 1981, and Lutz, 1989) and marketing literature (e.g., Menezes and Quelch, 1990). Under information asymmetry, manufacturers, who possess better information about a product's expected performance, issue warranty plans to signal product quality. In the presence of imperfect information regarding the future performance of the product, even without any information asymmetry, warranties can be a means of insurance for risk-averse buyers against product failure (Heal, 1977). The seller may specify the conditions under which warranties are effective, thereby encouraging the proper usage of the product in the presence of moral hazard. Finally, warranties may be used to screen consumers of different types (e.g., risk aversion) so that the seller can price discriminate them effectively.

The accounting aspects of product warranties have yet to be studied. In this paper, we fill this void in the literature by investigating the role of warranty information. We use a unique and comprehensive database of warranty disclosures that has not been available to researchers until recently. Although firms were at liberty to disclose warranty information voluntarily, FIN 45, which took effect starting in 2003, mandated the disclosure of such information. We study a sample of 806

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[1] Most products are sold with either an express or implied warranty. An express warranty is typically specified by a written warranty policy that spells out the terms of warranty, while an implied warranty is an implicit understanding that the product being sold meets the warranty of merchantability, i.e., fit for sale and consumption as represented at the time of sale. An extended warranty may be offered by retailers for an additional premium.

firms which disclosed quarterly warranty information from 2003 to 2006. We also hand-collect information on warranty durations from firms' annual reports for a subsample of 159 firms.

Our research questions are twofold. First, how does the market interpret accounting information on warranties? Specifically, we ask whether the capital market interprets warranty reserves as a contingent liability, an informational signal, and/or an earnings management tool.[2] Second, how do managers make accrual choices regarding warranty expenses and liabilities?

Our first research question examines the market valuation of warranty reserves.[3] If firms provide warranties as insurance, warranty liabilities are simply contingent liabilities: future obligations to perform service if a product fails. One dollar of warranty liabilities is expected to reduce firm's value by one dollar. The value of insurance is presumably captured by increased demand for the product. However, if firms offer warranties to signal product quality, warranty liabilities can have an additional role in providing information on firm value and future firm performance. Due to this dual nature of warranty liabilities, we expect them to differ from other monetary liabilities such as bank loans.

Our empirical analysis demonstrates that the stock market values warranty liabilities differently from other liabilities, by placing a smaller negative valuation coefficient on warranty liabilities. However, after controlling for analyst earnings growth expectations and the duration of warranties, the valuation coefficients on both warranty liabilities and other liabilities approach negative one. This is consistent with the market interpreting warranty liabilities as informational signals for future earnings' growth prospects.

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[2] Throughout the paper we use the terms "warranty reserve/s" and "warranty liability/ies" interchangeably.

[3] Several studies have generally documented a negative relation between other types of liabilities and market prices (e.g., Barth, 1991; Espahbodi et al. 1991; Landsman, 1986; Mittelstaedt and Warshawsky, 1993; Barth and McNichols, 1994).

Our second research question investigates whether managers exercise discretion over warranty accruals. In making accrual choices, managers may incorporate information about warranty policies, or alternatively, engage in opportunistic earnings management. Since a warranty policy is part of an overall business strategy, managers' accounting choices regarding warranties may reflect product quality and may be correlated with future performance. In the accounting literature, such managerial discretion has sometimes been viewed as a tool to improve the informativeness of accounting numbers (e.g., Watts and Zimmerman, 1986; Bernard and Skinner, 1996; Subramanyam, 1996, among others).

We find a significant positive relation between abnormal warranty expenses, future sales growth, and future return on assets. This finding suggests that firms incorporate information about warranty policies, which translates into future firm performance, into the warranty reserves. In addition, we document a positive stock market reaction to abnormal warranty expenses around earnings announcements. Although these results only represent associations, together, they are consistent with the hypothesis that the market incorporates warranty information in a manner consistent with the signaling model.

Alternatively, managers might exercise discretion over the accounting treatment of warranties as a means of opportunistic earnings management. Under this scenario, managers gain private benefits from manipulating the reported accounting numbers. These opportunistic accounting decisions can be achieved through changes in the assumptions and estimates underlying warranty accruals. In particular, we examine whether managers use warranty accruals in order to meet short-term financial reporting objectives. Achieving earnings targets, such as avoiding losses, avoiding earnings decreases and meeting or beating analysts' forecasts, has been extensively studied in the accounting literature (e.g., Burgstahler and Dichev, 1997; DeGeorge et al., 1999). In general, the consensus in prior research is that managers care greatly about these benchmarks and are willing to engage in costly earnings management strategies to achieve them (e.g., Brown and Caylor, 2005; Graham et al., 2005).

We find evidence consistent with managers using warranty accruals to achieve specific financial reporting objectives. We document that firms that achieve earnings targets report significantly lower warranty expenses than their counterparts. Our evidence implies that managers use the flexibility in the assumptions underlying the calculation of warranty expenses and exercise their discretion to achieve these financial reporting targets.

Our final analysis, which combines the valuation and earnings management aspects, shows that, after controlling for both the information role of warranty reserves and earnings management incentives, the market views warranty liabilities similarly to other liabilities. Consequently, each one dollar of warranty liability reduces a firm's market value by one dollar.[4] We also document that firms that used warranty accruals to achieve earnings targets have a stronger negative valuation coefficient on their warranty liabilities. This suggests that investors recognize that the warranty liabilities of these firms are understated.

Our study is the first to exploit a unique and comprehensive database on warranty disclosures. We contribute to the existing accounting literature in several ways. First, we extend prior research on the role of accounting information by examining how the capital market evaluates warranty information, and whether managers use their discretion over accounting for warranties to incorporate information about future firm performance. Second, we document that warranty liabilities play dual roles: as a contingent liability and as a signal of product quality and future earnings growth. Third, by focusing on a specific accounting choice, which allows us to increase the power of our analysis, we specifically answer the calls made by accounting researchers (for example, McNichols, 2003) for disaggregating empirical measures of accounting choices. Fourth, we advance the literature on earnings management by exploring whether managers use their accounting discretion over warranty accruals to attain financial reporting targets. This allows us to shed light on specific methods that

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[4] This assumes that liabilities are measured in present value. To the extent that the warranty liabilities are reported without discounting, the reduction would be less than one.

managers use to achieve these targets. Thus far, the evidence on these specific methods has been scarce. Finally, we document that the market seems to take into account the possibility of earnings management in evaluating the firm's liabilities.

The paper proceeds as follows. In section 2 we provide some background on the economic role and accounting treatment of warranties. In section 3 we develop our hypotheses and in section 4 we describe our research design. We report our results in section 5 and we conclude in section 6.

2. Background

2.1 The Economic Role of Warranties

In the U.S., issuing a warranty plan for consumer products has its roots in the automobile industry. Consumer complaints about automobile quality increased in the 1950's and intensified the pressure on Congress to act on behalf of consumers. In 1968, a report issued by the Federal Trade Commission recognized the need to improve the quality of automobiles, but went short of mandating warranty plans. Slowly, more manufacturers began issuing warranties for consumer products as a standard practice. Ambiguities in these contracts, however, presented enforcement problems and to achieve a uniform standard in warranty contracts, Congress passed the Magnuson-Moss Act in 1975.[5] Although the Act did not mandate issuing warranties, it required that a warranty plan explicitly describe the scope and duration of coverage, the means to obtain warranty services, and how various state laws on warranties are affected.

Warranties became an increasingly important strategic mechanism for manufactures/vendors. The economics literature posits that warranties are a means to overcome information asymmetries regarding product quality between an informed manufacturer/vendor and uninformed customers. By

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[5] Consumer products are governed by the Magnuson-Moss Federal Trade Improvement and the Uniform Commercial Code, which is state specific. All commercial goods are under the Uniform Commercial Code.

issuing a warranty plan that depends on an *ex post* verifiable outcome that is correlated with product quality, the manufacturer bonds herself (and the buyer protects himself) to its product quality (Grossman, 1981). Spence (1977) posits that manufacturers provide warranties with better terms to signal their firm type (higher product quality). Boulding and Kirmani (1993) confirm in an experiment that consumers learn about product quality through the warranties offered. In addition, warranties are also used as a marketing tool to promote products (Menezes and Quelch, 1990).

Another view on warranties is that they facilitate risk sharing between sellers and buyers (Heal, 1977). Sellers and buyers might be aware of the failure rate (i.e., no information asymmetry about product quality), but it may be impossible to determine if a specific item is a lemon. If warranties are provided as insurance, then differences in warranty plans mainly reflect different consumers' attitude toward risk. In addition, the terms of warranty plans might specify the conditions under which the plan is honored, thereby promoting proper use of the product. Consumers would value products with warranties more and would be willing to pay higher prices for them. Costs of servicing warranties are additional product costs, while warranty liabilities represent contingent liabilities.

In a simple signaling model, firms use warranty plans as a signal of their type (Spence, 1977). If a separating equilibrium exists, a positive relation prevails between firm type and the quality of warranty plans. Although this relation is intuitively appealing, it is by no means the only theoretical prediction in signaling games. If a pooling equilibrium prevails, all firms offer identical warranty plans. Even if a separating equilibrium obtains, the relation between warranty coverage and firm type can be negative. For example, Lutz (1989) derives a separating equilibrium in which high product quality is signaled with a low warranty plan and a low product price when consumers are subject to moral hazard. Under double moral hazard (both consumers and producers), the relation between warranty policy and firm type can be either positive or negative, depending on the parameter values (Cooper and Ross, 1985). Gal-Or (1989) analyzes the role of warranty in an oligopolistic market and shows that multiple equilibria can result; warranty/type relation is positive in one, but negative in

another equilibrium. Thus, in these equilibria, the information content of a warranty plan regarding firm type is extremely limited. Given the contradicting predictions proposed by these models, the relation between warranty policies and firm type in the U.S. product market is, to a large extent, an empirical issue.

2.2 Accounting for Warranties

Manufacturers who provide product warranties are required to record an accrued warranty expense at the time of sale.[6] Like many other accruals, these warranty expenses are estimated based on company's projections of future claims. Such warranty expenses are an important component of firms' selling expenses and can be substantial in magnitude. In our sample, the average warranty expense constitutes about one percent of sales and about eleven percent of operating income.

The disclosures of warranty expenses and liabilities were voluntary until the issuance of Financial Interpretation No. 45 - *Guarantor's Accounting and Disclosure Requirement for Guarantees, Including Indirect Guarantees of Indebtedness of Others* (FIN 45) in 2002 (see FASB, 2002).[7] By mandating disclosures, FIN 45 expands the information made available to investors about firms' warranty accruals, claims, and liabilities.[8] Beginning in 2003, firms provide: (1) the estimated potential amount of future payments under the warranty plan (warranty reserves or liabilities), (2) the accounting policy and methodology used in determining the liability for product warranties, and (3) a tabular reconciliation of the changes in the warranty liability for the reporting period. This detailed reconciliation presents the beginning balance of the aggregate product warranty liability, the

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[6] Under the current accounting regulation (Technical Bulletin 90-1), revenues from extended warranties are deferred and service costs are expensed as incurred. Thus, accounting information on warranties does not include information on extended warranties.

[7] Prior to FIN 45, the disclosure on warranty obligations were voluntary unless the warranty liabilities exceed 5% of total liabilities. FIN 45 applies to financial reports ending after December 15, 2002.

[8] Gu (1998) documents that prior to FIN 45, firms differ in their voluntary disclosure behavior with respect to warranty information.

aggregate reductions in that liability for payments made under the warranty plan (i.e., claims), the aggregate changes in the liability for accruals (i.e., warranty expenses) related to product warranties issued during the reporting period, the aggregate changes in the liability for accruals related to preexisting warranties (including adjustments related to changes in estimates), and the ending balance of the aggregate product warranty liability. Appendix A provides two examples of warranty disclosures from the financial statements of Dell and Western Digital.

2.3 Interpretation of Warranty Data: A Signaling Perspective

We now discuss how one could interpret the accounting information on warranties (warranty expenses, warranty claims, and warranty liabilities) from a signaling perspective based on the assumption that the primary purpose of providing a warranty is to signal firm "type" (product quality) to the market.[9] If a firm uses a warranty policy as a signal of product quality, then product quality may be indirectly reflected in the accounting information on warranties. Of course, the direct signaling mechanism is the warranty policy itself. However, the information on warranty policies may be (1) uninformative about firm type if firms have identical warranty policies (pooling equilibrium) or (2) imperfect and may not provide sufficient information on the firm type. In such cases, accounting information on warranties may provide incremental information on firm type.

Accrued warranty expenses are estimated warranty costs of products that are sold during the accounting period. Warranty costs depend on, among other things, the failure rate (product quality) and the coverage (scope and duration) of the warranty policy. Given a quality level (with a positive failure rate), the expected cost of warranty increases with coverage, while for the same warranty coverage, the expected costs decrease as product quality increases (or the failure rate decreases).

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[9] If, instead, warranties are provided for insurance purpose (risk-sharing without any information asymmetry between the buyers and the sellers), we would interpret accrued warranty expenses as a cost of providing insurance and warranty liabilities as contingent liabilities. The choice of insurance policy would reflect the firm's business strategy and its buyers' risk aversion, but may be independent of firm type.

An interesting question is how the market interprets the warranty data and prices the stock of a firm. To see how one might interpret information on warranties, which is assumed to be observed without noise, consider possible equilibria in a signaling game: pooling, fully separating, and partially pooling equilibria. If a pooling equilibrium prevails, clearly one cannot discriminate firm type by studying warranty coverage. But, accounting information on warranties can reveal firm type; inferior quality will result in higher claims and higher warranty expenses. In this case, quality and warranty costs are, *ceteris paribus,* negatively related. Next, consider a fully separating equilibrium, in which better-quality sellers provide better warranty coverage.[10] In such a scenario, warranty policies signal product quality and fully reveal firm type. Although accounting information reflects the cost of providing the signal, it does not provide any incremental information about firm type. Finally, in the case of a partial pooling equilibrium, warranty cost information is informative about firms within a pool with the identical warranty policy, but does not provide any incremental information across pools. Again, warranty policies themselves fully reveal firm type across policy pools.

In sum, if information on warranty policies is observed perfectly, accounting information provides incremental information about firm type if either a pooling or partial pooling equilibrium prevails. If information on warranty is not observed perfectly, as we discuss below, accounting information may provide incremental information in a separating equilibrium as well.

Information on warranty policies may be imperfect and empirical measures of warranty plans are likely to be measured with noise. There are two sources of noise. First, firms typically provide only coarse information on warranty policies such as the range of warranty duration for their

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[10] For simplicity, we assume that warranty coverage can be characterized by its duration and scope. Even though scope entails different features (full or limited product replacement, parts and labor, money back guarantee, etc.), we assume that buyers are able to assign a strict preference ordering over (and possibly monetary values to) these various plan features. Therefore, a warranty plan with a longer warranty period and a more extensive scope of coverage is considered better than one with a shorter period and less scope. Since duration and scope may be regarded as substitutes, we further assume that buyers are able to assign values to all possible combinations.

products.[11] Even though we devise a method to evaluate various features of warranty plans for a specific product and to assign a score for the warranty plans, most of these features may not be easily observable. Second, since most firms sell many products, to obtain a perfect measure for each firm, one needs information on the warranty policies and the sales levels of all products sold by the firm. However, such disaggregated data are not available. Thus, the necessary information to make an accurate assessment of warranty plans for each firm is simply not available. We acknowledge that we have an imperfect proxy for warranty policies.

While firm type and warranty costs are negatively correlated in a pooling equilibrium, the relation is not clear in a separating equilibrium (or across pools in a partially pooling equilibrium). A separating equilibrium requires a cost structure in which the marginal cost of providing better coverage is lower for firms with better product quality than for firms with poorer product quality (referred to as the single crossing property). Since buyers are willing to pay more for better products, sellers will trade-off a higher product price and the cost of signal (i.e., coverage). However, a better warranty plan for a better product need not cost more than a slightly inferior plan offered by a slightly inferior firm. Thus, we cannot conclude unambiguously that better firms would have higher warranty expenses. On the other hand, a firm without any warranty plan would have zero warranty expenses.[12] Therefore, under a certain cost structure, we expect better coverage chosen by a higher-quality firm to be more costly. Of course, better firms would incur more warranty costs only if they generate higher

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[11] Although disclosure of warranty policies is not mandated, many firms provide information on their policies, such as the duration of warranty policies in their financial statements. In our empirical analysis, we obtain information on warranty duration from annual reports and use it as the proxy for warranty plans. A typical description often specifies the range of duration such as "from one to three years."

[12] In a separating equilibrium, we would expect the worst firm type to offer no warranty plan and report no warranty costs. Other firms offer warranty plans and incur strictly positive warranty costs to separate themselves from the worst type. It is unlikely that a firm with an extensive warranty plan would accrue zero warranty expenses by claiming that their products never fail. For the warranty costs to increase with type in equilibrium, the cost advantage in providing warranty services of the better-type firms cannot be too large, given the benefit of separating themselves, where the benefit depends on the buyers' perception about the quality of products.

prices and/or sales, which ultimately result in higher profits. Thus, warranty expenses and product quality may be positively related in a separating equilibrium.

Perusal of warranty policies show that warranty coverage varies within an industry, especially in terms of duration. We also find that variations appear to be small and that there are clusters of firms with the same warranty duration. That is, many industries exhibit partially pooling equilibria. We therefore expect firms with the same warranty duration to exhibit a negative relation between product quality and warranty costs, while firms with different durations may possibly exhibit a positive relation between product quality and warranty costs (warranty expenses and/or warranty liabilities).[13] That is, once we control for duration, the relation between product quality and warranty costs (warranty expenses and warranty liabilities) is positive under certain conditions.[14]

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[13] Warranty liabilities are determined by warranty expenses and the claims processed during the accounting period. Consider again the scenario in which warranty expenses increase with the coverage (cross sectionally) in a signaling equilibrium. Recall that plan coverage differs in scope and duration. Then, *ceteris paribus*, warranty reserves would be larger for warranty plans with longer duration because sales from longer periods are still under warranty. For simplicity, further assume a product fails (if it fails at all) on the last day of the warranty coverage period and claims are processed next day; then all of the warranty expenses would be outstanding as warranty liabilities at the end of the accounting period. If a warranty duration is very short, say a week, then the maximum warranty liability that a firm would have is based on the sales during the last week, while if a warranty period is one year, the maximum warranty liability would be based on the sales during the last one-year period. To the extent that a better warranty plan offers a longer duration, firms with a better quality product would have larger warranty liabilities. Similarly, if a firm has a warranty plan with better scope of coverage, the warranty cost per unit would be higher. Thus, the maximum warranty liabilities are again higher for better quality firms. Of course, products would fail throughout the accounting period, and many claims are processed before the period end. Consider another simple scenario: assume that products fail continuously, say uniformly during the warranty period, and claims are submitted and processed instantaneously. Then the outstanding warranty liabilities would correspond to one half of the sales made during the warranty period (i.e., one half of one week sales or one half of one-year sales in the example above). Therefore, as before, the relation between warranty coverage and warranty reserves is positive as long as all firms have the same failure/claim pattern. Hence warranty reserves increase with firm type.

[14] While we focus on the signaling role as the main function of warranties, they may also reflect a firm's strategy to improve its reputation among its customers. *Ceteris paribus*, customers might infer that a company providing products with better warranty coverage is a more reliable one than a company providing less warranty coverage (Murthy and Djamaludin, 2002). If so, companies with better warranty coverage develop a stronger reputation among customers regarding their products. In addition, firms may use warranties to strategically promote future sales and growth even though it is costly to do so. The marketing literature suggests that firms offer a warranty plan over a longer duration and/or more comprehensive coverage as an effective marketing tool (Menezes and Quelch, 1990). Since all these strategies are costly to implement, we expect, on average, that better firms are more likely and able to pursue them to separate themselves from other firms.

3. Hypothesis Development

We now develop specific hypotheses for our empirical analysis. The first set of hypotheses focuses on warranty policies as part of an overall business strategy (as opposed to accounting choices) and how the capital market evaluates accounting information on warranties, i.e., the warranty reserve and warranty accruals. The second set of hypotheses relates to the accounting choices regarding warranties. To the extent that firms have discretion over warranty accounting, we examine if they incorporate information accurately in the accounting numbers or alternatively use the discretion to manage earnings to achieve targets.

3.1 Valuation of the Warranty Liability

A product warranty is "an obligation incurred in connection with the sale of goods or services that may require further performance by the seller after the sale has taken place" (SFAS No. 5, Accounting for Contingencies). Because of the uncertainty involved with future claims, a product warranty falls under the definition of a contingent liability. FASB requires the recognition and disclosure of a warranty liability when it is probable that a liability has incurred and the amount of loss can be reasonably estimated. If investors believe that warranty liabilities are correctly estimated, they would place equal weights on warranty liabilities and on other liabilities. In this case, the stock market values warranty liabilities as reflecting the future cash flows to be paid out.

Valuation of contingent liabilities is complex and involves assumptions and estimates that are unobservable by outsiders. Several studies investigated the valuation implications of contingent liabilities such as pensions (e.g., Barth, 1991; Espahbodi et al. 1991 and Landsman, 1986, among others), retirees' health benefits (Mittelstaedt and Warshawsky, 1993), bank loan loss provisions (Petroni 1992; Wahlen 1994; Liu et al. 1997), and environmental liabilities (Barth and McNichols, 1994). In general, they find that contingent liabilities are negatively associated with share prices.

Warranty liabilities can also capture the warranty policies' signal about product quality. As discussed in section 2.3, under a reasonable scenario, we expect firms with better quality products to incur larger warranty expenses and have larger warranty liabilities. Firms may try to mimic each other by offering identical warranty plans. However, such a pooling equilibrium may not be sustainable. Since buyers will be able to infer the quality of the products by examining warranty expenses (i.e., the higher warranty expenses, the lower the product quality), a lower quality firm is likely to reduce the level of warranty plans. Thus, in the long run, better firms are more likely to offer better plans.[15]

Thus, we conjecture that the stock market will consider the signaling value of warranty liabilities and differentiate between warranty liabilities and other liabilities (e.g., bank loans) by recognizing the dual nature of warranty liabilities. In particular, the valuation coefficient placed on warranty liabilities is expected to be less negative than that on other liabilities. This is because, on the one hand, the stock market infers that warranty liabilities are obligations to provide services in the future, but, on the other hand, the stock market recognizes that warranty liabilities contain information about product quality and future firm performance. Therefore our first hypothesis, stated in alternative form, is as follows:

H1: The valuation coefficient placed on warranty liability is less negative than the valuation coefficient placed on other recognized liabilities.

To investigate whether the stock market correctly values the true underlying "liability" role of warranty reserves, we examine the valuation of warranty liabilities after controlling for their signaling role. If higher quality products lead to faster future earnings growth, we can separate the two roles by

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[15] However, there are reasons why this scenario does not hold in some markets as discussed in the economics literature.

introducing explicitly the earnings growth expectations of the firm.[16] Under this scenario, warranty liabilities serving as contingent liabilities are expected to be valued similarly to other liabilities. Furthermore, we expect that warranty liabilities reduce share prices dollar-for-dollar once we control for growth expectations. Thus, our second set of hypotheses, stated in null form, is as follows:

H2: After controlling for earnings growth expectations, the valuation coefficient placed on warranty liability is equal to the valuation coefficient placed on other liabilities.

H2a: After controlling for earnings growth expectations, the valuation coefficient placed on warranty liability is equal to negative one.

3.2 Managerial Discretion over Accounting for Warranties

Next, we examine whether changes in warranty accounting information provides any incremental signal about future firm performance. From the perspective of a firm, estimation of warranty liabilities require modeling the failure rates and the costs of rectification actions over the warranty period (Murthy and Djamaludin, 2002). That is, accruals related to warranty expenses should reflect the estimates of the inherent quality of the products, given the warranty policy. When the quality of a product improves, a firm is likely to alter the warranty policy to incorporate the change. In such a case, we expect the change in warranty expenses (referred to as "abnormal" expenses) to reflect the underlying change in warranty policy and serve as a harbinger of good future firm performance, assuming a positive relation between quality and future performance. Thus, abnormal warranty expenses are expected to be *positively* related to future firm performance, in cases in which product quality and warranty expenses are positively related (see section 2.3).

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[16] The positive relation between product quality and future accounting performance is supported by the positive relation between customer satisfaction and future performance, since customer satisfaction is, at least in part, due to product quality (Ittner and Larcker, 1998). Further, Nagar and Rajan (2001) provide more direct evidence, documenting a negative relation between product defects and future sales. Also the literature on Balanced Scorecard discusses the relation between future performance and product quality as one form of nonfinancial performance measures (Kaplan and Norton, 1992, 1996).

Incorporating changes in warranty policies into warranty expenses is likely to be a result of altering assumptions about, for example, expected future failure rates. Thus, this process can be viewed as "informative" discretion applied to reported earnings, in that it improves how current earnings are related to future firm performance (e.g., Watts and Zimmerman, 1986; Bernard and Skinner, 1996; Subramanyam, 1996).

Managers could also have incentives for intertemporal earnings management due to a desire to smooth income over time. When future prospects are expected to be poor, managers can over-accrue warranty expenses in the current period, creating "cookie jar" reserves. The reserves are used to offset the future poor performance, by shifting income from the present period to the future. If managers expect better future prospects, then smoothing calls for under-accruing of warranties in the current period and shifting income from the future to the present. Thus, the smoothing behavior predicts a *negative* relation between current abnormal warranty expenses and future firm performance, regardless of whether the expected future performance is good or bad.

The association between future performance and current abnormal warranty expenses is expected to be positive under the informational (signaling) hypothesis, while it is expected to be negative under the smoothing hypothesis. We use future sales growth and future return on assets ratios as future firm performance metrics.

H3a: Future sales growth is positively (negatively) associated with abnormal warranty expense.

H3b: Future profitability is positively (negatively) associated with abnormal warranty expense.

To the extent that the stock market can observe warranty expenses when financial statements are disclosed (or infer information about them through other means of communications, such as conference calls) we expect stock prices to react to unexpected or abnormal warranty expenses.

H3c: The stock market reacts positively (negatively) to abnormal warranty expense around quarterly earnings announcements.

3.3 Benchmark Beating and Warranty Accruals

We now examine the relation between accounting choices over warranty accruals and short-term managerial incentives to meet or beat earnings benchmarks. The means by which managers achieve earnings targets are numerous, and could be generally classified into either accrual-based strategies or real earnings manipulations.[17] Despite this broad classification, the specific ways in which managers meet earnings targets have been quite elusive to accounting researchers. For example, Burgstahler and Dichev (1997) do not find any strong evidence that a particular accounting manipulation is responsible for benchmark beating. Dechow et al. (2003) find no evidence that aggregate discretionary accrual measures are associated with benchmark beating.[18]

In contrast to the aggregate accrual evidence, several studies examine specific accrual choices and find some evidence of earnings management. By limiting attention to a specific accounting choice, these studies are able to potentially increase the power of the tests.[19] McNichols (2003) emphasizes the importance of disaggregating empirical measures of accounting choices to generate a more powerful setting. The warranty context enables us to overcome some of the difficulties posed by aggregate accrual-based measures and directly addresses the call for more research on this important attribute of the accrual accounting system.

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[17] Another way to achieve one of the important benchmarks advanced in the literature, namely meeting or beating analysts' forecasts, is by managing analysts' expectations (Mastumoto, 2002).

[18] Based on this, they conclude that the kink in the reported earnings distribution is not solely attributed to earnings management. They acknowledge that one shortcoming to finding evidence of earnings management is the lack of statistical power in abnormal accrual models to differentiate earnings management at a fine level across the two groups of firms.

[19] For example, Beaver, McNichols and Nelson (2003) study the loan loss reserves in property-casualty insurance companies. They find that reserves are more understated in small profit firms than in small loss firms. This evidence is consistent with firms managing the loan loss reserve to avoid losses. Further, they find evidence that the loss reserve is managed throughout the earnings distribution but is managed mostly by small profit firms (income increasing) and by firms with the largest profits (income decreasing). Beatty et al. (2002) provide evidence that public banks reduce loan loss reserves to avoid reporting earnings declines. In addition, they show that the higher frequency of earnings increases, relative to earnings declines, is more prevalent in public banks than in private banks. They attribute this to the fact that public banks are more sensitive to beating earnings benchmarks because their investors are more likely to use heuristics in judging banks' performance. See also Moehrle (2002) and Dhaliwal, Gleason and Mills (2004).

We hypothesize that if firms use warranty expenses to achieve financial reporting objectives, there will be an association between abnormal warranty expenses and variables proxying for reporting incentives. We focus on three extensively-studied earnings benchmarks: (1) avoiding reporting a loss, (2) avoiding reporting an earnings decrease, and (3) meeting analysts' forecasts. The evidence in the literature regarding these benchmarks suggests that managers view meeting or beating them as very important. In particular, based on their survey, Graham et al., (2005) conclude that:

> *"…CFOs believe that earnings, not cash flows, are the key metric considered by outsiders. The two most important earnings benchmarks are quarterly earnings for the same quarter last year and the analyst consensus estimate. Meeting or exceeding benchmarks is very important." (p. 5)*

They also write:

> *"Several performance benchmarks have been proposed in the literature…such as previous years' or seasonally lagged quarterly earnings, loss avoidance, or analysts' consensus estimates. The survey evidence … indicates that all four metrics are important: (i) same quarter last year (85.1% agree or strongly agree that this metric is important); (ii) analyst consensus estimate (73.5%); (iii) reporting a profit (65.2%); and (iv) previous quarter EPS (54.2%)."*

According to Brown and Caylor (2005), analysts' forecasts have become the most important benchmark to beat since the mid-1990s. This evidence is consistent with a long list of archival studies that find a tendency of firms to report earnings patterns consistent with incentives to meet or beat benchmarks.

We examine whether firms appear to have managed warranty accruals to meet the three alternative benchmarks. For each of the three benchmarks, we define "suspect" firms as those firms that are more likely to have used warranty expenses to meet one of the three benchmarks. Specifically, we identify firms whose pre-managed earnings numbers fall short of the target benchmark, but whose post-managed numbers exceed the targets. Abnormal warranty expenses are used to compute pre-managed earnings. Thus, we compare abnormal warranty expenses of these firms to those of a set of non-suspect firms. Our hypothesis, in alternative form, is summarized as follows:

H4: Firms that were just able to exceed an earnings benchmark will report lower abnormal warranty expenses for that quarter compared to other firms.

3.4 Valuation of Warranty Liabilities Combining Growth Expectations and Earnings Management Incentives

As we noted earlier, the stock market valuation of warranty liabilities may reflect three aspects: (i) a contingent liability; (ii) information about the firm's product quality and future performance that is incorporated in the reserves; and (iii) an earnings management component that relates to managers' incentives to meet or beat earnings benchmarks. In section 3.1, we hypothesized (*H1*) that the reported warranty liabilities as a whole, are valued less negatively than other liabilities. We then hypothesized (*H2 and H2a*) that after controlling for the information role of warranty liabilities, which encapsulates earnings growth expectations, they are valued similarly to other liabilities.

We now incorporate earnings management incentives into our valuation framework. Firms with incentives to meet or beat earnings benchmarks may engage in upward earnings management by opportunistically cutting down warranty expenses. This leads to an under-estimation of warranty liabilities. If investors correctly infer that warranty liabilities are understated by these firms, they will adjust the underestimated warranty liabilities by placing a larger negative coefficient on them. Therefore, we expect a more negative coefficient on warranty liabilities for firms with incentives to meet or beat earnings benchmarks. Our hypothesis, stated in alternative form, is as follows:

H5: For firms that just exceeded an earnings benchmark using warranty accruals, the valuation coefficient placed on the warranty liability is more negative than the valuation coefficient placed on other liabilities.

Finally, we expect that after controlling for earnings management incentives and growth expectations, the market values warranty liabilities similarly to other liabilities. The valuation coefficients on warranty liabilities and other liabilities would be close to negative one. Thus, we state our hypotheses in null forms as follows:

H6: After controlling for earnings growth expectations and earnings management incentives, the valuation coefficient placed on warranty liabilities is equal to the valuation coefficient placed on other liabilities.

H6a: After controlling for growth expectations and earnings management incentives, the valuation coefficient placed on the warranty liability is equal to negative one.

4. Research Design: Proxies for abnormal warranty expenses and claims

In our analyses we use three proxies for quarterly abnormal warranty expenses and quarterly abnormal warranty claims. Our first proxy is based on the seasonal change in warranty expenses or claims, adjusted for the seasonal change in sales. In calculating this proxy we assume that the level of warranty expenses (or claims) is proportional to sales, i.e., $WEXP_t = \alpha_t SALES_t$ where $\alpha_t = \frac{WEXP_{j,t-4}}{SALES_{j,t-4}}$. Thus, abnormal warranty expenses in our time-series seasonal model (*ABWEXP)* are:

(Time-series model) $$ABWEXP\_TIME_{j,t} = \frac{WEXP_{j,t} - WEXP_{j,t-4} * \frac{SALES_{j,t}}{SALES_{j,t-4}}}{TA_{j,t-4}}$$

We obtain quarterly observations of each variable (*t*) and use as a benchmark the same variables in the same quarter in the previous year (*t-4*). In this model we control for growth in a firm's operations, which is one of the important determinants of warranty accruals. Marquardt and Weidman (2004) utilize a similar model in a different context.

In a similar way, we compute the abnormal (or unexpected) claims made during a particular period as:

(Time-series model) $$ABCLAIM\_TIME_{j,t} = \frac{CLAIM_{j,t} - CLAIM_{j,t-4} * \frac{SALES_{j,t}}{SALES_{j,t-4}}}{TA_{j,t-4}}$$

This will be a more direct measure of changes in product quality.

Our second proxy is an industry-adjusted measure based on membership in a common two-digit SIC code group. For each quarter, we compute the mean level of the ratio of expenses (or claims) to sales, excluding the firm for which we calculate the measure. We require at least ten firms in the industry group. We consider the deviation from the industry mean as our proxy for the industry-adjusted abnormal warranty expenses (or claims). Thus, abnormal warranty expense in our industry model is:

(Industry model) $$ABWEXP\_INDUSTRY_{j,t} = \frac{WEXP_{j,t}}{SALES_{j,t}} - AVERAGE\left(\frac{WEXP_{j,t}}{SALES_{j,t}}\right)_{OTHER\_FIRMS}$$

Similarly, abnormal claims are defined as:

(Industry model) $$ABCLAIM\_INDUSTRY_{j,t} = \frac{CLAIM_{j,t}}{SALES_{j,t}} - AVERAGE\left(\frac{CLAIM_{j,t}}{SALES_{j,t}}\right)_{OTHER\_FIRMS}$$

Our third proxy considers the duration of warranties in calculating industry-adjusted abnormal warranty expenses (or claims). For each industry-quarter, we classify observations into a low, medium, or high-term group if the warranty duration falls below industry median, equals to the industry median or exceeds the industry median, respectively. We then compute the mean level of the ratio of warranty expenses (or claims) to sales for each industry-quarter-term group, excluding the firm for which we calculate this measure. Finally, we take the deviation from the industry-quarter-term mean as our proxy for abnormal warranty expenses or claims.

5. Empirical Results

5.1 Data and Sample

FIN 45 introduced new disclosures about warranty accruals, warranty claims, and liabilities associated with firms' warranties. We obtain these data for the years 2003-2006.[20] The sample firms are drawn from the set of manufacturing firms that are expected to have significant warranty expenses. We also hand collect information about the duration of warranties from 10-K's of a subset of our sample firms that belong to industries that have more than ten firms in our sample.

We describe our sample construction in Table 1. The original file contains 14,510 firm-quarter observations covering 889 unique firms. Of these, we eliminate 516 observations belonging to 36 firms for which we could not obtain valid *Compustat* identification information. We further delete 4,473 observations for which warranty expenses and claims are missing. In the analyses that require information about abnormal warranty expenses, we lose up to 3,278 additional observations, depending on whether we use a time-series or industry-based model to compute abnormal warranty expenses. Thus, the number of observations in our analyses varies between 9,521 and 4,521, depending on the required variables.

We also conduct additional analyses on a subset of firms for which we obtain information about the duration of warranties. We require that these firms belong to industries with at least ten firms to ensure that we obtain a reliable benchmark against which to evaluate each firm's warranty terms. This requirement, as well as the existence of information about warranty duration, reduces the sample in these analyses to 1,651 observations spanning 159 firms.

The sample firms originate from several industries, but as manufacturing firms, they concentrate in a number of groups. As reported in Table 2, about 70 percent of firms belong to three industry groups: manufacturers of industrial machinery and equipment (196 firms, 24.3% of sample

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[20] We thank Eric Arnum of Warranty Week for his help (www.warrantyweek.com).

firms), manufacturers of electronic and other electric equipment (198 firms, 24.6% of sample firms), and manufacturers of instruments (165 firms, 20.5% of sample firms). Warranty expenses in these industries range between 1.45% and 1.82% of sales. Since these industries consist of a large number of firms, we also collect information about their duration, which we report in the last column of Table 2.

In Panel A of Table 3, we provide summary statistics that describe our sample firms. We measure all variables on a quarterly basis by taking averages from the first quarter of 2003 to the fourth quarter of 2006. For some of the variables, we also provide, for comparison purposes, their values for firms in the S&P 500 index. Our sample firms are dispersed in size, and the average firm is of medium size. The average (median) market capitalization of our sample firms is $3.2 billion ($678 million), although there is large variation, with an inter-quartile range of $208 million in Q1 to $2.2 billion in Q3. The average quarterly sales of firms in our sample is $639 million. The average (median) book-to-market ratio is 0.47 (0.42) compared to 0.42 (0.38) of the S&P 500 firms, indicating that our sample firms exhibit similar growth as the index firms. Our sample firms' quarterly ROA is, on average, 0.8%. ROA before warranty expense is on average 1.2%. This is comparable to 1.5% ROA for S&P 500 firms.

Turning to information about warranty expenses, the average (median) warranty expense is $8.54 ($1.16) million. It comprises about 1.4% of sales and 1.5% of total expenses. However, the average (median) ratio of warranty expenses to the absolute value of net income is 54.8% (13.1%), indicating that for many of our sample firms, the effect of managing warranty expenses could be economically significant. Finally, we find that the liability for future warranty services comprises, on average, about 4.1% of sample firms' total liabilities.

Panel A of Table 3 shows that abnormal warranty expenses comprise about 0.016% of total assets (median is 0.005%). The industry-adjusted warranty expense is 0.088% of total assets (median is 0.394% of total assets). The average deviation of warranty expenses from its benchmarks is small, which is not surprising since, absent of product quality changes or additional factors, warranty

expenses are expected to stay around the benchmark level. This also suggests that our benchmark models are reasonable. The average (median) quarterly warranty claims is $7.35 million ($1.15 million). These claims constitute about 1.3% of current sales. Similarly, the abnormal claims center around zero, indicating that our benchmarks are reasonable proxies of expected expenses.

In Panel B of Table 3 we report correlations of key variables. We focus on the warranty variables. There is a negative correlation between the fraction of warranty liabilities on firms' balance sheet and firm size, measured as either market capitalization, sales or total assets. Further, warranty liabilities are positively correlated with analysts' forecasted growth. Examining the abnormal warranty expenses, we find that they are positively correlated with the book-to-market ratio.

5.2 Stock Market Valuation of Warranty Liabilities

We first investigate whether and how warranty liabilities are related to firm's equity market prices. We estimate several models that include a firm's market price as the dependent variable, and various components of balance sheet items as well as net income as explanatory variables. We use shares outstanding as the deflator. Our empirical specifications are derived from the Ohlson (1995) model. They are consistent with prior research on valuation of pension liabilities (Landsman, 1986; Barth, 1991; Barth et al., 1992), liabilities on retirees' health benefits (Mittelstaedt and Warshawsky, 1993), and environmental liabilities (Barth and McNichols, 1994). Specifically, we estimate several variations of the following model for firm *i* and time *t*:

$$P_{i,t} = \beta_0 + \beta_1 ASSET_{i.t} + \beta_2 WLIAB_{i.t} + \beta_3 OTHER\_LIAB_{i.t} + \beta_4 ANALYST\_GR_{i.t} + \beta_5 NI_{i,t} + \beta_6 NI_{i,t} * Q_1 + \beta_7 NI_{i,t} * Q_2 + \beta_8 NI_{i,t} * Q_3 + \varepsilon_{i,t} \quad (1)$$

where $P_{i,t}$ is stock price, $ASSET_{i,t}$ is total assets per share, $WLIAB_{i,t}$ is the warranty liability per share, $OTHER\_LIAB_{i,t}$ is total liabilities excluding the warranty liability per share, $ANALYST\_GROWTH_{i,t}$ is analyst long-term earnings growth forecasts as reported in IBES, and $NI_{i,t}$ is earnings before extra-ordinary items per share. To control for earnings seasonality, we include Q_1, Q_2 and Q_3 as indicators for the first three fiscal quarters.

Panel A of Table 4 reports results of the market valuation of warranty liabilities.[21] The first two models serve as benchmarks to compare with subsequent regressions that incorporate warranty liabilities and growth expectations. Consistent with prior studies, the coefficient on book value per share (*BV*) in the first model is slightly above one (1.173) and the coefficient on earnings per share is positive and significant (15.228 in Q1, 13.972 in Q2, 14.016 in Q3, and 12.218 in Q4). When we decompose book value into assets and liabilities, in the second model, we find that the coefficient on assets is positive (0.913) and the coefficient on liabilities is negative (-0.915).

Next, we further decompose total liabilities into warranty liabilities and other liabilities and report the results under the third model. If the stock market recognizes the dual role of warranty liabilities - contingent liabilities and information signal - we expect them to be valued less negatively than other liabilities. That is, we expect $\beta_3 < \beta_2 < 0$ in support of *H1*. We find the estimated coefficient on *WLIAB* is negative but insignificant (coefficient is -0.442 with a t-statistic of -0.19). Consistent with *H1*, however, this coefficient is higher than the coefficient on other liabilities, which is negative and significant. The difference is significant at the 2% level. The results are consistent with warranty liabilities containing an information signal of future earnings growth prospects, which are positively correlated with equity prices.

It is possible that the informational role of warranty liabilities offsets their expected negative relation with market prices. We add analysts' forecasts of growth (*ANALYST_GR*) as an additional explanatory variable to separate the informational signaling role of warranty liabilities from their role as contingent liabilities. If the stock market correctly values the true "liability" part, we expect warranty liabilities and other liabilities to be valued similarly after controlling for growth. In support

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[21] In all of our regressions we base our inferences on standard errors that are clustered on both firm and fiscal period (Petersen, 2008) to account for potential dependence across multiple observations in the panel.

of *H2* and *H2a*, we expect that $\beta_2 = \beta_3 = -1$. We also expect a positive coefficient on *ANALYST_GR* if the market isolates the signaling component of warranty liabilities.

The results indicate that *ANALYST_GR* is positively related to equity prices (coefficient is 0.098 with a t-statistic of 2.69). Second, by including this variable, the coefficient on *WLIAB* becomes significantly negative and close to -1 (coefficient is -1.043 with a t-statistic of -2.42). An F-test provides support for *H2* that the coefficient on warranty liabilities is not significantly different from that on other liabilities (p=0.86). A second F-test provides support for *H2a* that the coefficient on *WLIAB* is not significantly different from –1 (p=0.98). Note that the coefficient on other liabilities is around negative one with or without analysts' growth expectations. Overall, the results in Panel A of Table 4 suggest that warranty liabilities contain information about firms' earnings growth prospects, in addition to information about contingent liabilities.

The relation between warranty liabilities and market values hinges on the linkages between product quality and warranty liabilities. These linkages could be positive or negative, because warranty liabilities can be a proxy for both product quality and warranty coverage. To address this possibility, we add to our analysis as a control variable the terms of warranties' coverage issued by the sample firms as reflected by the warranties' duration (*TERM*). We define *TERM* to equal: (i) zero, if a firm's warranty duration is lower than the industry's median, (ii) one, if a firm's warranty duration is equal to the industry's median and (iii) two, if a firm's warranty duration is higher than the industry's median. We define *TERM* as a relative variable because durations of warranty policies are related to the nature of the products and the industry. Therefore, in a cross-sectional test the relative duration of warranty policies is more informative than their absolute duration. We estimate the following model on a subset of firms and report its results in Panel B of Table 4:

$$\begin{aligned} P_{i,t} = {} & \beta_0 + \beta_1 ASSET_{i.t} + \beta_2 WLIAB_{i.t} + \beta_3 OTHER\_LIAB_{i.t} \\ & + \beta_4 ANALYST\_GR_{i.t} + \beta_5 TERM_{\ 2} + \beta_6 TERM^{\ 2} + \beta_7 NI_{i,t} \\ & + \beta_8 NI_{i,t} * Q_1 + \beta_9 NI_{i,t} * Q_2 + \beta_{10} NI_{i,t} * Q_3 + \varepsilon_{i,t} \end{aligned} \qquad (2)$$

The first model in Panel B shows that in this subsample the market value is related to *WLIAB* and *OTHER_LIAB* in a similar way as in the main sample (the last column of Panel A). The coefficient on *WLIAB* is negative and significant and is not different from -1. In the next column, we introduce *TERM*, to control for warranties' duration, in both a linear and a quadratic form ($TERM^2$) to allow for non-linearities in this relation. The results show that *TERM* is positively related to market values. That is, firms that issue longer-term warranties than their industry median garner a higher stock price. The strength of this relation is decreasing ($TERM^2$ is negative), suggesting that issuing a warranty that is shorter than the industry median is associated with a stronger price effect. In other words, the marginal benefit of longer-term warranty diminishes. In the second model, the coefficient on *WLIAB* is still negative and significant (coef. =-1.344, t-stat=-3.34), and its magnitude remains similar as in the first model. In the third model of Panel B, we include *TERM*, $TERM^2$ and *ANALYST_GR*. As in the previous models, the coefficient on *WLIAB* hovers around -1. Both *TERM* and $TERM^2$ variables remain significant and *ANALYST_GR* is positive and significant (t-stat=2.73).

In sum, the analyses in both panels of Table 4 suggest that warranty liability behaves as a contingent liability with a coefficient of -1, after isolating the information about future performance that it contains (proxied by *ANALYST_GR*) and after controlling for the duration of warranty policies. This supports the contention that warranty liabilities serve a dual role: a contingent liability and an informational signal.[22]

5.3 Stock Market Response to Warranty Information

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[22] An alternative interpretation for the positive association between liabilities and market values argues that because there is a relation between the timing of product sales and future growth, the results merely reflect the fact that firms whose sales are concentrated towards the end of the period report higher warranty liabilities than firms whose sales concentrate in the beginning of the quarter. We believe that any systematic pattern of sales within the quarter is correlated with the nature of the products and with industry membership. As such, our industry controls help in addressing this alternative explanation.

To further examine whether the market interprets accounting information on warranties as containing a signal of future growth prospects, we conduct a short-window event study around quarterly earnings announcements. We investigate whether investors respond to information related to warranty expenses and claims at that time. If warranty liabilities contain information about future growth, we expect a positive relation between abnormal warranty expenses and stock returns, controlling for earnings changes, abnormal claims and other relevant information. We estimate the following model:

$$CAR_{i,t} = \beta_0 + \beta_1 ABWEXP_{i,t} + \beta_2 ABCLAIM_{i,t} + \beta_3 ABGM_{i,t} + \beta_4 SALES\_GR_{i,t} + \beta_5 SURP_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 BM_{i.t} + \varepsilon_{i,t} \quad (3)$$

The dependent variable (CAR) is market-adjusted returns earned from one day before a quarterly earnings announcement to nine days following it (Balsam, Bartov and Marquardt, 2002).[23] The independent variables are defined as follows: abnormal warranty expenses (*ABWEXP*) and abnormal warranty claims (*ABCLAIM*) are estimated using both the time-series model and the two industry models, as described in section 4. Abnormal gross margin (*ABGM*) is constructed as

$ABGM_{j,t} = \dfrac{GM_{j,t} - GM_{j,t-4} * \dfrac{SALES_{j,t}}{SALES_{j,t-4}}}{TA_{j,t-4}}$ under the time-series model, and

$ABGM_{j,t} = \dfrac{GM_{j,t}}{SALES_{j,t}} - AVERAGE\left(\dfrac{GM_{j,t}}{SALES_{j,t}}\right)_{OTHER\_FIRMS}$ under the industry models. Sales growth (*SALES_GR*) is defined as the change in sales in the current quarter compared to the same quarter last year (time-series model) or over the industry average sales of other firms (industry models). *SURP* is defined as the difference between actual earnings and the most recent one-quarter-ahead consensus

[23] While explicit information about warranties may not be included in all firms' earnings releases, such information may be inferred from financial results or directly communicated to investors through other means, such as conference calls. In unreported analysis for firms whose earnings announcement and filing dates are separated by at least eleven days (available upon request), the response to warranty information occurs in the window around earnings announcement but not in the window around the filing dates. Thus, we believe that in this context, the window around earnings announcements is more relevant.

earnings forecast obtained from IBES. In the time series model, *SIZE* and *BM* are the natural logarithm of total assets and the book-to-market ratio, respectively. In the industry model, *SIZE* and *BM* are adjusted for industry averages of other firms.

The results in Table 5 indicate no significant stock price reaction to time-series-based abnormal warranty expenses and claims. However, consistent with *H3c*, investors react positively to industry-adjusted abnormal warranty expenses and claims. The coefficient on *ABWEXP* is positive and significant (coef. = 0.599, t = 2.03). This suggests that warranty expenses above the industry averages convey positive news to investors. Also, investors respond negatively to abnormal warranty claims (coef. = -0.920, t = -2.69). This suggests that changes in product quality, as evidenced by increasing claims, are viewed negatively by the market. Results are similar in the second industry model, where we account for warranties' duration in computing *ABWEXP* and *ABCLAIM*.

5.4 Future Firm Performance and Warranty Expenses

Next, we investigate whether abnormal warranty expenses reflect the changes in warranty policies that signal product quality and serve as an indicator of future firm performance. Alternatively, abnormal warranty expenses can be used as a mechanism to smooth earnings over time. To test *H3a* and *H3b*, we investigate the relation between current abnormal warranty expenses and two accounting-based metrics of future firm performance: (1) seasonally-adjusted sales growth in each of the next two quarters and (2) changes in ROA in each of the next two quarters.[24] We estimate the following model:

$$Y_{i,t+j} = \beta_0 + \beta_1 ABWEXP_{i,t} + \beta_2 ABCLAIM_{i,t} + \beta_3 ABGM_{i,t} + \beta_4 SALES\_GR_{i,t} + \beta_5 \Delta ROA_{i,t} + \beta_6 SIZE_{i,t} + \beta_7 BM_{i.t} + \varepsilon_{i,t} \quad (4)$$

[24] When we include as dependent variables the accounting-based metrics in quarter t+3, results are similar to those reported for quarter t+2.

where *Y* equals to either growth in sales in quarter *t+j* or the change in *ROA* in quarter *t+j,* where *j*=1,2. We define *ROA* as earnings before warranty expenses and extraordinary items, to avoid any mechanical relation between warranty expenses and future ROA. To ensure that our estimation is robust to the model chosen, we perform the analysis using both the time-series and the two industry models.

We include additional controls as follows. Abnormal warranty claims (*ABCLAIM*) control for changes in product quality. We expect a negative coefficient on it since higher claim costs are likely to lead to poor future firm performance (Nagar and Rajan, 2001). Abnormal gross margin (*ABGM*) may also controls for product quality as firms providing high-quality products are able to extract higher margins from their customers. We do not have any prediction on the coefficient of this variable in the sales growth model since it is not clear whether high quality firms pursue a higher sales-volume strategy. However, we expect a positive coefficient on this variable in the future earnings model since high quality firms are generally more profitable. We expect both current sales growth (*SALES_GR*) and current change in ROA (*ΔROA*) to be positively related to the dependent variables, because these variables persist in the short run. The coefficient on BM is expected to be negative, since it is negatively correlated with growth opportunities. Finally, we do not make any prediction on the signs of *SIZE*.

If abnormal warranty expenses reflect changes in warranty policies that are correlated with product quality and subsequent future performance, we expect a positive relation between abnormal warranty expenses and future sales as well as future earnings ($\beta_1 > 0$). If, however, managers use warranty expenses to smooth earnings, we expect a negative relation between abnormal warranty expenses and future sales as well as future earnings ($\beta_1 < 0$). Therefore, by investigating the sign of β_1, we are able to test *H3*a and *H3b* and find support for either a signaling or a smoothing function of the warranty expense.

Table 6 reports the results separately for the two dependent variables: future sales growth (Panel A) and future pre-warranty earnings growth (Panel B). The first, and fourth columns of Panel A present results using the time-series-based measures of abnormal warranty expenses ($ABWEXP_{\_TIME}$) and abnormal claims ($ABCLAIM_{\_TIME}$) as independent variables. We find that abnormal warranty expenses are positively associated with growth in sales in the next quarter (coef. = 8.662, t-statistic = 4.04) and quarter t+2 (coef. = 8.061, t-statistic = 4.01). This positive relation is consistent with managers adjusting warranty policies to signal good (bad) future performance. Changes in warranty policies are reflected with increasing (decreasing) the accruals for warranty expenses. This relation is not consistent with managers using warranty accruals to smooth reported earnings. The sign on *ABCLAIM*, which tracks changes in product quality, is negative and significant with respect to sales growth (coef. = -7.036, t = -2.76). This finding is consistent with the ability of changes in product quality, as reflected in abnormal claims, to predict future firm performance (Nagar and Rajan, 2001). We do not find evidence of an association between *ABGM* and future sales growth.

In the second and fifth columns of Panel A, we report results using the industry-based measures of both abnormal warranty expenses and ($ABWEXP_{\_INDUSTRY}$) and abnormal claims ($ABCLAIM_{\_INDUSTRY}$). The evidence of a positive relation between abnormal warranty expenses and future industry-adjusted sales growth is strong for both future quarters (coef. = 2.326, t = 7.69 in quarter t+1; coef. = 5.395, t = 12.29 in quarter t+2). The relation between abnormal industry-adjusted warranty claims and future industry-adjusted sales growth is negative and significant, consistent with changes in product quality being reflected in future firm performance. In the third and sixth columns we use *ABWEXP* and *ABCLAIM* computed using the industry model after adjusting for median duration of warranty policies in the industry. The results are similar in tenor to those using the regular industry model. However, they are slightly weaker because of the reduction in the number of observations in this analysis.

The results in Panel B of Table 6, where the dependent variable is changes in future *ROA* (after adding back future warranty expenses), are similar to the results reported in Panel A of Table 6.

There is still a positive relation between *ABWEXP* and future firm performance in quarter *t+1*, as reflected in the changes in *ROA* (t = 2.77). However, the relation between *ABWEXP* and firm performance in quarter *t+2* is weaker (t = 1.77). Regarding the relation between abnormal claims and future changes in ROA, we find a significant negative association with respect to both quarter t+1 (coef. = -0.938, t = -4.37) and quarter t+2 (coef. = -1.094, t = -2.88). The results of the industry-adjusted model in Panel B are also similar to those in Panel A of Table 6.

Based on the results documented in Table 6, we conclude that managers do not use warranty expenses to smooth income because we observe a positive association between abnormal warranty expenses and future sales growth as well as future earnings changes. Instead, we conclude that abnormal warranty expenses incorporate fundamental changes to warranty policies that are related to managers' beliefs about product quality. Furthermore, we document that changes in warranty claims are negatively related to future firm performance. The results in Table 6 are consistent with and complement the results reported in Table 5. Recall that investors respond positively to abnormal industry-adjusted warranty expenses. This response is consistent with the positive association of abnormal warranty expenses and future firm performance documented in Table 6. It appears that investors appreciate, at least partially, the signaling aspect of warranty expenses for future firm performance. Similarly, in Table 5 we document a negative market reaction to abnormal warranty claims. This response is consistent with the evidence in Table 6 of a negative relation between abnormal claims and future firm performance.

5.5 Benchmark Beating and Warranty Expenses

In this section, we test hypothesis 4, regarding the relation between abnormal warranty expenses and short-term incentives to meet or beat financial reporting benchmarks. We estimate the following regression model:

$$Y_{i,t} = \beta_0 + \beta_1 SUSPECT_{i,t} + \beta_2 ABCLAIM_{i,t} + \beta_3 ABGM_{i,t} + \beta_4 BENCHMARK_{i,t} + \beta_5 SIZE_{i,t} + \beta_6 BM_{i,t} + \varepsilon_{i,t} \quad (5)$$

The dependent variable, Y, is equal to abnormal warranty expenses based on either the time-

series or the two industry models.[25] The explanatory variable of interest is *SUSPECT*, which is defined in the following three alternative ways: *SUSPECT_ΔNI* takes the value of one if the change in pre-managed net income is negative and the change in reported net income is positive, where pre-managed net income is defined as net income before abnormal warranty expense. *SUSPECT_NI* takes the value of one if pre-managed net income is negative and reported net income is positive. *SUSPECT_MEET* takes the value of one if pre-managed earnings per share misses the last outstanding analyst consensus forecast prior to the quarterly earnings announcement while the reported earnings per share meets or beats analyst consensus forecast, where pre-managed earnings per share is defined as earnings per share before abnormal warranty expense per share.[26]

BENCHMARK is one of the three earnings benchmark managers seek to meet or beat. The other explanatory variables in the model (*CLAIM* and *GM*) are adjusted based on either the time-series or industry models, corresponding to the adjustment of the dependent variable.

Table 7 reports the results. Under all specifications we find strong evidence of unusually low abnormal warranty expenses in the three samples of firms that are suspected to have managed earnings to achieve benchmarks. All of the coefficients on *SUSPECT_ΔNI, SUSPECT_NI,* and *SUSPECT_MEET* are statistically significant at conventional levels. Specifically, firms reporting an increase in reported net income have lower abnormal warranty expenses, as reflected in the statistically significant negative coefficient on *SUSPECT_ΔNI* ranging from -0.173 (t = -12.28) to -0.483 (t= -6.27). This indicates that firms that are suspected to have engaged in opportunistic earnings management reduce warranty expenses significantly more than other firms. Also, the coefficients on

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[25] It is important to note that the dependent variable, abnormal warranty expenses, contains some measurement error. However, because we do not believe that there is a correlation between the measurement error and our independent variables, the reported results are not biased. Instead, our model will experience a reduction in explanatory power.

[26] We also performed analysis using an alternative definition of *SUSPECT,* similar to Roychowdhury (2006). Under this definition, *SUSPECT* is defined based on the proximity of the reported accounting number to the desired benchmark. The tenor of the results is similar to that of the reported results.

SUSPECT_NI are negative and significant (ranging from -0.216, t = -12.40 to -0.679, t= -9.17). Finally, the coefficients on *SUSPECT_MEET* are significantly negative, ranging from -0.152 (t = -15.88) to -0.551 (t = -16.86).

The results in Table 7 also show that not all of the abnormal warranty expenses are attributable to earnings management. The consistently positive coefficient on *ABCLAIM* in all three benchmark specifications (both in the time-series and in the industry-adjusted model) suggests that as the amount of claims increases, firms allocate more warranty expenses.

Overall, the results are consistent with managers using the flexibility in assumptions underlying the warranty expense calculation and exercising their discretion to achieve financial reporting benchmarks.

5.6 Valuation of Warranty Liability Combining Growth Expectation and Earnings Management Incentives

Finally, we investigate the market valuation of warranty liabilities by incorporating their contingent liability element, their information signaling role, and short-term earnings management incentives. We use an extension of model (1), as follows:

$$\begin{aligned} P_{i,t} = {} & \beta_0 + \beta_1 ASSET_{i.t} + \beta_2 WLIAB_{i.t} + \beta_3 OTHER\_LIAB_{i.t} \\ & + \beta_4 SUSPECT_{i,t} * WLIAB_{i.t} + \beta_5 SUSPECT_{i.t} + \beta_6 ANALYST\_GR_{i,t} * WLIAB_{i.t} \\ & + \beta_7 ANALYST\_GR_{i,t} + \beta_8 TERM + \beta_9 TERM^2 + \beta_{10} NI_{i,t} + \beta_{11} NI_{i,t} * Q_1 \\ & + \beta_{12} NI_{i,t} * Q_2 + \beta_{13} NI_{i,t} * Q_3 + \varepsilon_{i,t} \end{aligned} \quad (6)$$

As documented in section 5.5, firms with strong incentives to meet or beat earnings benchmarks cut warranty expenses. As in Table 7, we identify suspect firms that are likely to have manipulated earnings to avoid an earnings decline, avoid a loss, and meet analyst forecasts. If investors correctly infer that these firms understate their warranty liabilities, they would place a larger negative coefficient on warranty liabilities to correct for the underestimation.

Panel A of Table 8 reports the results of model (6) for the full sample. In Panel B we perform additional analysis on the subsample for which we obtain information on warranties' duration. The

first column reports results after controlling for incentives to avoid an earnings decline. In support of *H5*, we find that the stock market places a more negative coefficient on the warranty liabilities of firms that are suspected to have managed earnings to avoid reporting an earnings decline. The coefficient on the interaction term between *SUSPECT* and *WLIAB* is –1.268 with a t-statistic of –2.67. We find similar results for suspect firms that seek to avoid a loss (coef. = -1.832, t =-2.82), and those that seek to meet analyst forecasts (coef. = -0.606, t =-2.86).

To test *H6*, we add analysts' earnings growth expectations (*ANALYST_GR*) as an additional explanatory variable. *ANALYST_GR* is positively associated with share price across all three models. This is consistent with the conjecture that investors interpret the warranty liabilities also as a signal of future firm performance.

We add an interaction term between *ANALYST_GR* and *WLIAB* to examine whether the information signaling in warranty liabilities varies across firms with different growth opportunities. The interaction term is positive and significant, with a coefficient of 0.010 (t =3.02) for avoiding an earnings decline, 0.014 (t =2.23) for avoiding a loss, and 0.059 (t = 2.76) for meeting analyst forecast. We interpret these results as indicating that warranty liabilities serve as a stronger informational signal for high growth firms than for low growth firms.

As a formal test of *H6*, we conduct an F-test of whether the coefficient on *OTHER_LIAB* is equal to the sum of the coefficient of *WLIAB* and its interactions with *SUSPECT* and *ANALYST_GR*, both evaluated at their median values. The results of this F-test indicate that there is no evidence to reject the hypothesis that the coefficients of *WLIAB* and *OTHER_LIAB* are equal (p-values=0.56, 0.50 and 0.27). Further, we also examine whether the coefficient on *WLIAB* is different than -1, using another F-test. We cannot reject the hypothesis that *WLIAB* = -1 (p-values=0.75, 0.44, and 0.14). The analysis in Panel B of Table 8 provides similar results to those reported in Panel A. We include *TERM* and $TERM^2$ in the specification and take into account the duration of warranties in computing the industry-based measures of *ABWEXP* and *ABCLAIM*. Our conclusions remain unchanged after controlling for the duration of the warranties provided by our sample firms.

Overall, the results in Table 8 support the conjecture that warranty liabilities represent three aspects: a contingent liability, an informational signal about growth prospects, and an earnings management tool. We find that the stock market values warranty liabilities more negatively for firms that have managed earnings and that it places a positive weight on warranty liabilities as a signal of future growth prospects. After controlling for signaling and earnings management, we find that the stock market values warranty liabilities similarly as it values other recognized liabilities.

6. Conclusion

In this paper, we study the economics and accounting aspects of product warranties. We use a sample of over 800 firms that disclose warranty information following the requirement of FIN 45. Our paper provides insights into the market interpretation of warranty disclosures and managers' choices with regards to product warranty policies as well as the accounting treatment of warranties.

We first investigate the market valuation of warranty liabilities. We hypothesize that they serve as both contingent liabilities that reflect future services related to warranty obligations as well as an informational signal of product quality and future growth prospects. Our findings indicate that the stock market places a smaller negative valuation coefficient on warranty liabilities compared to other reported liabilities. When we control for the signaling role of warranty liabilities (with analyst growth expectations and warranty duration), the valuation coefficients on warranty liabilities and other liabilities approach negative one. This supports our hypothesis that the market interprets warranty liabilities also as informational signals for product quality and future growth prospects. Consistent with this hypothesis, we further show that firms with higher abnormal warranty expenses exhibit higher stock returns around quarterly earnings announcements and better future firm performance.

We also investigate whether managers use warranty accruals to meet earnings targets. We find evidence that firms with incentives to manage earnings to meet earnings targets report lower

abnormal warranty expenses. This evidence is consistent with managers using their discretion in the estimates of warranty accruals to achieve financial reporting targets.

In our final analysis, we investigate the market valuation of warranty liabilities after controlling for signaling and earnings management aspects. We show that warranty liabilities reduce share prices dollar-for-dollar. We also find that investors understand that warranty liabilities of firms that engaged in earnings management are underestimated. Overall, the findings in this paper show that disclosures on warranties provide valuable information to market participants.

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Appendix A
Sample warranty disclosures

Dell Corp.

	Fiscal Year Ended February 1, 2008	February 2, 2007	February 3, 2006
		(in millions)	
Warranty liability:			
Warranty liability at beginning of year	$ 958	$ 951	$ 722
Costs *accrued* for new warranty contracts and changes in estimates for pre-existing warranties [(a)]	1,141	1,242	1,391
Service obligations honored	(1,170)	(1,235)	(1,162)
Warranty liability at end of year	$ 929	$ 958	$ 951
Current portion	$ 690	$ 768	$ 714
Non-current portion	239	190	237

(a) Changes in cost estimates related to pre-existing warranties are aggregated with accruals for new warranty contracts. Dell's warranty liability process does not differentiate between estimates made for pre-existing warranties and new warranty obligations.

Western Digital

Product Warranty Liability

Changes in the warranty accrual for 2008, 2007 and 2006 were as follows (in millions):

	2008	2007	2006
Warranty accrual, beginning of period	$ 90	$ 89	$ 92
Charges to operations	106	74	76
Utilization	(73)	(52)	(49)
Changes in estimate related to pre-existing warranties	(9)	(21)	(30)
Warranty accrual, end of period	$ 114	$ 90	$ 89

Table 1
Sample Composition

Full Sample

	Firm-quarters	**Firms**
Original file	14,510	889
Observations without valid COMPUSTAT GVKEY information	(516)	(36)
Observations without direct information on warranty expenses and claims.	(4,473)	(47)
	9,521	**806**
Observations without valid abnormal warranty expense information	(3,278)	(110)
Observations without valid other variable information	(1,722)	(96)
	4,521	**600**

Subsample with TERM Information

	Firm-quarters	**Firms**
Full Sample	4,521	600
Observations lie in 4-digit SIC code industries with less than 10 firms	(1,540)	(256)
Observations without disclosure of warranty term information in 2006 10K filings or the disclosure is ambiguous.	(1,330)	(93)
	1,651	**159**

Table 2
Sample Composition by Industry

SIC Code (2 digits)	Industry	N	N (%)	WEXP /SALES (%)	CLAIM /SALES (%)	Duration (Median)
14	Mining and quarrying non-metallic minerals	1	0.12	0.020	0.133	-
15	General Building Contractors	24	2.98	0.750	0.617	-
16	Heavy Construction, Except Building	1	0.12	1.205	0.714	-
17	Construction - special contractors	3	0.37	0.968	0.900	-
22	Textile Mill Products	3	0.37	1.090	1.149	-
24	Lumber & Wood Products	13	1.61	3.468	3.625	-
25	Furniture & Fixtures	20	2.48	0.612	0.597	-
26	Paper & Allied Products	1	0.12	0.065	0.053	-
28	Chemical & Allied Products	20	2.49	2.593	2.154	-
29	Petroleum & Coal Products	3	0.37	0.838	0.854	-
30	Rubber & Miscellaneous Plastics Products	12	1.49	1.079	1.109	-
32	Glass, Pottery, and Related Products	2	0.25	0.220	0.376	-
33	Primary Metal Industries	5	0.62	0.492	0.498	-
34	Fabricated Metal Products	18	2.23	0.754	0.759	-
35	Industrial Machinery & Equipment	196	24.33	1.815	2.223	1.5
36	Electronic & Other Electric Equipment	198	24.58	1.449	1.397	1.5
37	Transportation Equipment	64	7.94	1.172	1.142	2.0
38	Instruments & Related Products	165	20.48	1.550	1.426	1.0
39	Miscellaneous Manufacturing Industries	11	1.36	1.177	1.012	-
48	Communications	1	0.12	0.000	4.227	-
50	Wholesale Trade- Durable Goods	8	1.00	0.389	0.459	-
51	Wholesale Trade - Nondurable Goods	1	0.12	0.648	0.648	-
55	Automotive Dealers & Service Stations	4	0.50	0.722	0.703	-
57	Retail	1	0.12	0.000	0.057	-
63	Insurance	1	0.12	0.153	0.093	-
67	Investment Offices, Holding Offices	1	0.12	0.120	0.249	-
73	Business Services	18	2.24	0.850	0.863	-
75	Auto Repair, Services, & Parking	1	0.12	3.394	4.009	-
80	Services - Health	1	0.12	1.219	1.203	-
87	Engineering & Management Services	3	0.37	1.461	1.706	-
99	Non classifiable Establishments	6	0.74	0.705	1.714	-
		806	**100.0**			

Table 3 Panel A: Summary Statistics

	N	MEAN	STD	Q1	MEDIAN	Q3
General variables--S&P 500 firms (from 2003 to 2006)						
MARKET CAPITALIZATION ($MILLION)	7,926	21,594	38,272	5,202	10,129	19,695
SALES ($MILLION)	7,943	3,837	7,159	763	1,775	3,771
TOTAL ASSETS ($MILLION)	7,925	44,754	136,019	4,111	11,368	28,870
BM	7,792	0.424	0.269	0.244	0.375	0.553
ROA	7,848	0.015	0.023	0.004	0.013	0.024
General variables—Warranty sample firms (from 2003 to 2006)						
MARKET CAPITALIZATION ($MILLION)	4,521	3,227	9,790	208	678	2,151
SALES ($MILLION)	4,521	639	1,807	34	112	464
TOTAL ASSETS ($MILLION)	4,521	2,620	8,091	137	488	1,844
BM	4,521	0.466	0.268	0.274	0.417	0.603
ROA	4,517	0.008	0.053	0.001	0.013	0.025
ROA BEFORE WEXP	4,517	0.012	0.053	0.004	0.017	0.029
ANALYST_GR (%)	4,512	16.6	8.3	12.0	15.0	19.3
Warranty-related variables						
WEXP ($MILLION)	4,521	8.541	37.927	0.252	1.155	4.770
WEXP/SALES (%)	4,521	1.377	1.336	0.479	0.962	1.863
WEXP/TOTAL ASSETS (%)	4,521	0.376	0.443	0.107	0.236	0.476
WEXP/OPINCOME (%)	4,288	10.973	152.679	1.648	5.903	14.329
WEXP/ ABS(NI) (%)	4,519	54.836	306.856	5.224	13.142	32.545
WEXP/ TOTAL_EXP (%)	4,247	1.478	1.438	0.494	1.024	2.048
$ABWEXP_{\_time}$ (%)	4,006	-0.016	0.305	-0.092	-0.005	0.066
$ABWEXP_{\_industry}$ (%)	4,521	-0.088	1.320	-0.968	-0.394	0.411
WLIAB/ LIAB (%)	4,512	4.144	4.267	1.429	2.824	5.447
Claims-related variables						
CLAIM ($MILLION)	4,521	7.349	32.984	0.249	1.145	4.233
CLAIM /SALES (%)	4,521	1.274	1.296	0.415	0.868	1.675
CLAIM /TOTAL ASSETS (%)	4,521	0.358	0.440	0.098	0.219	0.441
CLAIM / OPINCOME (%)	4,288	9.034	169.092	1.685	5.217	13.458
$ABCLAIM_{\_time}$ (%)	4,031	-0.031	0.270	-0.094	-0.009	0.056
$ABCLAIM_{\_industry}$ (%)	4,521	-0.108	1.353	-0.975	-0.414	0.321

Table 3 Panel B: Correlations

	MARKET CAP	SALES	TOTAL ASSETS	BM	ROA	WEXP/ SALES	ABWEXP_time	ABWEXP_industry	WLIAB/ LIAB	ANALYST_GR	CLAIM/SALES	ABCLAIM_time	ABCLAIM_industry
MARKET CAP		**0.737**	**0.797**	**-0.160**	**0.096**	**0.002**	-0.002	**-0.017**	**-0.086**	**-0.112**	**-0.008**	0.006	**-0.033**
SALES	**0.864**		**0.970**	**-0.049**	**0.040**	**-0.003**	0.000	**0.008**	**-0.101**	**-0.197**	**-0.017**	0.003	**-0.009**
TOTAL ASSETS	**0.896**	**0.958**		**-0.054**	0.021	**-0.007**	0.000	**-0.007**	**-0.124**	**-0.188**	**-0.016**	0.009	**-0.019**
BM	**-0.311**	**-0.059**	0.015		**-0.280**	**0.001**	**0.057**	**0.048**	0.008	**-0.189**	**0.046**	**0.072**	**0.090**
ROA	**0.297**	**0.184**	**0.077**	**-0.440**		**0.026**	0.002	0.033	**0.142**	**-0.097**	**-0.064**	**-0.052**	**-0.053**
WEXP/SALES	**0.701**	**0.824**	**0.784**	**-0.036**	**0.201**		0.244	**0.940**	**0.539**	0.033	**0.861**	**0.073**	**0.793**
ABWEXP_time	-0.025	-0.001	0.010	**0.082**	-0.022	**0.214**		**0.234**	0.002	-0.034	**0.083**	**0.450**	**0.074**
ABWEXP_industry	-0.026	0.016	-0.001	**0.064**	**0.108**	**0.901**	**0.195**		**0.507**	**0.028**	**0.805**	**0.076**	**0.850**
WLIAB/ LIAB	**-0.225**	**-0.240**	**-0.307**	-0.012	**0.205**	**0.632**	-0.013	**0.570**		**0.118**	**0.518**	-0.006	**0.480**
ANALYST_GR	**-0.275**	**-0.472**	**-0.446**	**-0.186**	0.037	**0.017**	-0.022	-0.005	**0.148**		**0.012**	-0.014	0.010
CLAIM/SALES	**-0.098**	**-0.089**	**-0.086**	**0.052**	**0.020**	**0.880**	0.083	**0.787**	**0.612**	**-0.022**		**0.206**	**0.933**
ABCLAIM_time	-0.037	-0.022	-0.003	**0.096**	**-0.072**	**0.072**	**0.481**	**0.074**	-0.018	-0.006	**0.173**		**0.205**
ABCLAIM_industry	**-0.055**	-0.007	-0.012	**0.119**	0.024	**0.754**	**0.071**	**0.864**	**0.520**	**-0.047**	**0.859**	**0.166**	

Notes:
Spearman correlations are reported on the lower left and Pearson correlations are reported on the upper right. Significance level at the 5% level is depicted with bold font. MARKET CAP is defined as quarterly closing price multiplied by number of common shares outstanding, SALES is quarterly sales revenue, TOTAL ASSETS is total assets measured at the end of fiscal quarter, BM is defined as book value of equity divided by market value of equity, ROA is defined as (income before extraordinary items$_t$ + warranty expense$_t$) /Total Assets$_{t-1}$, WEXP is warranty expense, ABWEXP is abnormal warranty expense based on either the time-series model or the industry model, WLIAB is warranty liability, ANALYST_GR is analyst long-term earnings growth forecasts as reported in I/B/E/S, CLAIM is claim costs, and ABCLAIM is abnormal claims based on either the time-series model or the industry model. All variables are calculated at the end of each fiscal quarter.

Table 4 Panel A: Market Valuation of Warranty Liability (Full Sample)

	Dependent Variable = $PRICE_t$							
	Coefficient	Robust t-statistic	Coefficient	Robust t-statistic	Coefficient	Robust t-statistic	Coefficient	Robust t-statistic
BV_t	1.173	9.65						
$ASSET_t$			0.913	7.35	0.917	9.82	0.914	9.45
$LIAB_t$			-0.915	-4.66				
$WLIAB_t$					-0.442	-0.19	-1.043	-2.42
$OTHER\_LIAB_t$					-0.865	-6.82	-0.883	-6.34
$ANALYST\_GR_t$							0.098	2.69
NI_t	12.218	12.90	12.404	12.08	13.367	10.08	12.295	14.92
NI_Q1_t	3.010	4.17	3.296	4.96	2.190	4.85	3.406	3.90
NI_Q2_t	1.754	2.58	1.835	3.15	1.482	3.11	1.894	2.57
NI_Q3_t	1.798	2.89	2.072	5.07	1.755	4.97	2.176	3.10
Test of $WLIAB_t = OTHER\_LIAB_t$					F = 5.62	p = 0.02	F = 0.03	p = 0.86
Test of $WLIAB_t = -1$					F = 9.77	p = 0.00	F = 0.00	p = 0.98
Adj R^2	85.8%		85.8%		86.6%		87.8%	
N	5,868		5,868		5,868		5,868	

Table 4 Panel B: Market Valuation of Warranty Liability (Subsample with TERM information)

	Dependent Variable = $PRICE_t$					
	Coefficient	Robust t-statistic	Coefficient	Robust t-statistic	Coefficient	Robust t-statistic
$ASSET_t$	1.259	11.57	1.114	9.78	1.178	10.28
$WLIAB_t$	-1.222	-3.33	-1.344	-3.34	-0.977	-2.27
$OTHER\_LIAB_t$	-0.691	-3.05	-0.657	-3.28	-0.711	-3.72
$ANALYST\_GR_t$	0.244	6.98			0.137	2.73
TERM			10.256	6.56	6.711	3.56
$TERM^2$			-2.767	-5.96	-1.918	-3.71
NI_t	20.857	13.05	22.747	12.43	22.155	12.57
NI_Q1_t	0.183	0.09	-1.430	-0.70	-0.894	-0.44
NI_Q2_t	-2.525	-1.48	-3.281	-2.19	-2.763	-1.72
NI_Q3_t	-1.994	-1.15	-2.338	-1.32	-2.774	-1.71
Test of $WLIAB_t = OTHER\_LIAB_t$	F=0.03	p=0.87	F=0.17	p=0.68	F=0.16	p=0.69
Test of $WLIAB_t = -1$	F=0.00	p=0.99	F=0.04	p=0.83	F=0.02	p=0.89
Adj R^2	90.8%		90.2%		90.7%	
N	1,651		1,651		1,651	

Notes: The above table shows the market valuation of warranty liabilities. The dependent variable is price per share. Coefficients on industry (2-digit SIC code) and quarterly dummies are not shown. BV is book value per share, ASSET is total assets per share, LIAB is total liabilities per share, WLIAB is warranty liabilities per share, OTHER_LIAB is total liabilities excluding the warranty liability per share, NI is earnings before extra-ordinary items per share, TERM is defined as 0 if the warranty duration is below industry median, 1 if it equals industry median and 2 if it is above industry median where industry is defined at the 4-digit SIC level with at least 10 firms in each industry, ANALYST_GR is analyst long-term earnings growth forecasts as reported in I/B/E/S, Q1, Q2, Q3 are indicators for fiscal quarter 1, 2, and 3, respectively. The robust t-statistics are based on standard errors that are clustered by both firm and quarter.

Table 5 Market Return and Abnormal Warranty Expense

	Dependent variable = CAR (-1, +9)					
	Time-series model		Industry model			
			Without controlling for TERM		Controlling for TERM	
	Coeff.	Robust t-statistic	Coeff.	Robust t-statistic	Coeff.	Robust t-statistic
INTERCEPT	-0.010	-0.77	-2.024	-7.22	-2.072	-10.29
$ABWEXP_t$	-0.005	-0.78	0.599	2.03	1.026	1.85
$ABCLAIM_t$	-0.001	-0.10	-0.920	-2.69	-1.346	-2.18
$ABGM_t$	-0.018	-0.41	0.017	1.38	-0.018	-0.80
$SALES\_GR_t$	0.000	1.73	0.013	0.91	0.019	1.37
$SURP_t$	0.384	9.43	0.488	10.13	0.778	8.75
$SIZE_t$	-0.001	-0.92	-0.348	-2.17	-0.864	-2.87
BM_t	0.025	3.00	2.335	1.86	3.223	1.37
Adj R^2	11.3%		11.6%		9.0%	
N	2,662		2,205		1,002	

Notes: CAR (-1, +9) is defined as market-adjusted returns cumulated from one day before to nine days after quarterly earnings announcement. ABWEXP is abnormal warranty expenses, ABCLAIM is abnormal claims, ABGM is abnormal gross margin, SALES_GR is sales growth relative to the same quarter of the preceding year, SURP is the difference between actual earnings and the most recent one-quarter-ahead consensus earnings forecast obtained from I/B/E/S, SIZE is defined as the logarithm of total assets, BM is book-to-market ratio. SURP, SALES_GR, ABWEXP, ABCLAIM and ABGM are expressed in percentage. In the industry model without controlling for TERM, all variables are measured as the deviation from the industry average of other firms where the industry is defined at the 2-digit SIC level with at least 10 firms in each industry. In the industry model controlling for TERM, all variables are measured as the deviation from the average of other firms in the same industry- quarter-term group where the industry is defined at the 2-digit SIC level. The term groups are defined as follows: 0 if the warranty duration is below industry median, 1 if it equals industry median and 2 if it is above industry median where industry is defined at the 4-digit SIC level with at least 10 firms in each industry. The robust t-statistics are based on standard errors that are clustered by both firm and quarter. Coefficients on industry and quarterly dummies are not shown.

Table 6 Future Performance and Abnormal Warranty Expense

Panel A Future Sales Growth and Abnormal Warranty Expense

	Dependent Variables					
	SALES GR $_{t+1}$			SALES GR $_{t+2}$		
	Time-series model	Industry model	Industry model controlling for TERM	Time-series model	Industry model	Industry model controlling for TERM
	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)
INTERCEPT	9.999 (1.02)	70.004 (29.64)	0.688 (0.56)	20.202 (2.81)	94.425 (43.29)	-0.814 (-0.54)
ABWEXP $_t$	8.662 (4.04)	2.326 (7.69)	2.177 (2.19)	8.061 (4.01)	5.395 (12.29)	4.078 (2.88)
ABCLAIM $_t$	-7.036 (-2.76)	-4.286 (-6.83)	-1.735 (-1.38)	-5.083 (-2.77)	-5.262 (-13.73)	-3.828 (-2.75)
ABGM $_t$	-0.291 (-0.67)	-0.016 (-0.32)	-0.004 (-0.64)	-0.234 (-0.62)	-0.000 (-4.16)	-0.005 (-0.46)
SALES_GR $_t$	0.620 (6.01)	0.481 (97.19)	0.612 (16.08)	0.425 (8.50)	0.128 (16.99)	0.331 (8.85)
ΔROA $_t$	0.679 (1.16)	-0.633 (-1.01)	-0.866 (-3.57)	0.684 (1.60)	-0.428 (-1.50)	-0.596 (-2.21)
SIZE$_t$	-0.555 (-1.48)	0.014 (5.87)	0.908 (1.85)	-1.468 (-2.24)	0.018 (0.46)	0.754 (1.04)
BM $_t$	-5.568 (-2.55)	-0.229 (-2.53)	-5.897 (-2.81)	-7.183 (-3.72)	-0.380 (-2.27)	-5.984 (-1.71)
Adj R^2	41.9%	75.6%	49.3%	19.0%	55.9%	20.2%
N	4,154	6,133	1,555	3,695	5,636	1,375

Table 6 Continued

Panel B Pre-Warranty Future Earnings and Abnormal Warranty Expense

	Dependent Variables					
	ΔROA_{t+1}			ΔROA_{t+2}		
	Time-series model	Industry model	Industry model controlling for TERM	Time-series model	Industry model	Industry model controlling for TERM
	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)	Coefficient (Robust t-statistic)
INTERCEPT	0.041 (0.09)	-0.744 (-1.80)	-0.446 (-2.40)	0.304 (1.33)	-0.980 (-1.68)	-0.338 (-1.49)
$ABWEXP_t$	0.734 (2.77)	0.372 (3.02)	0.383 (2.80)	0.701 (1.77)	0.189 (1.96)	0.264 (1.87)
$ABCLAIM_t$	-0.938 (-4.37)	-0.290 (-1.74)	-0.168 (-1.25)	-1.094 (-2.88)	-0.083 (-0.79)	-0.083 (-0.59)
$ABGM_t$	0.327 (2.75)	0.002 (0.83)	0.001 (1.86)	0.128 (2.10)	0.003 (1.39)	0.000 (0.64)
$SALES\_GR_t$	0.017 (3.32)	0.013 (4.34)	0.015 (3.60)	0.009 (2.62)	0.009 (3.35)	0.012 (1.87)
ΔROA_t	0.231 (4.03)	0.628 (13.69)	0.537 (7.18)	0.132 (4.65)	0.541 (10.36)	0.595 (6.19)
$STD(OI/SALES)_t$	-0.862 (-0.13)			-0.947 (-0.17)		
$SIZE_t$	-0.002 (-0.05)	0.239 (4.79)	0.400 (3.02)	-0.009 (-0.08)	0.280 (4.15)	0.533 (3.09)
BM_t	-1.271 (-2.69)	-1.685 (-4.45)	-1.861 (-2.32)	-0.702 (-2.77)	-1.692 (-4.05)	-1.132 (-1.03)
Adj R^2	12.0%	34.7%	27.2%	5.5%	24.5%	23.8%
N	3,974	4,494	1,568	3,476	4,029	1,388

Notes: ROA is defined as earnings before extraordinary items and warranty expenses deflated by beginning-of-year total assets. STD (OI/SALE) is defined as the standard deviation of operating income deflated by sales for the past 8 quarters. ΔROA, SALES_GR, ABWEXP, ABCLAIM and ABGM are expressed in percentage. In the industry model, all variables are measured as the deviation from the industry average of other firms where the industry is defined as the 2-digit SIC level with at least 10 firms in each industry. The robust t-statistics are based on standard errors that are clustered by both firm and quarter. Coefficients on industry and quarterly dummies are not shown.

Table 7 Incentives, Earnings Management and Warranty Expenses

	Dependent Variables = $ABWEXP_t$								
	Avoid earnings decline			Avoid loss			Meet analyst forecast		
	Time-series model	Industry model	Industry model controlling for TERM	Time-series model	Industry model	Industry model controlling for TERM	Time-series model	Industry model	Industry model controlling for TERM
	Coef. (Robust t-stat)	Coef. (Robust t-stat)	Coef. (Robust t-stat)	Coef. (Robust t-stat)	Coef. (Robust t-stat)	Coef. (Robust t-stat)	Coef. (Robust t-stat)	Coef. (Robust t-stat)	Coef. (Robust t-stat)
INTERCEPT	0.028 (1.35)	0.011 (0.27)	0.003 (0.05)	-0.073 (-1.04)	0.449 (6.70)	0.250 (6.35)	-0.021 (-1.36)	0.363 (6.67)	0.183 (2.89)
$SUSPECT\_\Delta NI_t$	-0.173 (-12.28)	-0.373 (-4.60)	-0.483 (-6.27)						
$SUSPECT\_NI_t$				-0.216 (-12.40)	-0.918 (-8.02)	-0.679 (-9.17)			
$SUSPECT\_MEET_t$							-0.152 (-15.88)	-0.831 (-9.58)	-0.551 (-6.86)
$ABCLAIM_t$	0.512 (12.79)	0.575 (6.11)	0.809 (17.66)	0.446 (9.71)	0.454 (5.57)	0.706 (15.21)	0.475 (10.37)	0.489 (7.85)	0.702 (14.87)
$ABGM_t$	0.249 (1.09)	0.064 (2.20)	-0.072 (-1.42)	-1.151 (-1.53)	0.009 (0.71)	-0.065 (-1.50)	-0.425 (-1.44)	0.222 (1.48)	-0.423 (-2.23)
ΔNI_t	0.258 (2.15)	5.186 (0.93)	3.411 (4.35)						
NI_t				1.097 (2.60)	2.689 (3.40)	6.092 (7.00)			
EPS_t							0.014 (2.50)	2.163 (2.85)	0.445 (3.90)
$SIZE_t$	0.008 (3.80)	0.047 (1.22)	0.007 (0.33)	0.007 (2.59)	0.028 (2.41)	0.014 (0.67)	0.008 (6.68)	0.002 (0.14)	-0.046 (-1.60)
BM_t	0.033 (2.22)	-0.106 (-0.77)	-0.175 (-1.83)	0.065 (2.25)	0.046 (0.78)	-0.139 (-1.77)	0.027 (2.19)	0.030 (0.41)	-0.552 (-3.21)
Adj R^2	29.9%	53.0%	72.5%	31.6%	60.0%	71.1%	42.1%	66.9%	77.4%
N	4,948	5,530	1,385	5,361	6,043	1,282	3,698	4,835	1,038

Notes:
SUSPECT_ΔNI takes the value of one if the change in pre-managed net income is negative and the change in net income is positive, where pre-managed net income is defined as net income before abnormal warranty expense. *SUSPECT_NI* takes the value of one if pre-managed net income is negative and net income is positive. *SUSPECT_MEET* takes the value of one if a firm's pre-managed earnings per share misses the last outstanding analyst consensus forecast prior to the quarterly earnings announcement while the earnings per share meets or beats analyst consensus forecast, where pre-managed earnings per share is defined as earnings per share before abnormal warranty expense. SIZE is the logarithm of the market value of equity at the beginning of the quarter. NI is earnings before extraordinary items scaled by lagged total assets. ΔROA, SALES_GR, ABWEXP, ABCLAIM and ABGM are expressed in percentages. In the industry model, all variables are measured as the deviation from the industry average of other firms where the industry is defined as the 2-digit SIC level with at least 10 firms in each industry. The robust t-statistics are based on standard errors that are clustered by both firm and quarter. Coefficients on industry and quarterly dummies are not shown.

Table 8 Panel A: Valuation of Warranty Liability Incorporating Growth and Earnings Management (Full Sample)

	Dependent Variable = $PRICE_t$					
	Avoid earnings decline		Avoid loss		Meet analyst forecast	
	Coeff	Robust t-statistic	Coeff	Robust t-statistic	Coeff	Robust t-statistic
$ASSET_t$	1.093	13.22	0.944	9.06	0.992	9.00
$WLIAB_t$	-0.842	-3.43	-1.082	-4.61	-0.890	-3.37
$OTHER\_LIAB_t$	-0.938	-7.60	-0.769	-5.09	-0.806	-5.13
$SUSPECT_t * WLIAB_t$	-1.268	-2.67	-1.832	-2.82	-0.606	-2.86
$SUSPECT_t$	2.841	4.66	6.961	8.50	4.991	8.11
$ANALYST\_GR_t * WLIAB_t$	0.010	3.02	0.014	2.23	0.059	2.76
$ANALYST\_GR_t$	0.043	4.93	0.105	3.93	0.118	3.31
NI_t	13.047	10.00	11.417	7.23	13.450	7.89
NI_Qtr1_t	3.170	6.60	2.883	4.19	3.119	4.86
NI_Qtr2_t	1.717	1.03	1.685	1.76	1.815	1.68
NI_Qtr3_t	2.111	4.01	1.466	3.00	1.556	2.90
Test of $WLIAB_t * [1 + Median(SUSPECT) + Median(ANALYST\_GR_t)] = OTHER\_LIAB_t$						
	F = 0.33	p = 0.56	F = 0.46	p = 0.50	F = 1.23	p = 0.27
Test of $WLIAB_t * [1 + Median(SUSPECT) + Median(ANALYST\_GR_t)] = -1$						
	F = 0.10	p = 0.75	F = 0.59	p = 0.44	F = 2.15	p = 0.14
Adj R^2	0.873		0.880		0.894	
N	4,965		4,954		4,659	

Table 8 Panel B: Valuation of Warranty Liability Incorporating Growth and Earnings Management (Subsample)

	Dependent Variable = $PRICE_t$					
	Avoid earnings decline		Avoid loss		Meet analyst forecast	
	Coeff	Robust t-statistic	Coeff	Robust t-statistic	Coeff	Robust t-statistic
$ASSET_t$	1.157	8.80	1.136	8.52	1.149	7.90
$WLIAB_t$	-4.834	-1.73	-7.540	-2.14	-7.442	-2.05
$OTHER\_LIAB_t$	-0.873	-4.15	-0.815	-3.81	-0.781	-3.30
$SUSPECT_t$ *$WLIAB_t$	-2.145	-2.17	-8.022	-2.14	-1.250	-2.59
$SUSPECT_t$	4.290	1.61	2.358	0.37	1.154	1.77
$ANALYST\_GR_t$*$WLIAB_t$	0.144	0.34	0.121	0.05	0.305	0.57
$ANALYST\_GR_t$	0.131	1.91	0.138	2.01	0.118	1.59
TERM	8.880	3.75	7.747	3.36	6.829	2.66
$TERM^2$	-2.446	-3.98	-2.154	-3.59	-1.931	-2.90
NI_t	23.575	11.55	20.932	10.24	22.065	9.97
NI_Qtr1_t	-1.152	-0.60	-0.668	-0.37	0.978	0.70
NI_Qtr2_t	-2.395	-1.59	-2.315	-1.39	-1.424	-0.77
NI_Qtr3_t	-2.502	-1.44	-2.760	-1.62	-1.744	-0.90
Test of $WLIAB_t$ * [1+ Median (SUSPECT) + Median ($ANALYST\_GR_t$)] = $OTHER\_LIAB_t$						
	F = 0.64	p = 0.42	F = 0.11	p = 0.73	F = 0.13	p = 0.72
Test of $WLIAB_t$ * [1+ Median (SUSPECT) + Median ($ANALYST\_GR_t$)] = -1						
	F = 0.52	p = 0.47	F = 0.16	p = 0.69	F = 0.08	p = 0.78
Adj R^2	0.893		0.894		0.894	
N	1,689		1,689		1,689	

Notes: The above table shows market valuation of warranty liability after incorporating earnings management incentives. The dependent variable is price per share. Coefficients on industry and quarterly dummies are not shown. SUSPECT is defined as SUSPECT_ΔNI in the "avoid earnings decline" regression, SUSPECT_NI in the "avoid loss" regression, and SUSPECT_MEET in the "meet analyst forecast" regression. SUSPECT_ΔNI, SUSPECT_NI, and SUSPECT_MEET are defined as in table 7. All the independent variables except $SUSPECT_t$, $ANALYST\_GR_t$, TERM, and $TERM^2$ are deflated by common shares outstanding. The robust t-statistics are based on standard errors that are clustered by both firm and quarter. TERM is defined as 0 if the warranty duration is below industry median, 1 if it equals industry median and 2 if it is above industry median where industry is defined at the 4-digit SIC level with at least 10 firms in each industry.