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A review of derivatives research in accounting and suggestions for future work

John L. Campbell[a], Landon M. Mauler[b], Spencer R. Pierce[b,*]

[a] J.M. Tull School of Accounting, Terry College of Business, University of Georgia, Athens, GA, 30602-6252, United States
[b] Department of Accounting, The College of Business, Florida State University, Tallahassee, FL, 32304, United States

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ABSTRACT

This paper provides a review of research on financial derivatives, with an emphasis on and comprehensive coverage of research published in 15 top accounting journals from 1996 to 2017. We begin with some brief institutional details about derivatives and then summarize studies explaining when and why firms use derivatives. We then discuss the evolution of the accounting rules related to derivatives (and associated disclosure requirements) and studies that examine changes in these requirements over the years. Next, we review the literature that examines the consequences of firms' derivative use to various capital market participants (i.e., managers, analysts, investors, boards of directors, etc.), with an emphasis on the role that the accounting and disclosure rules play in such consequences. Finally, we discuss the importance of industry affiliation on firms' derivative use and the role that industry affiliation plays in derivatives research. Overall, our review suggests that, perhaps due to their inherent complexity and data limitations, derivatives are relatively understudied in accounting, and we highlight several areas where future research is needed.

1. Introduction

Over the last few decades, the use of financial derivatives has increased exponentially, and consequently the accounting for these derivative instruments has evolved greatly. Perhaps not surprisingly, as a result of this growth, the role that derivatives play in the capital markets has garnered significant attention from researchers, regulators, and financial statement users. At the heart of business investment is the risk and reward trade-off, and derivatives have emerged as an important tool that managers use to mitigate the consequences of undesirable risks their firms face. Consistent with the complexity associated with numerous financial derivative instruments in the economy, the financial reporting for derivatives and hedging activities is similarly complex and has evolved dramatically over the last few decades. In this paper, we review the derivative literature that is most relevant to the accounting for derivatives, with an emphasis on and comprehensive coverage of studies published in 15 top accounting journals from 1996 to 2017.[1]

A financial derivative is a contract between two or more parties whose value is derived from the value of an underlying

* Corresponding author.
E-mail addresses: johnc@uga.edu (J.L. Campbell), lmauler@business.fsu.edu (L.M. Mauler), spierce@business.fsu.edu (S.R. Pierce).

[1] The journals we examine include *Accounting, Organizations and Society*; *Contemporary Accounting Research*; *Journal of Accounting, Auditing & Finance*; *Journal of Accounting and Public Policy*; *Journal of Accounting and Economics*; *Journal of Accounting Research*; *Journal of American Taxation Association*; *Journal of Business Finance and Accounting*; *Journal of Management Accounting Research*; *Review of Accounting Studies*; *The Accounting Review*; *Auditing: A Journal of Practice & Theory*; *Behavioral Research in Accounting*; *Journal of Accounting Literature*; and *Management Accounting Research*.

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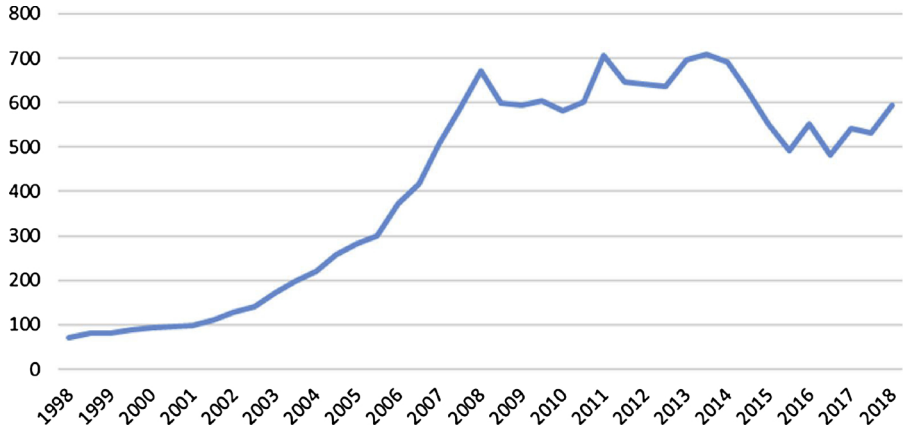

Fig. 1. OTC Derivatives Growth.
Fig. 1 displays the growth in the notional amount of OTC derivatives from 1998 to 2018 (in USD trillion). These data are provided by the Bank for International Settlements (https://www.bis.org).

instrument, which typically changes in value following changes in an underlying market variable such as a rate (i.e., interest rate, foreign exchange rate) or a price (i.e., stock or commodity). Consequently, derivatives provide a way for firms to hedge their exposures to undesirable risks as they allow firms to enter into contracts whose value moves in the opposite direction of firms' existing financial risks. For example, a firm might hedge against rising commodity prices by entering into a contract to buy that commodity at a specified price on a specific future date. The value of this contract moves in tandem with the price of the commodity, offsetting the risk associated with rising commodity prices.

Firms' derivative use has increased exponentially over the last few decades. As shown in Fig. 1, the total notional amount of global derivatives has increased from $72 trillion in 1998 to almost $600 trillion in 2018 (an increase of over 700%).[2] In Table 1, we provide the decomposition of this growth by derivative type – finding that all areas have experienced growth of over 300% since 1998, with the largest growth rates concentrating in interest rate and credit derivatives. Fig. 2 demonstrates that the aggregated amount of the absolute value of unrealized gains/losses on cash flow hedges (hedges related to future transactions denominated in commodity prices, interest rates, or foreign currency exchange rates) recognized across all balance sheets of North American Compustat firms has been over 95 billion dollars, on average, over the last decade.[3] Furthermore, the total amount of the absolute value of these gains/losses flowing through comprehensive income has been over 81 billion dollars annually, on average, over the last decade. Overall, Figs. 1 and 2 as well as Table 1 all point to firms' increased use of derivatives over the last couple of decades and the significant role derivatives play in the economy. Furthermore, capital markets' interest in derivatives has increased over the last decade not only because of their sheer magnitude, but also because of the role that derivatives played in the 2008 financial crisis, which highlighted how little many people understand about them and the challenge of how to best account for them.

The accounting for derivatives is inherently complex for several reasons. Some of these reasons include that the intent behind derivative use may vary (i.e., hedging versus speculation), the decision to enter into a derivative to hedge may be driven by an existing or potential risk exposure that may or may not be currently recognized in the firm's accounting system, and the ability of the derivative to hedge the identified risk exposure may be imperfect or difficult to measure. As evidence of the challenge of effectively communicating information about derivatives to users of financial statements, the FASB has issued several standards over the last few decades that have substantially changed the accounting and disclosure requirements for derivatives.[4] The changes involved in these evolving accounting standards have revolved around several fundamental accounting debates such as historical cost versus fair value as well as disclosure versus recognition. This review is timely and relevant because the FASB continues to have projects on its agenda related to financial instruments (FASB, 2018).

Given that risk is a major driver of value for any firm and that derivatives have become an important and economically significant way for firms to manage their risk, derivative use has been widely studied in other disciplines, particularly in finance. In finance,

[2] Abdel-khalik and Chen (2015) examine the growth in the use of financial derivatives between 1995 and 2012, with an emphasis on three potential drivers for this growth. Using a similar data source, they show that the notional amounts of global derivatives increased from $57.5 trillion in 1995 to $696 trillion in 2012. Relatedly, Millo and MacKenzie (2009) examine the growth of financial risk management and how it gained a reputation among different market participants.

[3] While notional values can be useful to measure the growth of derivative use, they do not capture the actual economic effect of derivative use on firms. For this reason, we also present the analysis in Fig. 2 that measures the gains and losses from a subset of the derivatives firms use. Due to data limitations regarding firms' derivative use that we discuss in detail in Section 3, we can provide this information for only cash flow hedges and not all derivative types. Thus, this is a lower bound of the economic effect of derivatives on firms.

[4] For example, prior to the codification of derivative-related standards under ASC 815, the FASB issued several statements related to the accounting for derivatives such as statements 80, 105, 107, 119, 126, 133, 137, 138, 149, and 161. Additional changes such as ASU 2017-12 have been made since that time. We discuss changes in the accounting for derivatives in detail in Section 3.

Table 1
Growth in derivative notional amounts from 1998 to 2018, by category.

	1998	2018	Percentage Increase
All Contracts	72.107	594.833	725%
Foreign Exchange Contracts	22.044	95.798	335%
Interest Rate Contracts	48.1	481.085	900%
Equity-Linked Contracts	1.341	7.071	427%
Commodity contracts	0.504	2.133	323%
Credit Derivatives	0.108	8.582	7846%
Credit default swaps	–	8.346	–
Other Derivatives	0.01	0.164	1540%
Total	72.107	603.179	737%

Table 1 displays the growth in the notional amount of derivatives from 1998 to 2018 (all balances are in USD trillion). Percentage Increase is calculated as the difference between the 1998 and 2018 amount, scaled by the 1998 amount [(2018 amount–1998 amount)/1998 amount]. These data are provided by the Bank for International Settlements (https://stats.bis.org/statx/srs/table/d5.1 and https://stats.bis.org/statx/srs/table/d5.2).

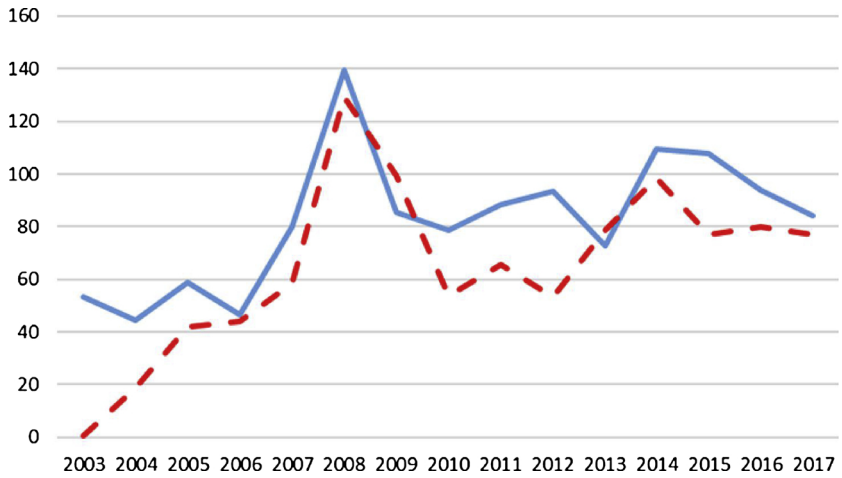

Fig. 2. Financial Statement Impact of Derivatives.
The solid line in Fig. 2 displays the cumulative amount of the absolute value of unrealized gains and losses (in billions) on derivative transactions (AOCIDERGL) on the balance sheet at the end of each year for the entire Compustat population of firms. The dashed line in Fig. 2 displays the cumulative amount of the absolute value of recognized gains and losses (in billions) on derivative transactions recognized in comprehensive income (CIDERGL) during each year for the entire Compustat population of firms.

studies examining derivatives have largely focused on fundamental questions such as why firms use derivatives and what the effect of derivative use is on firm value (e.g., Allayannis and Weston, 2001; Smith & Stulz, 1985). The derivative studies in accounting also touch on these major topics with an emphasis on the challenges and implications of derivative accounting and disclosure. While there are prior derivative literature reviews published in finance, which largely focus on studies examining the theories explaining derivative use and the effect of hedging on shareholder value (i.e., Aretz & Bartram, 2010; Judge, 2006), we are unaware of any literature reviews of derivative research in accounting (i.e., studies published in preeminent accounting journals).

An important limitation of this review is that because our focus is accounting-related derivative studies, we provide comprehensive coverage only of studies published from 1996 to 2017 in 15 prominent accounting journals. We identify relevant studies by searching for articles that use one of the following words as a keyword to categorize the study: “Hedge,” “Hedging,” “Derivative,” and “Risk Management.”[5] This search identified 77 articles. We then manually checked each article to ensure the study’s relevance to this review. This process resulted in the exclusion of several articles that focused on non-derivative issues such as hedge funds, hedge portfolio returns, and non-derivative related hedging activities. The final number of relevant research articles was 48. However, it is important to note that, in addition to covering these 48 studies in this review, we also discuss several other important and relevant derivative studies to supplement those identified by our comprehensive search within accounting journals.[6]

[5] We also attempted other search approaches that included broader sets of search terms. However, these other approaches identified several studies that were not relevant to our review and failed to identify additional relevant studies beyond those identified.

[6] We also note that we identified a few studies that are relevant to this review and published in the accounting journals we search, which our search did not identify due to them not providing key words. While we discuss these studies in this review, we do not count them in our tables. Thus, our count is a lower bound of the actual number of derivative-related studies published in the journals we examine.

Table 2
Count of publications in primary search.

Panel A: by topical area and methodology

Methodology	Topical Area			
	Financial	Auditing	Tax	Total
Archival	30	1	1	32
Experimental	4	–	–	4
Theory	7	–	–	7
Other	4	–	1	5
Total	45	1	2	48

Panel B: by journal

Accounting, Organizations and Society	3
Auditing: A Journal of Practice & Theory	0
Behavioral Research in Accounting	0
Contemporary Accounting Research	4
Journal of Accounting, Auditing & Finance	2
Journal of Accounting and Public Policy	1
Journal of Accounting and Economics	7
Journal of Accounting Literature	0
Journal of Accounting Research	6
Journal of the American Taxation Association	1
Journal of Business Finance & Accounting	6
Journal of Management Accounting Research	1
Management Accounting Research	0
Review of Accounting Studies	6
The Accounting Review	11
Total	48

Panel C: by year

1996	3
1997	1
1998	0
1999	3
2000	3
2001	1
2002	4
2003	0
2004	2
2005	2
2006	2
2007	2
2008	2
2009	2
2010	1
2011	2
2012	3
2013	5
2014	0
2015	7
2016	2
2017	1
Total	48

Table 2 presents counts of derivative studies identified by our search. This search begins by identifying articles in the fifteen journals listed in Panel B between 1996 and 2017 that list keywords “Hedge,” “Hedging,” “Derivative,” or “Risk Management”. We then manually inspect all identified articles to remove those that do not relate to firms’ use of derivatives. Panel A presents counts by methodology and topical area. Because some studies overlap in two or more topical areas or methodology, we use our discretion to try to identify the methodology and topical area that each study best matches. Panel B presents the count by journal. Panel C presents the counts by year.

Table 2 lists the research methodology, journal, and publication year of the 48 articles our search identifies. There is a fairly steady number of publications over the past few decades, with a slight increase in the most recent years. These articles have been published in 11 prominent accounting journals. The most common journal outlets for derivative research include *The Accounting Review, Journal of Accounting and Economics, Journal of Accounting Research, Review of Accounting Studies, Journal of Business Finance and Accounting,* and *Contemporary Accounting Research*. While many of the articles touch on multiple topics, the vast majority of derivative research in accounting involves financial accounting topics. In addition, most of these studies use archival techniques, with the second most common research methodology being theoretical modeling. The results in Table 2 suggest that, when compared to other areas of accounting research (i.e., earnings management, conservatism, or even other complex transactions such as off-balance sheet liabilities [pensions, leases, securitizations, and special purpose entities]), firms' use of derivative contracts is a relatively understudied area. Consequently, we provide a number of suggestions for future research directions.

The rest of the paper proceeds as follows. In the next section, we discuss relevant background information on derivative use and then review studies that examine the determinants of firms' derivative use. In Section 3, we describe the evolution of accounting standards, the current accounting and disclosure framework for derivatives, and studies that examine the consequences of these accounting standards. In Section 4, we review accounting studies related to the other consequences of derivatives to various capital market participants (i.e., managers, analysts, investors, boards of directors, etc.). In Section 5, we review the role that industry affiliation plays in derivative research, particularly the fact that many studies tend to focus on industries of heavy derivatives use such as the banking industry and the oil and gas industry. Section 6 concludes. Where relevant, we offer suggestions for future research.

2. Background on derivative use

2.1. Institutional details

A financial derivative is a contract between two or more parties whose value is derived from the value of an underlying rate or price. The value of the underlying rate or price is based on some underlying market variable such as an interest rate, commodity price, or foreign exchange rate. Accordingly, derivatives most commonly correspond to interest rate, commodity, and foreign exchange risk. The majority of financial derivatives can be broadly categorized into four types: forwards, futures, options, and swaps. There are similarities between the four types of derivatives, but they vary as to the responsibilities and rights of the two counterparties, typically referred to as the buyer and seller of the contract. The unique structure of each derivative type, in conjunction with the value of the underlying rate or price, determines the value of the derivative.

While derivatives are more commonly viewed as a risk-management tool used by managers to decrease firms' risk exposure to a particular rate or price, managers can also use derivatives for speculative purposes that increase risk exposure. Identifying whether a derivative is speculative or not depends on the risk the firm faces prior to entering into the derivative contract, as well as whether the derivative contract hedges or increases the firm's exposure. For example, if a firm commonly purchases oil as part of its manufacturing process, the firm's costs are exposed to increases in oil prices because higher oil prices would hurt firm profitability (unless the firm can pass along oil price changes to its customers). If the firm enters into a derivative that increases in value when oil prices increase, this would help to offset rising raw material prices, serving as a hedge against changes in oil prices. In this case, the derivative is not speculative but rather is known as a "hedge."

On the other hand, the firm could just as easily enter into a derivatives contract that increases (decreases) in value when oil prices decrease (increase). Entering into such a position would increase the firm's exposure to oil prices. If oil prices increase (decrease), the firm would experience an amplified decrease (increase) in profitability than if it had not entered into the speculative derivative position.

2.2. Academic research on determinants of derivative use

There is a vast literature examining why firms use derivatives. As mentioned previously, a firm could use derivatives to hedge (and decrease its risk exposure to a particular rate or price), or to speculate (and increase its risk exposure to a particular rate or price). In a Modigliani-Miller world of complete and perfect capital markets, using derivatives to hedge is irrelevant (Modigliani & Miller, 1958). That is, investors should be able to diversify away a firm's exposure to a given rate or price if they wish to, or instead may not want to do so because investors *want exposure* to a particular rate or price. From this perspective, the prevalence of derivative use is puzzling because derivative use may be costly and individual investors could use derivatives according to their risk preferences more efficiently than could a firm (DeMarzo & Duffie, 1991).

Corporate risk-management theory explains the extensive use of derivatives as a result of market imperfections that make the volatility in underlying rates or prices particularly costly to a firm. Specifically, Guay and Kothari (2003) classify these market imperfections into four types of situations where performance volatility would increase firms' cost of capital (and thus decrease firm value): (i) financial distress costs, (ii) costly external financing, (iii) asymmetry in tax costs, and (iv) costs of managerial risk aversion. Consistent with each of these frictions, there is substantial empirical and analytical research examining derivative use and establishing that derivatives allow firms to smooth out their cash flows and earnings, and as a result reduce their cost of capital and increase firm value.[7]

[7] Some papers examining determinants of firms' derivative use do not fit directly into these four categories. For example, Marsden and Prevost (2005) examine the role that internal corporate governance plays in firms' derivative use. They find, for a sample of firms in New Zealand, that derivative use decreased after a regulatory change that increased the risk of liability on outside directors for poor investment decisions.

Smith and Stulz (1985) argue that derivative use can increase the value of a levered firm by reducing the probability of a large negative shock to the firm's cash flows and thus reduces the probability of bankruptcy. In so doing, the firm experiences a reduction in its cost of capital and therefore an increase in firm value. Additionally, Myers (1977) finds that in periods of financial distress, shareholders may forgo positive net present value projects if the gains accrue to debtholders. Thus, research provides evidence that derivatives can increase firm value by reducing the likelihood of encountering financial distress.

Other studies examine the effect of derivatives on external financing costs. Froot, Scharfstein, and Stein (1993) argue that if internal financing is less costly than external financing, derivative use can better match cash inflows and outflows, reducing the likelihood that the firm needs more costly external financing and thus increasing firm value. Relatedly, Géczy, Minton, and Schrand (1997) find that firms with greater growth opportunities and tighter financial constraints are more likely to use currency derivatives. Also in support of this argument, Choi, Mao, and Upadhyay (2013) find that hedging is associated with higher firm value for firms with more growth opportunities and for firms with greater information asymmetry. Firms with smoother performance also have a lower probability of bankruptcy and, therefore lower borrowing costs (Trueman & Titman, 1988). Beatty, Petacchi, and Zhang (2012) provide evidence that firms decrease borrowing costs by credibly committing to the use of derivatives to smooth out cash flow and earnings volatility.[8]

Because the tax code is convex and asymmetric (i.e., firms pay taxes when their earnings are positive, but do not receive money from the government for negative earnings), firms can use derivatives to reduce their earnings volatility and thus smooth out their associated tax payments (Smith & Stulz, 1985).[9] Furthermore, firms face a convex tax schedule because of statutory progressivity and tax-preferenced items such as foreign tax credits, tax loss carry forwards, and investment credits (Nance, Smith, & Smithson, 1993). Firms with smoother earnings have lower expected tax rates (Graham & Smith, 1999; Smith & Stulz, 1985). Consistent with this perspective, Donohoe (2015a) finds that firms that initiate a derivatives program experience a significant reduction in their cash effective tax rates. Furthermore, Leland (2002) and Stulz (1996) argue that decreased cash-flow volatility from derivative use can allow firms to increase their debt capacity and receive the tax benefits of increased debt. Graham and Rogers (2002) provide empirical evidence consistent with this claim.

Although decreasing volatility via derivatives does not directly benefit diversified and risk-neutral investors, it may benefit undiversified and risk-averse managers. Smith and Stulz (1985) argue that risk-averse managers can use derivatives to decrease uncertainty in their compensation, and that, consequently, firm value increases as risk-averse managers require lower compensation when there is less uncertainty. Spanò (2007) finds that, for a sample of non-financial firms, managerial risk aversion is an incentive to deviate from the optimal hedging position. Volatility may also affect managerial compensation through the valuation of stock holdings or managers' ability to meet earnings benchmarks for bonuses. Graham, Harvey, and Rajgopal (2005) find that 78 percent of the executives they surveyed admit to sacrificing long-term value in order to smooth earnings. A primary motivation given for this behavior is that executives believe that investors perceive firms with smoother performance to be less risky, and thus demand a lower expected return.[10] There is some empirical evidence that smoother earnings are associated with a lower cost of equity capital (Francis, LaFond, Olsson, & Schipper, 2004; Minton & Schrand, 1999).[11] Related to executive compensation, prior research finds that managerial stock and option holdings are associated with hedging decisions (Barton, 2001; Knopf, Nam, & Thornton, 2002).

In general, identifying the effect of derivatives on firm risk is difficult because of the endogenous nature of both risk and derivative use, as well as the difficulty in identifying a firm's risk excluding the effect of derivatives. For example, a positive relation between derivative use and firm risk could suggest that firms use derivatives to increase risk. However, it could also indicate that firms that are inherently riskier use derivatives more extensively. Thus, it is hard to interpret results from studies that merely examine the association between derivative holdings and firm risk. To address this concern of endogeneity, Guay (1999) introduces a novel approach to examine the effect of derivatives use on firm risk by examining changes in firm risk when a firm first adopts a derivative program. He examines 254 non-financial corporations that begin using derivatives and finds that firm risk, measured in several ways, declines in the period following the initiation of the derivative program. Overall, his results provide compelling evidence that firms use derivatives to decrease risk. Subsequent studies follow this approach.[12] For example, Zhang (2009) uses a similar approach to identify effective or ineffective hedgers based on whether their risk exposures increased or decreased after adopting a derivative program.

In contrast to these studies examining the use of derivatives for hedging purposes, other studies find evidence that some firms use derivatives to speculate or increase firm risk.[13] Several well-known financial disasters occurred in the early 1990s that involved the speculative use of derivatives (e.g., Barings Bank and Orange County).[14] Especially in the period subsequent to these disasters, using

[8] Vasvari (2012) discusses that assessing the benefits of hedging are more complex than this study suggests and that there are other important related issues that future research can address. We agree with this perspective.

[9] Donohoe (2015b) provides a thorough description of how derivatives play a role in corporate tax avoidance and presents a framework of research, practical issues, and anecdotes about derivatives-based tax avoidance.

[10] Using an experimental setting, Koonce, Miller, and Winchel (2015) argue that while most studies indicate that a firm's use of derivatives is viewed favorably by investors, this perception is affected by firm and industry norms. They find that investors view derivative use as unfavorable when firms' derivative decisions are inconsistent with firm or industry norms.

[11] However, a study by McInnis (2010) suggests that earnings smoothness does not lower a firm's cost of capital.

[12] Beatty (1999) cautions that use of the approach in Guay (1999) may not fully address endogeneity concerns unless the initiation of a derivative program is driven by some exogenous shock such as a reduction in transaction costs. She encourages future studies to isolate alternative exogenous changes in firms' risk management strategies.

[13] Schöndube-Pirchegger (2006) explains firms' use of derivatives to hedge or speculate using a two period rational expectations model.

[14] These are only two of several well-known financial bankruptcies that were a result of speculative derivative use during the 1990s. A trader at Barings Bank ran up losses of more than 1 billion dollars by speculating on the Japanese stock market, resulting in the collapse of the bank. In 1994, Orange County announced a loss of $1.6 billion on its investment pool due to speculating with derivatives and subsequently went bankrupt.

derivatives for speculation is often frowned upon by investors and thus most firms publically claim that they use derivatives only for hedging purposes. Nevertheless, there is evidence that firms do use derivatives to speculate and may benefit from doing so. The commonly used phrase "taking a view" refers to firms using derivatives to speculate on the direction of future foreign exchange rate, commodity price, or interest rate movements. Evidence from private surveys suggests that firms commonly use derivatives to "take a view" or speculate (Bodnar, Hayt, Marston, & Smithson, 1995; Bodnar, Hayt, & Marston, 1998) and that they do so because of perceived information and cost advantages rather than speculating simply to increase risk by "betting the ranch" (Géczy, Minton, & Schrand, 2007). Empirical evidence by Adam and Fernando (2006) suggests that some firms are able to benefit from this approach. Specifically, they find that gold mining firms consistently realize significant cash flow gains using speculative derivatives without increasing their systematic risk, suggesting that they have industry-specific information that allows them to profit from speculative derivative transactions.

Chernenko and Faulkender (2011) point out that the finding that firms use derivatives to speculate complicates the ability to interpret the results from archival hedging research because the proxies used in these studies may include derivatives that are used for either hedging or speculation. Thus, it is unclear whether the documented associations are driven by derivatives used for hedging or derivatives used for speculation. Chernenko and Faulkender (2011) attempt to distinguish between interest rate derivatives used for hedging versus speculation by taking advantage of the time-series component of panel data. They find that firms simultaneously use interest rate swaps to hedge and speculate, and that firms use these derivatives to manage earnings as well as to speculate when executive compensation contracts are more performance sensitive.

2.3. Determinants of derivatives use – suggestions for future research

We believe there are opportunities to revisit the research on the determinants of firms' derivative use in light of the recent exponential growth in derivatives markets. In the accounting literature, Guay and Kothari (2003) use data from 1997 to argue that non-financial firms' use of derivatives is minimal. Unfortunately, this study has served as a basis for some researchers to conclude that: (1) there is no need to research derivatives use of non-financial firms because it is not economically meaningful, or (2) research should only examine non-financial firms in the oil and gas industry. However, these conclusions seem misguided or at least outdated as the notional amount of derivatives contracts has increased over 700% since 1998, including additional contracts for new rates and/or prices.[15] Consequently, we encourage future research to broadly examine non-financial firms' use of derivatives and to document how this use has changed over the last two decades.

We also see opportunities for studies to build off the concerns raised by Chernenko and Faulkender (2011) that using total derivative use as a proxy for "hedging" activity could result in incorrect inferences because this measure likely also includes "speculative" activity. Specifically, we recommend that future researchers improve upon prior derivative research examining the explanations for and consequences of derivatives use by using accounting disclosures to develop cleaner proxies that adequately separate derivatives as either hedging or speculation. As previously mentioned, one measure that does this is the measure developed by Zhang (2009) that examines whether firms' sensitivity to rate or prices changes increases or decreases after the increased use of derivatives.

3. Accounting for derivatives

3.1. Evolution of derivative accounting and disclosure

Currently, Accounting Standards Codification (ASC) Topic 815 stipulates the accounting and disclosure regulations for derivatives.[16] These standards have evolved significantly over time, largely to keep up with the ever-growing use of derivatives. Prior to 1991, the derivatives accounting framework largely revolved around two standards: FAS 52 and FAS 80. These standards were limited in scope and failed to address many types of commonly used derivatives such as interest rate swaps and option contracts. As a result, some derivative contracts were required to be recorded on firms' balance sheets while others were not. Furthermore, for those derivative contracts that were required to be recorded on the balance sheet, these standards required that they be recorded at historical cost. Critics argued that this was problematic because many derivatives such as futures, forwards, and swaps involve trivial initial exchanges of cash or other assets resulting in them having a minimal effect on firms' balance sheets even if their use was economically significant.

Subsequent standards, such as FAS 105, 107, and 119, largely dealt only with footnote disclosures of derivatives. These standards were relatively short-lived. For example, FAS 105 was effective in 1991 and superseded in 1998, and FAS 119 was effective in 1995 and superseded in 1998. Furthermore, these standards were limited in scope as they applied mostly to interest rate and foreign exchange derivatives.[17] FAS 105 required firms to disclose the face, contract, or notional amount of derivatives. FAS 107 expanded the disclosures required under FAS 105 regarding risk by also requiring the disclosure of the fair values of firms' derivative positions.

[15] See https://www.bis.org/statistics/derstats.htm?m=6%7C32%7C71.

[16] While all of the accounting requirements for derivatives are codified under ASC 815, we regularly refer to the pre-codification classification of accounting standards related to derivatives to facilitate our discussion of the changes in derivative accounting and disclosure requirements.

[17] Most commodity derivatives did not fall under the scope of these standards because their definition of a financial instrument excluded contracts involving the required or optional future exchange or delivery of an item that is not a financial instrument, which would include most commodity derivatives. During this time period, Barton (2001) finds that most firms disclosed information about foreign exchange and interest rate derivatives but not commodity derivatives.

FAS 119 required additional disclosure regarding firms' use of derivatives for trading or hedging purposes.

In 1997, the SEC required yet one additional derivative disclosure with FRR 48. FRR 48 required qualitative disclosures about firms' risk management objectives and strategies for a broader set of instruments than did FAS 119 (as it included commodity derivatives). Furthermore, FRR 48 made it mandatory for firms to disclose quantitative information about their derivatives using one of the three allowable methods: value-at-risk, sensitivity analysis, or tabular disclosures.

3.2. Current accounting for derivatives

The current derivatives accounting framework is largely prescribed by FAS 133, which was released in 1998 and became effective in 2001.[18] FAS 133 addressed many of the shortcomings of the prior derivatives standards it superseded.[19] Specifically, it took a more comprehensive and standardized approach, as its rules applied to nearly all derivative types. FAS 133 also exhibited a move away from disclosure to recognition as it removed the disclosure requirements of the prior standards it superseded and instead recognized derivatives on the balance sheet at their fair value.[20]

Currently, all derivative contracts are treated as liabilities or assets that are recorded at their fair value on the balance sheet, with changes in fair value flowing through the income statement. Critics of FAS 133 contended that because the offsetting gain or loss from the hedged risk would not occur until a future period, immediate recognition of derivative fair value gains and losses would increase earnings volatility in a way that misrepresented the underlying economics of the hedging activity. To address this concern, FAS 133 allows for the use of hedge accounting. If certain requirements are met to ensure it is a "highly effective" hedge and a firm chooses to use hedge accounting for a derivative, then the derivative is recognized on the balance sheet at fair value, but the recognition of fair value changes is delayed until the offsetting earnings effect of the hedged risk is also recognized.[21,22]

FAS 133 describes three hedge types: fair value hedges, cash flow hedges, and hedges of net investment. Fair value hedges and cash flow hedges are most common. A fair value hedge is "a hedge of the exposure to changes in the fair value of a recognized asset or liability" (FAS 133, para. 4). A fair value hedge addresses the concern of earnings volatility by immediately recognizing both the change in value of the fair value hedge and the change in the carrying value of the hedged asset or liability. Because the fair value changes in both the hedging instrument and the underlying asset or liability are recognized in earnings immediately, their effects offset to the extent the derivative effectively hedges the underlying asset or liability. A cash flow hedge is a "hedge of the exposure to variability in the cash flows of a recognized asset or liability, or of a forecasted transaction" (FAS 133, para. 4). Cash flow hedge gains and losses are recognized in Other Comprehensive Income and then recorded on an after-tax basis in Accumulated Other Comprehensive Income (AOCI) in the equity section of the balance sheet. This results in the derivative being recognized on the balance sheet at its fair value without affecting current net income. When the gain or loss from the hedged item is realized in earnings, the offsetting amount from the cash flow hedge from AOCI is reclassified into earnings.[23]

While FAS 133 comprehensively standardized and revised derivative accounting, it also removed the majority of derivative disclosures required by the standards it superseded. As a result, academics and practitioners criticized FAS 133 for not requiring sufficient information about derivatives and hedging activities (FASB, 2008). In response, the FASB issued FAS 161, effective in 2009, to require enhanced derivative disclosures because "existing disclosure requirements…[did] not provide adequate information about how derivative and hedging activities affect an entity's financial position, financial performance, and cash flows" (FASB, 2008). While FAS 161 did not modify derivative accounting, it did require firms to provide "…enhanced disclosures about (a) how and why an entity uses derivative instruments, (b) how derivative instruments and related hedged items are accounted for under Statement 133 and its related interpretations, and (c) how derivative instruments and related hedged items affect an entity's financial position, financial performance, and cash flows" (FASB, 2008). FAS 161 requires firms to disclose the fair value amount of derivative assets and liabilities on the balance sheet separated by risk type (e.g., commodity, interest rate, foreign currency, etc.) and accounting designation (i.e., designated for hedge accounting or not) in a tabular format. Further, rather than netting their derivative positions into one amount, firms must now disclose derivative assets and liabilities separately. With respect to the income statement, firms must disclose the location and amount of derivative gains and losses impacting net income, including the location of the gain or loss in the

[18] While the accounting rules set forth by FAS 133 still largely dictate the accounting for derivatives, there have been subsequent changes, such as FAS 161 and other more minor adjustments, which we discuss throughout this section.

[19] See Ahmed et al. (2011) for a detailed discussion of the hedge accounting for derivatives before and after FAS 133.

[20] While FAS 133 superseded many of the previous accounting standards, it did not supersede FRR 48, which was issued by the SEC. Thus, FRR 48 contained the majority of quantitative derivative footnote disclosure that was available to investors after FAS 133.

[21] FAS 133 required that in order for a firm to designate a derivative for hedge accounting, it must specify the hedged item, identify the derivative and hedging strategy, and document the basis for expecting the hedge to be "highly effective" in offsetting the designated risk exposure. Documenting that a hedge is expected to be highly effective must be completed before entering into the hedge and on an ongoing basis to justify continued use of hedge accounting. The firm must also perform retrospective testing each quarter to verify that the hedge was effective during the quarter. The FASB has recently changed these requirements to facilitate firms' use of hedge accounting.

[22] As an example of how derivatives may not always be a perfect hedge, Holmes (1996) examines the hedge effectiveness of a specific futures contract (FTSE-100) and how it varies with the length of duration. Frestad and Beisland (2015) use a model to examine hedge effectiveness and find that the "highly effective" criterion used by the FASB and IASB does not recognize the variation of hedge effectiveness for pure hedges of different risk types.

[23] Hedges of net investment, which are hedges of currency exposure of a net investment in a foreign operation, are accounted for similarly to cash flow hedges.

income statement, segregated by risk type and accounting designation.

3.3. Academic research involving derivative accounting changes

Several studies examine the consequences of derivative disclosure and accounting changes required by standard setters. These studies provide two main contributions to the derivative literature. First, they provide evidence of whether or not the changes in the accounting treatment and disclosures of derivatives achieved the objectives of standard setters, which typically revolve around providing better information about firms' derivative use to investors. Second, they describe and use different measures of derivative use that are available to researchers. In this section, we first review academic studies examining the consequences of changes in derivative disclosure. While the difference between accounting treatment and disclosure is nuanced, we next discuss studies that focus more on the accounting treatment rather than disclosure for derivatives. Lastly, we examine how the different studies measure derivative use, which is largely a function of the accounting information available to researchers at the time of the studies.

3.3.1. Studies examining the consequences of derivative disclosure changes

The majority of studies during our sample period examine the consequences of derivative disclosure changes focus on the changes in required footnote disclosures (i.e. FAS 119 or FRR 48).[24] The evidence is largely consistent with the additional disclosures improving investors' ability to understand firms' use of derivatives. Specifically, Venkatachalam (1996) finds that, for a sample of banks, the FAS 119 disclosures are value relevant.[25,26] Similarly, Wong (2000) finds that the quantitative disclosures required under FAS 119 are associated with the information used by investors to assess currency exposure in a sample of manufacturing firms. Relying on regulatory filings, Schrand (1997) examines whether disclosures similar to those required by FAS 119 provide useful information for assessing the interest rate exposure of a sample of savings and loan associations. Overall, these studies suggest that the information provided by FAS 119 was useful to investors.

Other studies examine the disclosures required under FRR 48, which requires firms to disclose information related to their risk exposures to interest rate, foreign exchange rate, and commodity price changes using value-at-risk, sensitivity analysis, or tabular disclosures. Roulstone (1999) finds that most firms disclose value-at-risk or sensitivity analysis, which are difficult for investors or researchers to use in a meaningful way. However, Linsmeier, Thornton, Venkatachalam, and Welker (2002) use the FRR 48 disclosures to evaluate the effect of interest rate, exchange rate, and commodity price movements on trading volume sensitivity. They argue that the FRR 48 disclosures reduced uncertainty and diversity of opinion, which in turn led to decreased trading volume sensitivity to changes in interest rates, exchange rates, and commodity prices, consistent with these disclosures providing useful information to investors. Rajgopal (1999) studies the oil and gas industry and finds a positive association between FRR 48 disclosure proxies and firms' stock return sensitivities to oil and gas price changes. Thornton and Welker (2004) use actual FRR 48 disclosures to assess the effect of disclosure on equity price sensitivities to oil and gas price changes. Jorion (2002) finds that the value-at-risk disclosures required by FRR 48 are informative because they predict the variability of trading revenues in a sample of commercial banks. Liu, Ryan, and Tan (2004) extend the analysis in Jorion (2002) by examining a larger sample of commercial banks and examining other characteristics of firm risk predicted by their value-at-risk disclosures. Overall, these studies suggest that the FRR 48 disclosures are informative to investors despite their level of aggregation and lack of uniformity.[27]

While the empirical literature examining derivative disclosures largely supports the addition of new disclosures from investors' perspective, studies utilizing theoretical and experimental methodologies provide additional evidence on potential costs and benefits of derivative disclosure. In an experimental study, Koonce, Lipe, and McAnally (2005) find that the labels firms use to describe derivatives affect the way that investors interpret their effect on risk, resulting in investors perceiving similar derivatives differently. However, they find that some disclosure methods such as providing investors with upside and downside risk disclosures may help investors to identify firms' risk-management strategies. In a theoretical study, Sapra (2002) argues that additional disclosure may not be a panacea, as his model suggests that disclosures may actually cause firms to enter into excessive speculative positions and that firms may choose a prudent risk management strategy even without requiring hedge disclosures. However, in support of derivative disclosure he finds that the absence of such disclosures may distort a firm's production policy. Taking a different perspective, Kanodia, Mukherji, Sapra, and Venugopalan (2000) use a model to argue that additional hedge accounting disclosure is important beyond the effect of hedge accounting on earnings volatility. Their model suggests that hedge accounting disclosure is informative about firms' underlying risk and improves efficiency in the futures market. Without such disclosure, inefficiency in the futures market can distort firms' production decisions.[28]

[24] Some published studies examine the consequences of derivative accounting changes in countries other than the U.S. For example, Chalmers and Godfrey (2004) examine managers' responses to proposed derivative disclosures in Australia. In a study examining Korean firms, Chung, Kim, Kim, and Yoo (2012) examine the effect of disclosure quality on the pricing of derivative information.

[25] Following the approach that is largely used in the studies we review, we refer to these studies as using disclosures required by FAS 119 even though some of the information they use may have originally been originally required by FAS 105 and FAS 107.

[26] Skinner (1996) points out that there are limits to what we can learn from such value relevance tests that rely on a cross-sectional "levels" research design.

[27] In an experimental setting that examines how investors respond to the sensitivity analysis disclosures required by FRR 48, Nelson and Rupar (2015) find that investor's risk adjustments are affected by the numerical format used in such disclosures.

[28] Hayes (2000) cautions against prematurely concluding from this study that such disclosures should be mandated because there are other mechanisms in place to achieve efficiency which the model does not examine such as firms' private disclosure incentives.

3.3.2. Derivatives disclosures – suggestions for future research

Future research could examine the effectiveness of derivatives disclosures after FAS 133 (when all derivatives appear on the balance sheet at fair value). As previously discussed, critics of FAS 133 expressed concern that the standard failed to provide sufficient disclosure for investors to understand a firm's derivatives strategy, and regulators issued FAS 161 to address these criticisms. Future research could examine whether FAS 161 was effective in improving investors understanding of firms' derivative use. Some recent working papers appear to be working in this direction. For example, Steffen (2016) finds that information asymmetry improves for derivatives users after FAS 161. Chen, Dou, and Zou (2018) find that firms' stock price liquidity improves when their major customers provide FAS 161 disclosures, suggesting that the disclosure has spillover effects in a firm's supply chain. Finally, Campbell, Khan, and Pierce (2018) find that FAS 161 disclosures appear to have improved stock market efficiency.

While most prior empirical studies largely focus on the benefit of increased derivatives disclosure to investors, future research may also wish to consider the costs to the firm of increased derivatives disclosure. Interestingly, Khan, Li, Rajgopal, and Venkatachalam (2018) find significantly negative market reactions to FAS 133 and FAS 161, the two most recent major accounting changes for derivatives. One possible explanation for this reaction is that the preparation and other costs (i.e., proprietary costs) of derivatives disclosure may be high, whereas the informational benefits to investors could be limited, both arising from the complex nature of derivatives. This may explain why firms did not voluntarily provide such disclosures prior to the mandatory requirements. Khan et al.'s (2018) finding supports this view and offers opportunities and tension for future research examining the costs and benefits of derivative disclosures specifically, and disclosures of other complicated but rapidly growing transactions (e.g., securitization) generally. In a recent working paper that provides evidence of such costs, Zou (2018) finds that firms face proprietary costs from increased derivatives disclosures because they provide information about future production costs to competitors. Future research could also examine whether the theoretical findings from Kanodia et al. (2000) hold true. Specifically, research could examine whether derivatives disclosures have an effect on the efficiency of futures market prices or on firms' production decisions.

3.3.3. Studies examining the consequences of derivative accounting changes

Compared to the studies examining additional derivative disclosure, the studies examining the consequences of derivative accounting treatment changes provide relatively more mixed evidence as to the benefit of the accounting change to investors. Most of these studies focus on hedge accounting treatment and the use of fair value accounting generally or the implementation of FAS 133 specifically.[29] Likely due to insufficient derivative disclosure following FAS 133, many of these studies are theoretical in nature. For example, DeMarzo and Duffie (1995) and Melumad, Weyns, and Ziv (1999) argue that the accounting used for derivatives affects managers' hedging strategies, resulting in suboptimal hedging.[30] Similarly, Gigler, Kanodia, and Venugopalan (2007) examine under what circumstances using mark-to-market accounting for derivatives facilitates or detracts from providing information about potential financial distress.[31] Also using a theoretical model, Nan (2011) argues that FAS 133 may have the unintended consequence of promoting speculation due to the early recognition of unrealized gains and losses from non-designated derivatives.

Using an experimental setting, Chen, Tan, and Wang (2013) examine how the use of fair value accounting affects managers' real economic decisions. They find that when the fair value accounting information is presented, "managers" are more likely to make suboptimal hedging decisions, relative to when only the economic impact or the economic impact and historical cost information are disclosed. Paradoxically, this effect is stronger for firms with more volatile assets, which is when hedging would be more beneficial. These studies provide consistent evidence that the accounting treatment used for derivatives can affect the way that managers use derivatives and how investors interpret their use, sometimes in suboptimal manners.

Empirical studies focus more specifically on the consequences of the adoption of FAS 133. As discussed previously, there were concerns that FAS 133 and its associated use of fair value accounting might mislead investors as to the risk relevance of firms' derivatives. Contrary to this concern, Ahmed, Kilic, and Lobo (2011) find that, for a sample of banks, FAS 133 increased the risk relevance of accounting-based measures of derivative exposures for bond investors.[32] Examining the real effects of FAS 133 on firms' use of derivatives for risk-management purposes, Zhang (2009) finds that FAS 133 led ineffective hedgers to use derivatives more prudently after FAS 133. Ahmed, Kilic, and Lobo (2006) use FAS 133 as a setting to examine recognition versus disclosure of derivatives. They find compelling evidence that disclosure and recognition are not substitutes, and that recognized derivatives are more value-relevant than are disclosed derivatives. There findings are especially relevant in the derivative literature given that FAS 133 increased the recognition of derivatives while removing many of the disclosure requirements for derivatives.

Motivated by prior studies such as Barton (2001) and Pincus and Rajgopal (2002) documenting that derivatives and earnings management may be partial substitutes in smoothing earnings, Choi, Mao, and Upadhyay (2015) find that the substitution relation between derivative use and discretionary accruals attenuates after FAS 133. Similarly, Kilic, Lobo, Ranasinghe, and Sivaramakrishnan (2013) find that banks that are more affected by FAS 133 rely more on loan loss provisions to smooth income, resulting in loan loss

[29] Some published studies examine the consequences of derivative accounting changes in countries other than the U.S. For example, Panaretou et al. (2013) examine the effects of hedge accounting under the adoption of IFRS. They find that the new standards reduced the level of information asymmetry faced by derivative users.

[30] DeMarzo and Duffie (1995) examine both differences in accounting treatment and disclosure requirements.

[31] A puzzling assumption in Gigler et al.'s (2007) theoretical model (see their footnote 1) is that gains/losses on cash flow hedge derivatives are recorded immediately in net income. This assumption is incorrect, as FAS 133 explicitly states that these gains/losses be recorded in AOCI until the underlying item affects net income. Thus, researchers should exercise caution when interpreting Gigler et al.'s theoretical predictions.

[32] In a related study that also examines banks, Hodder, Hopkins, and Wahlen (2006) find that applying full-fair-value accounting to all of a firm's financial instruments results in higher volatility relative to other income measures and that this volatility is risk relevant to investors.

provisions being less informative about future loan defaults. As discussed previously, the application of hedge accounting under FAS 133 was complex. Hughen (2010) documents that after the implementation of FAS 133 many firms misapplied hedge accounting. Hughen (2010) also examines how these firms respond to losing hedge accounting. She finds variation as to whether firms choose to maintain stability in economic earnings but increase the volatility of accounting earnings by maintaining the derivative position or whether they choose to maintain stability in accounting earnings but increase the volatility of economic earnings by discontinuing the derivative position. She finds that variation in this decision is driven by firms' historical ability to meet or beat earnings benchmarks.

3.3.4. Accounting for derivatives – suggestions for future research

Future research may wish to examine how the accounting for various derivative instruments affects firms' decisions as to whether they designate the derivatives as hedges or not, or the extent to which the accounting for hedge types (i.e., fair value hedges versus cash flow hedges) affects the likelihood with which firms designate derivatives as a particular hedge type. Stated differently, while prior research has examined why firms use derivatives in general, there has been no effort to determine when firms decide to designate their derivatives as hedges and when they do not. Similarly, there has been no effort to understand the determinants for when firms are more likely to enter into fair value hedges, cash flow hedges, or net investment hedges. With the improved disclosure requirements set forth in FAS 161, such questions should be possible to answer. Furthermore, the FASB recently issued ASU 2017-12 (which facilitates the use of hedge accounting for a broader set of derivative instruments and removes the disclosure of hedge ineffectiveness) could provide fruitful for future research. Specifically, future research could examine the effect of this change on firms' decision to use hedge accounting and whether the disclosure of hedge ineffectiveness is risk-relevant to investors.

3.3.5. Measuring derivative use

Studies examining derivative accounting and disclosure changes highlight that a major challenge faced by the derivative literature is how to best measure a firm's derivative use. The measures used by prior studies largely rely on the required disclosure at the time of their sample periods. Ideally, a measure of derivative use would disaggregate notional and fair values by long and short positions taken, class of instrument, time to maturity, degree of leverage, and level of complexity (Wong, 2000). However, neither prior nor current accounting standards have ever required this level of detail, and most studies rely on relatively poor measures of derivative exposure. For example, several prior studies (Allayannis & Weston, 2001; Chang, Donohoe, & Sougiannis, 2016; Guay, 1999; Zhang, 2009) merely use indicator variables to identify whether or not a firm uses derivatives to proxy for the level a firm's derivative use, without the ability to capture the extent of derivative use or the firm's hedge ratio. Some studies improve upon this approach by using required quantitative disclosures about derivatives such as those required by FRR 48 to identify the extent of derivative use. However, one weakness of the FRR 48 disclosures is that firms have discretion over which disclosure method to use, making it difficult to compare derivative usage across firms (Roulstone, 1999). Thus, studies such as Linsmeier et al. (2002), which rely on these data to identify specific risks that firms hedge, are able to identify firms only categorically as users of derivatives based on providing disclosure in a given risk category.

The most consistent and detailed disclosures of firms' derivative use have been required by FAS 119 and FAS 161.[33] While both of these disclosures require substantial quantitative information about firms' derivative use, they also have limitations. For example, the most recent standard (FAS 161) requires disclosure of derivative fair values but does not require the disclosure of notional amounts. Neither notional nor fair value amounts are perfect measures of derivatives (Hentschel & Kothari, 2001), and these amounts have been shown to provide incremental information to each other (Nelson, 1996; Venkatachalam, 1996). Also, as discussed previously, FAS 119 was limited in scope (i.e., typically only foreign exchange and interest rate derivatives). Nevertheless, several studies used the notional values for derivatives that were disclosed under FAS 119 (e.g., Barton, 2001; Venkatachalam, 1996)

As discussed previously, when FAS 133 superseded FAS 119 it left very little quantitative derivative information available for researchers to use until FAS 161 became effective in 2009. FAS 161 required enhanced derivative disclosures because "existing disclosure requirements…[did] not provide adequate information about how derivative and hedging activities affect an entity's financial position, financial performance, and cash flows" (FASB, 2008). Our search of published studies identified one study by Manchiraju, Hamlen, Kross, and Suk (2016) that uses the FAS 161 disclosures to quantify derivative use. They use the fair value gains and losses on derivatives to examine the relation between executive compensation and derivative use.[34]

3.3.6. Measuring derivative use – suggestions for future research

We encourage future research to start using the disclosures required by FAS 161 to quantify firms' derivative use, as its tabular and segregated format provides a rich source of data that can be used to answer new research questions and potentially to better re-examine work done in prior studies that relied on poor (and incomplete) quantitative derivative information.

[33] Some industries, such as financial services, have additional disclosure requirements beyond those required for most firms.

[34] Current unpublished working papers also use data from FAS 161 disclosures to quantify derivative use, including Manchiraju, Pierce, and Sridharan (2018) and Pierce (2018).

4. Consequences of derivatives within accounting research

4.1. Consequences for the firm

Several studies examine the consequences of derivative use for the firm – including on earnings management activity, cost of capital, and firm value. Specifically, derivatives may affect firms' earnings management activity in various ways. Brown (2001) and Chernenko and Faulkender (2011) find that firms use derivatives opportunistically to boost earnings in order to meet or beat analysts' forecasts. However, perhaps the earnings management objective most relevant to derivative use is smoothing earnings because of the hedging effect of derivatives and its impact on reducing earnings volatility. Consistent with derivative use affecting firms' earnings management decisions, Barton (2001) finds that, for a sample of Fortune 500 firms, managers use derivatives and discretionary accruals as partial substitutes for smoothing earnings. The argument is that managers desire to maintain a given level of earnings volatility, and if they are able to maintain sufficiently smooth earnings via greater derivative use, they rely less on discretionary accruals to smooth earnings. Similarly, Pincus and Rajgopal (2002) find that oil and gas firms first use derivatives to hedge oil price risk, and then manage the remaining earnings volatility by trading off abnormal accruals and hedging to smooth earnings. Interestingly, Choi et al. (2015) find that the relation between derivatives and using accruals to smooth earnings decreased after FAS 133, arguably because derivatives became less effective in smoothing earnings due to the mandated use of fair value accounting for derivatives. Using a theoretical model, Nan (2008) also identifies a substitutional relation between hedging and earnings management. However, her model provides a different explanation for this relation: hedging affects the cost of earnings management and other endogenous incentives.

Related to the use of derivatives to decrease risk and smooth earnings is the effect of derivatives on firms' cost of capital or valuation. Consistent with firms' motivation to use derivatives to smooth earnings for valuation reasons, there is some empirical evidence that smoother earnings are associated with a lower cost of equity capital (Francis et al., 2004). However, a study by McInnis (2010) suggests that earnings smoothness does not lower a firm's cost of capital. Regardless, these studies do not directly examine the effect of derivatives on smoothing earnings.

Many studies in accounting and finance examine the relation between derivative use and firm value, with mixed results. For example, Allayannis and Weston (2001), Graham and Rogers (2002), Rountree, Weston, and Allayannis (2008), and Pérez-González and Yun (2013) find that derivative use is positively associated with firm value. Guay and Kothari (2003) and Jin and Jorion (2006) find no such association. However, the measures of derivative use in these studies typically do not capture the actual economic effect of derivative use on firms, and some even rely only on categorically identifying firms as derivative users or not.

4.2. Firm consequences – directions for future research

We recommend that future research could use the better data now available from FAS 161 to revisit these important questions of the relation between derivative use and firm risk/cost of capital, as well as documenting the existence of any "hedging premium" and its implications for firm value. Other potential areas for future research in this area could include an examination of the effect of derivative use on firms' investment efficiency.

4.3. Consequences for investors

One oft-mentioned consequence of derivative use is that, despite standard setters' efforts, investors struggle to identify the economic effect of derivative use on firms. Because of the use of derivatives to alter firm risk, most studies examine the effect of derivatives on investors' risk assessments. However, another struggle investors face, identified by prior studies and unrelated to the volatility of firm performance, is the mispricing of cash flow hedge information. These studies find that unrealized gains and losses on cash flow hedges held in AOCI are negatively associated with future profitability and cash flows and equity investors and even sophisticated users like sell-side analysts fail to fully incorporate these effects (Bratten, Causholli, & Khan, 2016; Campbell, 2015; Makar, Wang, & Alam, 2013).[35] Makar et al. (2013) argue that this relation between unrealized gains and future returns occurs because firms do not fully hedge their underlying transactions and that investors are repeatedly surprised that firms are under-hedged when the firm reclassifies its hedges into earnings. In contrast, Campbell (2015) shows that these unrealized gains predict future changes in profitability that occur after (not when) the firm reclassifies its hedges into earnings. His evidence suggests this relation between unrealized cash flow hedge gains and losses and future profitability exists because an unrealized gain on a cash flow hedge implies that the price of the underlying hedged item moved in a direction that will negatively affect the firm's profits after the hedge expires.

Campbell (2015) proposes that this mispricing of unrealized cash flow hedge information arises because of either the complex and incomplete derivative disclosures or the unique and complicated accounting treatment for cash flow hedges, which requires recording unrealized cash flow hedge gains/losses each period in AOCI with the changes in the fair value of the future hedged transaction not recorded until the transaction occurs. Supporting, the notion that the mispricing exists because investors and analysts struggle to identify the future economic consequences of firms' cash flow hedges, Campbell, Downes, and Schwartz (2015) provide evidence that

[35] Campbell (2015) and Makar et al. (2013) document a negative relation between unrealized cash flow hedge gains and losses in samples of nonfinancial firms. In contrast, Bratten et al. (2016) document this same phenomenon in a sample of banks.

analysts and investors better process cash-flow-hedge information when managers provide forecasts. Taking advantage of the new disclosures required by FAS 161, Campbell, Khan et al. (2018) find that this mispricing has gone away after the improved disclosures from FAS 161. This finding suggests that the mispricing was a result of poor disclosure rather than the unique accounting for cash flow hedges because FAS 161 changed only the disclosure and not the accounting for cash flow hedges.

4.4. Investor consequences – directions for future research

While these studies focus on investors' ability to process information about firms' cash flow hedges, we encourage future research to use the improved disclosures from FAS 161 to examine a broader set of derivative types. For example, while many studies focus on financial firms' use of derivatives broadly, more work can be done to learn more about financial firms' use of derivatives such as fair value hedges, as well as about the role that the fair value option (from FAS 159) plays. Such studies need not be limited to the effect of fair value hedges on investors.

4.5. Consequences for analysts

Related to the struggle that investors face in understanding the economic consequences of firms' derivative use, some studies examine analysts' ability to understand firms' derivative use when making their forecasts. There is evidence that even sophisticated users such as sell-side analysts struggle to process the consequences of firms' derivative use. For example, using a methodology similar to Chang et al. (2016), Guay (1999) find evidence that analysts have a harder time forecasting earnings for firms once they initiate a derivative program. They also find that the adoption of FAS 133 exacerbated this problem, potentially due to the application of fair value accounting to some derivatives making earnings even more difficult to predict. However, they find improvements once subsequent standards amend and clarify the accounting for derivatives. Similarly, Campbell et al. (2015) find that analysts' forecast errors are related to firms' unrealized cash flow hedge gains and losses, unless managers provide guidance. Campbell, Cao, Chang, and Chiorean (2018), Campbell, Khan et al. (2018) provide evidence that this relation between analysts' forecasts errors and unrealized cash flow hedge gains and losses goes away after FAS 161, suggesting that the improved disclosures required by FAS 161 helped analysts to process firms' derivative use. Panaretou, Shackleton, and Taylor (2013) examine the effect of IFRS adoption on analysts' forecasts errors for firms that hedge. Consistent with decreased information asymmetry for derivative using firms after IFRS adoption, they find that for firms that hedge under IFRS, analysts' forecast errors are lower after IFRS adoption. Further, they find that forecast accuracy is lower for firms that hold derivative positions that do not qualify for hedge accounting under IFRS.

4.6. Analyst consequences – directions for future research

Future research can provide further insight into how analysts incorporate firms' derivative use. For example, Campbell et al. (2015) provide some initial evidence that sell-side analysts might not incorporate derivative gains and losses into their forecasts. Further evidence on this point is needed, because studies such as Chernenko and Faulkender (2011) find that firms use derivatives to meet or beat analysts' earnings benchmarks. One avenue to do this might be to see whether buy-side analysts or other sophisticated investors (i.e., institutional investors or analysts on social media platforms such as SeekingAlpha or Estimize) appear to incorporate derivatives gains/losses. In addition, future research may wish to provide further insight into the interest analysts have regarding derivatives, which could perhaps be gained through textual analysis by the extent to which analysts ask derivatives questions on earnings conference calls with management. Finally, future research could examine the interaction between derivatives gains/losses and analyst outputs other than forecast errors, such as buy/hold/sell recommendations and target prices.

4.7. Other consequences

A few of the studies we identify with our search examine other parties that are affected by firms' derivative use. Some studies examine how derivative use affects managers. Using an experimental methodology, Koonce, Lipe, and McAnally (2008) examine how managers are perceived by investors based on their derivative use. The authors find that while investors often have a negative ex ante perception of derivatives, investors view derivative-using managers more favorably after the effects of the derivative use are realized. In one of their experiments, Koonce et al. (2008) find that this effect occurs because managers who use derivatives are believed to exhibit a higher level of decision-making care than managers who do not. While, as discussed previously, executive compensation is considered one of the main explanations for derivative use, few studies provide compelling examining the consequences of derivative use on executive compensation. This is potentially due to limited data under previous accounting regimes. One exception in the recent literature is Manchiraju et al. (2016), who examine the effect of derivative use on compensation. Using the FAS 161 disclosures, they find that managers are compensated for derivatives gains, regardless of whether the gains are from derivatives designated as hedges or not. This is somewhat surprising given that derivatives not designated for hedges are more likely to be speculative or less effective hedges. However, they also find that the presence of an accounting financial expert on the compensation committee improves efficient contracting.

Another group that could be affected by firms' use of derivatives is auditors. However, we find very few studies that examine the effect of derivative use on auditors. Examining a sample of Australian firms, Chalmers and Godfrey (2004) find no evidence that auditor affiliation determines whether firms voluntarily provide additional derivative disclosure. One empirical study by Lambert, Jones, Brazel, and Showalter (2017) finds that the time pressure on auditors reduces audit quality. They also provide survey evidence

from retired audit partners suggesting that time pressure imposes challenges on receiving and evaluating complex valuations such as derivatives. However, they do not perform any analysis identifying a relation between derivative use and audit quality when auditors face time pressure.

4.8. Other consequences – directions for future research

We encourage future work to improve our understanding of the direct role that derivatives play in executive compensation. We also encourage researchers to examine other ways that managers may be affected by derivative use, including how derivative use may affect their other financial reporting decisions. Recent studies such as Campbell, Cao et al. (2018) are beginning to do this. They examine the effect of derivative use on managers' voluntary disclosure decisions and find that managers are more likely to provide guidance after beginning the use of derivatives. They argue that this change in disclosure behavior occurs because it becomes easier to predict earnings after using derivatives to smooth earnings. We also encourage future work to improve our understanding of the role that derivatives play in firms' audit process. Specifically, research might examine what role, if any, auditors play in firms' derivative decisions and whether the inherent complexity of derivatives affects auditors' ability to effectively audit a firm.

5. Derivative use and industry affiliation

5.1. Industry-specific studies and derivative use

One unique feature of the derivative literature is that many of the studies are industry specific. For example, many studies focus only on oil and gas (Jin & Jorion, 2006; Pincus & Rajgopal, 2002; Rajgopal, 1999; Thornton & Welker, 2004), mining (Adam & Fernando, 2006; Tufano, 1998), airline (Carter, Rogers, & Simkins, 2006), or financial firms (Ahmed et al., 2011; Jorion, 2002; Liu et al., 2004). There are several reasons for this. For example, focusing on one industry facilitates the identification of the effect of derivatives as firms within an industry hedge similar risks. In these specific industries, the single most pertinent risk firms are exposed to that they hedge is clear (i.e., oil and gas prices, gold prices, interest rates), and these risks have robust derivative markets, which facilitate firms' cost-effective use of derivatives. Also from a more practical perspective, focusing on one industry facilitates the collection of derivative information. This is because some industries (e.g., financial firms) have specific regulatory disclosure requirements for derivatives that are greater than those required for other industries. Further, the collection of derivative information for any firm typically requires intensive hand-collection, and focusing on one industry decreases the amount of required hand-collection for data. Even those studies that focus more generally on all non-financial firms typically limit their sample to only a subsample of large firms (e.g., Guay & Kothari, 2003). One other reason for the focus on specific industries was that when the derivative literature began to develop, extensive derivative use was largely limited to only these industries.

5.2. Industry-specific studies and derivative use – directions for future research

While there are benefits to focusing on smaller samples like prior studies have done, there are inherent limitations such as less powerful tests due to smaller sample sizes and limited generalizability. However, this issue of limited derivative use by a small number of firms in specific industries is no longer the case as the use of derivatives has become much more pervasive across a broad spectrum of firms. Thus, while much of what we know about derivatives is driven by studies of specific industries, such as oil and gas firms, researchers now have greater ability to study the effects of derivatives across a broader set of firms. Further, the increased disclosure requirements over the last decade should also facilitate researchers' ability to address derivative-related questions across a broader set of firms. We encourage future researchers to expand prior literature by examining the effects of derivatives and the accounting for derivatives on a broader set of firms to enhance the generalizability of results from prior studies.

However, we also encourage researchers to continue to do industry-specific derivatives studies when interesting research questions relate only to specific industries or where industry-specific regulations may provide additional insights about derivatives. The financial services industry is one industry that may be especially fruitful in this regard, given the unique role that banks play in the economy and their unique use of derivative contracts. For example, there has been relatively little research on fair value hedges. Banks heavily use fair value hedges, as they help banks to mitigate the interest rate risk inherent in their investment and loan portfolios. Future research could examine whether fair value hedge accounting rules (and the fair value option) has allowed banks to more effectively manage their interest rate risk.

Furthermore, the lack of transparency of the Over-The-Counter (OTC) derivative market gained a lot of attention after the financial crisis, as it became clear that a lack of data prevented market participants from being able to assess both counterparty and systematic risks. Studies have examined the role that banks' use of fair value accounting for their financial instruments played in the financial crisis (e.g., Badertscher, Burks, & Easton, 2011). However, more work could be done to examine the role that accounting could play in improving the opacity of the OTC derivative market. Further, there have been accounting changes that primarily affect banks due to the unique way that they use derivatives. For example, the FASB prescribed and then clarified the disclosure requirements for offsetting derivative positions by issuing ASU 2011-01 and ASU 2013-01. These changes are relevant because there is a current debate over whether or not netting derivative assets and liabilities obscures information about bank risk and threats to financial stability. We are aware of one working paper by Neilson, Wang, Williams, and Xie (2018) that addresses this issue.

6. Final thoughts

The derivative literature in accounting has grown substantially over the past two decades concurrent with the growth of firms' derivative use. We expect that derivatives will continue to garner significant interest from accounting researchers as the economic importance of derivatives in the broader economy continues to increase and information about the economic impact of derivatives on firms has become more readily available due to improved derivative disclosures. We anticipate that as accounting researchers utilize their accounting expertise to exploit the information in improved derivative disclosures, they will be able to answer many important research questions, including improving upon prior studies which have struggled to answer fundamental research questions, such as what is the relation between derivative use and firm value and risk.

A large part of the academic literature over the last two decades has centered around the changes in accounting and disclosure requirements for derivatives. We anticipate that future research will continue to provide insights into the consequences of future changes in derivative accounting and disclosure requirements. We hope that future derivative research will be informative to standard setters as they continuously work to provide useful information to financial statement users about firms' derivative use as the effect of derivatives on firms and other parties continues to grow and evolve.

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