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The Feltham-Ohlson Model: Goodwill and Price Volatility

Bachelor thesis

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Abstract

This paper derives and tests the hypothesis that there exists a positive relationship between the amount of unrecognized goodwill a company has in relation to the book value of its equity, and the volatility of the price of its stock and the average trading volume of its shares, and that further this relationship is stronger when the source of that goodwill cannot be traced to items recognized in accounting. The hypothesis is derived from the theory of residual income valuation and the Feltham-Ohlson model of company valuation, and is tested on the accounting and market data of 92 companies listed on the New York Stock Exchange. While the results do not offer sufficient reason to reject any of the paper's hypotheses, they provide only partial support to them, and further research is required.

Abstrakt

Tato práce odvozuje a testuje hypotézu, že vyšší hodnota dobrého jména firmy v poměru k účetní hodnotě vlastního jmění zvyšuje volatilitu ceny akcií a objem obchodování, a že dále tento vztah je silnější, pokud zdroje dobrého jména nemohou být zaneseny do účetnictví. Hypotéza je odvozena z teorie oceňování residuálních přijmů a Feltham-Ohlsonova modelu oceňování společností, a je testována na účetních a tržních datech 92 společností obchodovaných na newyorské burze cenných papírů. Ačkoli výsledky testů nedávají dostatek důvodů k zamítnutí žádné z hypotéz, poskytují jim jenom částečnou podporu, a je potřeba provést další výzkum.

Keywords

unrecognized goodwill, price volatility, Feltham-Ohlson model, trading volume, residual income valuation

Klíčová slova

dobré jméno firmy, goodwill, volatilita ceny akcie, Feltham-Ohlsonův model, objem obchodování, oceňování residuálního zisku

Extent

89 785 characters (49.88 normal pages)

Declaration

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2. I hereby declare that this thesis has not been used to obtain another academic title.
3. I give my consent for this work to be made available for study and research purposes.

In Prague May 19, 2011, signed in my own hand

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V Praze dne **19.5.2011** **Michael Janský**

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Institute of Economic Studies
Bachelor thesis proposal

The following is based on the official proposal handed in at IES FSV UK June 11, 2010. The proposed name of the work was changed to reflect the final title, and the contents of the proposal were changed to reflect the final state of the work.

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Supervisor:	Jiří Novák, Ph.D.
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This paper derives and tests the hypothesis that there exists a positive relationship between the amount of unrecognized goodwill a company has in relation to the book value of its equity, and the volatility of the price of its stock and the average trading volume of its shares, and that further this relationship is stronger when the source of that goodwill cannot be traced to items recognized in accounting.

The hypothesis is derived from the theory of residual income valuation and the Feltham-Ohlson model of company valuation, and is tested on the accounting and market data of 92 companies listed on the New York Stock Exchange.

The main components of this paper are: (i) the theory of unrecognized goodwill, residual income valuation, and the Feltham-Ohlson model, (ii) own work linking the theory to the hypotheses, (iii) the design of the empirical research, and (iv) tests of the hypotheses by means of equality-of-means tests and linear regression.

The basic literature used in the working-out of this paper is the following:

1. Feltham, G. A. & Ohlson, J. A. (1995) 'Valuation and Clean Surplus Accounting for Operating and Financial Activities', *Contemporary Accounting Research*, vol. 11, no. 2, pp. 689–731.

2. Ohlson, J. A. (1995) 'Earnings, Book Values, and Dividends in Equity Valuation', *Contemporary Accounting Research*, vol. 11, no. 2, pp. 661–687.

3. Liu, J. & Ohlson, J. A. (2000) 'The Feltham-Ohlson (1995) model: empirical implications', *Journal of Accounting, Auditing and Finance*.

In Prague June 11, 2010, modified May 19, 2011

Signed

Michael Janský, author

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Jiří Novák, Ph.D., supervisor

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1. INTRODUCTION

This paper tests the hypothesis that the amount of unrecognized goodwill a company has in relation to its recognized equity increases the volatility of the market price of its stock, as well as the traded volume of said stock.

Unrecognized goodwill is a property of a company that is characterized by its intangible[1] nature and by the fact that it is generally thought to impact the value of the company's equity. Some of the more precise definitions of unrecognized goodwill to be found in literature describe it as any asset that is not permitted to be recognized in accounting, but that influences the performance of the company. Goodwill may be recognized as an asset only when it is the product of a merger or acquisition (M&A), in which case it is the premium paid by the acquirer for the target over the fair value of the target's assets. The "recognized goodwill" asset, as this type of goodwill is commonly known, is different from unrecognized goodwill in that it is transaction-derived, arising from the necessity to balance the accounting, whereas unrecognized goodwill is a fundamental quality of the company possessing it.

Common examples of sources of goodwill to be found in literature are the value of brand names, patents, research and development results, business synergies (i.e. the company as a whole being more productive than the sum of its parts would imply, be it a team of workers that work well together, or a certain technological or organizational process that improves productivity by its particular composition), management ability, customer loyalty or confidence, awareness generated by good

[1] Often, the term "unrecognized goodwill" is equivalent to the term "intangible assets". The definitions of goodwill and intangible assets vary across literature. Sometimes they coincide to mean the same, sometimes they do not. In most cases however, one is at least a subset of the other.

marketing, etc. The common denominator of unrecognized goodwill is that it is internally-generated (the term "internally generated" is sometimes swapped for "unrecognized" in literature), i.e. attributable, directly or indirectly, to the efforts of the company. Thus, for example an opportunity created by the opening of borders and markets of an emerging country is not unrecognized goodwill of any market actor. In contrast, an opportunity for higher profit margins on a new product created by the success of its predecessor is unrecognized goodwill of the company in question. Finally, most definitions of goodwill stress permanence: the ability of a company to perform above expectations has market value only if it is lasting.

It is the difficulty to consistently define and/or objectively value unrecognized goodwill, as well as the uncertainty of the materialization of its effects, that is cited as a reason for the prohibition of its entering into the books by many accounting standards. Even if it were possible to accurately define and objectively value goodwill, the valuation may only be performed through expectation of its impact on the company's future performance, and uncertain future benefits are prohibited to be recorded as assets by conservative accounting.

It is this difficulty of description, as well as the uncertain nature of the valuation, of that form the basis for my hypothesis that the amount of unrecognized goodwill relative to book equity increases stock price variance and trading volume. The elementary reasoning behind this is that if goodwill is hard to determine and hard to value, there will be a larger variance in its valuation than in the valuation of the company's recognized properties. To support this reasoning by theory, I have chosen to base my research on the approach to company value known as residual income

valuation (RIV), and its concrete incarnation in the model of Feltham and Ohlson (1995), as the theory of this approach provides a precise and robust apparatus for integrating goodwill into company valuation, as well as for obtaining more precise results about its effects on value.

The remainder of this paper is organized as follows: Section 2 contains the theoretical background of this paper: it provides an exposition of the views on goodwill in literature, and of the theory of residual income valuation and the Feltham-Ohlson model, as well as of the available literature on these two topics. Section 3 summarizes the consequences of the theory for my hypothesis about goodwill and price volatility, and derives additional hypotheses. Section 4 contains the research design and an overview of descriptive statistics used. Section 5 presents results and Section 6 concludes.

2. THEORY

2.1. VIEWS ON GOODWILL

Traditionally, we distinguish between two types of goodwill: recognized, which is recorded on the balance sheet, and unrecognized, which is not. From this point forward, any use of the word "goodwill" shall be taken to mean "unrecognized goodwill" unless explicitly stated otherwise.

As put forward in Introduction, the main characteristics of goodwill are (i) the difficulty of the identification of its sources and, consequently, its estimation, (ii) intangibility and the prohibition of its recognition unless bought, and, for

unrecognized goodwill, (iii) its effect on value, (iv) requirement on internal origin, and (v) requirement on the permanence of a value-related effect for its source to be classified as goodwill. The final requirement rules out transitory effects (such as accounting standards chages, one-time market events, etc.,) as candidates for goodwill components, even though transitory effects may still influence estimates of value as long as they are expected (see Appendices for a discussion of transitory effects and value).

Recognized goodwill may, under most accounting systems, only arise from mergers and acquisitions. That goodwill is defined as the difference between the purchase price of the target, and the fair value of its assets. The reason this goodwill may be recognized is to maintain accounting consistency: the acquirer adds the net fair value of the pruchased assets on their balance sheet under whichever type of assets they are, but if the pruchase price was higher, there has to be a corresponding item created in assets to reflect that the company paid for more than that. That item is the recognized goodwill asset. In this sense, M&A goodwill is essentially a "plug" that keeps the accounting balanced, as is often cited by researchers. Further, by the act of paying for its acquisition, the purchaser accounts for M&A goodwill mark-to-market, i.e. its net present value[2] is zero (as the purchaser has paid for all benefits in excess of fair value that they expect to obtain from the M&A action) and thus M&A goodwill should have no impact on the acquirer's unrecognized goodwill, nor in fact on the value of the acquirer's equity. For this reason, we can focus only on unrecognized goodwill and disregard M&A goodwill in further considerations.

[2] Net present value (NPV) of an asset is the present value of its expected future earnings, less the investment into the asset, i.e. $NPV = -I_0 + \sum_{t=0}^{\infty} Df^{-t} E(x_t)$, where Df is a discount rate, x_t is period earnings, and I_0 is the initial investment, i.e. the purchase price.

Chauvin and Hirschey (1994) note that any internally generated goodwill cannot, for the reason of conflict with the principle of conservative accounting, be recognized, despite being proven to have value. They believe its omission may be in part responsible for the divergence of accounting and market value, which is significant in most stocks today.

The simplest approach is to define goodwill as the difference between market and book value of equity. The approach is as old as Preinreich (1939) and used by many even to this day, e.g. Ahmed and Morton (1998) or Nobes and Norton (1996). However, since the aim of this work is to look for the relationship of goodwill and stock price volatility, using this definition would cause correlation (perfect correlation, barring changes to book value of equity) of the goodwill estimate and market price, ruining the research.

An unpleasant property of the literature on unrecognized (or "economic", as Chewning and Churyk (2003) call it) goodwill is its scarcity. What literature exists on goodwill mostly deals either with recognized goodwill, or the accounting for the same. Still, even from these papers some relevant insights may be gleaned. After all, recognized goodwill should, more or less, stem from the similar sources as unrecognized goodwill, except in that it was purchased, not internally generated (another two terms that reasearchers sometimes use instead of "recognized" and "unrecognized").

For example, Chewning and Churyk (2003) find, in an empirical study based on the FO framework, that recognized, or purchased, goodwill is viewed by investors as an asset of diminishing value, where the rate of value loss is associated with the goodwill amortization policy the firm employs. Henning, Lewis and Shaw (2000) in an extensive (1500+ firms) study of the valuation of the components of purchased goodwill find that the market values the part of acquired goodwill corresponding to the going-concern value of the target about the same they would value any other asset, and that they value the synergistic benefits of the purchase[3] higher than a normal asset. In a recent paper Comiskey et al. (2010) find that negative recognized goodwill does not seem to be valued by investors, however, they admit to their sample (43 business combination trasactions) being rather small (as the relevant data is apparently very hard to get and negative goodwill (i.e. a "bargain purchase") is not overly common).

Results similar to Chewning and Churyk were obtained e.g. by Jennings et. al. (1996). The diminishing value property would be consistent with the assessment that at least some components of goodwill are not of lasting value, even though the composition of purchased and internal goodwill likely differs, if not in nature, then at least in source (purchased goodwill only comes from the part of the acquirer that was formerly the purchased company, unrecognized goodwill comes from the entire company in question, which may or may not have recognized goodwill on its balance sheets). Further corroboration can be found in Bugeja and Gallery (2006), who find that recognized goodwill is only value relevant if it is not older than three years.

[3] "Synergistic effects" here means any effects that the newly purchased target may have on the purchasing company that will cause the consolidated financial result of both to be higher than the sum of the results of the acquirer and target had they stayed separate entities, i.e. had the M&A not taken place. This concept closely parallels the "abnormal earnings" concept used in the FO-derived definition of goodwill.

Although this is likely a matter of investor perceptions and/or integration of the goodwill into the company after the M&A action, it may suggest similar patterns in certain types of internal goodwill as well. On the other hand, Johansson et al. (2010), in an as yet unfinished paper, have found that business combination (M&A) goodwill should not, under normal conditions and conservative accounting, lose value significantly and therefore should not be impaired. However, the study is, pending its completion, only theoretical.

On the topic of goodwill impairment and amortization, that is a point of constant contest among accountants and regulation authorities. The impairment (loss of vaue) of purchased goodwill and the corresponding writedown (amortization) have rather rigid rules and many researchers and practitioners find them lacking. Besides Johansson et al., for example Nwogugu (2009) notes that the recently-adopted IFRS-3R, or the SFAS-141R/142 do not provide sufficient guidance for internally-generated goodwill. Several other papers, e.g. Massoud and Raiborn (2003) discuss the impacts of either of these new standards on accounting practice and/or market and business, although mostly in a positivistic fashion.

Returning to the problem of defining goodwill, van Triest et al. (2008) discuss at length the predicament of goodwill recognition, measurement, classification, and management. They find the current accounting regulations ("goodwill only arises in business combinations"), the predominant view of the wider business community ("goodwill is market less book"), as well as the view of the US Supreme Court ("goodwill is an accounting leftover") sorely lacking. The USSC opinion is due to the traditional sources of goodwill (brand name, market position, etc.) being lately

viewed in official positions as separate intangible assets, and goodwill being systematically narrowed to whatever is left.

For example Chauvin and Hirschey (1994) develop a model where goodwill has, through net income, effect on market value; in this model, goodwill is proxied for by R&D, advertising, market share, tangible and intangible assets (in a weighted sum, with weights being unknown coefficients). They identify R&D, advertising, market position, brand name, and customer loyalty among components of unrecognized goodwill. Including PP&E reserve, R&D and marketing expenditures into sources of goodwill per their advice is quite unproblematic, as all of these are based in accounting figures. Their reason for being looked to as a source of goodwill is that these items are either not recognized due to conservatism (PP&E reserve) or expensed when common sense would indicate that they should be capitalized, as they are basically an investment into future performance (marketing and R&D expenditure). However, what about other components of goodwill?

Ma and Hopkins (1988) define internally generated goodwill in an uncommon and interesting fashion: they view a firm as a dynamic open system, and contend that its value (based on a discounted future earnings stream) is more than the sum of the fair values of its assets, because (i) synergies between the firm's assets arise in the firm as a dynamic system when these assets are employed jointly toward a goal, and (ii) similar synergies arise between the firm's assets and its environment, as the firm is an open system. The value of these two types of synergies is then internally generated goodwill. However, the authors note that such a valuation is subjective and thus unfit for accounting records. Their notion of subjectivity is derived from the

fact that the total value of the firm is considered from the point of shareholders, who are not the only group with claims on the company. It should be noted, though, that this type of subjectivity (investor point of view) is present in all market valuation.

Falk and Gordon (1977), in a reasearch dealing with purchased goodwill and one of the rare papers that actually attempts to define the components of goodwill, write

> "(…) *the total value of these favourable market imperfections and related government regulations is the firm's goodwill. Purchased goodwill is the amount one firm pays another firm for the sum of these assets*." (p. 449)

Falk and Gordon identify 17 characteristics that make up goodwill and test their percieved importance for a business combination decision (i.e. how desirable qualities they are in an M&A target), and have identified the following to be of the highest importance, in descending order: (i) managerial talent, (ii) good labour relations, (iii) the ability to raise more funds, (iv) brand name, (v) production economies, (vi) access to technology, (vii) reducing seasonality and cyclicality, (viii) assurance of supply (through vertical integration).

However, the paper's empirics were based on questionnaires sent to CEOs of US and Canadian companies, and therefore reflect mainly those men's opinions and/or the the point of view of the acquiring firm, having no relation to the stock market. The ranking is based on the average importance grade the CEOs assigned each factor (multiple assignments of the same grade were allowed) on a scale 1-7, with the results being very evenly distributed in the range of approx. 2-6. Also, the sample size was fairly small (66 firms responded in full). There is a significant differential of the first rated (management ability, 5.96 avg.) and the second (labour relations,

5.02). Except for the last (0.72), the remaining differentials tend to be smaller than 0.3. This leads me to suspect that the managers, for the purposes of M&A, are biased to value managerial ability inordinately high (attributable e.g. to professional bias, tunnel vision, or self-importance, depending on how generous one wishes to be with the managers in question), and that the market would value managerial skill lower. As for the other factors, I do not have enough information on the topic to second-guess. Finally, the paper is, by general standards of recency, ancient (1977), possibly making the results obsolete. Despite all that, it is one of the only such divisions of goodwill available, and I believe it should not be ignored at least as a rule of thumb.

2.2. Residual income valuation: Basic Notions

There are many approaches to valuing the equity of a firm, some based on accounting measures, some on measures of market performance. One of the main branches are the so-called naïve models, which are based on generally very simple notions, such as that the average ratio of equity market price to its book value stays the same ("the P/E model"). Another branch are the multiple-based models (based on the evaluation of various ratios of accounting and market figures over time and across industry), and yet another are the discounted dividend/cash flow models, which are among the more complex and popular ones, and are based on trying to determine the income/value stream of the share and the cost of capital to discount it with.

Residual income valuation (RIV) is a primarily accounting-based approach that has spawned several models since its inception in the 1930s. The basic principle of RIV is the valuation of so-called "residual income". Most RIV systems' valuation equations

define present value of equity as its accounting, or book, value, plus the sum of future expected residual income, discounted by some measure of cost of capital.

Residual income is defined as income above what is required to pay the firm's cost of equity, i.e. $I_{res} = NI - ce * bv_c$, where bv_c is the book value of equity and ce is the cost of equity, expressed as a rate (thus the product of the two is the absolute-value cost of equity, CE). Generally-accepted finance theory defines the cost of equity as the opportunity cost of the investor purchasing the equity. Net income is then the measure of the company's realized return, and residual income is thus the excess of net income above the amount required to cover the investor's opportunity cost, or the company's cost of equity. As long as this value is positive, the firm is earning above what it "can be expected" to earn. The reason RIV values only this "excess" of actual over required income is that an investment's net present value (NPV) for the investor is zero if and only if his opportunity costs are paid for by the investment. That, as said above, occurs when realized return equals required return, i.e. when residual income is zero. Any return above the required return then has positive value for the investor (conversely, return below required return implies negative NPV for the investor).

In a setting where a risk-free investment exists, no investor will have a lower return requirement than the return of the risk-free investment, as any investor can always take the risk-free investment and surely get whatever return there exists on it, which is the risk-free return. The actual required rate of return is determined by the model used and by the setting (e.g. a certain vs. uncertain environment). In reality, it is often a function of the risk-free rate and the market premium, such as for example

the formula derived by Sharpe and Lintner in their Capital Assets Pricing Model (CAPM)[4]. Measures of required return are commonly called "cost of equity". The income equal to required return is often termed "normal income" in RIV frameworks. It follows from the theory of NPV, as explained above, that in RIV, income equal to the normal income adds exactly zero value above book to the company's equity, as normal income is defined as such an income at which the investment into the company's stock has zero net present value.

2.3.A Brief History of Residual Income Valuation

The RIV line of thought was pioneered by Preinreich (1938), who in an article concerned mainly with the treatment of depreciation observed that 'Capital value equals the book value, plus the discounted excess profits.' This original RIV is developed almost as a side thought when trying to asses the way the depreciation method and depreciation accounting affect the value of the machinery in question. Despite that, and the age of the work, Preinreich develops a formal apparatus no less rigorous than many today. However, the RIV is mentioned as a corollary of the statements of the main line of inquiry (i.e. a review of the current state of the theory of depreciation) and is not pursued beyond the aforementioned observation.

After Preireich's passing remark, research into RIV had not been picked up until the sixties, when advancements made by Miller and Modigliani (1958, 1961) made it possible to reconcile accounting and analyst measures of value. The traditional market approach had been that dividends are a crucial part of a share's value (as

[4] The CAPM defines cost of equity as the risk free rate plus the market's risk premium times the so-called CAPM beta, which is defined as $\beta = cov(return_{Eq}, return_{mkt})/var(return_{mkt})$. It is one of the most frequently used methods of estimation of the cost of equity under risk and uncertainty.

they are the only actual income the investor receives). Miller and Modigliani (MM) turned the accounting world upside down when they proved that as long as the clean surplus relation holds, dividend policy has no impact whatsoever on the value of a company's stock. This breakthrough enabled researchers to draw value-relevant information from accounting as well as the market, as there now was a way to relate one to the other – no matter what dividend policy prevails at the market at any given time, the estimate of value based on accounting performance will always stay the same thanks to the "MM property". It also closed pointless lines of inquiry where value was being based either on the dividend stream alone, or only on book data. Another result of the works of Miller and Modigliani has been that fLev (financial leverage, or the ratio of balance sheet liabilities to balance sheet equity) has no effect on value, either, as the higher-risk, higher-profitability situation of higher fLev is compensated by a higher rate of return required by the investors in that situation.

The inclusion of the MM dividend policy irrelevance enabled an important step in RIV: the separation of value into the value of financing and operating activities, with financing activities being defined as those that have zero net present value, and operating activities as all other activities, i.e. those that have non-zero NPV. Such a separation is merely a thought exercise, as any balance sheet may be thus separated, provided it complies with the clean surplus condition required by the MM irrelevance. Miller and Modigliani also enabled to supplant dividends by measures of value related to income retained in the company. As they have shown that the effect on value is the same regardless of whether this value was retained or paid out as dividends, one can, without loss of generality, assume that no dividend was (or ever will be) paid out, and work only with the retained income, which in this case is all

income. In the FO, the measure of income utilized is the "abnormal operating earnings" discussed in Introduction, however, most RIV research that is recent and/or sophisticated enough to incorporate the financial/operating division and the dividend irrelevance uses some kind or other of an operations-derived value measure net of costs of capital as the basis of its valuation equation.

This approach to company valuation has been, according to Feltham and Ohlson (1995) used by Edey (1957), Edwards and Bell (1961), and Peasnell (1981, 1982). Peasnell (1982) even creates a rigorous framework employing the idea of "abnormal earnings". Unfortunately, due to the age of the works of Edey, Edwards, and Bell, I have been unable to ascertain the precise contents of these works, beyond that Edey apparently concerns himself with goodwill and business valuation, and Edwards and Bell's work is a book on the measurement of business income, facts in both cases readily apparent from their titles. However, both Peasnell (1982) and Feltham and Ohlson (1995) observe that "research linking accounting to market value is generally unsystematic and scattered in time and among various authors", loosely quoted.

To sum up, the term "residual income valuation" may be, in the context of academic research, applied to models with these basic features: (i) the value of a company is expressed as book value, plus the present value of expected future above-normal profitability, (ii) the MM dividend policy irrelevance is applied to supplant dividends by earnings, (iii) the cost of capital is taken into account when evaluating future profitability, and (iv) the valuation is performed on items with non-zero net present value, which are the residue of the separation of the balance sheet into zero- and non-zero-NPV items. The last item is optional, but preferrable (see above).

2.4. The Feltham-Ohlson Model: Basic Notions

Having explained the theory of residual income valuation, let me advance to the Feltham-Ohlson model. The Feltham-Ohlson model is a model of residual income valuation first proposed by Feltham and Ohlson in 1995, and among the various other RIV models it stands out not only by its recency, the generally positive reception by the scientific community, and the relatively large volume of literature based on it, but also by its robust theory, its flexibility and applicability to a variety of situations, and the possibility to derive detailed consequences from its basic premises, all while maintaining relative simplicity in statement and assumptions.

The model defines the value of a company's equity as a sum of the book value of equity and the present value of its expected future residual operating earnings. The main improvements above the RIV mainstay are the division of activities into operating and financial, and the stochastic process that is assumed to generate residual operating earnings. This process provides a synthesis of accounting and market information: residual operating earnings are a function of operating assets, previous-period residual operating earnings, and "other information". The process is linear and contains first-order autoregressive (AR(1)) elements. The "other information" variable provides the linkage to market: while the model does not define its contents, the proxies usually assumed in empirical research are analyst opinions and/or market expectations.

For the remainder of this paper, I am going to use the terminology that Feltham and Ohlson use in their 1995 and subsequent papers: the residual income from (all)

operating activities is termed "abnormal operating earnings", where "abnormal" is, according to the authors, a contraction of "above normal". Conversely, the normal income from operating activities is termed "normal operating earnings", when applied. The sum of the two is, as is traditional in accounting, termed "operating earnings". Alternatively, "income from operations" may be used instead of "operating earnings" in all of the above. The notation is x for earnings, ox for operating earnings, x^a for abnormal earnings, and ox^a for abnormal operating earnings. Abnormal operating earnings ox^a is the key item in the model's valuation equation, and most of the model's theory refers to it, rather than the other measures of income mentioned above.

The Feltham-Ohlson model is more than merely the latest incarnation of RIV – for the first time in RIV, it enables market expectations and other factors exogenous to the company and its accounting to enter valuation, while maintaining the conceptually clean, formally rigorous setting for which the RIV approach is so appealing. Let me first introduce the formal expression of the model, then explain. The basis of the FO framework is this model developed by Ohlson (1995):

$$V_t = bv_t + \alpha_1 x_t^a + \beta_1 v_t$$

$$x_{t+1}^a = \omega_{11} x_t^a + v_t + \varepsilon_{1t+1}$$

$$v_{t+1} = \gamma v_t + \varepsilon_{2t+1}$$

where V is stock value, bv is book value of equity, x^a is abnormal earnings, v is other information, ε_i are random, zero-mean disturbance terms, and ω_{11} and α, β, γ are the model's coefficients,

and its immediate refinement co-authored by Feltham and Ohlson (1995) published as a "double-feature" in the very same issue of Contemporary Accounting Research:

$$V_t = bv_t + \sum_{\tau=1}^{\infty} {R_F}^{-\tau} E_t[o\tilde{x}^a_{t+\tau}]$$

$$o\tilde{x}^a_{t+1} = \omega_{11} ox^a_t + \omega_{12} oa_t + v_{1t} + \tilde{\varepsilon}_{1t+1}$$

$$o\tilde{a}_{t+1} = \omega_{22} oa_t + v_{2t} + \tilde{\varepsilon}_{2t+1}$$

$$\tilde{v}_{1t+1} = \gamma_1 v_{2t} + \tilde{\varepsilon}_{3t+1}$$

$$\tilde{v}_{2t+1} = \gamma_2 v_{2t} + \tilde{\varepsilon}_{4t+1}$$

where V is stock value, bv is book value of equity, R_F is the risk-free rate of return, ox^a is abnormal operating earnings, $\sim$ signifies estimated values, oa is operating assets, v_i is other information, ε_i are random, zero-mean disturbance terms, and ω_{ij} and γ_i are the model's coefficients. Please note that all items designated "income" or "earnings" throughout this paper are net of tax, unless indicated otherwise.

Obviously, the original Ohlson model has the (i) – (iii) properties of RIV mentioned above, however, it lacks the separation into operating and financial activities. What it has in excess of the RIV baseline, however, are the two latter equations. The first states that the abnormal earnings follow a first-order autoregressive (AR(1)) process, which is a refinement above the basic assumptions of RIV theory. Even more

importantly, the process is modified by the presence of an "other information" coefficient, which is also first-order autoregressive. Ohlson calls this combination of AR(1) abnormal operating earnings generation and AR(1) other information corrections a "linear information dynamic" (LID), and it is probably the FO framework's greatest conceptual improvement above the standard run-of-the-mill RIV, as it enables one to link the best (arguably) of accounting-based valuation, i.e. the formal precision and straightforwardness embodied here by RIV, to the market forces that most believe also determine value.

In fact, there have been purely market-based approaches, whose adherents maintained that the information contained in accounting has no impact on value whatsoever. Counter to this, the market-based approaches have been criticised countless times for the lack of any theoretical foundation, and for a weak linkage to real performance and hard data. The FO framework is the first to build on the solid foundations of accounting, and make room for the formidable forces of the market to influence valuation as well.

Returning to the explanation of the models, the Feltham-Ohlson (1995) version is a more precise and concrete statement of the same basic logic. This variant does contain the division into operating and financial activities, with financial activities being those that are irrelevant for value, i.e. zero-NPV. The valuation equation now includes a discounted infinite series of abnormal operating earnings expectations, and while the LID with its AR1 processes has been maintained, it has been expanded to also contain operating assets as a codeterminant of future abnormal operating earnings. Note that now both the operating assets and abnormal operating earnings

are generated in the same fashion, both with autoregressive other information terms, which are independent of each other. Both the Ohlson and Feltham-Ohlson LIDs further accomodate the presence of random, zero-mean disturbances, enabling the data-generation process to be stochastic instead of deterministic.

Since this paper will not explicitly work with the models, I refer those interested to the articles of Feltham and Ohlson for detailed exposition and in-depth analysis. What remains to be mentioned here are the assumptions the models require to hold. They are surprisingly few, a property often noted by reviewers, as well as the authors themselves. The only actual assumption of both models is the clean surplus relation (CSR), which is required for the valuation function to be valid (otherwise, MM would not hold and the switching of dividends for other value measures would not be possible). It has been stated by Ohlson (2000) that in the real world CSR does in fact not hold in general, due to "renegade" items on the balance sheet, and that the best one can hope for is the "dirty surplus relation", which however is incompatible with the model. Thus, any RIV-based valuation will be imprecise. This shortcoming is however somewhat mitigated by the fact that these renegade items tend to be small in comparison to the total value of the firm's equity, and therefore the imprecision caused by their presence can be expected to be quite small as well.

In the articles of Ohlson (1995) and Feltham and Ohlson (1995) one will further find a series of assumptions in the form of certain accounting relations required to hold, the most important being the so-called financial assets relation (FAR), by means of which operating activities are separated from financial in Feltham and Ohlson (1995). However, these relations may be achieved on any balance sheet by design –

one simply redefines the notion of "financial asset" to comply with the FAR, that is, to fulfill the already mentioned condition of an asset being "financial" if and only if it is zero-NPV. The other assumed relations then follow from the FAR and CSR.

The third type of "assumption" present are the model's limitations: the investors are considered risk-neutral and systemic risk is nonexistent. That is why the valuation equation contains the risk-free rate as the discout factor, instead of the intuitive option of market cost of equity. Obviously, a risk-free environment is not the case in the real world, however, Feltham and Ohlson (1995) note that if the model were to be applied in real-world conditions of risk and risk-aversion, then this would be done by adjusting the expected value operator in the valuation equation for risk (risk-adjusted expectations), *not* by substituting cost of equity under risk for the risk-free rate as the discount factor. They show why that is so based on the model's theory. Uncertainty, as opposed to risk, is included in the original model already, in the form of the expectation operator itself[5]. There has also since been a generalization of the model by Feltham and Ohlson (1999) which includes risk and non-flat interest rates that follow stochastic processes, which can be obtained by restating the 1995 model with just one extra parameter in the LID. The logic and other features of the model stay the same.

There is, however, one remaining problem with the model: what exactly is the "other information"? It has already been said that this vector exists to link the accounting data in the model to market forces, and as such can accomodate practically any

[5] The E (·) operator is in itself a resolution of uncertainty. Consider that if the future were certain, there would be no need for any "expectations" at all, because the future realizations of the relevant variables would already have been determined to materialize at some precise value with probability p=1.

information exogenous to the company believed to influence value. However, researchers are far from united on the exact operationalisation of the concept, some to the point of leaving the entire LID out when testing the FO models.

To make the discussion of model variants complete and conclude this section: Further work was done to tackle conservatism by Feltham and Ohlson (1996) in developing a variant of the model which is based upon the same principles, but restated so as to be expressed in cash flows instead of accruals (which is permitted by FO (1995)) and the valuation equation now contains three separate parameters that capture various effects of conservatism, which is here allowed to only take the form of depreciation policy. Also, the v_t vector is concretized somewhat, so that now it represents i) information about cash reciepts, and ii) other information about future investments.

A possibility for comparison is the model of Ang and Liu (2000), which is based on the FO, but is more an alternative than an extension, as it contains no LIM and approaches the task somewhat differently (retaining, however, present value of expected dividends; and RIV in its core specification). The model is less parsimonious, but provides a way to account for dirty surplus, as well as the possibility to derive a continuous case.

The final major contribution to the FO line so far is the model by Begley and Feltham (2002), based on FO (1995) and FO (1996) and incorporating the suggestion of Liu and Ohlson (2000) to use analysts' predictions of future residual (abnormal) operating earnings as proxies for the v_t vector. The LIM and valuation function

remain simple, however the relations between the various coefficients in the model are more complicated than in the others.

2.5. Empirical Results on the Feltham-Ohlson Model

The testing of the hypothesis put forward in the introduction does not require any modifications to or application of the Feltham-Ohlson model. The model is merely used as a theoretical backing of the hypothesis. However, the hypothesis is extensively dependent on the model's theory, and therefore I must assume that the Feltham-Ohlson model holds. That is certainly a strong assumption, and while I cannot prove it, it is necessary to at least cover the empirical and review literature published on the model since its inception to make clear how much that assumption may be overstated. There have been several empirical papers testing the various forms of the FO model. The properties most commonly tested are (i) the relational and dynamic properties attributed to the model's constituent elements in the papers by Feltham and Ohlson (which are among the more sophisticated results of the model and not discussed in this paper), (ii) whether the valuation equation conforms to observed data, (iii) whether the LID conforms to observed data, and (iv) predictive power over stock price movements.

Among the tests of the models' finer points, a paper by Ahmed and Morton (1998) tests on a sample of about 900 firms by using real-world data to estimate the value drivers (abnormal operating earnings and operating assets) of the FO (1996) model, then testing for rank-order correlations with the underlying accounting items that the model assumes generate these value drivers. There are also further tests regressing parameters on each other where a linear relationship between them is

implied, and repetitions of these tests for different statements of parameters. Overall, Ahmed and Morton find the results to conform with the model's theoretical properties with good significance and robustness. Similar results regarding the conformity of empirically estimated coefficients with model theory are reported by Dechow et al. (1999) working with the original Ohlson model where analyst forecasts are used as proxies for the "other information", an approach endorsed and suggested by Liu and Ohlson (2000), and since frequently used. Callen and Segal (2005) in a more recent and extesive (3500+ firms) study find the coefficients of the FO (1995) model with other information again proxied for by analyst expectations mostly conforming as well, with one exception where a coeffcient has the wrong sign. Again included are tests of various restatements of the model's parameters, which turn out favorably. The statistics used in these papers are mainly rank correlations of parameters and their determinants, linear regressions between various parameters, and tests of equality of means for theoretical elements of the model and their empirical estimates.

The tests of the plausibility of the model's valuation function may be found in Ahmed and Morton (1998), who find that the valuation equation of FO (1996) conforms to empirical data in that goodwill is a function of beginning operating assets and abnormal operating earnings, and so do some finer points of the implied dynamics of the function. Dechow et al. (1999) find that the original Ohlson (1995, with analyst expectations) model's predictions of value are superior to models that either lack the LID, use only earnings (without book values), or don’t use accounting data at all. Callen and Segal (2005) find that the valuation function of FO (1995) with analyst

expectations estimated from real data conforms to theory with exceptions, namely two auxiliary coefficients being outside the limits implied by the model.

The LID of Ohlson (1995) is extensively evaluated by Ota (2002). He develops seven modifications, differing in the order of the AR process used (second- and third-order instead of first-order), or the treatment of the v_t vector (zero or non-zero constant). These are then used to predict stock prices, and regressions are run on the results and compared. He finds that of the six modifications, only one dominates the original specification with v_t set to zero. That one is a specification with an AR(1) process, v_t set to zero, and the effect of v_t modelled by serial correlation in the error terms (GLS-GRID method). The result is valuable because it shows i) that v_t matters, ii) that increasing the AR process order doesn't help, iii) that while it is very hard to find a reliable proxy for v_t and constant or zero functions are not it, v_t may be, at least partially, circumvented through modelling serial correlation in the error terms instead. However, enthusiasm is premature, as the improvement is only marginal (about 5% of added R-squared). Richardson and Tinaikar (2004) also mention the *other information* problem, and while they are aware of the analyst forecast proxying, they find that to function well, so many periods ahead must be used so as to render the solution infeasible in practical application, as (i) getting the data may become a problem and (ii) even if one does, so much forecasting eventually "crowds out" the accounting-based parts of the model, essentially turning it into a fancy capitalized earnings model. The forecasts of the independent private analyst firm Value Line are suggested as a good choice for analyst information.

Hand and Landsman (1998), in a paper reacting to the strong critique of omitting other information found in Ohlson (2000) (taken by Hand and Landsman from its first publishing as a working paper in 1998) find that the original Ohlson (1995) model yields empirical results contrary to theory both when the other information is zero and when it is included as the difference between a fully rational expectation of abnormal earnings and a completely naïve, autoregressive one (this approach is chosen because proxies that would enable to measure all non-accounting valuation-relevant information (i.e. the "true" v) ex ante are effectively impossible to find in the real world). While this satisfies Ohlson's (2000) criticism of not including other information, and of not dealing with expectations about earnings, the results are still in contradiction to the model's underlying theory. Hand and Landsman believe this is due to either (i) dividends actually being value relevant, i.e. Miller-Modigliani not holding, or (ii) that accounting captures market-based determinants of value significantly better than previously thought, or (iii) that the importance of non-accounting imformation for valuation is much lower than currently thought. Both suggestions (i) and (iii) are in contradiction to the arguments I use to underpin my propositions about goodwill and price volatility, and hence, if my tests result in failure, can be looked to for possible explanantions.

Finally, the sore point of the Feltham-Ohlson framework: Considering its sophistication and the appealing ability to reconcile accounting and market determinants of value, the model delivers a rather disappointing performance in stock price prediction. This is found by Dechow et al. (1999) for the original Ohlson model. Richardson and Tinaikar (2004) find that while the 1995 FO model is generally superior to simpler restatements of the FO framework, as well as some

non-FO models, the original Ohlson variant of the model has generally better predictive power than any FO-1995-based model, despite not being able to capture accounting conservatism, and even that is still inferior to a P/E model. Callen and Segal (2005) find basically the same: FO-1995 is comparable to Ohlson (1995), and both are inferior to a naïve model. The reason is unknown: Dechow et al. suggest this may be because of stock traders paying too much attention to analysts and too little to financial statements, Callen and Segal theorize that it is because the model doesn't incorporate frictions like taxes, information asymmetry, bankruptcy costs, etc. No conclusive evidence exists.

Putting together the empirical results in the four areas of the model discussed above, the evidence seems to show that the Feltham-Ohlson framework is structurally sound, sufficiently robust and internally consistent, that the valuation equation is based in fact and that the LID is a helpful and useful element, despite the widely-acknowledged problems with reliably operationalizing the link to market through the *other information* vector. Despite these favorable results, the model fails to impress in predicting stock prices, and is even inconsistent in that the much simpler Ohlson (1995) version doesn't seem to predict prices any worse than the more sophisticated later specifications. While the situation is rather unpleasant, considering the high hopes many have for the FO framework (e.g. Bernard (1995)), it is not completely contradictory. The model itself is designed to measure *value*, not price. There is a difference. Market price is prone to investor mispricing and misperception, which the model is not designed to explicitly work with. Also, the market is a fluid place, and changes virtually every day. Accounting values change quarterly at best. If one wanted a realistic price prediction, one would have to change

the *other information* coefficients in the model daily, which would make for some rather tedious work.

So while of course there always is the undeniable possibility that the model simply is a bad approach or omits some important factor, it is not a necessity. I personally believe that if the model were bad, it would not have generated such good results in the tests of robustness and structure, discussed above. In fact, I believe that the model would, granted a good treatment of the "other information", have the potential to be very accurate at measuring *value*. However, such a theory is not easily verifiable, as "real value", as opposed to realised market price, is a theoretical concept that is not measurable (although there exist approximation methods, such as intrinsic value). Also, even though the evidence is inconclusive (as there are other explanations just as likely at this point), the findings regarding the model would be consistent with a situation where the FO framework captures value well, but market price oscillates around "true value" at least partially due to mispricing, misperception, and general difference of opinion among investors.

Despite the problems, the FO models have received generally favorable reviews: The first review ever written on Ohslon (1995) and Feltham and Ohlson (1995) is Bernard (1995), published in the very same issue of Contemporary Accounting Research (CAR). Bernard, very enthusiastically – some say too enthusiastically (Lo & Lys (2000)) – credits Ohlson with not only reviving interest in RIV and accounting-based valuation as a whole (after two decades of market approach dominance), but also with laying firm foundations others can build upon, and foresees a bright future fot the Ohlson approach. Bernard additionally finds the model vastly superior in

predictive power, but this has since been called into question: Lo & Lys (2000) criticize Bernard's reasoning specifically, other empirical results that contradict Bernard in fact are mentioned above.

Liu and Ohlson (2000) discuss empirical issues connected to the FO (1995) model – they argue that *expected*, as opposed to current earnings and book values contain better information and should be used in the model (both alternatives are allowed by the framework for periods where realized data is available). Ohlson (2000) surprisingly criticizes his own creation, on the grounds that in the real world the clean surplus relationship does not hold, and therefore per share values should be used instead of the total ones. Moreover, he proposes that only *earnings per share* should be used for valuation and that book values should be dropped completely, which goes against the core principles of all his other work on this model. He also states that not only is RIV not the only valuation approach (which is obvious), but that he believes it may even not be the best one.

Richardson and Tinaikar (2004) extensively review the entire field of accounting-based valuation over the decade since Ohlson (1995). The FO functions as a "red thread" throughout their paper. They find worth in the FO model as a benchmark and starting point, in the sense that any modified model must prove that it can surpass the FO to "earn its keep". They discuss the difficulties in integrating conservatism, especially with regard to the multiple forms it can take, and remark that few models actually try to capture conservatism in any meaningful way, and the few that do are mostly beaten even by the unbiased-accounting Ohlson model in predictive power.

To briefly summarize the most important points of the review and empirical testing literature, the scientific community in general appears to value the FO as a starting point, benchmark, and unifying theory. Most find that it performs better than other RIV models, but still inexplicably loses out to some naïve models. Also, the biggest problem of the model remains the *other information* vector which, although apparently crucial for proper valuation, is very hard to proxy for reliably. Although analyst information has been suggested and tested, there are still problems.

3. RESEARCH OBJECTIVES

3.1. LINK TO THEORY

We have covered all of the theory relevant for formulating my hypothesis. What remains now is to actually link the two together. The first hypothesis of this paper, as put forward in Introduction, is that a higher amount of goodwill in relation to book value of equity implies higher stock price volatility and higher trading volume. Let us begin by evaluating first the relationship between goodwill and stock price variance, as the extension to trading volume can then arise as a corollary.

We shall begin with the valuation equation of the 1995 Feltham-Ohlson model:

$$V_t = bv_t + \sum_{\tau=t}^{\infty} {R_F}^{t-\tau} E_t[o\tilde{x}^a_{t+\tau}]$$

or, in words, the value of equity is equal to the book value of equity plus the sum of future expected abnormal operating earnings (notation as established in Section 2). For the remainder of this paper, we will disregard the linear information dynamic (LIM, the data generation process of the model), except where expressly invoked.

This does not constitute an error, as at no point does this paper actually derive value or its constituent elements specified in the LID. Rather, I only assume that the expression of value specified by the above equation is true. We shall futher assume that the Feltham-Ohlson model holds insofar that the value returned by this equation is the "true" value of the company's stock.

The point can be made that the book value of equity is the simplest to examine: the equation does not require book value to be an expectation (though it would permit it, as the authors show in one of the later papers that deal with the model), and uses current, i.e. realized, book value. That means there is no uncertainty about book value involved in the valuation, and while book values of course can change in time and thus exhibit some "natural" variance, this variance is equal to the item's total variance. Simply put, book value only changes the total value of equity when a change in book value is realized. There is no educated guessing and no assumptions involved in this component of value.

The other component, the sum of future expected abnormal operating earnings, however, is not nearly as simple. It contains expectations about uncertain future, which by themselves may vary over time as circumstances develop. That alone adds a degree of freedom to the variance of this element which is not present in realized book values. It is still possible that the two terms of the valuation equation will be negatively correlated, which would ruin any hypothesis about the second term's indivudually larger variance increasing the variance of the whole, and even though this is another point where the hypothesis is not robust, I see no reason why the two terms should be negatively correlated.

Next, I will show a particularly appealing result that is one of the main reasons I have chosen the Feltham-Ohlson model: that in the Feltham-Ohlson framework, the term $\sum_{\tau=t}^{\infty} {R_F}^{t-\tau} E_t[o\tilde{x}^a_{t+\tau}]$ from the valuation equation is equal to the company's unrecognized goodwill. The proof starts with the FO's separation of operating and financing activities. As discussed in Section 2, Feltham and Ohlson (1995) show that any company's assets may be separated so that the net present value of all financial assets is zero, i.e. financial are those assets that are accounted for mark-to-market. The residue, i.e. assets with nonzero net present value, are then classified as operating. This separation is merely a thought exercise and may be performed on any balance sheet. It allows to concentrate in valuation only on operating assets, since, as discussed in Introduction, an asset with zero net present value will not be seen by an investor to influence the value of the company. Feltham and Ohlson further show that this separation, as performed in greater detail in their paper, satisfies the properties of Miller-Modigliani irrelevance, and MM's twin results of dividend policy and financial leverage irrelevance for valuation apply.

Thanks to this separation, we can value operating earnings instead of total earnings. Financial income will always be zero because the return on financial assets is by definition of these assets the normal return. Hence also abnormal operating earnings are always equal to total abnormal earnings. Further, as shown in Introduction and Section 2, normal income from operations also has exactly zero value for the investor, as it only serves to equal their required return (i.e. cover their opportunity costs). Therefore, the only component that impacts share value is abnormal operating earnings. In the beginning of Section 2, several definitions of goodwill

were given. Now, in the context of the FO framework, we can define goodwill more precisely as the source of the abnormal operating earnings.

That is, one can imagine the hypothetical situation where all operating assets only have a return equal to the required, or normal, return, and there is an extra asset on the balance sheet which each period provides the difference between the normal return generated by the company's operating assets and the total return generated by the company, i.e. which provides each period's abnormal return. Since this hypothetical asset was acquired for free (no expense was ever incurred in its acquisition that could be attributed to it, as the asset is a hypothetical construct), its net present value equals the present value of the sum of its expected future returns. And as those returns are defined to be period abnormal operating earnings, the net present value of this asset is equal to $\sum_{\tau=t}^{\infty} {R_F}^{t-\tau} E_t[o\tilde{x}^a_{t+\tau}]$. Thus, goodwill is consistently defined as the internally-generated unrecognized asset which is the source of the company's ability to produce abnormal earnings. By that definition, the present value of expected future abnormal (operating) earnings *is* goodwill. We can therefore write $gw_t = \sum_{\tau=t}^{\infty} {R_F}^{t-\tau} E_t[o\tilde{x}^a_{t+\tau}]$, and finally

$$V_t = bv_t + gw_t$$

where gw is goodwill.

Since we have identified the second term of the FO valuation equation with goodwill, we can extend to goodwill our earlier result about higher variance, originally derived for the sum of future expected abnormal operating earnings. We can now also apply

the results on goodwill from Section 2. Namely, it is my contention that since sources of goodwill are difficult to identify and value, and since goodwill is intangible and unobservable until its results materialize, assumptions about outcomes of future events, which are uncertain at present, must be made in its valuation, and also assumptions about the nature of the intangible sources of goodwill must be made. Neither of these two types of assumption can be *ex ante* determined as either true or false, and therefore discretion is possible, adding another degree of freedom to the valuation of goodwill: not only is the value of goodwill uncertain because its value will only manifest in the future, as derived earlier ("objective" uncertainty), but also because discretionary judgements are possible and required in its valuation that may take a range of values among which the *ex post* true value cannot be *ex ante* known ("subjective" uncertainty).

In less formal speech, bias may and likely will arise in valuing goodwill because the circumstances that determine its value lie in the future and cannot be known in the present. Among different investors at the same time, this bias will likely take a range of different values, which will influence percieved value as the final vector of that bias (the "average market opinion" at the moment) need not be constant over time. That is, at any one time the result of the total market bias may be different in both direction and magnitude than at some different time. While in the long term, the bias can be expected to converge to zero, its short-term presence will still increase the volatility of the value of the stock, even though in this case only the value percieved by the market, not the "true" value, will be affected.

The final step that remains to reach my first hypothesis is to relate value to price. To that end, I am assuming efficient markets, that is, value as currently percieved by the consensus of the market is always translated into price. That assumption is not in conflict with the "bias effect" described above, as the efficient markets assumption states that all *available* information is included in price, and I have discussed that the bias effect arises from the unavailability of certain information (namely, information about sources of goodwill and about outcomes of future events). Efficient markets incorporate the assumption of no arbitrage (which is also required by the Feltham-Ohlson model). Finally,

PROPOSITION 1

There is a positive relationship between the ratio of unrecognized goodwill in relation to the book value of equity, and stock price volatility.

Before we move on, let me sum up my assumptions so far: (i) efficient markets, (ii) no arbitrage in financial markets, (iii) the Feltham-Ohlson model's valuation equation expresses the "true" value of a company's stock, (iv) book value and goodwill are independent, (v) the clean surplus relationship holds, (vi) the Miller-Modigliani irrelevance theorem and its corollaries hold. Efficient markets also contain the tacit assumption that investors value stocks rationally, i.e. with their best possible estimate of its true value. While that may seem trivial, it is actually a strong assumption that is cited (or at least implied by default) as the possible explanation for negative results in virtually every paper in the field.

3.2. ADDITIONAL HYPOTHESES

With the apparatus we have developed in the preceding subsection, it is now easy to derive a corollary for trading volume from Proposition 1:

COROLLARY 2

There is a positive relationship between the ratio of unrecognized goodwill in relation to the book value of equity, and stock price volatility.

It is easy to show that on both of our degrees of freedom derived for goodwill and price volatility, i.e. the "objective" and "subjective" uncertainty of the value of goodwill, opportunities are created for trading volume to rise by the same mechanisms that increase price volatility. Since "objective" uncertainty means the "true" value of the stock can change in time on 2 instead of 1 degrees of freedom (realized and expected), then under our assumptions listed above and *ceteris paribus*, the stock's value, price, and return relative to the rest of the market can change in time on 2 degrees of freedom. When a stock's return relative to market changes, it should increase the volume of that stock traded, as the stock becomes either more or less advantageous to buy or sell, or in other words, the market equilibrium will shift. The third degree of freedom is again added by the bias effect, as in establishing the "market average bias" the investors will trade the stock amongst themselves, based on the fact that some value it higher than others. As the bias vector changes in time, the arbitrage is carried out for each instance.

To derive further results, we must turn to the determination of the sources of goodwill. Based on the literature review in Section 2, we can safely say that there are many sources of goodwill cited, and very little consensus. However, a dividing line

may be drawn in the nature of the various sources of goodwill: some of them can be traced to accounting values, while others are purely exogenous to accounting (but not to the company's activities).

Prime examples of the accounting-based goodwill measures are (i) reserves in the valuation of book assets due to conservative accounting, and (ii) items that can be argued to have lasting effects on performance, but are required to be expensed. Sub (i), that is primarily the so-called PP&E reserve, defined as the difference between the market value of fixed assets, i.e. the price at which these could be sold on the spol, and their depreciated accounting value. The latter is determined by binding accounting principles, while the former is determined by market conditions and, due to conservatism, is usually higher. Sub (ii), those are mainly marketing and research and development expenses. These both influence the current and future ability of the company to turn a profit, and could be considered investments into future profitability rather than expenditures, and accordingly capitalized.

Examples of the non-accounting sources are items such as brand name, customer loyalty, or market position. The value of brand name is usually defined as the value of the difference of the profit margin on brand sales compared to sales of a comparable but brand-generic ("no-name") product. This approach is presently being taugth by A. Damodaran, even though no peer-reviewed paper on the methodology as yet exists. Also, private analysts such as the Interbrand Corporation, which compiles the annual Bloomberg Businessweek Top 100 Best Global Brands list. Customer loyalty can be defined as the subjective preference of a customer for the product of a particular brand over a comparable (or even better) product of a different brand or a

brand-generic product. The Interbrand list, for example, includes customer loyalty in its measure of brand value, as far as can be determined from the available details on the proprietary methodology.

Arguments for the value of market position can be found in microeconomics, where a monopoly is able to sell with a higher producer surplus than a company under perfect competition. Even though perfect competition does not exist in reality and no other world-states except the current one can be observed for comparison, it is logical to assume that the closer a firm is to monopoly, the more value that position has as compared to a position where all market actors have the same market share, measured by the difference in earnings under the two scenarios. Again, only the exsting situation can be observed, which makes the value of market position difficult to express.

There is one more contention to be made: let us denote accounting-based goodwill, represented here by the PP&E reserve, and capitalized marketing and research and development costs, as goodwill of the first type, gw_1 , and the non-accounting-based measures such as brand name, customer loyalty, and market position as goodwill of the second type, gw_2 . Then

PROPOSITION 3

Goodwill of the second type increases, per unit of its value, stock price volatility more than goodwill of the first type.

And from Propositions 1 and 3 and Corollary 2:

COROLLARY 4

Goodwill of the second type increases, per unit of its value, trading volume more than goodwill of the first type.

The reasoning for these two hypotheses is an analogy to the reasoning employed for the similar relationship between goodwill and book value of equity. Because gw_1 has basis in accounting fact and can be extrapolated into the future from a realized past time-series, and is further within the discretionary power of the company to influence for R&D and marketing expenditures, or set partially by relatively static accounting standards and/or legal policy for the PP&E reserve, the overall number of assumptions required in expectations about its future realized benefits is lower compared to gw_2. For gw_1 there exists a firm point of reference for future realizations, constituted by the fact that the current realization of this type of goodwill source is directly observable, whereas for gw_2 the only observable quality is the result in the form of abnormal earnings, not the goodwill source itself. That removes, at least for the current period, one degree of freedom on the variance of value of gw_1 by providing a certain present-time baseline, and reduces the likely variance added by the other degree of freedom (the magnitude of bias) as well.

Especially important is the qualitative distinction that gw_1 is directly observable once realized, but for gw_2 the observable quantity is only the *effect* of it on realized earnings. While the quantitative effects of observable baseline for future expectations would converge to zero as estimation methods got better (so that eventually the expectations of the effect of gw_2 would attain the same level of

certainty as those of the effect of gw_1), the qualitative effect of direct observability is rooted in the nature of the division into the two types of goodwill and cannot be "guessed away". That is, gw_1 is only uncertain because its value is dependent on future events, whereas gw_2 is not only dependent on the future, but also unobservable at all times. In yet other terms, no assumptions need be made on the nature of the sources of gw_1 , in contrast to gw_2 .

Finally, to ensure maximum hypothesis robustness, the issues of business combinations (M&A) goodwill, the effects of transitory earnings and taxation should also be addressed. Please turn to Appendices for a discussion of these three topics.

Figure 1: Types of goodwill considered for testing

Goodwill		
1	**→Recognized**	
	a) M&A (not tested)	
2	**→Unrecognized**	
	2.1	**→1st type**
		a) Hidden PP&E reserve
		b) Capitalized R&D expenditure
		c) Capitalized marketing expenditure
	2.2	**→2nd type**
		a) Brand name
		b) Customer loyalty
		c) Market position

4. RESEARCH DESIGN

4.1. ASSUMED STRUCTURE OF DATA

Our first task in designing an empirical study that would evaluate my three hypotheses is to formally express those hypotheses. Proposition 1 and Corollary 2 can be formalized as follows:

$$vol_p(x) = \beta_0 + \beta_1 \left(\frac{gw(x)}{eq(x)}\right) + \varepsilon$$

and

$$V(x) = \gamma_0 + \gamma_1 \left(\frac{gw(x)}{eq(x)}\right) + \nu$$

where

$$\beta_1 > 0 \quad \text{and} \quad \gamma_1 > 0$$

respectively, where vol_p is the volatility of stock price, V is the trading volume of the stock, and x is the stock in question. Volatility is mathematically best defined through variance, but I purposely avoid writing the relationship as a sum of variances, because then I would have to deal with covariance between the non-goodwill and goodwill-related elements of these relationship, as well as precisely quantify the relationship. That may be possible for a single stock, but likely not generalizable, and also such a level of precision is not necessary to test my hypotheses.

If we assume a structure of price volatility and volume as seen above, and the division of goodwill into gw_1 and gw_2 , we can formalise Proposition 3 as

$$vol_p(x) = \beta_0 + \beta_1 \left(\frac{gw_1(x)}{eq(x)}\right) + \beta_2 \left(\frac{gw_2(x)}{eq(x)}\right) + \varepsilon$$

and

$$V(x) = \gamma_0 + \gamma_1\left(\frac{gw_1(x)}{eq(x)}\right) + \gamma_2\left(\frac{gw_2(x)}{eq(x)}\right) + \varepsilon$$

where

$$\beta_1 > 0 \quad \wedge \quad \beta_2 > \beta_1$$

and

$$\gamma_1 > 0 \quad \wedge \quad \gamma_2 > \gamma_1$$

,and where obviously the coefficients β and γ are different from the ones in the representations of Proposition 1 and Corollary 2 above, despite being designated by the same letters.

Having formally expressed the propositions, we further need to define the components of goodwill. Based on my earlier discussion of the topic, we can write

$$gw_1(t) = Res_{PPE}(t) + CME_{CP}(t) + CRD_{CP}(t)$$

and

$$gw_2(t) = Brand(t) + cLoy(t) + mPos(t)$$

and

$$gw(t) = gw_1(t) + gw_2(t)$$

where Res_{PPE} is the current value of the PP&E hidden reserve, CME_{CP} is the current portion of capitalized marketing expenditure, i.e. the portion recognized at time *t*, CRD_{CP} is the current portion of capitalized R&D expenditure, $Brand$ is brand value,

$cLoy$ is the value of customer loyalty, and $mPos$ is the value of the current market position.

The definitions of the elements of goodwill are as follows:

$$Res_{PPE}(t) = \frac{IV_{PPE}(t)}{ir(t)} - bv_{PPE}(t)$$

where IV_{PPE} is the insurance value of PP&E, ir is the insurance rate, defined as the percentage of market value at which PP&E is required by law to be insured, and bv_{PPE} is the book value of PP&E. From the definition of ir , it is obvious that $IV_{PPE}(t)/ir(t) = MV_{PPE}(t)$, where MV_{PPE} is the market value of PP&E, i.e. that $RES_{PPE}(t) = MV_{PPE}(t) - bv_{PPE}(t)$.

To determine the current portions of capitalized R&D and marketing expenditures, we must choose the time horizon for the capitalization, as well as the value distribution into that horizon. For R&D, I am setting the horizon to three years, as this period length seems appropriate for the duration of benefits of research and development. The period length would likely be industry-dependent in reality, however, three years is close to the average expected market life (i.e. time before a new model is introduced) of many products, from cars to blow-dryers. From another point of view, some research takes effect immediately, some after a year or so, but the edge provided by any one new technology usually doesn't last more than three years, as by then the competition will have adapted or the technology descended into mainstream. For marketing, I am setting the period to two years, as I believe the

intangible benefits of marketing fade quicker than the physical benefits of R&D, especially in today's advertisement-saturated market full of aggressive competition, which requires marketing effects to be maintained by constant repetition. For simplicity, I am setting the distribution method to linear. Thus

$$CME_{CP}(t) = \frac{1}{2}ME(t) + \frac{1}{2}ME(t-1)$$

and

$$CRD_{CP}(t) = \frac{1}{3}RDE(t) + \frac{1}{3}RDE(t-1) + \frac{1}{3}RDE(t-2)$$

where ME is marketing expenditure and RDE is R&D expenditure. The current portions correspond to the depreciation charge for the year to the capitalized expenditure asset held for the indicated amount of years and depreciated linearly, summed for all such assets currently on the balance sheet[6].

Brand value and customer loyalty have to be analyst-valued. It has been discussed before that some analysts, such as Interbrand Corporation, offer brand value estimates which already incorporate an estimate of the value of customer loyalty.

It has also been discussed earlier that market position could be objectively valued if (at least) earnings under "equal" competition (i.e. one where all actors have the same market share, see Footnote 7, p.41) could be observed and compared to earnings realized under current market position, i.e. that $mPos(t) = \sum_{\tau=t}^{\infty} Rf^{t-\tau}E(NI_{CMP,\tau}) -$

[6] Assume the capitalized expenditure asset is entered into the books at t-2 at the value of that year's expense and depreciated linearly over three years. Then the charges will be 1/3 each at t-2, t-1, and t. For the equivalent asset entered next year (i.e. at t-1), the charges will be 1/3 each at t-1, t, and t+1. For the asset entered at t, the charges will be 1/3 each at t, t+1, and t+2. Thus the total charge at t will be 1/3 each of the assets entered at t-2, t-1, and t.

$\sum_{\tau=t}^{\infty} Rf^{t-\tau} E(NI_{EC,\tau})$. However, since such an observation cannot be made in practice (as the required world-state does not exist), and since proxying for it would be exceedingly difficult, I am simplifying the treatment of market position to a dummy variable that is active when the company is a "market leader", inactive otherwise, i.e.

$$mPos(t) = 1 \mid market\ leader(t)$$

and

$$mPos(t) = 0 \mid \neg\, market\ leader(t)$$

This then requires the model to be written as

$$vol_p(x) = \beta_0 + \beta_1 \left(\frac{gw_1(x)}{eq(x)}\right) + \beta_2 \left(\frac{gw_2(x)}{eq(x)}\right) + \beta_3 mPos + \varepsilon$$

and

$$V(x) = \gamma_0 + \gamma_1 \left(\frac{gw_1(x)}{eq(x)}\right) + \gamma_2 \left(\frac{gw_2(x)}{eq(x)}\right) + \gamma_3 mPos + \varepsilon$$

where gw_2 is now defined as only $gw_2(t) = Brand(t) + cLoy(t)$ and $gw(t) = gw_1(t) + gw_2(t) + mPos_{AV}(t)$, where $mPos_{AV}$ is the unknown actual value of the market position. Needless to say, the coefficients in the model will again be different than in the previous specifications, but it should still hold that

$$\beta_1 > 0 \quad \wedge \quad \beta_2 > \beta_1$$

and

$$\gamma_1 > 0 \quad \wedge \quad \gamma_2 > \gamma_1$$

and

$$\beta_3 > 0 \quad \text{and} \quad \gamma_3 > 0$$

I am defining "market leader" as a company for which a competitor of comparable size cannot be found in its market.

4.2. DATA

I have built a theoretical model that can be tested, but before that can be done, it is necessary to consider the selection and availability of data, and the conditions imposed on that data by the model and by practical considerations. The model requires data to be collected on price, book equity, trading volume, and the various components of goodwill described above.

I am limiting myself on a single stock market, as doing so will remove many effects that could otherwise spoil the data, such as different currencies, different required returns, different legislations or accounting principles applicable (as the choice of a single market implies the choice of a signle country's laws and accounting standards), etc. I am choosing the New York Stock Exchange, as it is the largest in the world, with the most stocks listed, and with probably the highest likelihood that the assumption of efficient markets mentioned early in this paper will hold within reasonable tolerance.

I am excluding financial and utility companies from consideration, as financial companies follow significantly different rules than non-financial ones, and as the market for utilities tends to be distorted by natural monopoly and protection of public interest.

I will collect data for years 2005 through 2007 (meaning the data regarding marketing and R&D expenditure will have to be collected starting 2004 and 2003, respectively). Even though panel evaluation is not going to be part of this paper, the separate results for the three years can be compared for additional insight. The reason I am not including more recent data is the likely presence of the effects of the recent global financial crisis in data for the years 2008 through 2010. Crises generally increase the pace and magnitude of the change of expectations, which would be compatible with the model, however, they also introduce shocks of uncertain origin and properties that may spoil the data and are almost impossible to control for.

The testing of my hypotheses requires cross-sectional data, and therefore issues of scale have to be considered. Namely, the response varibles of price variance and trading volume as defined in the Theory subsection above are scale-dependent, precluding effective comparison. I will use scaling by period mean for prices, as it does not, unlike the possible transformation of price into returns, cause the loss of information about trend. That said, *any* transformation of data comes at the cost of *some* information loss, in the case of mean scaling, it is the introduction of some slight nonlinearity. In mean-scaled price volatility, we are trying to measure the variance of a variable whose values are dependent on its mean. Since mean is also employed in the calculation of variance, the variance of the transformed data is not a linear function of the untransformed data. Formally,

$$var(y) = var\left(\frac{x}{E(x)}\right) = E\big(y - E(y)\big)^2 = E\left(\frac{x}{E(x)} - E\left(\frac{x}{E(x)}\right)\right)^2$$

$$\neq$$

$$L\big(var(x)\big) = L\left(E\big(x - E(x)\big)^2\right)$$

I.e. we can see that the variance of the data obtained by the transformation $y = x/E(x)$ is not a linear combination of the variance of the plain data *x*. However, the functional relationship between the variances *is* monotone, and therefore should not affect the relationships implied in my hypotheses. The price type used will be the adjusted close price, which is the closing price adjusted for dividends and splits.

In the case of trading volume, the equivalent variable to variance of price consistent with Proposition 2 is average trading volume. The (necessary) use of average precludes the use of mean-scaling, as average is in this context equal to mean, and thus average scaled by mean is always unity. As trading volume is the number of shares that changed hands, I will use scaling by number of shares outstanding for the period. That scaling disregards splits, repurchases, and new issuances, but daily shares outstanding data is generally not publicly available. This scaling is likely to reduce fit of data to the model, as it disregards variables, and thus may be another of the possible reasons if the tests cannot confirm my hypotheses. However, the effect should be somewhat mitigated if we can assume that the biasing effect of this transformation is roughly the same for each stock.

The data frequency used for both response variables is daily for prices and volumes, annual for the variance of the mean-scaled price and for the shares-outstanding-scaled average trading volume. The data frequency for the explanatory variables is annual. I believe it is possible that the assumption that the biasing effect of period-shares-outstanding scaling is similar for all companies, discussed above, is accurate for a year-long period, but I also believe that it is far from certain. Without further

tests, which I have no way of performing without the aforementioned daily shares outstanding data, I cannot say one way or the other.

Finally, I have not been able to acquire data for the PP&E reserve, as companies do not generally disclose the insurance value of their fixed assets, which is required to compute the reserve from book fixed assets. For this reason, the corresponding term must be left out from the definition of gw_1 for testing.

5. RESULTS

5.1. MATCHED SAMPLE TESTS

The results of a matched-sample test between 45 companies with high-goodwill, defined as those that made the Businessweek 100 Best Global Brands list for the given year, and a control sample of 45 companies considered low-goodwill, selected as the closest possible matches in terms of industry type and size that did *not* make said list for the year, are as follows:

The paired-sample test using Student's t for paired variables returns p-values of approximately 0.046 for 2007, 0.038 for 2006, and 0.59 for 2005 for the hypothesis that the means of the *variance of mean-scaled stock price* are not equal for companies with high and low unrecognized goodwill, on a sample of 45, 42, and 41 pairs of NYSE-listed non-financial non-utility publicly-traded companies. The same test for the hypothesis that the means of *average daily traded volume of shares expressed as a ratio of the total volume of shares outstanding* are not equal for high-goodwill and

low-goodwill companies, on the same sample, returns p-values of 0.97, 0.94, and 0.98 for the years 2007, 2006, and 2005, respectively.

Figure 2: Results of paired Student's t-test

Results of matched-sample test: Student's t, paired				
Variable:		**variance of price, mean-scaled (Proposition 1)**		
Period	mean of differences	p-value	observations	means not equal at significance level
2007	**-0.0091**	**0.0476**	**45**	**5%**
2006	**-0.0056**	**0.0377**	**42**	**5%**
2005	**0.0038**	**0.5859**	**41**	**none**
Variable:		**average traded volume as portion of shares outstanding (Corollary 2)**		
Period	mean of differences	p-value	observations	means not equal at significance level
2007	**0.0001**	**0.9735**	**45**	**none**
2006	**-0.0003**	**0.9441**	**42**	**none**
2005	**-0.0001**	**0.9788**	**41**	**none**

While in all tests, the effect on trading volume is rejected, the effect on prices, when significant, has the wrong sign, i.e. the primary sample displays lower average variance than the control. Since the result is contrary to my hypothesis, and significant at the 5% level, I must try and find some rationale. As all of the theory employed by this paper suggests a positive relationship, I belive the fault lies with

the design of the test: the primary-control division is based solely on the absolute value of the company's brand, which is a poor proxy for the ratio of goodwill to book equity required by the theory. Also, the sample is of relatively small size, and outliers may have undue influence, which is a likely reason why the 2005 price volatility results are not significant at all.

Figure 3: Results of unpaired Student's t-test

Results of matched-sample test: Student's t, unpaired					
Variable:			**variance of price, mean-scaled (Proposition 1)**		
Period	mean of primary	mean of control	p-value	observations	means not equal at significance level
2007	**0.0067**	**0.0157**	**0.1063**	**45**	**none**
2006	**0.0057**	**0.0113**	**0.0468**	**42**	**5%**
2005	**0.0139**	**0.0102**	**0.5743**	**41**	**none**
Variable:			**average traded volume as portion of shares outstanding (Corollary 2)**		
Period	mean of primary	mean of control	p-value	observations	means not equal at significance level
2007	**0.0094**	**0.0093**	**0.9736**	**45**	**none**
2006	**0.0076**	**0.0079**	**0.9439**	**42**	**none**
2005	**0.0070**	**0.0071**	**0.9785**	**41**	**none**

The unpaired test yields approximately the same results, except that in 2007 the influence of goodwill on price variance is significant only slightly above the 10%

level. The p-values of the rejected hypotheses were not significantly changed either way. As said earlier, the results on price variance are contrary to theory, and, based on my reservations to the pairing method, I consider bad test design to be to blame, at least until proven otherwise.

Finally, the pairing is not perfect, as due to database limitations I had to use current (May 2011) market cap as the pairing measure of size, and furthermore, despite my best efforts the paired sample contains 16 companies that are significantly smaller (three times or smaller market cap) than their primary-sample "partners" (none significantly larger) and 11 companies whose field of business differs substantially from their counterparts' (e.g. an agricultural products company being paired with a soft drinks company).

5.2. Linear Regression Tests

Regression analysis was performed on the following two models:

$$log\left(vol_p(x)\right) = \beta_0 + \beta_1 log\left(\frac{gw_1(x)}{eq(x)}\right) + \beta_2 log\left(\frac{gw_2(x)}{eq(x)}\right) + \beta_3 mPos + \varepsilon$$

and

$$log\big(V(x)\big) = \beta_0 + \beta_1 log\left(\frac{gw_1(x)}{eq(x)}\right) + \beta_2 log\left(\frac{gw_2(x)}{eq(x)}\right) + \beta_3 mPos + \varepsilon$$

where *x* denotes individual observations. A logarithmic model was used because the original data showed significant heteroskedasticity. The sum of capitalized marketing expense and capitalized research and development expense was used as a proxy for gw_1 , as discussed earlier. The proxy for gw_2 was the Interbrand estimate

of brand value also discussed earlier, and the market position dummy $mPos$ was active for the 16 companies for which no firm of similar size could be found within the same industry, i.e. the members of the "badly matched" list from the preceding matched samples analysis.

The results were mostly inconclusive, as even in cases where the coefficient relationships implied by theory were present, the significance of the coefficient in question, and often the model as a whole, was very low, and so was overall model fit. Surprisingly, significance was generally better for regressions testing Corollary 2. This is probably due to the trading volume data showing a very low amount of heteroskedasticity (which was still rampant elsewhere despite the logarithmization). In fact, the second explanatory variable (the ratio of brand value to book equity) was found to be significant on the unrestricted sample of 46 companies at the 5% level in 2005 and 2006, and at the 10% level in 2007, in explaining average trading volume relative to shares outstanding, with a large positive coefficient. This constitutes solid evidence for Corollary 2, however, it is in direct conflict with the results of the preceding matched sample tests.

Figure 4: Results of OLS, unrestricted sample

Results of Ordinary Least Squares regression: Unrestricted Sample, Proposition 1

Response variable: **natural logarithm of variance of price, mean-scaled (Proposition 1)**

Period	intercept	ln(gw1/eq)		ln(gw2/eq)		market position	
		coefficient	p-value	coefficient	p-value	coefficient	p-value
2007	**-5.6933**	**-0.1329**	**0.3330**	**0.1360**	**0.3360**	**-0.0171**	**0.9560**
2006	**-5.3476**	**-0.1432**	**0.2790**	**0.2489**	**0.0633**	**-0.2303**	**0.4494**
2005	**-5.2669**	**-0.1088**	**0.5837**	**-0.1132**	**0.5737**	**-0.9836**	**0.0412**

Model statistics

Period	model		Jarque-Bera	Breusch-Pagan	condition nr.	n
	adj. R squared	F-test p-value	p-value	p-value		
2007	**-0.0403**	**0.7404**	**0.7097**	**0.5474**	**5.14**	**46**
2006	**0.0287**	**0.2437**	**<0.001**	**0.6859**	**5.26**	**46**
2005	**0.0509**	**0.1611**	**<0.001**	**0.4278**	**5.21**	**46**

Results of Ordinary Least Squares regression: Unrestricted Sample, Corollary 2

Response variable: **natural logarithm of average traded volume as portion of shares outstanding (Corollary 2)**

Period	intercept	ln(gw1/eq)		ln(gw2/eq)		market position	
		coefficient	p-value	coefficient	p-value	coefficient	p-value
2007	**-5.6736**	**-0.0451**	**0.8275**	**0.4228**	**0.0523**	**-0.4545**	**0.3384**
2006	**-5.8754**	**-0.1336**	**0.5706**	**0.5437**	**0.0247**	**-0.6524**	**0.2335**
2005	**-6.0661**	**-0.1142**	**0.6419**	**0.6096**	**0.0177**	**-0.4837**	**0.4072**

Model statstics

Period	model		Jarque-Bera	Breusch-Pagan	condition nr.	n
	adj. R squared	F-test p-value	p-value	p-value		
2007	**0.0712**	**0.1082**	**<0.001**	**0.0035**	**5.14**	**46**
2006	**0.0287**	**0.0955**	**<0.001**	**0.0245**	**5.26**	**46**
2005	**0.0935**	**0.0687**	**<0.001**	**0.0312**	**5.21**	**46**

Figure 5: Results of OLS, restricted sample

Results of Ordinary Least Squares regression: Restricted Sample, Proposition 1

Response variable: **natural logarithm of variance of price, mean-scaled (Proposition 1)**

Period	intercept	ln(gw1/eq)		ln(gw2/eq)		market position	
		coefficient	p-value	coefficient	p-value	coefficient	p-value
2007	**-5.3553**	**0.1039**	**0.5330**	**0.1465**	**0.2850**	**-0.1172**	**0.6950**
2006	**-5.0027**	**0.0937**	**0.3960**	**-0.0264**	**0.7560**	**-0.3176**	**0.1000**
2005	**-5.0787**	**0.0977**	**0.7570**	**-0.1308**	**0.5740**	**-0.5619**	**0.2860**

Model statistics

Period	model		Jarque-Bera	Breusch-Pagan	condition nr.	n
	adj. R squared	F-test p-value	p-value	p-value		
2007	**0.0244**	**0.3342**	**<0.001**	**0.5397**	**3.92**	**25**
2006	**0.0309**	**0.3153**	**0.8913**	**0.9020**	**4.00**	**25**
2005	**-0.0785**	**0.7419**	**0.6205**	**0.3542**	**3.82**	**25**

Results of Ordinary Least Squares regression: Restricted Sample, Corollary 2

Response variable: **natural logarithm of average traded volume as portion of shares outstanding (Corollary 2)**

Period	intercept	ln(gw1/eq)		ln(gw2/eq)		market position	
		coefficient	p-value	coefficient	p-value	coefficient	p-value
2007	**-5.2312**	**0.3187**	**0.3301**	**0.4743**	**0.0827**	**-0.3184**	**0.5856**
2006	**-5.4458**	**0.4124**	**0.2139**	**0.5080**	**0.0542**	**-0.1830**	**0.7426**
2005	**-5.5293**	**0.4960**	**0.1511**	**0.6481**	**0.0149**	**0.0072**	**0.9896**

Model statstics

Period	model		Jarque-Bera	Breusch-Pagan	condition nr.	n
	adj. R squared	F-test p-value	p-value	p-value		
2007	**0.2095**	**0.0478**	**0.5109**	**0.0121**	**3.92**	**25**
2006	**0.2803**	**0.0192**	**0.4468**	**0.0138**	**4.00**	**25**
2005	**0.3617**	**0.0058**	**0.7132**	**0.0063**	**3.82**	**25**

On the restricted sample, which numbered only 25 companies, and which was the result of the exclusion of all observations for which any part of the data was missing, significance was generally improved, showing that the missing data is probably spoiling the unrestricted regression, however, most of these improvements were

insufficient to reach acceptable significance levels. Tests of Proposition 1 on the restricted sample failed completely in terms of significance, as well as by gross violations of OLS assumptions (which are to be expected, as sample size is below the generally-accepted threshold of 30 for samplings from continuous distributions). Tests of Corollary 2 repeated the result of significance of brand value for trading volume, with even smaller p-values.

As for OLS assumptions, normality of disturbances generally held on the unrestricted sample, but was almost always rejected on the restricted sample. Heteroskedasticity was present throughout all tests of Proposition 1, but was not detected in tests of Corollary 2. Condition numbers in the range of 3-6 for all relevant design matrices suggest little to no multicollinearity. Autocorrelation was not checked, as the regression employs cross-sectional data.

The regression analysis cannot support or reject Proposition 1 on account of heteroskedastic data. The analysis supports, at the 5% significance level, Corollary 2, but cannot reject or support Proposition 3 and Corollary 4, as the joint significance of coefficients on both types of goodwill would be required to meaningfully establish order relations between them.

Regarding possible explanations for the contradictory results of the paired sample test (which rejects an effect of goodwill on trading volume) and of the linear regression (which supports it), I believe at this point that the most likely one is that the samples were badly matched: The primary sample, composed of "the world's 100 most valuable brands" contains large and successful companies. The market cap-

oriented matching therefore favours equally large and successful companies, or the closest equivalent, whose only qualification for the control sample is that they didn't make the brand value list. It is impossible to tell from available data if the matched-sample counterpart is the 101st, or the 1001st most valuable brand in the world. Further, the explanatory variables in the regression are defined in relation to book equity, whereas the sole qualification for the matched sample testing is the absolute value of a company's brand. It is completely possible that many of the companies in the control sample would exhibit comparable or even larger ratios of brand value to equity than their primary-sample counterparts.

For that reason, I believe that the contradiction of the tests lies in incompatible variable selection, and not in fundamental reasons. In any case, linear regression is the more robust method, and therefore its results should be given precedence, especially since for this particular result, all performed assumption tests (normality, homoskedasticity, non-collinearity, joint significance) held.

6. CONCLUSION

This paper has derived from the theory of residual income valuation and the Feltham-Ohlson model, and subsequently tested, the hypothesis that a larger amount of goodwill in relation to book equity leads to higher volatility of stock price and to higher average trading volume, and that this effect is stronger when the sources of the goodwill cannot be recorded in accounting. The main argument for this hypothesis has been the higher uncertainty about the value of goodwill, stemming from the fact that goodwill is equal to the present value of expected future abnormal earnings, and thus cannot be determined exactly at time of valuation, and further

that if even the sources of that goodwill cannot be recorded in accounting, such goodwill lacks an observable basis for estimation, making its present value more uncertain than that of goodwill that can be sourced to recognized accounting items. These arguments directly rest on the theory of residual income valuation and the Feltham-Ohlson model, and would lack solid foundation if this theory were not used as a starting point.

Empirical tests by means of matched samples and linear regressions have yielded mixed results: while there is no conclusive evidence that any of the hypotheses are invalid, only partial support may be found for them. Namely, an equality-of-means test on a matched sample of 45 and 45 companies finds that at the 5% level, goodwill decreases price volatility in two of the three observed years, and cannot prove any effect on trading volume in any observed year. However, the result is in contradiction to theory, and I have reason to believe that the reson is poor design of the matched-sample tests.

Tests by linear regression show that on a sample of 46 companies across three years, brand value in relation to book equity increases trading volume, and the result is robust with regard to assumptions of OLS, but can neither support nor reject any other hypotheses or parts thereof, mainly because of low variable significance and bad model fit, assumed due to heteroskedasticity of parts of the data.

Overall, the results of the tests warrant further research, which should mainly concentrate on the improvement of sample size, the removing of heteroskedasticity, finding more exhaustive measures of unrecognized goodwill, and testing whether

unrecognized goodwill is stastically independent of the book value of equity, which is an untested hypothesis assumed to hold throughout this paper.

ZÁVĚR

Tato práce odvozuje z teorie oceňování residuálních zisků a Feltham-Ohlsonova modelu a posléze testuje hypotézu, že větší poměr hodnoty dobrého jména firmy k účetní hodnotě vlastního jmění zvyšuje volatilitu ceny akcií a průměrný objem obchodování, a že tento vliv je silnější, nelze-li původ dobrého jména spojit s žádnými účetními položkami. Hlavním argumentem pro tuto hypotézu je vyšší nejistota ohledně hodnoty dobrého jména firmy v porovnání s účetní hodnotou vlastního jmění, která vyplývá z vyjádření hodnoty dobrého jména firmy jako současné hodnoty očekávaných abnormálních zisků. To znamená, že tato hodnota nemůže být zjištěna přesně v době oceňování, a pokud navíc ani zdroje této hodnoty nemohou být zaneseny do účetnictví, pozbývá dobré jméno jakéhokoli pozorovatelného základu pro odhadování, což činí současnou hodnotu dobrého jména takového původu méně jistou, než je hodnota dobrého jména, jehož zdroje lze vysledovat v účetních záznamech. Tyto argumenty se přímo opírají o teorii oceňování residuálních zisků a Feltham-Ohlsonova modelu, bez jejichž použití jako výchozího bodu by ztratily pevný základ.

Empirické testy metodou párových dat a metodou lineární regrese přinesly smíšené výsledky: ačkoliv nepodávají jasné důkazy proti platnosti hypotéz, důkazy v jejich prospěch jsou pouze částečné. Konkrétně, test shody středních hodnot na párovém souboru 45 a 45 společností shledal, že na 5% hladině významnosti dobré jméno firmy snižuje volatilitu ceny akcií ve dvou ze tří sledovaných let, a v žádném z

pozorovaných let nemůže prokázat žádný efekt na objem obchodování. Výsledky ohledně volatility cen jsou ovšem v rozporu s teorií, a mám důvod se domnívat, že důvodem je špatný design párového testu.

Testy lineární regresí ukazují, že na vzorku 46 společností během tří sledovaných let zvyšuje hodnota značky objem obchodování, kterýžto výsledek je robustní s ohledem na předpoklady OLS, ale nemohou potvrdit ani vyvrátit žádné další hypotézy ani jejich části, a to hlavně kvůli nízké signifikanci proměnných a špatné shodě modelu s daty, která má pravděpodobně původ v heteroskedasticitě části dat.

V souhrnu výsledky testů ospravedlňují další výzkum, který by se měl především soustředit na zvýšení velikosti vzorku, odstranění heteroskedasticity, nalezení úplnějších měřítek dobrého jména, a testování hypotézy, že hodnota dobrého jména firmy je statisticky nezávislá na účetní hodnotě vlastního jmění, jejíž platnost je bez ověření předpokládána touto prací.

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List of Appendices

APPENDIX 1

ON THE REVIEWED LITERATURE

The paper statistics for the FO literature are as follows: Theory papers – 6, empirical papers – 6, review papers – 6. The oldest paper is from 1995, the most recent from 2005. The most cited has currently 2152 citations, the least cited has 25 citations (in Google Scholar). In an effort to identify the most influential papers, as well as keep the review in manageable proportions, I set an arbitrary cutoff at 10 citations.

I am aware that citation counts are but a proxy for a paper's scientific worth, however, the platform of a bachelor thesis does not afford the space required for a *full* review of relevant literature, if one wishes to discuss articles in any detail.

There are a further 14 papers on the subject of goodwill reviewed to a lesser extent in this paper, as well as 7 more papers for supplementary reference, for a total of 39 papers reviewed or cited.

APPENDIX 2

ON TRANSITORY EARNINGS

The Feltham-Ohlson model does not address the issue of transitory earnings, i.e. earnings that are the results of once-only effects and either unpredictable, unrepeatable, or both. In fact, we may conveniently define transitory earnings within the Feltham-Ohlson framework as any earnings that could not have been expected, and thus could not have been included in the expectation term of the valuation equation $V_t = bv_t + \sum_{\tau=1}^{\infty} {R_F}^{-\tau} E_t[o\tilde{x}_{t+\tau}^a]$. This not only eliminates unrepeatable, but

predictable effects from the definition, but also allows for the valuation equation to be extended to

$$V_t = bv_t + \sum_{\tau=1}^{\infty} {R_F}^{-\tau} E_t[o\tilde{x}^a_{t+\tau}] + ox_{tr}$$

where ox_{tr} is the value of transitory operating earnings, entered when they materialize. otherwise left blank. Notice that financial transitory earnings do not enter valuation, as, transitory or not, they are still subject to the same principles that make financial activities irrelevant for valuation. However, one could notice that such an equation can be rewritten as

$$V_t = (bv_t + ox_{tr}) + \sum_{\tau=1}^{\infty} {R_F}^{-\tau} E_t[o\tilde{x}^a_{t+\tau}]$$

and since the financial aspects of the company have been taken care of through the FAR (see the exposition on the FO model in Section 2, and the paper by Feltham and Ohlson (1995) for more details), in the next period we can write

$$V_{t+1} = bv_{t+1} + \sum_{\tau=1}^{\infty} {R_F}^{-\tau} E_{t+1}[o\tilde{x}^a_{t+1+\tau}]$$

where

$$bv_{t+1} = bv_t + \Delta bv_{t,t+1} + ox_{tr}$$

i.e. these earnings "have nowhere to go" and for the next period become part of book equity. The term $\Delta bv_{t,t+1}$ is the change in equity between these two periods due to other sources than the transitory operating earnings, i.e. the change that "would have happened anyway" (had the transitory earnings not been realized).

This formalism shows that (i) transitory earnings only affect value onwards from the moment they are realized (which is consistent with their being defined as

unexpectable), that (ii) they do so by affecting the book value of equity for the current and all future periods (changing the value of the firm for all future t by ox_{tr}) and that (iii) because of (i) and (ii) they do not affect the present value of future expected abnormal operating earnings, i.e. they do not affect goodwill. Because of this, transitory earnings do not factor in any way into the contribution of goodwill to price and volume volatility. They do, however, influence it in another way: they dilute the effect of goodwill by increasing equity, i.e. increasing the denominator of the variable by the goodwill coefficient in $vol_p = \alpha + \beta_p(gw/bv) + \varepsilon_p$, as well as in $vol_V = \gamma + \beta_V(gw/bv) + \varepsilon_V$ (price and volume volatilities).

That is, according to this model transitory earnings should (i) already be included in valuation if they are expected (expectable) and therefore be of no consequence for my hypotheses, or (ii) ex post dilute the effect of the proportion of goodwill to equity on stock price and trading volume volatility, simply by reducing that proportion. However, we should not forget the simple fact that if these earnings are completely unexpected (indeed unexpectable, as we assume), the shock to value they cause upon materialization will, again assuming the logic upon which my hypotheses are based actually holds, cause an increase in price and volume volatility proportional to the volume of the transitory earnings in question, and possibly even larger due to being unexpected than the same increase in value would were it the result of "normal", i.e. nontransitory circumstances.

APPENDIX 3

ON TAX

One could ask if the goodwill used in the research should not be cleared of tax (the components that can be, anyway), as the abnormal earnings it generates will be taxed. However, upon closer scrutiny it is revealed that tax is really not an issue. The taxation is already built into the expectation operator on abnormal operating earnings: very simply, expected abnormal operating earnings equal expected gross abnormal operating earnings net of expected tax. Of course, changing expectations of taxation are one of the parameters that imply a change in value when we use the FO valuation equation, but a parameter like any other in all respects. Indeed, trying to tax the goodwill that generates the earnings would be a significant error, as it would mean double taxation – once of the goodwill, then again in the transformation of goodwill into ox^a , which already incorporates taxation as any other relationship of an asset and its associated income would.

APPENDIX 4

ZERO NET PRESENT VALUE OF RECOGNIZED GOODWILL

It is discussed in Section 2 that recognized goodwill is the asset that arises in a business combination (a merger or an acquisition, M&A) as a balancing item on the balance sheet of the acquirer. Recognized goodwill is always recorded at the difference between the price paid for the target upon acquisition, and the fair value of the target's book assets, which equals their market value in perfect markets. The market value of an asset is defined as the present value of future earnings expected from the asset. By paying more than this value, the acquirer (assuming he is rational)

reveals that he values the asset higher than that, i.e. that he expects future earnings of higher present value from it. For that reason, the acquirer is allowed to add this "difference of opinion" to their book assets. If the acquirer and the market are both rational, then the only reason their valuations of the asset may differ is because the acquirer expects to get greater benefits from the asset than the rest of the market. Therefore, the value of this difference to the acquirer is equal by definition to the excess price he paid, which is equal to the goodwill asset, and therefore, the net present value of the goodwill asset to the acquirer equals zero.

In other words, the acquirer always pays a price for the target equal to the future earnings they expect from it, and if this price differs from the fair market value of the target, then the difference is recorded as purchased goodwill in the books of the acquirer. Since zero-NPV investments in the context of the Feltham-Ohlson model imply no abnormal earnings, the impact of an M&A on future expected abnormal earnings of the acquirer is always zero. Put another way, any future expected earnings that the acquirer has purchased for a price equal to their present value are by definition normal earnings (as opposed to abnormal earnings).