Managerial Discretion, Matching, and the Market

Andrew Bird
Tepper School of Business
Carnegie Mellon University
apmb@andrew.cmu.edu

Thomas G. Ruchti
Tepper School of Business
Carnegie Mellon University
ruchti@andrew.cmu.edu

July 6, 2015

Keywords: matching, value relevance, financial reporting, managerial discretion

JEL codes:

Data Availability: Data used in this study are available from public sources identified in the paper.

For helpful discussion and advice, the authors thank Jeremy Bertomeu, Chen Li, Jon Glover, Pierre Liang, Tong Lu, Jack Stecher, and Bo Sun. We gratefully acknowledge financial support from the Tepper School of Business, Carnegie Mellon University.
Managerial Discretion, Matching, and the Market

Abstract

We investigate two similar, but distinct goals in financial reporting, that expenses match the revenues they generate, and that revenues and expenses produce earnings that are value relevant. To investigate how well these objectives are achieved in practice, we study a managerial choice subject to discretion, and important to earnings: depreciation choice. Estimating firm-specific real and counterfactual depreciation policies using the time series of capital expenditures and reported depreciation expenses, we find two core results. First, there is a matching–market gap, which means these two important objectives cannot be simultaneously achieved by a single earnings measure or accounting standard. Second, we find that current reporting practice is more aggressive than either reporting objective, consistent with managerial discretion.
1. Introduction

The objective of financial reporting has been, and continues to be, a topic of interest to industry professionals, regulators, and academics alike. The firm produces financial statements of which earnings is the key output (Graham et al. (2005)). These numbers are interpreted by the market and reflected in prices. The way management follows accounting standards in its earnings disclosures affects how the market may react to firm performance (Dechow et al. (2010))—the proverbial black box of valuation. In this paper, we investigate two similar, but distinct goals in financial reporting, that expenses match the revenues they generate, and that revenues and expenses produce earnings that are value relevant. Because managers typically have private information about the operations of the firm, the degree to which these objectives are met is dependent on managerial discretion in implementing the accounting standard (Lewellen et al. (1996)). In the matter of depreciation, Paton and Littleton (1940) proposed that the standard should require that firms implement matching, tying expenses to the revenues they create. This is reflected in the current standard, which states that “Generally accepted accounting principles require that this cost be spread over the expected useful life of the facility in such a way as to allocate it as equitably as possible to the periods during which services are obtained from the use of the facility,” (FASB ASC paragaph 360-10-35-4, 2015). Dichev and Tang (2008) find, both analytically and empirically, that matching produces earnings which best reflect firm performance. Further, if valuation is an important goal of an accounting standard, then value relevance of earnings is a natural benchmark. In this paper, we investigate the degree to which matching and value relevance relate to one another as reporting objectives, and use data on firms’ accounting choices to uncover the

\[^1\] There is no direct reason for the manager to make reporting choices consistent with either the matching or market objectives unless that is either in her own interest, or is both mandated by standard-setters and verifiable by auditors. However, in the context of revenue recognition, Srivastava (2014b) finds that a rule that limited the scope of managerial discretion led to reduced earnings informativeness, which shows that the effect of discretion depends on the context.
degree to which these objectives are met in practice.\textsuperscript{2}

We study this choice because “depreciation expense is one of the larger accruals over which managers exercise discretion,” (Keating and Zimmerman (1999)). Accordingly, the decisions managers make regarding the depreciation of fixed assets have large effects on earnings, and therefore the reaction by the market to accounting information. We propose a method that uses the inherent structure of accounting information, and the variation of these numbers over time, to estimate depreciation decisions firm by firm.\textsuperscript{3} While studies have shown that the properties of earnings have changed over time (Donelson et al. (2011), Srivastava (2014a)), to the best of our knowledge, we are the first to use time series data to measure, firm by firm, the degree to which matching or market-based rules are met by reporting. We find that the depreciation choices following the value relevance (market) objective differs systematically, on a firm by firm basis, from the matching objective, perhaps contrary to theoretical intuition (Dichev and Tang (2008)). The depreciation choice of firms in practice (actual reporting) is aggressive, spreading costs over a longer period of time than either the matching or market objectives would dictate. That this choice is more aggressive is in keeping with broad managerial incentives to improve earnings in the short term (Dechow et al. (1994)).

Measuring depreciation choices can be a difficult task, depending on various types of fixed assets of differing vintages. The typical problem researchers face when measuring depreciation decisions is that firms make capital expenditures every year, and depreciation expenses vary significantly over time. While useful lives are disclosed in footnotes, these numbers are rarely more specific than ranges of years, and the allocation across various types of asset vintages goes undisclosed. Even so, the structure of depreciation schedules allows for the recovery of accounting choices made by firms. At

\textsuperscript{2}It is difficult to assess accounting rules in theory alone because we do not know the valuation black box. We must assess the discretion and method used in turning expenses into revenues (matching objective), or the way accounting information is used by markets (market objective). The literature on empirical research on accounting choice is surveyed by Fields et al. (2001).

\textsuperscript{3}For a related method, but looking at R&D expenditures, see Lev and Sougiannis (1996).
the individual firm level, we use the time series of capital expenditures and depreciation expenses to estimate a two-parameter average depreciation schedule for the firm’s property, plant, and equipment (PPE). The first parameter is the depreciable fraction, which represents the proportion of fixed assets that are actually depreciated, rather than indefinitely lived, such as land. The second is the useful life, or the number of years a firm uses to depreciate assets.4 Validating our method, our estimates provide a sensible pattern of cross-industry depreciation rates.5 Our results yield an average depreciable fraction of 0.81 and an average useful life, which we call $\tau^{Book}$, of 8.35 years, corresponding to a depreciation rate of about 12% per year.

To assess how well these actual accounting choices meet different reporting objectives, we consider a series of alternative useful life choices, varying from one (expensing) to an upper bound, and use these to construct counterfactual time series for expenses and earnings from the time series of capital expenditures. For example, a counterfactual depreciation choice of expensing would construct earnings by immediately deducting capital expenditures in each year. The procedure we follow for both the matching objective and the market objective is to look across this set of choices to find the one that best meets the reporting objective. For matching, we run a simple regression of revenues on expenses, with some controls, and call $\tau^{Matching}$ the useful life which produces the highest $R^2$ – that is, the depreciation schedule which best fits the expenses time series to the revenues time series. For the market objective, we employ the standard earnings informativeness regression as in Lev and Zarowin (1999)—performed firm by firm—modeling stock returns with the level and first difference of earnings. We call the

---

4 It is standard to divide depreciation by total depreciable assets (Lindenberg and Ross (1981)), to find the depreciation rate, however this ignores much of the data available, producing inefficient estimates (Greene (2008)).

5 Keating and Zimmerman (1999) find that managers change depreciation policies in predictable ways, which supports the importance of studying the effects of these policies on the quality of accounting earnings; in our paper, we use cross-sectional differences in policies to study this question. Jackson et al. (2009) investigate the determinants of these choices, starting with the methodology of Bowen et al. (1995). The authors find that changing depreciation methods influences capital investment decisions, with less investment following a switch away from accelerated to straight line depreciation.
useful life choice which produces the time series of earnings which maximizes the $R^2$ in this regression the ‘value-relevance preferred choice’, which we denote by $\tau^{Market}$. These two procedures parallel each other; loosely speaking, for matching, we want to choose expenses so that revenues follow expenses; for market, we want expenses to produce earnings which fit returns. The three sets of useful life choices we seek to estimate for each firm in our sample are therefore $\tau^{Book}$, $\tau^{Matching}$, and $\tau^{Market}$, which reflect the firm’s actual reporting, the reporting choice which would best accomplish matching, and the reporting choice which would maximize earnings informativeness.

After data requirements, principally requiring sufficient lags of capital expenditures to explain current year depreciation, we are able to model the depreciation choices of 559 firms during the period 2003-2007. The useful life which would best accomplish matching is on average 8.07. The median difference between the matching-optimal useful life and the book useful life is minus one; that is, useful lives would be closest to accomplishing matching if they were one year shorter than what is actually used. This is consistent with managerial discretion acting to make depreciation choices somewhat more aggressive than envisaged by the matching objective. If we break down this result further, we see that for 8% of firms, the two choices line up; when this is not the case, book is relatively aggressive for 54% of firms.

Turning to the market objective, we find a much starker result, with a useful life of 5.60 the average choice which maximizes the value relevance of earnings. The median difference relative to book depreciation is minus three in this case; evidently, actual depreciation choices are much more aggressive than the value-relevance preferred choice. As for the matching objective, we can split firms into three categories: those whose actual depreciation maximizes value relevance (7%), those for which it is more conservative (28%), and those for which it is more aggressive (65%). Even more strikingly, the market criterion yields depreciation which is almost always conservative, or accelerated, relative to the matching criterion. Thus, despite the suggestion from theory that the two objectives
should coincide (Dichev and Tang (2008)), our empirical results show that this is not the case in practice. These findings call into question whether or not the accounting standard in this case is consistent with a broad goal for financial reporting of producing earnings which are value relevant, and points to a clear tradeoff between the matching and value relevance objectives.

Overall, our results suggest that depreciation choices are relatively close to meeting the matching objective, which is reassuring given how the standard is written, but still somewhat aggressive and highly so relative to the value relevance objective. This means that expenses are being delayed in time, and so the balance sheet shows higher net asset values as well. When we restrict our sample to those firms for which we have the most confidence in the fit of the 2-parameter depreciation model, all of these results get more stark. We also consider depreciation choices during the subsequent five-year period, 2008-2012, to assess the robustness of these findings for a somewhat different set of firms and different macroeconomic conditions and likewise find larger differences between actual accounting choices and either the matching or market objectives.

We also engage in a wide variety of robustness tests, including the inclusion of a variety of other controls in either the matching or earnings informativeness regressions, without meaningfully changing the results. Our sample is somewhat different from the universe of publicly traded firms since we require many years of lags when estimating counterfactual depreciation policies. This raises the possibility of sample selection bias. To address this issue, we perform within sample tests to show that firm age is not correlated with the relative aggressiveness of book depreciation choices. Thus we would expect to find similar results if we were able to include firms with fewer years of available data in our analysis. A second important issue is to rule out the possibility that noise in our estimation procedure is driving the results. We do placebo simulations which show that noise biases against our findings, illustrating that we are extremely unlikely to have
arrived at relative aggressiveness by chance.\textsuperscript{6}

Given our findings of relative aggressiveness, one might also worry that book depreciation is strongly influenced by tax depreciation. The Internal Revenue Service dictates that firms use the Modified Accelerated Cost Recovery System (MACRS) for tax depreciation, and it is indeed aggressive relative to straight-line depreciation. However, the variation exhibited in firms’ depreciation rates, especially within industry, shows it is unlikely that managers are exclusively using tax accounting to make depreciation choices. Furthermore, anecdotal investigation of financial statement footnotes yield many examples where the range of useful lives for a particular group of assets does not obviously match those dictated by MACRS. Finally, and most significantly, the codification explicitly states that firms should use an objective close to matching, and explicitly should not use MACRS if this choice does not fall close to the asset’s actual useful life.\textsuperscript{7}

The remainder of the paper proceeds as follows: Section 2 discusses the estimation and describes the data, Section 3 presents our results, Section 4 investigates placebo tests, survivorship bias, alternative specifications, and extending our analysis to another sample period, and Section 5 concludes.

2. Empirical Methodology

In this section, we propose a method of estimation to uncover a firm’s actual depreciation choice ($\tau^{Book}$), as well as the useful life which would maximize the matching or market

\textsuperscript{6}Loosely speaking, this is because, relative to a book useful life of about eight, we allow for more possible conservative choices (11) than we do aggressive ones (7). Thus, a purely random procedure for choosing according to either the matching or market objective would be more likely to arrive at relative conservatism.

\textsuperscript{7}FASB ASC paragraph 360-10-35-9 (2015) states that “[i]f the number of years specified by the Accelerated Cost Recovery System of the Internal Revenue Service (IRS) for recovery deductions for an asset does not fall within a reasonable range of the asset’s useful life, the recovery deductions shall not be used as depreciation expense for financial reporting.”
objective, respectively, from the perspective of that particular firm.\footnote{This work is related to the development of a cost allocating estimation theory in Brief and Owen (1970). In estimation theory, the authors attempt to codify measures of performance across periods to evaluate rate of return on a single asset, extending this analysis to a multiple asset framework (as in a firm) in Brief and Owen (1973). These methods are extended more generally by Ohlson and Zhang (1998), though most importantly, the authors make clear the choices necessarily made by accounting systems and how they influence the measure of economic performance. Beyond accounting systems, our goal is to rely on the market to determine the optimal allocation of costs. Using earnings informativeness, we infer the value relevance preferred choice. Ohlson and Zhang (1998) delineate the inputs to financial statements, the potential outputs, and the class of functional mappings from these transactions to outputs. The authors stress the restrictions noninvertibility (aggregation) in accounting naturally entails, but attempt to formulat\textsuperscript{e} the properties accrual rules satisfy. While their analysis depends on so-called soft as well as hard information being included in equity, they are able to meet some desirable conceptual criteria through an efficient accounting mechanism. For further discussion, see Liang (2001) and Arya et al. (2002).}

2.1. Estimating $\tau^{Book}$

To find the depreciation choice of a firm from financial statement information, we use the following strategy. Using variation in capital expenditures to explain the resulting depreciation expenses over time allows us to produce an efficient estimator of the useful life assigned by managers to their property, plant, and equipment.\footnote{See Greene (2008) and Wooldridge (2010) for discussions of efficient time series estimators.} Our method therefore employs more data in identification than standard approaches for estimating useful life that involve dividing contemporaneous depreciation expense by the book value of equity (Lindenberg and Ross (1981), Feltham and Ohlson (1996), and for issues with this method, Lewellen and Badrinath (1997)). The two firm-level parameters we estimate are the average useful life of the firm’s capital stock ($\tau^{Book}$), and the depreciable fraction, or the fraction of the capital stock that the firm depreciates at all. The depreciable fraction accounts for the expected residual value of fixed assets that goes un-depreciated, or the portion of assets that have very long or even infinite useful lives, such as land. Our framework is designed to capture firm-level choice, and so it is less important that our measure delineate specific vintages. Whether PPE of a firm differ in useful lives, service patterns, are purchased over the course of the year, or face early retirement or disposal, we measure the average useful life of PPE within the firm. Our two parameters capture the...
choice behind this variability.\footnote{A measure of net disposals is usually available from the cash flow statement, however there are several problems with incorporating it in our analysis. One issue is that we do not know gross disposals. A second issue is that we do not know which vintages of depreciable investments are being disposed.}

Firms make disclosures about their depreciable assets and depreciation choice in the footnotes of their financial statements. Collecting and organizing the information contained in these footnotes is difficult for several reasons. The first problem with this approach is that firms usually specify, for a coarse category of depreciable assets, only a range of years for the useful life, and this range is often too wide to be of much use. Second, the proportion of depreciable assets which fall into each category is rarely disclosed, rendering a precise, or even approximate, calculation of the firm’s average assumed useful life impossible. While these footnote disclosures are not sufficient for understanding the specifics of a firm’s depreciation choice, they can be used to illuminate several aspects of depreciation choices which are useful inputs to our empirical model. Depreciation choice for financial reporting purposes generally falls into two categories: straight line and accelerated. Jackson et al. (2009) find, looking from 1988 to 2006, that 80\% of firms use straight line depreciation exclusively. This figure is likely an underestimate for firms in our sample for two reasons. The first is that the authors show that this number has increased monotonically over time, to 86\% by 2006. Additionally, their categorization excludes from the straight line category all firms which use accelerated depreciation for any of their assets.\footnote{Of the 20\% in the accelerated category, 84\% use a combination of straight line and accelerated.} The authors also find that straight line depreciation is the predominant method in most industries.\footnote{Excluding these three industries (metal mining, oil and gas extraction, and petroleum refining), which make up only 9\% of our sample, has no substantive effect on our results.} Hence, we feel confident in the fact that straight line depreciation is a valid assumption for nearly all of the firms in our sample, though we investigate this assumption further in Appendix B.

We estimate the useful life used by the firm, $\tau^{Book}$, and the depreciable fraction by regressing actual depreciation on the time series of capital expenditures that, over time, move to the income statement and become depreciation expenses. For firm $i$ in year $t$, [10]
*CapX*<sub>i,t</sub> is the reported capital expenditures. Our empirical model to explain depreciation expense is the following:

\[
Depreciation_{i,t} = \lambda_i \left[ \frac{CapX_{i,t}}{\tau_i} + \frac{CapX_{i,t-1}}{\tau_i} + \ldots + \frac{CapX_{i,t-\tau_i+1}}{\tau_i} \right] + \epsilon_{i,t}
\]

(1)

where a \( \lambda_i \) (depreciable fraction) proportion of CapX are depreciated on a \( \tau_i \) (average useful life) year schedule. We estimate parameters that best explain the data, leading us to \( \tau^{Book} \) and the depreciable fraction.\(^{13}\) This particular choice pair, \( \tau^{Book} \) and a depreciable fraction, is the actual choice we refer to in the remainder of the paper—as it represents what the firm is actually reporting. We relegate a more technical discussion of our empirical implementation to Appendix A.1. \(^{14}\)

2.2. Estimating \( \tau^{Matching} \)

We estimate \( \tau^{Matching} \), the depreciation choice following the matching objective, by finding the number of years such that assets move from the balance sheet to the income statement as they produce *revenue*. Our method allocates capital expenditures over time to best match the revenues they generate. We therefore use counterfactual depreciation expenses—calculated by varying depreciation years choice—to model depreciation-adjusted revenues (add back *actual* depreciation expense). We then compare \( \tau^{Matching} \) to \( \tau^{Book} \) (*matching* to actual) to find how well firms achieve the revenues-oriented reporting objective.

We produce a measure of matching by regressing earnings before depreciation on counterfactual depreciation and total assets. For firm \( i \) in year \( t \), \( E_{i,t}^0 \) is earnings, and

\(^{13}\)This regression form looks non-standard, but is equivalent to maximization of a likelihood function, without imposing structure on the error term itself.

\(^{14}\)Our methodology is similar to Lev and Sougiannis (1996) and their investigation of R&D value relevance in that they use lags to describe outcomes. However, while Lev and Sougiannis impose a reduced parameter polynomial structure in their estimating equations, we instead employ an accounting-based structure on the data.
$Dep_{i,t}^0$ is reported depreciation expense. Our simple empirical model to implement the objective of matching is as follows:

$$Earnings\ before\ Depreciation_{i,t} = \alpha_{i,\tau} + \beta_{i,1,\tau}Dep_{i,t}(\tau) + \beta_{i,2,\tau}Assets_{i,t} + \epsilon_{i,t}$$

where $Earnings\ before\ Depreciation_{i,t} = E_{0,i,t} + Dep_{i,t}^0$, $Dep_{i,t}(\tau)$ is the counterfactual depreciation, with a $\tau$ year depreciation schedule, or can be replaced with $Dep_{i,t}^0$ for the baseline matching regression. We use the $R^2$ in the above regression as our measure of firm-level matching. We use estimating equation 3 for each of counterfactual time series of earnings (calculated by varying the depreciation choice), and we pick the one which best fits depreciation-adjusted earnings. The corresponding depreciation choice becomes our estimate of $\tau^{Matching}$. Details of the estimation procedure can be found in Appendix A.2.

### 2.3. Estimating $\tau^{Market}$

We estimate $\tau^{Market}$, the depreciation choice following the value-relevance objective, by finding the number of years such that assets move from the balance sheet to the income statement as they produce value. Essentially, our method uses the market’s pricing of firms to uncover the process by which the market would allocate capital expenditures over time to value performance. We therefore use counterfactual earnings—calculated by varying depreciation years choice, and allotting capital expenditure numbers across years—to model returns. We then compare $\tau^{Market}$ to $\tau^{Book}$ (value relevant to actual) to find how well firms achieve the returns-oriented reporting objective.

We produce a measure of value relevance by regressing returns on earnings and change in earnings, as in Lev and Zarowin (1999). For firm $i$ in year $t$, $Return_{i,t}$ is the total stock return, while $E_{i,t}^0$ and $\triangle E_{i,t,t-1}^0 (= E_{i,t}^0 - E_{i,t-1}^0)$ denote earnings and change in earnings relative to the prior period, as actually reported by the firm. Our simple empirical
model to implement the value relevance objective is as follows:\textsuperscript{15}

\[ Return_{i,t} = \alpha_i + \beta_{i,1} E_{i,t}^1(\tau) + \beta_{i,2} \Delta E_{i,t,t-1}^1(\tau) + \epsilon_{i,t} \]  

(3)

where \( E_{i,t}^1(\tau) \) (and \( \Delta E_{i,t,t-1}^1(\tau) \)) represent counterfactual earnings and change in earnings with a \( \tau \) year depreciation schedule, or can be replaced with \( E_{i,t}^0 \) and \( \Delta E_{i,t,t-1}^0 \), for the baseline value relevance regression. We use the \( R^2 \) in the above regression as our measure of firm-level earnings informativeness,\textsuperscript{16} and are interested in the explanatory power of counterfactual earnings created by varying the depreciation choice. We use estimating equation 3 for each of counterfactual time series of earnings (calculated by varying the depreciation choice), and we pick the one which best fits stock returns. The corresponding depreciation choice becomes our estimate of \( \tau^{Market} \). Details of the estimation procedure can be found in Appendix A.2.\textsuperscript{17}

2.4. Data

We collect data on publicly traded U.S. firms from Compustat and get fiscal year total stock returns from CRSP. To be included in the main estimation sample, firms must have non-missing depreciation expense, capital expenditures and earnings before extraordinary items in each year from 1980 to 2007. In addition, firms must have non-missing total

\textsuperscript{15}More recent research on earnings informativeness recognizes that one aspect of information provided by earnings is its effect on expectations over future earnings. For simplicity and data constraints, we focus on this parsimonious model. Alternative specifications could involve other control variables such as book value. We investigate this in Section 4.3 and find similar results.

\textsuperscript{16}The sum of \( \beta_{i,1} \) and \( \beta_{i,2} \) is another possible measure of earnings informativeness at the firm level, though we employ \( R^2 \) as the simplest and most intuitive criterion.

\textsuperscript{17}We use the years 2003-07, and 2008-2012 in each of the returns regressions. One limitation with using five years of returns data is that the feasibility of including other covariates in the regressions is limited. In the baseline, we include earnings, change in earnings, and a constant term. If we were to pool together the data, as is standard in many earnings relevance papers, this would not be an issue; however, we model earnings relevance \textit{firm by firm}, because we want to study choice at the individual firm level, rather than the aggregate, or average, choice. Of course, the time horizon for our study could be extended, though this would reduce the validity and precision of our results, because we would then be averaging over too many years to create a meaningful benchmark for the market’s interpretation of depreciation choice. In addition, we would have to include data prior to the Sarbanes-Oxley reform, or after the start of the financial crisis. Our chosen sample period is designed to strike a balance between these competing concerns.
annual stock returns for each fiscal year in the 2003-2007 window for the returns regressions in the second stage of the estimation procedure. There are 559 firms satisfying these restrictions for which we model depreciation. We also look at years 1985-2012, with focal years 2008-2012 in robustness checks in Section 4.4. We discuss survivorship and show that selection on firm tenure in the sample does not appear to bias our results in Section 4.2. Summary statistics for these firms are displayed in Table 1.

[Table 1 about here.]

From the table, we see that our sample naturally tends towards larger firms, with greater sales, and better performance. We would also expect that the quality of financial statements is higher—something which is promising for our analysis—and this is related to several factors, including a track record of financial performance and producing financial statements, economies of scale in auditing, relative prevalence of financial analyst forecasts and reports, and institutional ownership.

3. Results

In this section, we measure $\tau^{Book}$, the number of years that a firm depreciates fixed assets in practice. To better understand the objectives met by the choice the firm makes, we estimate $\tau^{Matching}$, the Matching (revenues-oriented) depreciation expense schedule, and $\tau^{Market}$, the Market (returns-oriented) depreciation expense schedule. In Figure 1, we show results for our two estimation periods, 2003-2007, and 2008-2012, for our main sample (559 firms) and our restricted sample (220 firms for which our results are more robust). Figure 1 illustrates the median $\tau^{Book}$ for each time period and sample, and the median differences between $\tau^{Book}$ and $\tau^{Matching}$ and $\tau^{Market}$, respectively.

[Figure 1 about here.]

$^{18}$The sample period for stock returns is post Sarbanes-Oxley, which means we avoid the issue identified by Cohen et al. (2008) that accrual based earnings management decreased significantly due to the reform.
\( \tau^{Book} \) is seven or eight years in all our estimates, and \( \tau^{Matching} \) has a median difference of at least one, and is shorter. \( \tau^{Market} \) is also shorter, from three years in the main samples to four or five years in the restricted samples. This figure illustrates that while \( \tau^{Matching} \) is close to \( \tau^{Book} \), that \( \tau^{Book} \) on average is not in between the market and matching benchmarks, and there must be other reporting incentives involved. It is also clear that the market reporting objective in valuation of the firm, \( \tau^{Market} \), requires a much shorter period of depreciation than firms use in practice. The following subsections outline detailed 2003-2007 estimates of book depreciation choice, \( \tau^{Book} \), and comparisons between that and the \( \tau^{Matching} \) and \( \tau^{Market} \) objectives.

3.1. \( \tau^{Book} \)

We find \( \tau^{Book} \), the number of years that a firm depreciates fixed assets in practice, using Equation 5. We begin by describing the results for \( \tau^{Book} \) for all 559 firms in our sample. We then discuss our results for the depreciable fraction, which measures residual values used by the firm and very long lived capital stock. Finally, we present an industry breakdown of normalized \( \tau^{Book} \) values, to better illustrate the external validity of our \( \tau^{Book} \) measure.

In Figure 2, we present \( \tau^{Book} \) for all 559 firms in our sample. The mode of \( \tau^{Book} \) is 5 years. In addition, the mean is 8.35 (std. dev. 5.16), which corresponds to a 12% depreciation rate in practice. As can be seen in the figure, there are fewer and fewer firms which depreciate at lengthy rates above 5 years.\(^{19}\)

\(^{19}\)It is important to note that there is a small statistical artifact of restricting our \( \tau^{Max} \) to 19 years. A small number of firms use longer periods to depreciate and are measured as depreciating 18 and 19 years, causing a slight buildup of firms at and near the \( \tau^{Max} \). As is discussed later, this only biases against our findings of a shorter time of depreciation for the market objective vs. actual depreciation.
depreciable fraction, which represents the proportion of fixed assets that are actually depreciated, rather than indefinitely lived, such as land a firm owns that it does depreciate at a significant rate. Figure 3 plots these depreciable fractions, which should cluster near 1 (as can be seen in the figure) as most firms do not extensively use salvage value or have significant holdings in very long-lived assets, like real estate. The mean Depreciable Fraction is high, at 0.81, and including this extra parameter in our model nontrivially allows us to increase our sample by 66%.20

[Figure 3 about here.]

Finally, our measure of $\tau^{Book}$ varies across industries. To control for differing business models across firms and across industries, we normalize $\tau^{Book}$ by the depreciable fraction, thus illustrating the depreciation choice that a firm uses in one summarizing factor. In Figure 4, we show normalized $\tau^{Book}$, the number of years that the firm depreciates fixed assets in practice, for the 559 firms in our sample. We find that normalized $\tau^{Book}$ values range from 10.3 years for manufacturing (an industry that requires consistent reinvestment), to 21.9 years for real estate (an industry with a significant amount of very long-lived assets). Firms with lower numbers are in industries such as information technology, wholesale, and mining operations. Firms with higher numbers are in industries such as utilities and accommodation & food services.

[Figure 4 about here.]

3.2. $\tau^{Matching}$

We find the Matching (revenues-oriented) depreciation expense schedule, $\tau^{Matching}$, using Equation 2. We find $\tau^{Matching}$ to be 8.07 years on average, the time firms should take to fully depreciate fixed assets if the goal is matching. This is lower than $\tau^{Book}$, the 8.35

20It is natural to question whether including another degree of freedom to our estimating equations could lead to a similar increase sample size, yet placebo tests show that the additional parameter has statistically significant explanatory power in describing depreciation by firms.
years firms actually take on average to depreciate fixed assets. We see that $\tau^{Matching} < \tau^{Book}$ and that the median difference between $\tau^{Matching}$ and $\tau^{Book}$, $(\tau^{Matching} - \tau^{Book})$, is -1 for the main sample, and -2 for the restricted sample. This difference is shown graphically in Figure 5.\textsuperscript{21} The distribution of differences skews negative in Subfigure 5a, and more strongly for the restricted sample, Subfigure 5b. This shows that if this aspect of reporting were faithfully following Matching, depreciation of fixed assets would happen over a shorter period of time than in practice.

Moreover, we find that 42.2\% of the main sample has a higher $\tau^{Matching}$ than $\tau^{Book}$, whereas 50.1\% of the main sample has a lower $\tau^{Matching}$ than $\tau^{Book}$ (in 7.7\% of cases, these coincide). This means that in practice, firms will depreciate fixed assets for longer than would best match earnings. In addition, and as one may expect, expensing PPE investments would be the best Matching choice for 12.9\% of firms—capital expenditures do not reliably produce revenues past the first year.

3.3. $\tau^{Market}$

We find the Market (returns-oriented) depreciation expense schedule, $\tau^{Market}$, using Equation 3. We find $\tau^{Market}$ to be 5.60 years on average, the time firms would take to fully depreciate fixed assets if the goal were to make earnings informative for returns. This is even lower in the restricted sample, which is 4.09 years on average. Both in the main sample and the restricted sample, the depreciation times are lower than $\tau^{Book}$, the 8.35 (8.56 in restricted) years firms actually take on average to depreciate fixed assets. Broadly, $\tau^{Market} < \tau^{Book}$. We also see that the median difference between $\tau^{Market}$ and $\tau^{Book}$, $(\tau^{Market} - \tau^{Book})$, is -3 for the main sample, and -4 for the restricted sample. This

\textsuperscript{21}The differences distribution contains significant noise. As we discuss in Section 4.1, this only strengthens the robustness of our results as the noise biases against our results that $\tau^{Matching}$ is smaller than $\tau^{Book}$ in the majority of cases.
difference is shown graphically in Figure 6. The distribution of differences skews negative in Subfigure 6a, and more strongly for the restricted sample, Subfigure 6b. Our results demonstrate that depreciation with the goal of making earnings more informative for returns would be significantly shorter—accelerating expenses—than what happens in practice.

We find that 27.7% (18.2%) of the main (restricted) sample has a higher $\tau^{Market}$ than $\tau^{Book}$, whereas 65.3% (81.8%) of the main (restricted) sample has a lower $\tau^{Market}$ than $\tau^{Book}$. This means that in practice firms will depreciate fixed assets for longer than would be most informative for returns. In addition, and as one may expect, expensing PPE investments would be the best Market choice for 25.0% of firms (35.5% in the restricted sample).

Results for both $\tau^{Matching}$ and $\tau^{Market}$ are detailed in Table 2. We include comparisons, restricting the sample to firms for which our method works better, and further removing firms that either depreciate assets very quickly or very slowly. Our findings are consistent with the fact that most firms use a $\tau^{Book}$ larger than $\tau^{Matching}$, and that this is true for the overwhelming majority of firms when comparing $\tau^{Book}$ to $\tau^{Market}$. Only a small number of firms would do better at matching by expensing capital expenditures, but this number increases for firms when considering the returns-oriented or market objective.

Table 2 about here.

4. Robustness and Extensions

In this section we consider the robustness and validity of our methodology and findings. While $\tau^{Matching}$, the earnings-oriented depreciation expense schedule, is remarkably close to the actual $\tau^{Book}$ depreciation expense schedule, the returns-oriented depreciation
expense schedule $\tau^{Market}$ differs systematically. There is a large $\tau^{Matching} - \tau^{Market}$ gap, but there is also a divergence between $\tau^{Book}$ and $\tau^{Market}$. We focus on showing the robustness of our $\tau^{Market}$ estimates—and therefore the presence of the $\tau^{Matching} - \tau^{Market}$ gap, and a divergence between $\tau^{Book}$ and $\tau^{Market}$—by addressing placebo test results, survivorship, our choice of specification, and sample period. We first study the bias which noise\textsuperscript{22} may introduce in our results. To do this, we allow for firms to be assigned randomly to market-inferred depreciation policies and show that our measures of varying degrees of aggressiveness in reporting (longer period used for depreciation means costs are deferred to the future) are unlikely to be obtained by chance. Next, we use alternative specifications in our estimation—first adjusting for amortization expense in estimation of $\tau^{Book}$ and then controlling separately for book value and net property, plant, and equipment in estimation of $\tau^{Market}$. These robustness checks leave our results on relative aggressiveness essentially unchanged. Finally, we produce estimates for 2008-2012, the period following our initial sample of 2003-2007, and find that our results are consistent, if not stronger, for the post-crisis period when compared to the pre-crisis period.

4.1. Noise as Placebo Test—$\tau^{Market}$ vs. $\tau^{Book}$

Our estimation procedure is noisy. This would be concerning if it were possible to obtain our results even in the absence of an effect of depreciation choice on the value relevance of earnings. If our $\tau^{Market}$ estimates were random, in principle our results could lead to spurious conclusions about how many more years $\tau^{Book}$ uses to depreciate capital stock when compared to $\tau^{Market}$. In principle, a computational procedure could bias in either direction: in favor of finding a shorter $\tau^{Book}$ relative to the value relevant choice, or in favor of finding a longer $\tau^{Book}$ relative to the value relevant choice. We find that precisely the opposite is the case. Our computational procedure instead biases against our results, and actually pushes $\tau^{Market}$ closer to $\tau^{Book}$, reducing our gap. Because we still have a gap, \textsuperscript{22}By noise, we mean the numerical biases introduced in our modeling procedure.
this bias strengthens the validity of our findings. We illustrate this bias below, using pure noise as a benchmark for the numerical bias of our method.

For each firm, we denote by $\tau^{Book}$ the firm’s estimated depreciation choice. Given the $T$ years investigated by our procedure, for each firm there are $T$ possible market-inferred depreciation policies, $\tau = 1, \ldots, T$. Hence, the likelihood that the two policies match, $\tau^{Market} = \tau^{Book}$, by pure chance is just $\frac{1}{T}$ for each estimated depreciation choice. Similarly, the likelihood of $\tau^{Market} > \tau^{Book}$—where the firm depreciates at a faster rate than the market perceives—is $\frac{T - \tau^{Book}}{T}$, and the likelihood of $\tau^{Market} < \tau^{Book}$—where the firm uses slower depreciation than inferred by the market—is $\frac{\tau^{Book} - 1}{T}$. We consider a firm with $\tau^{Book} = 8$ (as the mean of our sample is 8.3 years in the 2003-2007 estimates), for illustration, meaning there are seven potential policies which involve depreciating investment over a shorter period of time (1, \ldots, 7), and eleven potential policies which depreciate over a longer period of time (9, \ldots, 19). Given our particular $T = 19$, and our data, the two policies would coincide 5.3% ($\frac{1}{19}$) of the time. The noise benchmark would also yield seven policies out of 19 (36.8\%—38.7\% in our sample) as denoting faster depreciation, and eleven out of 19 (57.9\%—56.1\% in our sample) as denoting slower depreciation. In fact, the mean is a sufficient statistic for the direction of any pure noise-induced bias. We conclude that plausible estimation-induced noise would mechanically bias against our results.

It is also possible to formally test whether our results are statistically different from a noise benchmark for the particular case of the restricted sample.\(^{23}\) We use this sample because of the better fit and the associated binary categorization into faster or slower depreciation. For this sample of 220 firms, 40 firms (18\%) are categorized as unaggressive, whereas chance would yield 130 (59\%). To test whether this difference is statistically significant, let $x \sim B(n, p)$—binomially distributed—with $n = 220$ and $p = 0.592$. We get $p$ from averaging over firms in the restricted sample using calculations

\(^{23}\)Where we require a good fit in the first stage and second stage. The minimum $R^2$ in the first stage is 0.5; in the second stage it is .05. Also, we require a change from $\tau^{Book}$ to $\tau^{Market}$. 

18
as described above. We want to find the probability of getting \( x \leq 40 \) firms, or the likelihood we could obtain our results from noise alone. To evaluate this probability, we use the normal approximation to the binomial distribution, \( \bar{x} \sim N(np, np(1 - p)) \). From this,

\[
Prob(\bar{x} \leq 40) = Prob\left( z \leq -\frac{(130.22 - 40)}{7.29} \right) 
\approx 10^{-35}
\]  

or more than 12 standard deviations away from the mean of the normal distribution. We reject the hypothesis that the noise in our procedure could reasonably explain our results.

4.2. Survivorship Bias

We select firms such that there is sufficient data to perform our estimation. This requires that we have depreciation expense, capital expenditures and earnings before extraordinary items in each year from 1980 to 2007. Such a large sample leaves out many shorter-lived firms, and there could be concern that this would bias our results. We find that the depreciation choice used by firms is on average three years longer than the value relevance preferred choice, meaning that markets value earnings as though capital expenditures are expensed more quickly than they actually are. This relationship could be due to something idiosyncratic about long-lived firms, meaning we might not observe this phenomenon for younger or expiring firms, if we were to have the data—this concern, if valid, would not necessarily undermine our results, but would cast doubt on their external validity.

To investigate this issue, we construct a measure of firm age using the number of years that the firm is included in Compustat. Given that this database begins in 1950 and our investigation ends in 2007, firm age runs from 28 to 58. If survivorship bias were to be a concern, we would expect our results to vary according to this variable.
Comparing the difference between actual and inferred depreciation policies for firms above and below the median firm age, we get -2.82 for “old” firms and -2.68 for “young” firms. This difference is not close to statistically significant, with a p-value of 0.8215; a similar result obtains using a test of medians across the two groups. Putting this reporting difference and firm age in a simple linear regression framework again reveals no statistically significant relationship. The fact that there seems to be no relationship between our results and firm age in sample alleviates concern about such a relationship outside of the sample.

4.3. Alternative Specifications

In estimating $\tau^{Book}$, which involves modeling the relationship between depreciation and capital expenditures (Equation 1), we want our data on depreciation to reflect exactly the depreciation of capital assets. For a variety of institutional and data collection issues, the primary measure of depreciation available in Compustat combines reported depreciation with amortization of intangible assets. The simplest correction for this issue would be to use a measure of the latter to disentangle the true depreciation by year, for each firm. Amortization of intangibles appears not to have been collected for all firms in the Compustat universe, particularly for earlier years. This causes measurement error in estimating depreciation choice—with systematic biases for firms for which Compustat is missing data. In our primary analysis, we have avoided correcting for amortization because it is missing for so many firm years. Our sample would be much smaller, unless we were to impute zeros for the missing data. While our fit is somewhat improved by using this imputation, an important distortion is introduced because there is a bias in data availability across firms and over time. In Table 3, we re-estimate our results on reporting conservatism using the correction for amortization. We find that our results are similar in both the main sample and the restricted sample. It appears that any measurement error induced by including amortization in our specification does not have a meaningful impact.
on our results or the $\tau^{Book} - \tau^{Market}$ gap.

Our $\tau^{Market}$ analysis regresses returns on earnings and change in earnings, as in Lev and Zarowin (1999), but using counterfactual earnings numbers by recalculating depreciation expense. We model $\tau^{Market}$, the returns-oriented depreciation expense schedule, on a firm by firm basis, and despite the small number of years we have for each regression, there are some clear controls that we could include in our model. The first alternative specification we test uses book value as an additional control. We find in Table 3 that the categorization of firms in each sample is consistent with our main specification. This indicates the robustness of our results. Further, book value controls make our results slightly less aggressive in the main sample. It is important to note that the restricted sample is now smaller (152 vs. 220). This is due to our requirement in this restricted sample that the explanatory power increase considerably when compared to earnings with the estimated useful life. Book value is collinear, to a degree, with earnings, and so reduces the incremental explanatory power, while leaving similar the direction of change in choices.

An alternative control which could be included in the returns regressions for $\tau^{Market}$, given its relation to depreciation is net property, plant, and equipment. Including this control variable, we find that our results on conservatism are the same for the main sample as from the more parsimonious model we use. The sample size decreases when moving to the restricted sample, though this is similarly explained by collinearity of net PPE to earnings, and the effect of the 10% $R^2$ restriction in the presence of a model with more explanatory power. If anything, in the restricted sample, aggressive reporting is actually more common.

Our measure of unaggressive vs. aggressive reporting is quite stable. However, this similarity may hide differences in the distribution of market-inferred choices across specifications. In Figure 7 we reproduce the distribution of differences between optimally
fitted and estimated useful life using our baseline specification for all 559 firms, and then overlay the same histogram for the specification controlling for book value in the returns regressions. This figure shows the unaggressive (positive) vs. aggressive (negative) reporting and the number of firms by which the market’s interpretation differs. The distributions appear very similar. In fact, a pairwise t-test, where the null hypothesis is that the distributions are the same, yields a p-value of 0.35, while the Kolmogorov-Smirnov test, which employs sensitivities to both location and shape, finds a p-value of 0.867; these results mean we cannot reject the null hypothesis that the two distributions are the same.

[Figure 7 about here.]

4.4. Changing Sample Period

Our attempt in performing our analysis for the years 2003-2007 was to avoid possible confounding factors the financial crisis may have introduced to financial reporting incentives. Looking at only one period of time may introduce issues of external validity to years other than this period of time. While we have shown the fact that our results are robust to bias, survivorship, and specification changes, there may be unobservable secular trends that are driving our results. In Table 4 we present estimates for the post-crisis period, 2008-2012. When examined side by side, the results for 2008-2012 vs. 2003-2007 show that the number of firms for which $\tau^{Book}>\tau^{Matching}$—those firms with aggressive reporting choices—remains the same, if not increases during the post-crisis period. The same is essentially true for those firms for which $\tau^{Book}>\tau^{Market}$. This shows that our results are also robust to time period. If we were to do rolling period analysis, 2004-2008, 2005-2009, etc. through until 2008-2012, we end up with roughly a convex combination of the results for the two disjoint estimation periods.

[Table 4 about here.]
5. Conclusion

The process and goals of financial reporting black box remain a topic of interest for professionals, regulators, and academics. Recent academic research argues that accounting standards increasingly reflect the informational demands of the market. While theoretically the goal of the standard and the goal that best reflects market preferences may not be at odds, it is possible that the optimal reporting choices for each may differ in practice. We investigate a setting in which the standard requires significant managerial discretion, depreciation, and compare actual choice (assumed useful life, Book) to the choices that best match revenues (Matching) and returns (Market). We find that not only does Book choice differ consistently from Matching and Market, but that it is more aggressive—firms depreciate for longer periods of time than reflect either goal. What is more striking is that we find a sizable Matching—Market gap. Our findings thus show that actual depreciation choice reflects managerial choices that perfectly meet neither Matching nor Market goals, likely the product of managerial discretion of one form or another. These findings may bring into question theoretical arguments regarding the consistency of Matching and Market reporting objectives (Dichev and Tang (2008)).

The fact that $\tau^{Book}$, our measure of actual depreciation choice, is larger than $\tau^{Matching}$ or $\tau^{Market}$ in general indicates that the manager may have other goals in mind when evaluating the average useful life of capital expenditures. Proper valuation of book assets is a goal that is difficult to test given the relative lack of market valuation of book assets available for firms in any dataset. Further, there may be reporting incentives that may involve earnings management, or window dressing. It is striking, however, the relative consistency that $\tau^{Book}$ is far from $\tau^{Market}$, but closer to $\tau^{Matching}$, indicating the relative importance of the standard in making depreciation decisions. This topic, we argue, requires further investigation into the actual mechanisms of valuation, and the role of financial reporting in that process.
We introduce a new two parameter model for depreciation choice that allows us to uncover the actual choice, but also choices that align with certain objectives, like matching revenues, or reflecting returns. However, our methodology could in principle be used to address reporting incentives in other contexts, such as managerial forecasts, analyst forecasts, managerial guidance, auditor opinions, prosecutions by regulators, and the broader topic of earnings management. By tying reported numbers to different benchmarks in a similar way, researchers can better understand how a particular reporting choice may achieve that goal versus a competing reporting goal. In this way, we contribute methodologically to the accounting literature in better understanding incentives in financial reporting. Naturally, we leave these other applications for further research.
References


A. Estimation Procedure

A.1. Estimating $\tau_{Book}$—Detail

For each firm, we calculate a depreciation schedule according to capital expenditures. Here, $Dep_{0,t}^i$ represents actual depreciation for firm $i$ in year $t$, $CapX_{i,t}$ represents capital expenditure by firm $i$ in year $t$, whereas $Dep_{i,t}(\tau, \lambda)$ represents the structural depreciation schedule for firm $i$ in year $t$, which is to be estimated. In this last expression, $\tau$ is the useful life of capital assets, and $\lambda$ is the depreciable fraction (or the fraction of investment to be depreciated). The latter captures both nonzero residual values for depreciable investment as well as a positive fraction of investment in nondepreciable assets, such as land. This second category can also be thought of as representing a separate type of investment with a very long but finite useful life, and so having a low rate of depreciation, such as for power plants or other utilities, which may be assumed to operate for upwards of 50 years. We calculate $Dep_{i,t}(\tau, \lambda)$ as,$^{24}$

$$Dep_{i,t}(\tau, \lambda) = \lambda \left[ \frac{CapX_{i,t}}{\tau} + \frac{CapX_{i,t-1}}{\tau} + \cdots + \frac{CapX_{i,t-\tau+1}}{\tau} \right]$$

(5)

Essentially, $Dep_{i,t}(\tau, \lambda)$ represents $\frac{1}{\tau}$ of capital expenditures in the previous $\tau$ years, beginning with capital expenditures this year, with the remaining portion of capital expenditures $\tau - 1$ years ago being the remaining capital vintage to be depreciated. The depreciable fraction, $\lambda$, is the part of capital which is depreciated. For $T$ years in the sample, $t = \text{Begin Year}, \text{Begin Year} + 1, \ldots, \text{End Year}$,$^{25}$ the structural depreciation schedule is calculated for $\tau = 1, 2, \ldots, \tau_{\text{MAX}} - 1$ years of average useful life.$^{26}$ If $T$ is the total number of years in the sample, normalizing $t = 1$ as the beginning year in the sample, the fit of $Dep_{i,t}(\tau, \lambda)$ to $Dep_{i,t}^0$ for $i = 1, \ldots, \tau$ is,

$$R_{i,\tau,\lambda}^2 = 1 - \frac{\sum_{t=1}^{T} (Dep_{i,t}^0 - Dep_{i,t}(\tau, \lambda))^2}{\sum_{t=1}^{T} (Dep_{i,t}^0 - Dep_{i,t}^0)^2}$$

(6)

$^{24}$Our parameterization, using both average useful life, $\tau$, and a depreciable fraction, $\lambda$, has approximation issues. Namely, our data limits the number of years that we can go back in terms of looking at capital investment. Given a $\tau_{\text{MAX}}$, the maximum number of years we allow for in depreciating capital assets, some firms’ depreciation choices will be approximated as shorter than they otherwise would. This biases against our result of aggressive reporting because some firms’ choices will be measured in the first stage as shorter than they actually are.

$^{25}$Begin Year represents the first year to be used in calculating the fit of the structural depreciation schedule. However, the sample must include data going back $\tau_{\text{MAX}}$ years.

$^{26}$$\tau_{\text{MAX}}$ represents the total number of years used in calculating possible average useful life.
where \( \overline{Dep_i^0} = \frac{1}{T} \sum_{t=1}^{T} Dep_i^{0,t} \). Using the objects \( Dep_{i,t}(\tau, \lambda) \) and \( R^2_{i,\tau} \), we find the best fitting expected useful life using a naive algorithm. It is important here to note that while this procedure is discussed in two steps, but in reality the steps are one step estimation. Using \( R^2 \) as opposed to maximum likelihood ratio is done because the two are equivalent except under distributional assumptions that make \( R^2 \) a superior metric (e.g., non-normality of errors). We first calculate \( Dep_{i,t}(\tau, \lambda) \) for \( t = 1, \ldots, T \) and \( \tau = 1, 2, \ldots, \tau_{MAX} \), using least squares to fit \( \lambda_i^{Book}(\tau) \) using \( Dep_{i,t}(\tau, \lambda_i(\tau)) \) fitted to \( Dep_{i,1}^{0,t} \), for \( t = 1, \ldots, T \).\(^{27}\) Next, for \( \tau = 1, 2, \ldots, \tau_{MAX} \), and using all years in the sample, we calculate \( R^2_{i,\tau,\lambda_i^{Book}(\tau)} \). This means we can find our best fits for the two parameter model, choosing \( \tau_i^{Book} = \arg\max_{\tau = 1, 2, \ldots, \tau_{MAX}} R^2_{i,\tau,\lambda_i^{Book}(\tau)} \), and \( \lambda_i^{Book} = \lambda_i^{Book}(\tau_i^{Book}) \). We repeat this procedure firm by firm for all firms in the sample. This means that \( Dep_i(\tau_{Book}, \lambda_i^{Book}) = [Dep_i^{0,1}(\tau_{Book}, \lambda_i^{Book}), \ldots, Dep_i^{0,T}(\tau_{Book}, \lambda_i^{Book})] \) is the best fit for \( Dep_i^0 = [Dep_i^{0,1}, \ldots, Dep_i^{0,T}] \), and so we have our structural parameters \( \tau_i^{Book} \), the average useful life, \( \lambda_i^{Book} \), the depreciable fraction, as well as the fit \( R^2_{i,\tau_{Book},\lambda_i^{Book}} \). We show the calculations in Figure A.1, below.

\(^{27}\) \( \tau_{MAX} \) remains an artificial limit on average useful lives. The reasoning is that a longer average useful life can be approximated using a smaller depreciable fraction.
This figure shows the $R^2$ fit of the one parameter and two parameter straight line depreciation schedule models for the firms in our sample. Depicted on the horizontal axis is the level of $R^2$, and on the vertical axis is the number of firms which fit into the (0–0.2), (0.2–0.4), (0.4–0.6), (0.6–0.8), and (0.8–1.0) levels of explanatory power. There are a total of 357 firms depicted for the one parameter model, and 559 firms depicted for the two parameter model. The sample uses depreciation and capital expenditure data from 1980-2007 from Compustat. The $R^2$ has mean 0.60 for the one parameter model, restricting $R^2$ above 0, and mean 0.65 for the two parameter model, so the two parameter model explains the depreciation of more firms, and does it better.

**A.2. Estimating $\tau^{\text{Matching}}$ and $\tau^{\text{Market}}$**

For finding either $\tau^{\text{Matching}}$ or $\tau^{\text{Market}}$, we must first find counterfactual depreciation schedules. Using capital expenditures and varying the expected useful life $\tau = 1, \ldots, \tau^{\text{MAX}}$, we can calculate structural depreciation schedules as in equation 5,

$$Dep_{i,t}(\tau, \lambda_{i,t}^*) = \lambda_{i,t}^{\text{Book}} \left[ \frac{CapX_{i,t}}{\tau} + \frac{CapX_{i,t-1}}{\tau} + \cdots + \frac{CapX_{i,t-\tau}}{\tau} \right]$$  \hspace{1cm} (7)$$

Which represents the counterfactual depreciation by firm $i$ in year $t$ using $\tau$ as the average useful life of depreciable assets.\textsuperscript{28} By restricting depreciation in this way, we can

\textsuperscript{28}Here we assume that $\lambda = \lambda_{i,t}^{\text{Book}}$, found in Stage 1, for best fitting $\tau^{\text{Book}}$. 

29
calculate counterfactual earnings according to any given useful life. Let $E_{i,t}(\tau)$ be the counterfactual earnings in year $t$ using a structural depreciation schedule $Dep_{i,t}(\tau, \lambda_{i,t}^{Book})$. As in Appendix A.2, $Dep_{i,t}^0$ represents actual depreciation by firm $i$ in year $t$. Then we calculate,

$$E_{i,t}(\tau) = E_{i,t}^0 + Dep_{i,t}^0 - Dep_{i,t}(\tau, \lambda_{i,t}^{Book})$$  \hspace{1cm} (8)

We use $E_{i,t}(\tau)$ to calculate $\Delta E_{i,t,t-1}(\tau) = E_{i,t}(\tau) - E_{i,t-1}(\tau)$, the change in counterfactual earnings from year $t - 1$ to year $t$ for the particular useful life $\tau$. We now have the pieces necessary to perform either the matching regression,

$$E_{i,t}^0 + Dep_{i,t}^0 = \alpha_{i,\tau} + \beta_{i,1,\tau}Dep_{i,t}(\tau, \lambda_{i,t}^{Book}) + \beta_{i,2,\tau}Assets_{i,t} + \epsilon_{i,t,\tau}$$  \hspace{1cm} (9)

or the counterfactual earnings informativeness regression,

$$Return_{i,t} = \alpha_{i,\tau} + \beta_{i,1,\tau}E_{i,t}(\tau) + \beta_{i,2,\tau} \Delta E_{i,t,t-1}(\tau)$$  \hspace{1cm} (10)

We run this regression for $\tau = 1, \ldots, \tau_{MAX}$, obtaining the $R^2$ for each possible average useful life. We choose the $\tau$ such that the regression of returns on counterfactual earnings explains the most variation. This means we find for each firm $i$,

$$\tau_{Ob jective, i}^0 = \arg\max_{\tau=1, \ldots, \tau_{MAX}} R^2_{i,\tau}(Objective),$$

where $Objective$ is $Matching$ or $Market$. There are two obvious earnings benchmarks which could be used when measuring the informativeness of counterfactual depreciation choices: $E_0^i = [E_{i,1}^0, \ldots, E_{i,T}^0]$, the actual, observed earnings, or $E_i(\tau_{Book}) = [E_{i,1}(\tau_{Book}), \ldots, E_{i,T}(\tau_{Book})]$, earnings computed using the best fitting two parameter depreciation choice from the Stage 1 estimation. The first case would seem to present a higher hurdle for our procedure since removing the information contained in $Dep_{i,t}^0$ and replacing it with a structural depreciation schedule $D_i(\tau_{Book}, \lambda_{Book})$ could reduce the explanatory power of earnings with respect to earnings. The second case may be more apt for comparison purposes when considering the counterfactual depreciation choices.

B. Accelerated Depreciation

Jackson et al. (2009) find, looking from 1988 to 2006, that 80% of firms use straight line depreciation exclusively. The authors also show that this number has increased
monotonically over time, to 86%. Additionally, their categorization excludes all firms which use accelerated depreciation for any of their assets. Of the 20% in the accelerated category, 84% use a combination of straight line and accelerated. The authors also find that straight line depreciation is the predominant method in most industries. Regardless, some firms do use accelerated depreciation. In our main specifications, we do not explicitly allow for any use of accelerated methods. We investigate here whether this restriction could be adding a significant bias to our results.

If firms are indeed using a significant amount of accelerated depreciation, our main concern is that this would bias our results in favor of finding aggressiveness, and so undermine the conclusions of the paper. As we discussed in Section 4.1, such a bias could come from a fundamental misestimation of the average useful lives employed by firms. We show below that when accounting for some accelerated depreciation by firms, the distribution of $\tau^*$, the average useful life of depreciable assets, remains unchanged.

Accelerating the depreciation process entails front loading the depreciation schedule such that much of the expense for a depreciated asset occurs in the first several years. We allow for some use of accelerated methods in a simple way—by imposing expensing for a fraction of capital. While this change affects all firms uniformly, it allows us to account for possible bias in our estimation of average useful life. In Figure B.1, we show the median model fit $R^2$ for all firms for which we can explain some of the variation across different accelerated fractions, from 0% to 15% in 1% increments. We also show the number of firms that are fitted. Naturally, the number of firms we can fit goes down, but so does the median $R^2$ as the accelerated fraction increases. This is striking as we are removing firms at the 0 and still get a decreasing median $R^2$. We cannot argue that allowing for acceleration improves the fit of our model.
Figure B.1: This figure shows the median $R^2$ fit and number of firms explained while incorporating 0% to 15% accelerated depreciation in 1% increments. On the horizontal axis is the level of % accelerated depreciation of capital expenditures. On the left vertical axis is the median $R^2$ for firms for which we can explain some variation and on the right vertical axis is the number of firms that can be modeled. The median $R^2$ is 0.72 for 0% accelerated depreciation, and is 0.66 for 15% accelerated. The total sample size is begins at 559 for 0% accelerated depreciation (our baseline specification) and decreases to 492 for 15% accelerated.

Further, we present histograms comparing our baseline specification to accelerating 1%, 5%, and 10%, respectively in Figure B.2, Figure B.3, and Figure B.4. Each table shows only those firms for which the accelerated sample produced $R^2$ estimates greater than zero, meaning that the sample is reduced from 559. For 1% we only lose one firm, but the sample decreases to 545 and 519, respectively for 5% and 10%. It is clear that the results are similar for average useful lives, regardless of the degree of accelerated depreciation employed. Not including accelerated depreciation in the first stage does not significantly alter our results, although with accelerated depreciation, our estimation procedure yields small decreases in average useful lives. The number falls to 8.31, 8.10, and 8.02 for 1%, 5%, and 10%, respectively. We therefore find that using straight-line depreciation has a negligible effect on estimated average useful lives and so our results as a whole.
Figure B.2: This figure shows the estimated average useful life for firms, $\tau^{\text{Book}}$, incorporating 1% accelerated depreciation. On the horizontal axis is the level of $\tau^{\text{Book}}$ in years and on the vertical axis is the number of firms which fit into each year bin. The total sample size is 558. In blue is the baseline, and in outlined black is the accelerated. The mean for baseline is 8.35 and the mean for 1% 8.31.

Figure B.3: This figure shows the estimated average useful life for firms, $\tau^{\text{Book}}$, incorporating 5% accelerated depreciation. On the horizontal axis is the level of $\tau^{\text{Book}}$ in years and on the vertical axis is the number of firms which fit into each year bin. The total sample size is 545. In blue is the baseline, and in outlined black is the accelerated. The mean for baseline is 8.35 and the mean for 5% 8.10.
Figure B.4: This figure shows the estimated average useful life for firms, $\tau^{Book}$, incorporating 10% accelerated depreciation. On the horizontal axis is the level of $\tau^{Book}$ in years and on the vertical axis is the number of firms which fit into each year bin. The total sample size is 519. In blue is the baseline, and in outlined black is the accelerated. The mean for baseline is 8.35 and the mean for 10% 8.02.
This figure shows median difference from τ_{Book} for τ_{Matching}, and τ_{Market}. This is the difference from the number of years that firms depreciate assets in practice, to the number for depreciating to best match costs with revenues, and depreciating to best improve value relevance of earnings, respectively, for the 559 firms in our sample. τ_{Book} is given and τ_{Matching} and τ_{Market} are depicted as median differences respectively on the timeline from 1 to 10 years (although longer depreciation schedules are allowed in estimates). A level of 5 years is essentially depreciation of an asset over the course of five years. τ_{Book} has a median of 7 years, an average of 8.35 years, and a mode of 5 years. The restricted sample requires that $R^2 > 0.5$ in estimation of τ_{Book}, that $R^2 > 0.05$ in the estimation of τ_{Matching} or τ_{Market}, and that the improvement in explanatory power increase by 10%.
This figure shows $\tau^{Book}$, the number of years that the firm depreciates assets in practice, for the 559 firms in our sample. On the horizontal axis is years. On the vertical axis is the number of firms that follow a particular average useful life depreciation schedule, by year. A level of 5 years is essentially depreciation of an asset over the course of five years. $\tau^{Book}$ has a median of 7 years, an average of 8.35 years, and a mode of 5 years.
This figure shows the *Depreciable Fraction*, which represents the proportion of fixed assets that are actually depreciated, rather than indefinitely lived, such as land, for the 559 firms in our sample. The depreciable fraction may also represent the proportion of depreciable assets that are depreciated and does not show up in salvage value. On the horizontal axis is the Depreciable Fraction. On the vertical axis is the number of firms which fit into each bin of depreciable fractions. The mean depreciable fraction is 0.81.
This figure shows the normalized $\tau^{Book}$, the number of years that the firm depreciates fixed assets in practice, for the 559 firms in our sample. $\tau^{Book}$ is normalized to account for the depreciable fraction, thus illustrating the depreciation choice that a firm uses in one summarizing factor. A larger normalized $\tau^{Book}$ corresponds to a greater mixture of longer-lived fixed assets. On the vertical axis are industries that have more than 10 firm observations. Manufacturing has the lowest normalized $\tau^{Book}$ at 10.3 years, and real estate has the highest at 21.9 years. Lower numbers are also depicted for information, mining, and wholesale, and higher numbers for utilities, and accommodation & food services.
This figure shows the difference between $\tau^{\text{Matching}}$, the depreciation time for fixed assets if the goal were matching, and $\tau^{\text{Book}}$, the actual depreciation time for fixed assets, for the 559 firms in our sample in panel 5a, and for the 220 firms in the restricted sample panel 5b. $\tau^{\text{Matching}}$ is found by choosing the number of years that best fit the model of earnings in Equation 2. $\tau^{\text{Book}}$ is found by choosing the number of years that the firm depreciates fixed assets in practice (See Equation 5). The restricted sample requires a more strict fit of the data, and an improvement of fit in estimating $\tau^{\text{Matching}}$. On the horizontal axis is the difference in years. On the vertical axis is the number of firms binned into each year differential. A negative number shows that $\tau^{\text{Matching}} < \tau^{\text{Book}}$ for a particular firm, meaning that the firm would depreciate assets over a shorter period of time if the goal of depreciation were matching. For the main sample, the median difference is -1 years. For the restricted sample, the median difference is -2 years, whereas the modal difference is -3 years.
This figure shows the difference between $\tau^{Market}$, the depreciation time for fixed assets if the goal were making earnings more informative for returns, and $\tau^{Book}$, the actual depreciation time for fixed assets, for the 559 firms in our sample in panel 6a, and for the 220 firms in the restricted sample panel 6b. $\tau^{Market}$ is found by choosing the number of years that best fit the model of market returns in Equation 3. $\tau^{Book}$ is found by choosing the number of years that the firm depreciates fixed assets in practice (See Equation 5). The restricted sample requires a more strict fit of the data, and an improvement of fit in estimating $\tau^{Market}$. On the horizontal axis is the difference in years. On the vertical axis is the number of firms binned into each year differential. A negative number shows that $\tau^{Market} < \tau^{Book}$ for a particular firm, meaning that the firm should depreciate assets over a shorter period of time if goal were making earnings more informative for returns. For the main sample, the median difference is -3 years. For the restricted sample, the median difference is -4 years, whereas the modal difference is -3 years in both cases.
This figure shows the difference between $\tau^{\text{Market}}$, the depreciation time for fixed assets if the goal were making earnings more informative for returns, and $\tau^{\text{Book}}$, the actual depreciation time for fixed assets, using our regular specification as well as an earnings informativeness regression that includes book value. $\tau^{\text{Market}}$ is found by choosing the number of years that best fit the model of market returns in Equation 3. $\tau^{\text{Book}}$ is found by choosing the number of years that the firm depreciates fixed assets in practice (See Equation 5). In the Book Value bars, $\tau^{\text{Market}}$ includes book value in the market returns regression. On the vertical axis is the number of firms binned into each year differential. A negative number depicts aggressiveness in accounting or depreciating fixed assets over a longer period of time, and a positive number depicts unaggressive accounting. The median and modal difference is -3 years and the mean is -2.7 years for the baseline specification. Controlling for book value gives us a median and modal difference of -3 years, and a mean difference of -3 years. Both specifications indicate most firms exhibit aggressiveness in their depreciation choice.
Table 1: Descriptive Statistics

This table shows descriptive data from the 559 firms in our sample from Compustat for 2005 (middle of years 2003-2007). Total assets, Net PPE, total sales, and earnings are in millions of dollars. Return on assets, sales divided by total assets, capital expenditures divided by Net PPE, depreciation rate, and leverage are all ratios.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>25th</th>
<th>50th</th>
<th>75th</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL ASSETS</td>
<td>10,816</td>
<td>39,904</td>
<td>262</td>
<td>1,613</td>
<td>7,599</td>
</tr>
<tr>
<td>NET PPE</td>
<td>3,229</td>
<td>8,930</td>
<td>61</td>
<td>421</td>
<td>2,206</td>
</tr>
<tr>
<td>SALES</td>
<td>8,950</td>
<td>26,306</td>
<td>247</td>
<td>1,601</td>
<td>7,186</td>
</tr>
<tr>
<td>EARNINGS</td>
<td>618</td>
<td>2,259</td>
<td>6</td>
<td>65</td>
<td>443</td>
</tr>
<tr>
<td>RETURN ON ASSETS</td>
<td>.054</td>
<td>.155</td>
<td>.028</td>
<td>.052</td>
<td>.092</td>
</tr>
<tr>
<td>SALES/TOTAL ASSETS</td>
<td>1.134</td>
<td>.793</td>
<td>.589</td>
<td>.944</td>
<td>1.495</td>
</tr>
<tr>
<td>CAPEX/NET PPE</td>
<td>.201</td>
<td>.053</td>
<td>.115</td>
<td>.163</td>
<td>.246</td>
</tr>
<tr>
<td>DEPRECIATION/NET PPE</td>
<td>.176</td>
<td>.175</td>
<td>.087</td>
<td>.143</td>
<td>.202</td>
</tr>
<tr>
<td>LEVERAGE</td>
<td>.173</td>
<td>.150</td>
<td>.039</td>
<td>.159</td>
<td>.263</td>
</tr>
<tr>
<td>REGULAR DIVIDENDS &gt; 0</td>
<td>.680</td>
<td>.467</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>
Table 2: $\tau^{Book}$ vs. $\tau^{Matching}$ and $\tau^{Market}$

This table shows the breakdown of how aggressive firms are in their depreciation choice compared to revenues-oriented or returns-oriented schedules. This is shown by a larger number of years than the Matching- or Market-oriented number of years, in Panels (a) and (b), respectively. The main estimation sample contains all 559 firms for which the first stage estimation has explanatory power. The restricted sample of 220 firms requires that $R^2 > 0.5$ in estimation of $\tau^{Book}$, that $R^2 > 0.05$ in the estimation of $\tau^{Matching}$, or $\tau^{Market}$, and that the improvement in explanatory power is 10% over actual depreciation. The third row of each panel starts with the restricted sample and also requires an estimated useful life greater than two years, causing firms with the two fastest depreciation choices to be dropped, leaving 204 firms. In the fourth row, this added restriction is changed to an estimated useful life less than 18, so that firms with the two lengthiest depreciation choices are dropped and 210 firms are left.

(a) Matching

<table>
<thead>
<tr>
<th></th>
<th>$\tau^{Book} &lt; \tau^{Matching}$</th>
<th>$\tau^{Book} &gt; \tau^{Matching}$</th>
<th>$\tau^{Matching} = 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Main Sample</td>
<td>.42</td>
<td>.50</td>
<td>.13</td>
</tr>
<tr>
<td>(2) Restricted</td>
<td>.45</td>
<td>.55</td>
<td>.12</td>
</tr>
<tr>
<td>(3) Restricted,</td>
<td>.42</td>
<td>.58</td>
<td>.12</td>
</tr>
<tr>
<td>$\tau^{Book} &gt; 2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Restricted,</td>
<td>.47</td>
<td>.53</td>
<td>.12</td>
</tr>
<tr>
<td>$\tau^{Book} &lt; 18$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(b) Market

<table>
<thead>
<tr>
<th></th>
<th>$\tau^{Book} &lt; \tau^{Market}$</th>
<th>$\tau^{Book} &gt; \tau^{Market}$</th>
<th>$\tau^{Market} = 1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Main Sample</td>
<td>.28</td>
<td>.65</td>
<td>.25</td>
</tr>
<tr>
<td>(2) Restricted</td>
<td>.18</td>
<td>.82</td>
<td>.35</td>
</tr>
<tr>
<td>(3) Restricted,</td>
<td>.14</td>
<td>.86</td>
<td>.36</td>
</tr>
<tr>
<td>$\tau^{Book} &gt; 2$</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Restricted,</td>
<td>.19</td>
<td>.81</td>
<td>.36</td>
</tr>
<tr>
<td>$\tau^{Book} &lt; 18$</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 3: Robustness Results

This table shows the breakdown of firms by whether \( \tau^{Book} \) actual depreciation is faster, the same, or slower than \( \tau^{Market} \) returns-oriented depreciation. The main estimation sample contains all 559 firms for which the first stage estimation has explanatory power. The restricted sample of 220 firms requires that \( R^2 > 0.5 \) in estimation of \( \tau^{Book} \), that \( R^2 > 0.05 \) in the estimation of \( \tau^{Market} \), and that the improvement in explanatory power of the optimally fitted earnings of firms over the counterfactual estimated earnings increase by 10%. The majority of firms are perceived as aggressive in their depreciation choice, and this only increases as the sample is restricted. Note that neutral reporting firms are dropped by definition in the restricted sample, which is why neutral reporting is zero for that sample in each case. The first column shows the reporting distribution for the noise benchmark, while the second column reproduces our main specification results of Table 2. The third column corrects depreciation with data on amortization and the last columns add book value and net property, plant and equipment to the \( \tau^{Market} \) regressions, respectively.

<table>
<thead>
<tr>
<th>Main Sample (firms)</th>
<th>Noise</th>
<th>Main Spec.</th>
<th>Amortization</th>
<th>Book Value</th>
<th>Net PPE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(559)</td>
<td>(559)</td>
<td>(611)</td>
<td>(559)</td>
<td>(559)</td>
</tr>
<tr>
<td>( \tau^{Book} &lt; \tau^{Market} )</td>
<td>.56</td>
<td>.28</td>
<td>.26</td>
<td>.25</td>
<td>.26</td>
</tr>
<tr>
<td>( \tau^{Book} = \tau^{Market} )</td>
<td>.05</td>
<td>.07</td>
<td>.06</td>
<td>.07</td>
<td>.09</td>
</tr>
<tr>
<td>( \tau^{Book} &gt; \tau^{Market} )</td>
<td>.39</td>
<td>.65</td>
<td>.68</td>
<td>.68</td>
<td>.65</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Restricted Sample (firms)</th>
<th>(220)</th>
<th>(220)</th>
<th>(247)</th>
<th>(152)</th>
<th>(138)</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \tau^{Book} &lt; \tau^{Market} )</td>
<td>.59</td>
<td>.18</td>
<td>.20</td>
<td>.20</td>
<td>.13</td>
</tr>
<tr>
<td>( \tau^{Book} = \tau^{Market} )</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>( \tau^{Book} &gt; \tau^{Market} )</td>
<td>.41</td>
<td>.82</td>
<td>.80</td>
<td>.80</td>
<td>.87</td>
</tr>
</tbody>
</table>
Table 4: $\tau^{Book}$ vs. $\tau^{Matching}$ and $\tau^{Market}$ Over Time

This table shows the breakdown of firms by whether the market perceives them to be unaggressive or aggressive in their depreciation choice. The main estimation sample contains all 559 firms for which estimation of $\tau^{Book}$ has explanatory power. The restricted sample of 220 firms requires that $R^2 > 0.5$ in estimation of $\tau^{Book}$, that $R^2 > 0.05$ in the estimation of $\tau^{Matching}$ or $\tau^{Market}$, and that the improvement in explanatory power is 10% over actual depreciation. The third row in each breakdown starts with the restricted sample and also requires an estimated useful life greater than two years, causing firms with the two fastest depreciation choices to be dropped, leaving 204 firms. In the fourth row, this added restriction is changed to an estimated useful life less than 18, so that firms with the two lengthiest depreciation choices are dropped and 210 firms are left.

(a) Matching

<table>
<thead>
<tr>
<th></th>
<th>$\tau^{Book} &lt; \tau^{Matching}$</th>
<th>$\tau^{Book} &gt; \tau^{Matching}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Main Sample</td>
<td>.42</td>
<td>.41</td>
</tr>
<tr>
<td>(2) Restricted Sample</td>
<td>.45</td>
<td>.41</td>
</tr>
<tr>
<td>(3) Restricted, $\tau^{Book} &gt; 2$</td>
<td>.42</td>
<td>.39</td>
</tr>
<tr>
<td>(4) Restricted, $\tau^{Book} &lt; 18$</td>
<td>.47</td>
<td>.45</td>
</tr>
</tbody>
</table>

(b) Market

<table>
<thead>
<tr>
<th></th>
<th>$\tau^{Book} &lt; \tau^{Market}$</th>
<th>$\tau^{Book} &gt; \tau^{Market}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Main Sample</td>
<td>.28</td>
<td>.23</td>
</tr>
<tr>
<td>(2) Restricted Sample</td>
<td>.18</td>
<td>.17</td>
</tr>
<tr>
<td>(3) Restricted, $\tau^{Book} &gt; 2$</td>
<td>.14</td>
<td>.15</td>
</tr>
<tr>
<td>(4) Restricted, $\tau^{Book} &lt; 18$</td>
<td>.19</td>
<td>.18</td>
</tr>
</tbody>
</table>