Journal of Contemporary Accounting and Economics 16 (2020) 100184

Contents lists available at ScienceDirect

Journal of Contemporary Accounting and Economics

journal homepage: www.elsevier.com/locate/jcae

The consequences of discount rate selection for defined benefit liabilities ☆

Nafiz Fahad [a], Nelson Ma [b], Tom Scott [a,*]

[a] Accounting Department, Auckland University of Technology, New Zealand
[b] Accounting Discipline Group, University of Technology Sydney, Australia

ARTICLE INFO

Article history:
Received 16 July 2019
Revised 3 November 2019
Accepted 4 November 2019
Available online 17 January 2020

Keywords:
Discount rate
IAS 19
Pension accounting
Audit fees
Value relevance

ABSTRACT

This paper provides evidence on the use of discount rates for calculating defined benefit liabilities (DBL), and their impact on value relevance and audit fees for Australian listed companies between 2011 and 2016. We document that the average discount rate is 3.96% but the yearly range across companies is 4.03% (2.76% excluding multinationals with multiple plans), despite the fact that AASB 119 provides guidance to use the yield of high quality corporate bonds or, if there is not a deep market, government bonds. We then find that the DBL or unfunded component (DBL less the fair value of the plan's assets) is value relevant, but is less so when a higher discount rate is used. Furthermore, we document that audit fees are higher when the DBL is larger, or the discount rate is higher, consistent with greater audit effort and risk. Overall, this paper contributes to the accounting literature by documenting both the discretion available in discount rate selection and its consequences.

1. Introduction

Discount rates are frequently used in accounting for estimating the present value of discounted cash flows. This paper contributes to our understanding of discount rates by providing evidence on the selection of discount rates in pension accounting, and examines their association with market value and audit fees. We focus on the use of discount rates in defined benefit liabilities (DBL) for several reasons. First, in contrast to other areas of accounting, companies typically disclose their discount rate for estimating the DBL, and the Australian Accounting Standards Board (AASB) 119 *Employee Benefits* provides clear guidance that the discount rate should be determined relative to high quality corporate bonds if available or, otherwise, to the market yields of government bonds.[1] Second, defined benefit liabilities are economically significant balance sheet items of interest to the broader public. Dixon (2013) describes defined benefits as "*a time bomb*" in The Australian newspaper given the significant but delayed impact of the unfunded component. Discount rate selection is materially significant in this setting as the Accounting Standards Board (ASB) (2007) reports that a 0.5% change in discount rate changes liabilities by 9.5%. Third, the selection of long-term discount rates has been highlighted as an area of concern, given its inclusion in the

☆ We thank participants at a University of Canterbury seminar and the 2019 JCAE Mid-Symposium and in particular our discussant Samuel Sherry, Ferdinand Gul, Neil Fargher, Andrew Ferguson, David Hay and Yuyu Zhang. For comments on earlier versions, we thank Michael Bradbury, Mukesh Garg and Matthew Grosse.
* Corresponding author at: Accounting Department, Auckland University of Technology, Private Bag 92006, Auckland 1142, New Zealand.
E-mail address: thomas.scott@aut.ac.nz (T. Scott).
[1] Within our sample of companies with a DBL, 93% report a discount rate. This contrasts with discount rate selections for other accounts. For example, IFRS 16 *Leases* refers to the incremental borrowing rate or the rate implicit in the lease, which would differ for each company.

https://doi.org/10.1016/j.jcae.2020.100184
1815-5669/

Australian Accounting Standards Board work program (AASB, 2019) and the focus of a recent (International Accounting Standards Board (IASB), 2019) project that noted frequent failure to specify or clearly describe discount rates in accounting standards. Discount rates were also the topic of an audit quality review by the Financial Reporting Council (FRC) (2018). Furthermore, there is corporate confusion about discount rate selection, resulting in the commissioning by Australian Chief Financial Officers (CFO) of an annual (Milliman Report, 2016) to provide guidance on discount rate selection.

We hand-collect defined benefit plan information, including the reported defined benefit liability, the fair value of the plan's assets and the discount rate, from the notes of the largest 100 publicly listed companies in Australia between 2011 and 2016.[2] We focus on the largest 100 companies, as defined benefit plans are typically the result of legacy arrangements in Australia and, thus, infrequent among smaller companies.[3] We first provide descriptive evidence on DBLs and discount rate selection. We find that the average DBL is $1.471 billion (median is $322 million) and is steadily increasing year to year, while the mean (median) unfunded DBL amount (DBL less the fair value of the plan's assets) is $194 million ($35 million) and largely decreasing over time, although only 20% of companies have sufficient plan assets to cover their DBL. The average discount rate is 3.96%, although this ranges from 0.80% to 7.04% over our sample period (2011 to 2016). The range in discount rates on a yearly basis averages 4.03%, almost twice the range found by Billings et al. (2017) using pre-2010 IAS 19 data of UK companies, although an important caveat is the geographic location of plans. However, when we exclude multinationals with multiple plans, the range is 2.76%.[4] We also document a decrease in discount rate disclosure, with only 80% of companies disclosing a discount rate by 2016, compared with 100% in 2011–2012.[5] A comparison of average discount rates, Government 10 Year Treasury Bill Rate (government bonds) rates and 'A' rated 10 year corporate bond rates shows the mean discount rate varies over time in line with government and corporate bond rates, suggesting they are revised annually following AASB 119 guidance. Furthermore, the average discount rate premium over the government bond rate increases over the sample period, becoming more similar to corporate bond rates, which AASB 119 references as an appropriate discount rate assuming there is sufficient liquidity.

Second, we provide evidence on the value relevance of DBLs and discount rate selection to ascertain whether market participants price this information. We document that the DBL, and the unfunded DBL are significantly associated with a lower market value of equity. Furthermore, we find that the relationship with market value is moderated by discount rate selection, with a higher discount rate resulting in the DBL and unfunded DBL not being impounded by the market. Thus we provide evidence that both the DBL and selection of discount rate matter for valuation purposes, contributing to prior pension accounting research (Barth et al., 1992; Bergstresser et al., 2006; Billings et al., 2017).

Third, we provide evidence on the auditor's perception of the DBL and the discount rate selection, based on audit fees. As DBLs are complex future forecasts requiring assumptions that allow for management discretion, we expect the auditor to charge higher audit fees in response to the increased audit risk and effort arising from the complexity of the DBL and for validating questionable assumptions. We find that both the DBL and discount rate are associated with higher audit fees. We interpret this as the result of auditors pricing the additional effort associated with auditing the DBL and related assumptions, and charging more for the greater risk arising from the use of a higher discount rate. We find weaker evidence when we examine the unfunded component. Thus our paper contributes to the broader audit fee literature by showing that beyond the effort required for auditing the underlying balance sheet item (*i.e.,* the DBL), auditors charge higher fees for more risky assumptions (Chen et al., 2017). Specifically, as a higher discount rate decreases the DBL, it may understate the company's future pension obligations, thus, increasing the risk for the auditor. However, a higher discount rate does not require the auditor to further increase audit effort for validating the DBL, as the results show the interaction between DBL and discount rate is not significantly associated with audit fees.

Thus, considering the uncertainty from preparers on how to apply discount rates as outlined above, we contribute to prior literature by empirically documenting there is a large range in the application of discount rates in Australian practice and that this has implications for equity valuation and audit pricing. Given the decreasing trend in quantitative discount rate disclosure and its relation with market values and audit fees, standard-setters may consider explicitly mandating its disclosure. However, such guidance should be mindful of US evidence that shows direct regulatory enforcement of discount rates reduced the level of discretion applied, but increased discretion in other pension assumptions (Naughton, 2019). However, we find that the market is not '*fooled*' by companies understating the DBL (and, thus, the unfunded component) via use of a higher discount rate, and companies pay for a higher discount rate with higher audit fees. This suggests that other users may be the focus of DBL discount rate selection, for example, current and past employees and union groups, who may be misled on the size of the unfunded DBL by the impact of discount rate selection. Thus, we conclude by noting that clear guidance and enforcement on this issue may be needed, given the potential use of the DBL (and unfunded DBL) by non-primary users of financial statements, who may be less sophisticated users of complex financial information.

[2] The plan's assets are those held to fund the liability when due. The difference between the DBL and plan assets is the unfunded component.

[3] We elaborate this point in section *3.3 Sample selection*.

[4] In our analyses, we take the midpoint or average when multiple rates or a range are disclosed. We detail robustness tests including controlling for multinationals with multiple plans, and using the lowest discount rate.

[5] The remaining companies not disclosing the quantitative rate simply provide the qualitative disclosure that the discount rate is benchmarked to the corporate bond rate.

The remainder of this paper is structured as follows. Section 2 provides background on pension accounting and summarizes prior literature. Section 3 details the empirical models and sample selection. Section 4 presents the results, and Section 5 concludes.

2. Background and literature review

2.1. Institutional setting

AASB 119 *Employee Benefits* (incorporating International Accounting Standard (IAS) 19 *Employee Benefits*) outlines the accounting treatment for two broad pension plans (*i.e.,* post-employment benefits): defined contribution and defined benefit.[6] In defined contribution plans, the entity pays a fixed contribution based on the employee's salary to a separate entity and has no additional obligation. In contrast, defined benefit plans involve the entity agreeing to a level of future entitlements for current and former employees. Defined benefit plans are less common in Australia than in other developed countries. Severinson (2008) compares the proportion of the largest 6,200 listed companies from over 50 countries, and finds that Australia has below the mean percentage (Countries with the highest proportions are Japan, Finland, Germany, Sweden and Ireland). Thus, although superannuation contributions are mandatory in Australia, defined contribution plans are more common with the (Australian Prudential Regulatory Authority (APRA), 2019) reporting that there are 905,000 defined benefit accounts in Australia relative to 25,646,000 defined contribution accounts. Consistent with this, a prominent Australian market commentator writes "*These days, only a small number of Australians joining the workforce (or changing jobs) can participate in defined benefits superannuation*." (Stammer, 2011).

In terms of accounting for defined benefits, the entity should use actuarial techniques to estimate the future entitlement, which is then discounted to present value to form the obligation; termed the defined benefit liability (DBL). The fair value of the plan's assets is the amount reserved to fund the obligation, with the difference between the obligation and assets being the deficit or surplus, colloquially known as the unfunded component (unfunded DBL).[7] Operational costs are recognised in the profit and loss (*e.g.* service costs, net interest on defined benefit liability), whilst re-measurements, including those from actuarial assessments and return on plan assets, are recognised in other comprehensive income. This differs from the US Statements of Financial Accounting Standards (SFAS) 158 in several ways, including that SFAS 158 requires expected return on plan assets to be recognised in profit and loss. Recall that AASB 119 currently requires the actual (as opposed to the expected) return to be recognised in other comprehensive income. Accordingly, there is less ability to influence net profit under AASB 119 through the expected rate of return, which has been the focus of much of the US based literature. Consistent with this, Pinto and Morais (2019) show that FTSE100 companies manage earnings more, where there is an expected rate of return.

Thus, a remaining key area of discretion under AASB 119 is the selection of the discount rate for the defined benefit liability. A higher discount rate decreases the future obligation and reduces any unfunded component, with the Accounting Standards Board (ASB, 2007) noting that a 0.5% change in the discount rate can change liabilities by 9.5%. AASB 119 states that the discount rate should be determined relative to high quality corporate bonds and, if such are not available, the market yields of government bonds should be used. However, it is less clear whether Australia has a sufficiently deep market in high quality corporate bonds. As at June 2016, the Milliman Report noted 123 'high-quality' corporate bonds in Australia (credit rating of AA or above) with debts outstanding of $42,350 million. This compares to a total US bond market size of $1,550.0 billion according to the Securities Industry and Financial Markets Association.[8] This uncertainty on discount rate selection prompted The Group of 100 (an organisation of the CFOs of leading Australian entities) to commission a report on the selection of discount rates. The report states "*The Group of 100 has commissioned Milliman to generate a standardised set of discount rates to be made publicly available for the purpose of discounting employee benefit liabilities under AASB 119*", and is updated monthly to ensure entities have access to the latest discount rates. Thus, the Milliman report validates that there is sufficient market depth to use the market yield of corporate bonds (Milliman, 2016). However, despite uncertainty from participants on how to apply discount rates, it has not been empirically documented whether there is a large range in the application of discount rates in Australian practice and whether it matters.

The importance to standard-setters of discount rates is emphasised by the inclusion of long-term discount rates in the AASB work program, although work is yet to start (AASB, 2019). Overall, because of the assumptions and judgment required around the discount rate, AASB 119 *para.* 55 states that "*Accounting for defined benefit plans is complex because actuarial assumptions are required to measure the obligation* ...", thus, highlighting the timely nature of this research into long-term discount rates, in terms of documenting the use and consequences of discount rate selection by Australian companies.

2.2. Hypothesis development

Glaum (2009) provides a review of pension accounting research, although that review predates the release of the current version of AASB 119, and notes both the controversial status of pension accounting in general and proposed changes. One

[6] AASB 119 serves as the Australian release of IAS 19 with qualitatively the same rules and treatments.
[7] This often attracts media attention under the term '*unfunded pension component*'.
[8] See https://www.sifma.org/resources/archive/research/.

stream of research considers the value relevance of pension accounting. Barth et al. (1992) find that the balance sheet and income statement components of pension accounting, respectively, are value relevant, although Barth et al. (1993) show that the balance sheet components are more important. Other research has considered the recognition or amortisation of gains and losses and their volatility (*e.g.* Davis-Friday et al., 1999; Shin and Yu, 2016).

In addition, there is a stream of research on managerial discretion on pension accounting. Scott (1991) finds that managers with bonuses tied to accounting profit are more likely to adopt FAS 87 early. Companies are also more likely to adopt changes in IAS 19 early, based on the effect on profit (Glaum et al., 2018), and to use higher expected rates of return for the plan's assets when they have a greater benefit from maximising earnings (Bergstresser et al., 2006; Comprix and Muller, 2006; Comprix and Muller, 2011). Li and Klumpes (2013) conclude that UK companies choose expected rates of return consistent with opportunistic behaviour. Hann et al. (2007) attempt to separate the discretionary and non-discretionary components of the defined benefit liability, and find no differences in their value relevance. Blankley and Swanson (1995) provide evidence that discount rates are in line with expected benchmarks. Using pre-2010 IAS 19 data, Billings et al. (2017) show that key assumptions, such as discount rates and inflation are affected by company characteristics. Specifically, they document that the discount rate used by UK companies increases from an average of 4.81% in 2005 to 6.00% in 2009, and within each year can fluctuate between companies, for example, between 5.29% and 7.20% in 2009. Furthermore, they find companies in weaker funding positions are more likely to have higher discount rates (and other actuarial assumptions), decreasing the DBL. Naughton (2019) examines large US companies and finds a shift away from discretion in discount rate selection to compensation plan assumptions after an increase in regulatory attention on appropriate discount rate selection.

Thus we expect defined benefit liabilities to be value relevant in Australia. Furthermore, as a higher (lower) discount rate decreases (increases) the size of the DBL, we expect the relationship with company value to be moderated by the discount rate selected. If the market views a higher discount rate as resulting in each dollar of the DBL implying a greater future obligation which is able to be estimated, we expect the joint effect to be negative. On the other hand, if an inappropriately high discount rate results in a DBL that is viewed by the market as unrepresentative of the company's true future obligation, with the '*true*' value unable to be estimated, the DBL would be less value relevant. Therefore, we state our first hypothesis as:

H_1: *Defined benefit liabilities are negatively associated with company value and this relationship is moderated by discount rate selection.*

Next we examine the association between audit fees and both DBL and discount rate choice, in order to test the costs of rate selection and its perception by auditors. Building on the literature above, as pension accounting requires future forecasts which allow for considerable discretion in their assumptions, management has opportunities to affect earnings, and manage the perceptions of interested stakeholders (*e.g.* unions) (An et al., 2014). In particular, the choice of discount rate may increase audit risk if the underlying assumptions chosen result in pension account balances that fail to reflect underlying economic reality. Accordingly, we would expect auditors to charge a larger audit risk premium or apply greater audit effort to compensate for the increased risk (Simunic, 1980). Reflecting greater audit risk, as part of their audit quality reviews, the FRC (2018) issued a report focusing on defined benefit plans, noting that these assets and liabilities can be material numbers, and are based on a range of assumptions.[9] They found five cases where the audit teams' validation of the discount rate could have been more clearly evidenced. Alternatively, audit fees may be higher from reliance on actuarial experts to validate the calculation of the DBL. Using US data, Chen et al. (2017) find that having a defined benefit plan is associated with higher audit fees, and that abnormal audit fees are associated with an abnormal expected rate of return on planned assets, but did not consider the discount rate. Accordingly, we expect that the DBL and discount rate will reflect increased audit effort and risk which, if impounded in audit fee pricing, results in higher audit fees. Furthermore, we expect that a larger DBL attracts more material effort from discount rate changes and, consequently, the additional audit effort is priced into the audit fee. Thus, we state our second hypothesis as:

H_2: *Defined benefit liabilities are positively associated with audit fees and this relationship is moderated by discount rate selection.*

3. Research design

3.1. Value relevance model

We test H_1 using the Ohlson (1995) model, stated in its base case as follows:

$$P = \beta_0 + \beta_2 DBL\_S/UNFUND\_S + \beta_2 BVE + \beta_3 NI + Year\ effects + \varepsilon \quad (1)$$

where P is the share price of company i four months after its balance date, *BVE* is the book value of equity and *NI* is the reported net profit after tax. Consistent with prior literature that highlights the importance of the deflator (Barth and Clinch, 1998; Easton, 1999), *BVE* and *NI* are scaled by shares outstanding. To test H_1, we then separate the DBL from *BVE* scaled by the number of shares outstanding (*DBL_S*) and include each component in the model. We also rerun tests using

[9] Although there are no formal thresholds under ASA 320, a common auditing rule of thumb places materiality thresholds at 1–2% of total assets or 5–10% of net income. For example ASA 320 A8 states "*... the auditor may consider five percent of profit before tax from continuing operations to be appropriate for a profit-oriented entity in a manufacturing industry ...*" Our descriptive statistics show that the mean DBL is greater than 1% of total assets, but the unfunded component is not. However, the mean (median) unfunded amount is 14.2% (5.1%) of net income, suggesting it could affect auditor judgements.

the surplus/deficit (*i.e.* unfunded component), calculated as the DBL less the fair value of the plan's assets scaled by the number of shares outstanding (*UNFUND_S*), with *BVE* adjusted to exclude the unfunded component. We then introduce a binary variable equal to one if the discount rate is above the median of discount rates for that year (*RATE*) and examine the incremental effect of higher discount rates on the DBL and the unfunded DBL, by interacting each of these variables with *RATE*.[10]

3.2. Audit fee model

For our audit fee model to test H_2, we examine whether variables representing the DBL and discount rate are associated with the reported audit fee, and control for fee determinants drawn from prior literature (*e.g.*, Hay et al., 2006; Causholli et al., 2010). We specify the following regression model, including year fixed effects (time and company subscripts omitted for convenience):

$$LNAF = \beta_0 + \beta_1 DBL\_TA/UNFUND\_TA + \beta_2 LNTA + \beta_3 SQRTSUB + \beta_4 FOREIGN + \beta_5 CURRENT + \beta_6 DTE + \beta_7 ROA + \beta_8 LOSS + \beta_9 YEND + \beta_{10} LNNAS + \beta_{11} INITIAL + Year\ effects + \varepsilon \quad (2)$$

The dependent variable, *LNAF*, is the natural log of audit fees paid by the company. Our variables of interest are *DBL_TA/UNFUND_TA*, measured as the defined benefit liabilities and the unfunded component (defined benefit liability less the fair value of the plan's assets), respectively, both scaled by total assets. To examine the moderating effect of high discount rates, we include *RATE* then interact it with *DBL_TA/UNFUND_TA*. We expect that the *DBL_TA* and *UNFUND_TA* are associated with higher audit fees from increased audit risk beyond the typical risks associated with liabilities, as these accounts employ more complex assumptions requiring greater discretion. Similarly, we expect *RATE* to lead to higher audit fees, because variations in this assumption can increase audit risk as they have a significant impact on both the DBL and whether the balance reflects the underlying economic reality (ASB, 2007). We include controls for the common determinants of audit fees, first controlling for company size, as a meta-analysis of published studies found that client size is the most important determinant of audit fees (Hay et al., 2006).[11] Thus we expect a positive sign on *LNTA*, the square root of the number of subsidiaries (*SQRTSUB*) and the proportion of subsidiaries that are foreign (*FOREIGN*), where the latter two variables capture client complexity. We expect a client and auditor litigation risk complexity are associated with higher audit fees and accordingly control for the current ratio (*CURRENT*), debt to equity (*DE*), return on assets (*ROA*) and incidences of losses (*LOSS*) (Simunic, 1980; Dickins et al., 2008). Companies with the most common financial year end of June (*YEND*) should have higher audit fees to reflect peak pricing. Last, we control for non-audit services (*LnNAS*), which may reflect the provision of actuarial services to justify the defined benefit plans, and changes in audit firm (*INITIAL*) as firms typically charge lower fees in the first year (Francis, 1984; Craswell and Francis, 1999; Carson et al., 2012). All variables are formally defined in Table 1.[12]

3.3. Sample selection

We hand collect the reported defined benefit liability, the fair value of the plan's assets and the discount rate from the notes in the annual report of the largest 100 companies listed on the ASX over 2011–2016. An example of the disclosures is shown in the Appendix from Sydney International Airport's (ASX: SYD) 2016 Annual Report. We focus on the largest 100 companies as defined benefit plans typically are legacy arrangements and thus uncommon in smaller companies.[13] This results in a sample of 36 unique companies with defined benefit liabilities in 2011, which reduces to 20 in 2016, giving a total of 190 observations with a defined benefit liability disclosed over the sample period. The reduction in unique companies reflects the termination of defined benefit plans by some companies during the sample period. However, some companies do not disclose their discount rate and, thus, our value relevance analysis is conducted on a sample of 177 company-year observations. For our audit fee analysis, we exclude financial and real estate companies, given differences in their financial reporting requirements (Simunic, 1980, Carson et al., 2012). This results in a sample of 125 company-year observations. We choose the period from 2011 to 2016, as there are several changes in the official cash rate over this sample period and, thus, we expect changes to be shown in the discount rate if they are revised each year.

4. Results

4.1. Summary statistics

Panel A of Table 2 provides sample statistics for defined benefit plans. We find that the mean DBL (as a percentage of total assets) is $1,471 million (4.03%), ranging from $6 million (0.00%) to $20,646 million (20.86%). The average of the plan assets

[10] If multiple discount rates are disclosed we use the average of those rates. If a range is disclosed we use the midpoint. As discussed in the additional analyses, we find that the results are generally robust to controlling for companies that disclose multiple rates or by using the lower of the rates disclosed.

[11] We also expect companies audited by the Big 4 audit firms (Simunic, 1980; Hay et al., 2006) or with adverse opinions (Davis et al., 1993; Schelleman and Knechel, 2010) to have a higher audit fees. However, within our sample, we find all companies use a Big 4 audit firm and receive a clean audit opinion.

[12] All continuous financial and audit variables are winsorized at the 1st and 99th percentile.

[13] Accordingly, we find no DBL use in the smallest decile of the largest 100 companies. Furthermore, as a robustness check, we examine every 10th observation for the 101-500th largest companies on the ASX in terms of market capitalisation in 2016. We find none report having a DBL.

Table 1
Variable definitions.

Variables of interest	
DBL	The defined benefit liability of company *i* in year *t* in millions.
PLANASSETS	The fair value of the assets to fund the DBL of company *i* in year *t* in millions.
UNFUND	*DBL* less *PLANASSETS*.
UNFUND%	*UNFUND* scaled by *DBL*.
DISCOUNTRATE	The discount rate used to calculate the *DBL* of company *i* in year *t*. If a range is disclosed the midpoint is used. If multiple discount rates are disclosed the average is used.
RATE	A binary variable equal to one if the discount rate is above the median of discount rates for that year.
Value Relevance Tests	
DBL_S	*DBL* scaled by shares outstanding.
UNFUND_S	*UNFUND* scaled by shares outstanding.
P	The share price of company *i* in year *t* four months after its balance date.
BVE	The book value of equity of company *i* in year *t* scaled by shares outstanding.
NI	The reported net profit after tax of company *i* in year *t* scaled by shares outstanding.
Audit Fee Tests	
DBL_TA	*DBL* scaled by total assets for company *i* in year *t*.
UNFUND_TA	*UNFUND* scaled by total assets for company *i* in year *t*.
LNAF	The natural logarithm of audit fees paid by company *i* in year *t*.
LNTA	The natural logarithm of total assets for company *i* in year *t*.
SQRTSUB	The square root of the number of subsidiaries for company *i* in year *t*.
FOREIGN	The ratio of number of foreign subsidiaries to number of subsidiaries for company *i* in year *t*.
CURRENT	The ratio of current assets to current liabilities for company *i* in year *t*.
DTE	The ratio of long term debt to equity for company *i* in year *t*.
ROA	The ratio of earnings before interest and tax to total assets for company *i* in year *t*.
LOSS	A binary variable equal to one if net profit after tax for company *i* in year *t* is negative, and 0 otherwise.
YEND	A binary variable equal to one if company *i* in year *t* has a 30 June year end, and 0 otherwise.
LNNAS	The natural logarithm of non-audit services fees paid by company *i* in year *t*.
INITIAL	A binary variable equal to one if the annual report of company *i* in year *t* is audited by a different audit firm than in the previous year, and 0 otherwise.

available to fund the DBL (*PLANASSETS*) (as a percentage of total assets) is $1,276 million (3.42%), with a range of $0 (0.00%) to $15,527 million (17.48%). Thus, defined benefit plans result in materially significant balance sheet items. Furthermore, we document that the average unfunded DBL (*UNFUND*) (as a percentage of the DBL) is $194 million (13.02%) with a range of -$292 million (-70.00%) to $6,047 million (100%[14]), highlighting the importance of pension accounting for stakeholders (*e.g.* employees). We also find that 80% of companies have insufficient plan assets to cover their DBL, given the proportion of companies with a positive unfunded DBL (*UNFUND (Dummy > 0)*). Panel B of Table 2 provides further evidence on the mean *UNFUND* over time, showing a gradual decrease in magnitude and as a percentage of the DBL. Fig. 1 graphs the discount rate against *UNFUND* over time, and shows that the unfunded component varies over time but is larger when the discount rate applied is higher. As the discount rate has decreased over time, tracking reductions in the official cash rate, this would decrease the DBL mechanically but not the fair value of the plan's assets and, thus, also decrease the unfunded component of the DBL. This highlights the importance of discount rate selection for calculating the DBL.

Although the average discount rate in our sample is 3.96%, there is a large range in discount rates used. The highest discount rate is 7.04%, which is the midpoint of the disclosed range of 3.20%-10.88% by Orica in 2011, with the highest discount rate representing a Brazilian based plan. The lowest discount rate is 0.80% used by CSL in 2016, representing a Swiss based plan. Fig. 2 compares the mean, minimum and maximum discount rates, to the 10 year Australian government bond market yield and average corporate bond rate at the end of June for each year. We find there is variation across time, with the mean discount rate changing by, on average, 32 basis points each year, with the same trajectory over time as the government and corporate bond rates. Thus, companies appear to revise their discount rate based on changes in market yields consistent with AASB 119 guidance.

Recall, that AASB 119 references high quality corporate bond rates as the appropriate discount rate, if available. Typically, these trade at a premium to the government bond rate. Thus, our results suggest that Australian companies were more likely to use government bond rates as reference points at the start of the period. The trend towards using a higher discount rate corresponds to the release of the first Milliman report in 2015, which reported that there was sufficient liquidity in the Australian corporate bond market for corporate bonds to be used as the discount rate. However, throughout our sample period we note a large range, with the minimum and maximum discount rates always smaller or larger than the government or corporate bond rates. Panel C of Table 2 provides further evidence on the discount rate over time.

In addition, we note that nine companies (25%) disclosed more than one plan in 2011, decreasing to four (16%) by 2016. Other companies also disclosed a range for the discount rate used – decreasing from five (14%) companies in 2011 to two (8%) in 2016. Together, these fourteen companies in 2011 are likely to represent multinationals that have defined benefit

[14] This is Ramsay Health Care (ASX: RHC), who in 2013 has a DBL of only $11 million.

Table 2
Pension accounting summary statistics.

Panel A: Pension accounting

Variables	N	Mean	Min	Percentiles			Max
				25th	50th	75th	
DBL ($m)	190	1,471	6	96	322	1,509	20,646
DBL (% of TA)	190	4.03	0.00	0.60	1.83	6.03	20.86
PLANASSETS ($m)	190	1,276	0.00	99	252	1,253	15,527
PLANASSETS (% of TA)	190	3.42	0.00	0.54	1.61	5.73	17.48
UNFUND ($m)	190	194	−292	1	35	113	6,047
UNFUND (% of DBL)	190	13.02	−70.00	2.37	13.06	22.49	100.00
UNFUND (Dummy> 0)	190	0.8	0	1	1	1	1
DISCOUNTRATE (%)	177	3.96	0.80	3.21	3.90	4.60	7.04

Panel B: DBL and unfunded DBL by year

Year	N	DBL *($m)*		Unfunded DBL *($m)*		Unfunded DBL *(% of DBL)*	
		Mean	Median	Mean	Median	Mean	Median
2011	36	1,384	233	249	34	15%	15%
2012	36	1,419	251	306	54	20%	20%
2013	34	1,445	263	162	41	10%	7%
2014	32	1,495	356	162	21	10%	9%
2015	27	1,655	509	110	22	8%	11%
2016	25	1,480	427	143	34	13%	9%

Panel C: Discount rates by year

Year	N	Mean	Min	Percentiles			Max	Range	Disclosure Rate
				25th	50th	75th		(Max – Min)	
2011	36	4.73	3.10	3.80	4.69	5.30	7.04	3.94	100%
2012	36	3.69	2.20	3.00	3.40	4.30	6.43	4.23	100%
2013	31	4.16	2.50	3.30	4.25	4.70	6.63	4.13	91%
2014	31	3.77	2.40	3.31	3.70	4.20	6.00	3.60	97%
2015	23	3.84	1.70	3.50	4.00	4.30	5.45	3.75	85%
2016	20	3.14	0.80	2.55	3.30	3.80	5.35	4.55	80%

Panel D: Sample by Industry

GICS Sector Code	Industry Sector Name	N	%	Mean Discount Rate (%)
10	Energy	11	6%	3.32
15	Materials	43	24%	4.07
20	Industrials	18	10%	4.50
25	Consumer Discretionary	2	1%	4.10
30	Consumer Staples	15	8%	3.89
35	Health Care	18	10%	3.15
40	Financials	42	24%	4.28
50	Communication Services	6	3%	3.60
50	Utilities	12	7%	3.83
55	Real Estate	10	6%	3.72
Total		177	100%	

Table 2 presents sample summary descriptive statistics.

plans in their overseas operations. Although some of these operations may have discount rates that are similar to those used in Australia (*e.g.* New Zealand), others may represent countries with significantly different discount rates and, frequently, developing countries with a higher rate. As previously mentioned, in our main tests, if multiple discount rates are disclosed, we used a midpoint. This is supported by nine of these fourteen companies with multiple plans had a discount rate above the median in 2011.[15] The average difference between the minimum and maximum rate used each year is 4.03%. However, this decreases to 3.98% (2.76%) when we apply the lowest rate used by (exclude) multinationals with multiple plans from the sample. As both these ranges are larger than the range found by Billings et al. (2017) using UK data from pre-2010 IAS 19[16], this highlights that discount rate selection is an area of substantial discretion in Australia.

[15] We conduct a range of robustness tests on multinationals with multiple plans.
[16] It is not clear whether the sample used by Billings et al. (2017) also has overseas based plans.

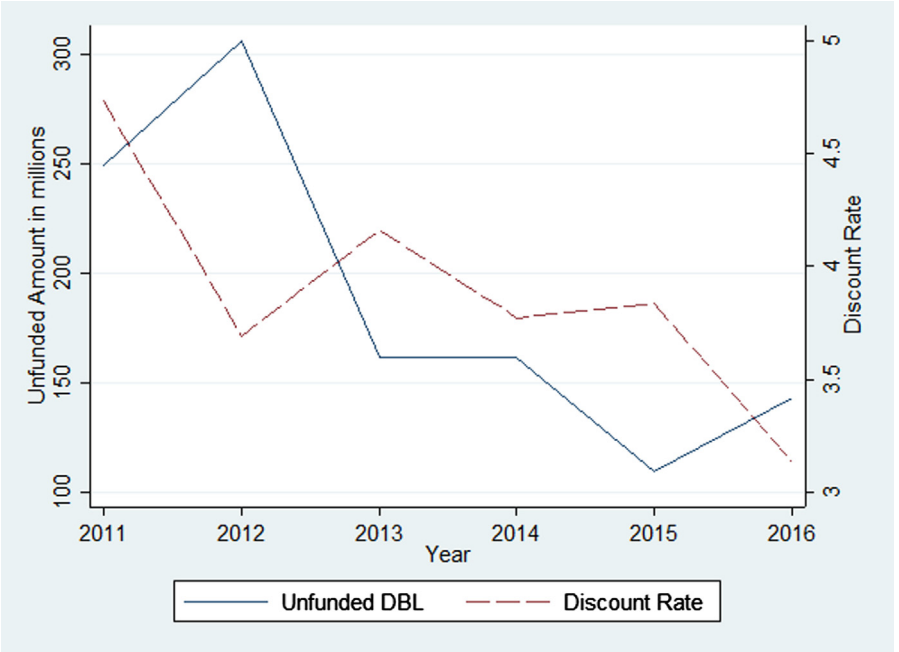

Fig. 1. Unfunded DBL and discount rates by year.

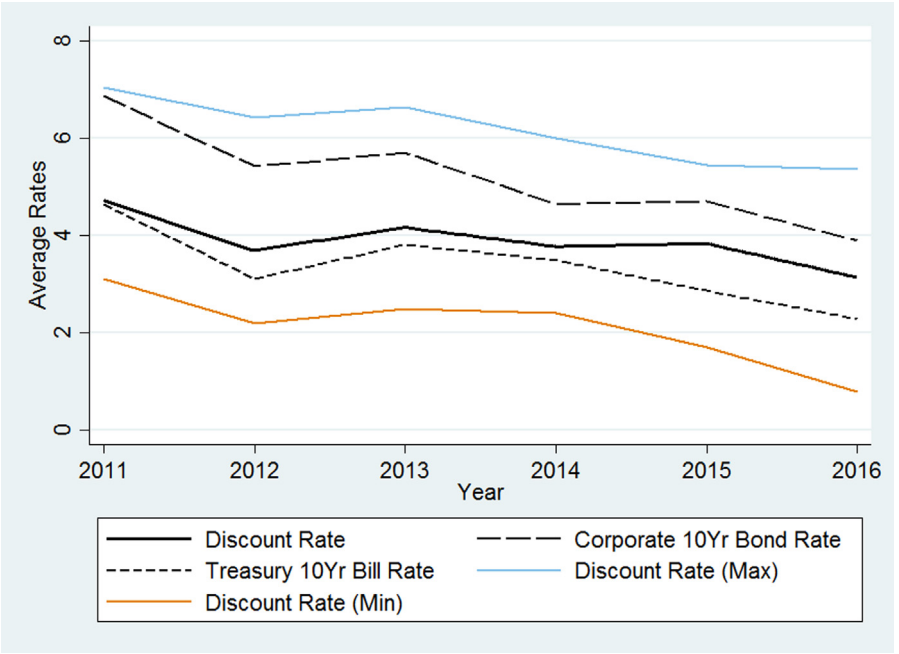

Fig. 2. Discount rates, government bond rates and corporate bond rates by year.

There are 36 companies with defined benefit plans in 2011. However this decreased to 25 in 2016, as some companies terminated their defined benefit plans during the sample period, with all benefits paid out. Furthermore, 17 of the 25 companies with DBLs in 2016 state that the plan is closed to new entrants, providing support for the view that defined benefit plans are predominantly legacy arrangements in Australia.[17] Companies are also less likely to disclose discount rates over

[17] For example, on *page.* 197 of their 2016 annual report, BHP write "*The Group has closed all defined benefit pensions schemes to new entrants.*"

time: trending from 100% disclosure in 2011 (36 of 36) to 80% in 2016 (20 of 25). Thus, there is a downward trend both in companies with a defined benefit plan and in discount rate disclosure. For companies that did not disclose the discount rate, we found that, typically, they provide a qualitative disclosure that high quality corporate bonds (or government bonds) were used as the benchmark. For example *page.* 196 of the BHP 2016 Annual report states "*Liabilities that are not expected to be settled within 12 months are discounted at the reporting date using market yields of high-quality corporate bonds or government bonds for countries where there is no deep market for corporate bonds.*" Given the wide range in discount rate disclosure and the materiality of defined benefit liabilities, standard-setters could reflect on mandating the disclosure of discount rates used.

A breakdown of the DBL companies by industry in Panel D of Table 2, shows that the sample is largely representative of the population of larger Australian listed companies, with materials (GICS Sector 15) (24%) and financial (GICS Sector 40) (24%) being the largest industries. Industrials firms (GICS Sector 20) have the highest mean discount rate (4.50%), while Health Care firms (GICS Sector 35) have the lowest (3.15%). Interestingly, we find no information technology companies (GICS Sector 45) within our sample criterion have a DBL consistent with these plans which, typically, are legacy arrangements focused around older companies that predate the rise of information technology companies.

4.2. Value relevance results

Table 3 presents our tests of value relevance on the sample of 177 company-year observations that disclose a DBL and a discount rate.[18] Panel A of Table 3 contains descriptive statistics for the variables used in this analysis. The average share price is $18.64, while the median is $11.53. The book value of equity is on average $7.82 per share, which implies an average market-to-book ratio of 2.38. The average earnings per share (*NI*) is $1.17. Student *t*-tests find no statistical difference in the mean of variables for higher (*RATE* = 1) and lower (*RATE* = 0) discount rate companies. Panel B of Table 3 reports the correlation matrix showing *DBL* and *UNFUND* are positively associated with market value (*P*) when the book value of equity (*BVE*) and net income (*NI*) are not controlled for.

Panel C of Table 3, Column (1) presents the base regression without a defined benefit variable, and shows that the book value of equity and net income are both significantly positively associated with higher market value. Next, in Column (2) we separate the DBL component from the book value of equity and find that it is significant and negatively associated with market value. Thus, consistent with prior literature, the larger the DBL that companies disclose, the lower market value. However, the unfunded component (defined benefit less the fair value of the plan's assets) is negative but not significant (Column (3)).

Next, we include a binary variable equal to one if the discount rate is above the median for that year (*RATE*), and interact it with *DBL_S* and *UNFUND_S*.[19] Columns (4) and (5) in Panel C of Table 3 provide consistent evidence that the DBL and the unfunded component are both significantly negatively associated with market value, but the interaction with a higher discount rate is significantly positive. Thus, we show the relationship between market value and DBL is weakened by a higher discount rate. As a standalone variable, *RATE* is significant and negative, suggesting this information is value relevant. Alternatively, a higher discount rate choice may imply other economic or accounting choices that affect market value. In Panel D of Table 3, we rerun our regression tests on companies that use a discount rate above and below the median for that year, separately. We find that *DBL_S* and *UNFUND_S* are significantly negatively associated with market value in the below-median discount rate subsample only. As a higher discount rate decreases the size of the DBL, our results suggest that higher discount rates may result in a defined benefit liability that is viewed by the market as unrepresentative of the company's true future obligations and, thus, not value relevant. Overall, our results highlight the importance of DBL and discount rate selection in market valuation and we find evidence in support of H_1.

4.3. Audit fee results

Our audit fee tests are presented in Table 4. Panel A of Table 4 contains descriptive statistics for the variables used in this analysis. The average audit fees (*LNAF*) is $3,291,014 (14.46).[20] Companies are also, on average, profitable and financially stable, with a mean return on assets (*ROA*) of 9%, a current (*CURRENT*) ratio of 1.32 and a debt to equity (*DTE*) ratio of 1.89. As all sample companies are audited by a Big 4 auditor and have clean audit opinions, we cannot control for these factors. In

[18] Results are unchanged when run on the 150 observations where we have data for every year over the sample period, or the broader sample of 190 observations which disclose a discount rate.

[19] One concern is that companies with a different financial year-end may be more likely to have a discount rate above or below the median rate for that year owing to changes in the official cash rate. However, we find no pattern between financial year-end and having a discount rate above or below the median for that year.

[20] *LnAF* is winsorised while *Audit fees* is not, leading to the discrepancy in the magnitude between *Audit fees* and *LnAF*.

Table 3
Tests of value relevance.

Panel A: Descriptive statistics for value relevance test variables

Year	N	Mean	Min	Percentiles			Max	Mean diff.
				25th	50th	75th		(*RATE* = 1 − *RATE* = 0)
P	177	18.64	0.90	5.02	11.53	25.63	100.51	−0.77
BVE	177	7.82	0.38	1.97	5.62	10.51	32.13	1.94
NI	177	1.17	−6.93	0.24	0.53	1.82	15.60	−0.27
DBL_S	177	1.80	0.01	0.13	0.36	1.02	47.37	−0.13
UNFUND_S	177	0.34	−0.14	0.00	0.04	0.11	13.88	−0.07
RATE	177	0.46	0.00	0.00	0.00	1.00	1.00	

Panel B: Correlation Matrix for value relevance test variables

	P	*BVE*	*NI*	*DBL_S*	*UNFUND_S*	*RATE*
P	1					
BVE	0.661*	1				
NI	0.541*	0.591*	1			
DBL_S	0.369*	0.567*	0.389*	1		
UNFUND_S	0.343*	0.530*	0.340*	0.954*	1	
RATE	−0.019	0.116	−0.059	−0.009	−0.020	1

Panel C: Analysis of DBL, UNFUND and discount rates on market value using full sample

	Exp. Sign	(1) *Full sample*	(2) *Full sample*	(3) *Full sample*	(4) *Full sample*	(5) *Full sample*
DBL_S	–		−1.103***		−2.018***	
			(−3.88)		(−6.60)	
UNFUND_S	–			−0.225		−5.562***
				(−0.30)		(−4.02)
RATE	–				−5.838***	−4.134*
					(−2.77)	(−1.93)
*DBL_S*RATE*	–				3.549***	
					(5.84)	
UNFUND_S RATE*	–					11.045***
						(4.46)
NI	+	2.145***	2.010***	1.990***	7.796***	6.272***
		(3.64)	(3.34)	(3.34)	(6.75)	(5.52)
BVE	+	1.351***	1.299***	1.291***	0.413*	0.678***
		(7.65)	(7.12)	(7.16)	(1.80)	(3.01)
Constant	?	0.854	1.115	1.085	9.048***	8.031***
		(0.32)	(0.42)	(0.41)	(5.39)	(4.68)
Year FE		Yes	Yes	Yes	Yes	Yes
Observations		177	177	177	177	177
Adjusted R-squared		0.473	0.473	0.477	0.550	0.518

Panel D: Analysis of DBL, UNFUND and discount rates on market value using subsamples of high and low discount rates

	Exp. Sign	(1) *RATE=1*	(2) *RATE=1*	(3) *RATE=0*	(4) *RATE=0*
DBL_S	–	−0.415		−3.634***	
		(−0.97)		(−5.93)	
UNFUND_S	–		1.390		−9.161***
			(1.25)		(−3.52)
NI	+	3.018***	2.561***	15.430***	10.179***
		(3.29)	(2.82)	(7.03)	(4.67)
BVE	+	1.274***	1.415***	−0.198	0.099
		(6.32)	(7.51)	(−0.57)	(0.26)
Constant	?	−0.692	−0.842	3.389	5.428
		(−0.34)	(−0.41)	(0.88)	(1.26)
Year FE		Yes	Yes	Yes	Yes
Observations		82	82	95	95
Adjusted R-squared		0.820	0.813	0.513	0.399

Table 3 presents the descriptive statistics and analysis of the value relevance analysis. Panel A reports sample descriptive statistics. Univariate Student *t*-tests are conducted on differences between variables. Panel B presents correlation matrix with significance (*) denoted at < 0.05. Panel C reports value relevance regressions with share price (*P*) as the dependent variable on the full sample. Panel D reports results on subsamples with share price (*P*) as the dependent variable where the discount rate is above or below the median for that year. Variables are as defined in Table 1. Two-tailed tests of significance: *** = <0.01, ** = <0.05 and * = <0.10.

Table 4
Tests of audit fees.

Panel A: Descriptive statistics for audit fee test variables

Year	N	Mean	Min	Percentiles			Max	Mean diff. (*RATE* = 1 − *RATE* = 0)
				25th	50th	75th		
Audit fees ($'000)	125	3,291	251	996	1,653	2,988	25,100	
LNAF	125	14.46	13.04	13.81	14.32	14.91	16.99	0.50***
Total Assets ($m)	125	19,983	689	5,496	8,603	20,200	160,736	
LNTA	125	22.98	20.38	22.43	22.88	23.73	25.80	0.31
Total Subsidiaries	125	75.83	0	31	52	107	298	
SQRTSUB	125	7.94	1.00	5.66	7.28	10.39	17.29	0.82
FOREIGN	125	0.39	0.00	0.09	0.27	0.71	0.97	0.07
CURRENT	125	1.32	0.26	0.86	1.08	1.58	3.79	−0.45***
DTE	125	1.89	0.43	0.95	1.56	2.28	10.34	−0.03
ROA	125	0.09	−0.02	0.05	0.08	0.11	0.22	−0.01*
LOSS	125	0.07	0.00	0.00	0.00	0.00	1.00	0.08
YEND	125	0.52	0.00	0.00	1.00	1.00	1.00	0.03
LNNAS	125	12.90	0.00	11.82	13.27	14.13	16.44	0.61
INITIAL	125	0.02	0.00	0.00	0.00	0.00	1.00	0.03
DBL_TA	125	0.05	0.00	0.01	0.03	0.09	0.21	−0.01
UNFUND_TA	125	0.01	−0.02	0.00	0.00	0.01	0.05	0.00
RATE	125	0.42	0.00	0.00	0.00	1.00	1.00	

Panel B: Correlation matrix for audit fee test variables

	LNAF	*LNTA*	*SQRTSUB*	*FOREIGN*	*CURRENT*	*DTE*	*ROA*	*LOSS*
LNAF	1							
LNTA	0.784*	1						
SQRTSUB	0.336*	0.156	1					
FOREIGN	0.330*	0.064	0.046	1				
CURRENT	−0.215	−0.310*	−0.085	0.245	1			
DTE	−0.215	−0.009	−0.315*	−0.161	−0.341*	1		
ROA	0.070	−0.078	−0.090	0.293	0.519*	−0.240	1	
LOSS	0.129	0.198	0.015	−0.071	−0.088	0.048	−0.066	1
YEND	0.229	0.192	0.306*	0.209	−0.065	0.017	0.157	−0.104
LnNAS	0.519*	0.576*	0.133	−0.096	−0.416*	0.130	−0.250	0.081
INITIAL	−0.080	−0.008	−0.122	−0.032	−0.113	0.034	−0.118	0.158
DBL_TA	0.235	0.003	−0.126	0.374*	0.093	0.150	0.265	0.140
UNFUND_TA	0.118	−0.05	−0.169	0.489*	0.286	−0.004	0.327*	0.107
RATE	0.262	0.130	0.110	0.113	−0.295	−0.012	−0.170	0.142

Panel B: Correlation matrix for audit fee test variables

	YEND	*LNNAS*	*INITIAL*	*DBL_TA*	*UNFUND_TA*	*RATE*
YEND	1					
LNNAS	0.137	1				
INITIAL	−0.163	−0.101	1			
DBL_TA	0.014	−0.034	−0.090	1		
UNFUND_TA	−0.053	−0.107	−0.03	0.704*	1	
RATE	0.031	0.134	0.080	−0.017	−0.104	1

Panel C: Analysis of DBL, UNFUND and discount rates on audit fees using full sample

	Exp. Sign	(1) *Full sample*	(2) *Full sample*	(3) *Full sample*	(4) *Full sample*	(5) *Full sample*
DBL_TA	+		3.839***		4.160***	
			(4.35)		(3.92)	
UNFUND_TA	+			5.944		8.606*
				(1.31)		(1.71)
RATE	+				0.272**	0.271**
					(2.22)	(2.51)
DBL_TAxRATE	+				−0.521	
					(−0.30)	
UNFUND_TAxRATE	+					−3.909
						(−0.44)
LNTA	+	0.495***	0.503***	0.497***	0.504***	0.499***
		(10.61)	(11.61)	(10.68)	(11.99)	(10.97)
SQRTSUB	+	0.046***	0.048***	0.048***	0.048***	0.048***
		(3.54)	(4.00)	(3.69)	(3.99)	(3.73)
FOREIGN	+	0.784***	0.540***	0.675***	0.450***	0.581***

(*continued on next page*)

Table 4 (*continued*)

Panel C: Analysis of DBL, UNFUND and discount rates on audit fees using full sample

	Exp. Sign	(1) *Full sample*	(2) *Full sample*	(3) *Full sample*	(4) *Full sample*	(5) *Full sample*
		(5.64)	(3.85)	(4.19)	(3.22)	(3.51)
CURRENT	–	−0.159**	−0.144**	−0.171**	−0.086	−0.122
		(−2.09)	(−2.04)	(−2.23)	(−1.20)	(−1.57)
DTE	+	−0.091***	−0.124***	−0.098***	−0.117***	−0.094***
		(−2.75)	(−3.93)	(−2.93)	(−3.82)	(−2.86)
ROA	–	2.735**	1.622	2.473**	1.740	2.556**
		(2.31)	(1.44)	(2.06)	(1.56)	(2.17)
LOSS	+	0.043	−0.102	−0.002	−0.144	−0.045
		(0.25)	(−0.63)	(−0.01)	(−0.87)	(−0.25)
YEND	+	−0.098	−0.057	−0.078	−0.053	−0.076
		(−1.04)	(−0.65)	(−0.81)	(−0.62)	(−0.80)
LNNAS	+	0.074***	0.071***	0.072***	0.071***	0.072***
		(2.92)	(3.03)	(2.86)	(3.12)	(2.92)
INITIAL	–	−0.206	−0.043	−0.169	−0.055	−0.177
		(−0.70)	(−0.16)	(−0.57)	(−0.20)	(−0.61)
Constant	?	1.682*	1.515*	1.659*	1.290	1.444
		(1.74)	(1.68)	(1.72)	(1.47)	(1.52)
Year FE		Yes	Yes	Yes	Yes	Yes
Observations		125	125	125	125	125
Adjusted R-squared		0.758	0.792	0.759	0.804	0.771

Panel D: Analysis of DBL, UNFUND and discount rates on audit fees using subsamples of high and low discount rates

	Exp. Sign	(1) *RATE = 1*	(2) *RATE = 1*	(3) *RATE = 0*	(4) *RATE = 0*
DBL_TA	+	2.676		4.612***	
		(1.57)		(3.99)	
UNFUND_TA	+		−4.570		8.113
			(−0.40)		(1.50)
LNTA	+	0.543***	0.541***	0.492***	0.481***
		(6.84)	(6.60)	(9.50)	(8.38)
SQRTSUB	+	0.038*	0.040**	0.046**	0.039*
		(2.00)	(2.05)	(2.57)	(1.97)
FOREIGN	+	0.380	0.545*	0.419**	0.645***
		(1.51)	(1.80)	(2.19)	(3.07)
CURRENT	–	0.127	0.171	−0.081	−0.169*
		(0.60)	(0.79)	(−0.94)	(−1.80)
DTE	+	−0.094*	−0.070	−0.136***	−0.126***
		(−1.69)	(−1.26)	(−3.34)	(−2.77)
ROA	–	3.926	3.728	0.282	2.026
		(1.67)	(1.51)	(0.19)	(1.32)
LOSS	+	0.040	0.227	−0.135	−0.316
		(0.15)	(0.82)	(−0.42)	(−0.91)
YEND	+	0.069	0.021	−0.116	−0.154
		(0.44)	(0.12)	(−0.98)	(−1.17)
LNNAS	+	0.040	0.037	0.081**	0.087**
		(1.03)	(0.92)	(2.67)	(2.57)
INITIAL	–	0.081	0.017	−0.228	−0.220
		(0.21)	(0.04)	(−0.43)	(−0.37)
Constant	?	0.767	0.887	1.598	1.904
		(0.47)	(0.53)	(1.45)	(1.56)
Year FE		Yes	Yes	Yes	Yes
Observations		52	52	73	73
Adjusted R-squared		0.768	0.753	0.801	0.754

Table 4 presents the descriptive statistics, correlation matrix and regression results for analysis of audit fees. Panel A reports sample descriptive statistics with comparison of means tests for and low discount rate sub-samples. Univariate Student *t*-tests are conducted on differences between variables. Panel B presents the correlations matrix where significance (*) is denoted < 0.05. Panel C regressions with audit fees (*LnAF*) as the dependent variable on the sample excluding financial companies (GICS 40). Panel D reports regressions with audit fees (*LnAF*) as the dependent variable on subsamples where the discount rate is above or below the median for that year. Variables are as defined in Table 1. Two-tailed tests of significance: *** = <0.01, ** = <0.05 and * = <0.10.

terms of univariate tests of differences, student *t*-tests comparing mean of variables for higher (*RATE* = 1)/lower (*RATE* = 0) discount rates show companies with higher discount rates have higher audit fees (*LNAF*), lower current ratios (*CURRENT*) and lower returns on assets (*ROA*). Thus, bedsides our variable of interest (audit fees), companies with higher and lower discount rates appear relatively similar. Panel B reports a Pearson's correlation matrix for regression variables, which shows that multi-collinearity does not appear to be a major issue, as the largest pair-wise correlation between independent variables is 0.576 between total assets (*LNTA*) and non-audit services (*LNNAS*). *DBL_TA* is significantly correlated with the proportion of foreign subsidiaries (*FOREIGN*) only.

Panel C of Table 4, Column (1) presents the baseline regression without a defined benefit or discount rate variable, and is a relatively good fit with an adjusted R^2 of 0.758. There are higher audit fees for companies with a larger DBL (*DBL_TA*) in Column (2), but this is not observed for the unfunded component (*UNFUND_TA)* in Column (3). We then consider the effect of the discount rate on audit fees. Column (4) shows that a larger DBL and the use of a high discount rate (*RATE*) are both significantly positively associated with audit fees. Taken together, we interpret these results as showing that DBLs increase audit fees via greater audit effort, whilst a larger discount rate results in higher audit fees from increased audit risk. We find consistent evidence in Column (5), as *UNFUND_TA* and *RATE* are significantly positive.[21] The Financial Reporting Council (FRC, 2018) noted in a quality review that the discount rate must be appropriately justified with supporting evidence. As the selection of a higher discount rate decreases the DBL, it may understate the company's future pension obligations, increasing the risk for the auditor. However, as the interaction is insignificant, the relationship between DBL and audit fees does not appear to be changed by a greater discount rate. Thus, a higher discount rate increases audit risk, but does not further increase the audit effort needed to validate the DBL (and its underlying assumptions). In Panel D of Table 4, we partition the sample based on the median discount rate (*RATE*) and find that the results are strongest for the low rate sample (*RATE = 0*) (Column (3)), but the lack of significance for *DBL_TA* in the high discount rate subsample is marginal (*t-stat* = 1.57). Overall, we find some evidence supporting H_2, as the DBL and the discount rate are associated with audit fees although the interaction is not.

4.4. Sensitivity tests

Our results are robust to a number of untabulated sensitivity tests. A revised version of AASB 119 became effective for reporting periods in Australia beginning on or after 1 January 2013.[22] We find similar results when we run our analysis on pre- and post-revised AASB 119 subsamples and interact our main test variables with a binary variable capturing the post period. We also consider the potential impact of multinationals with multiple plans and a range of discount rates. First, we include a binary variable to capture these companies and find the results do not differ qualitatively or statistically from the primary results. Second, given Australia would represent a lower risk setting relative to developing countries, we would expect the discount rate for Australian plans to be at the lower range. Accordingly, we re-define the discount rate for multinationals with multiple plans as the lowest rate disclosed in the range and find the results are largely robust, with the only notable exception being the interaction term between discount rate and *DBL* in the value relevance analysis, which remains positive but marginally insignificant (*t-stat* = 1.53). Furthermore, given the larger representation of specific industries in the sample, as documented in Table 2 Panel D, we first add additional binary variables to capture the effects of the largest 4 (3) industries in the value relevance (audit fee) analysis and, second, re-run the primary analyses after dropping each industry one at a time. Overall, we find our results are largely qualitatively and statistically similar to the primary results presented.[23]

Next, we note that the unfunded component may have different implications for those companies whose assets are in excess of the DBL. When we exclude these overfunded companies we find unchanged results. Next, we re-run results on subsamples where the DBL (UNFUND) is above/below the median to consider whether the magnitude of the DBL influences the result. We find the results are more in-line with our expectations in the larger DBL (UNFUND) sample. However, given our small sample size, we are reluctant to emphasize the results of these subsample tests. To better understand the determinants of discount rate selection, we conduct a logistical regression with *RATE* as the dependent variable, and find that *RATE* is negatively (positively) associated with unfunded DBL (the company's market value of equity[24] and incidence of a reported loss). When estimating the residual probability of higher rate selection from the determinants model, and applying that as an independent variable in the audit fee model, we find the residual is positively associated with audit fees. We also run results with

[21] The results for *UNFUND_TA* suggest the risk associated with unfunded DBL is not sufficient to warrant an increased risk premium, likely to be due to the long horizon until the majority of DBL payments are made.

[22] In response to the revision of IAS 19 *Employee Benefits* on 16 June 2011, AASB revised AASB 119 *Employee Benefits*. Under the revised version of AASB 119, actuarial gains and losses are to be recognised in other comprehensive income for retirement benefits, and in profit or loss for other long-term employee benefits. In addition, service costs also need to be recognised in profit or loss. Therefore, the net defined benefit liability (asset) recognised on the balance sheet will equal the actual deficit (surplus) in an entity's defined benefit plan.

[23] The only exceptions in the primary results are the significance on the *RATE* when replicating Table 3 Panel C Column (5) after dropping health care companies, where we find the *t*-statistic is insignificant (*t-stat*=-1.51) and Table 4 Panel C Column (4) when dropping materials firms (*t-stat*=1.02). The robustness of the results to industry also provides evidence that the results are not driven by particular industries favouring foreign operations in countries with significantly different discount rates.

[24] The significant association for size may be partly explained by larger multinationals with multiple plans and discount rates. However, the proportion of subsidiaries that are overseas is not significant.

firm or industry fixed effects (both jointly and separately) and find unchanged results. We also include different control variables in our audit fee model (*e.g.* firm, office and partner-level auditor specialisation, audit office size and location, governance characteristics etc.) and find unchanged results. However, we are mindful that a key limitation in our paper is our small sample and, thus, we aim to report a parsimonious audit fee model.

5. Conclusions

The choice of discount rates used by companies has garnered significant interest by practitioners, regulators and auditors, given its impact on the magnitude of the DBL (and unfunded components) and the significant range in its selection (Accounting Standards Board (ASB), 2007; Financial Reporting Council (FRC), 2018; Milliman Report, 2016). We first provide descriptive statistics on the Australian market and find the average DBL (unfunded DBL) is 4.03% of total assets (13.02% of the DBL) with only 20% of companies having sufficient plan assets to cover the DBL. The average discount rate is 3.96% and has decreased over time, consistent with downward changes in the government and corporate bond rates that AASB 119 states as the appropriate discount rate. Disclosure of discount rates is also decreasing, with all DBL companies disclosing their discount rate used in 2011, but only 80% disclosing it in 2016.

We then examine the consequences of the DBL, unfunded DBL, and discount rate choice on market value and audit fees. Value relevance tests show that the DBL and the unfunded DBL are negatively associated with the market value of equity, suggesting pension obligations are impounded into the share price. However, these associations are moderated by the discount rate, with the DBL and unfunded DBL being significantly negatively associated with the market value of equity only when the discount rate is lower. This suggests that the market impounds the DBL only when an appropriate discount rate is applied. In our analysis of audit fees, we find a significant, positive association between the DBL and audit fees, but weaker evidence for an association with the unfunded DBL. The discount rate is positively associated with higher audit fees, but does not moderate the associations between audit fees and DBL or unfunded DBL. These results suggest auditors' price the DBL and discount rate as additional effort and risk, respectively, while the long horizon until payment suggests that the unfunded DBL does not pose an additional audit risk. The conclusions drawn from our results are unchanged after addressing amendments to AASB 119, overfunded DBLs and industry effects. We are cognizant of the main limitations of our study, namely, the variability in discount rates disclosed by multinationals with multiple plans and the small sample size, although we note our results are largely robust to controlling for multinationals that disclose multiple discount rates, to using the lowest discount rate disclosed and to applying various sample iterations.[25]

Overall, our results will be of interest to regulators and practitioners concerned about the substantial variation in practice around discount rates used to estimate DBLs. Results show companies on average follow best practice when setting discount rates (*i.e.,* government and corporate bond rates) and when disclosing these rates (more than 80% disclose). However, the significant range in rates and the decrease in rate disclosure over time shows that the application of AASB 119 is not consistent across all companies, although an important caveat is the geographic location of plans. Furthermore, the market valuation and audit fee results suggest that discount rate choice impacts significantly upon decisions made by market participants and auditors, who view higher discount rates with caution. Taken together, the findings suggest the concerns that discount rate selection may be driven by accounting discretion are at least partly founded, bearing in mind that discount rates are revised annually and that they broadly track the government bond rate. Future research could further examine whether there is a need for stronger enforcement by providing clearer guidance on discount rate selection and by mandating discount rate disclosures to enable their use in decision-making by external stakeholders. Furthermore, research could examine whether alternative accounting methods provide more useful information, such as a contingent claims model (Willinger, 1985; Seow, 1995).

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix: Example of disclosure - Sydney International Airport (ASX: SYD) 2016 Annual Report

[25] In particular, we acknowledge that if the results for the higher discount rate group are driven by the use of higher discount rates from overseas jurisdictions, our results may be driven by the market viewing overseas DBL as less likely to eventuate. This may reduce the value relevance and increase costs from auditing overseas DBL, which accounts for our results.

15 SUPERANNUATION PLAN

Sydney Airport employees are entitled to varying levels of benefits on retirement, disability or death through the Sydney Airport Superannuation Plan (the Plan). The Plan consists of a defined benefit plan, available only to existing members, which is fully funded and provides lump sum or pension benefits based on years of service and final average salary; and a defined contribution plan, available to all Sydney Airport employees. The Plan also provides accumulation style benefits for the Superannuation Guarantee Charge and Members' Contributions. Employees contribute to the Plan at various percentages of their remuneration. Contributions by the SAL Group of 9.5% of employees' remuneration are legally enforceable in Australia and for the year ended 31 December 2016 amounted to $4.2 million (2015: $3.7 million).

The following table discloses details pertaining to the defined benefit plan.

	2016 $m	2015 $m
Amounts recognised in Consolidated Statements of Comprehensive Income in respect of defined benefit plans:		
Current service costs	(1.6)	(1.8)
Interest income	0.2	0.1
Total included in employee benefit expense	(1.4)	(1.7)
Remeasurement gains/(losses) recognised in other comprehensive income	(0.5)	3.3
The amounts included in the Consolidated Balance Sheets arising from the Groups' obligations in respect of its defined benefit plans were:		
Present value of defined benefit obligations	(23.3)	(21.3)
Fair value plan assets[1]	29.0	27.8
Net asset arising from defined benefit obligations	5.7	6.5

1 Plan assets include investments in unquoted securities of $17.4 million (2015: $15.6 million).

Recognition and measurement

Defined contribution plan

A defined contribution plan is a post-employment benefit plan under which an entity pays fixed contributions into a separate entity and will have no legal or constructive obligation to pay further amounts. Obligations for contributions to defined contribution plans are recognised as an employee benefit expense in profit or loss in the periods during which services are rendered by employees. Prepaid contributions are recognised as an asset to the extent that a cash refund or reduction in future payments is available.

Defined benefit plan (DBP)

The net obligation in respect of DBP is calculated separately for each plan by estimating the amount of future benefit that employees have earned in return for their service in the current and prior periods; that benefit is discounted to determine its present value. The fair value of any plan assets is deducted. The SAL Group determines the net interest expense or income on the net defined benefit liability or asset for the period by applying the discount rate used to measure the defined benefit obligation at the beginning of the annual period to the net defined benefit liability or asset.

15 SUPERANNUATION PLAN (CONT.)

The discount rate is the yield at the reporting date on corporate bonds that have maturity dates approximating the terms of the SAL Group's obligations and that are denominated in the same currency in which the benefits are expected to be paid. The calculation is performed annually by a qualified actuary using the projected unit credit method. When the calculation results in a benefit to the SAL Group, the recognised asset is limited to the present value of economic benefits available in the form of any future refunds from the plan or reductions in future contributions to the plan. In order to calculate the present value of economic benefits, consideration is given to any minimum funding requirements that apply to any plan in the SAL Group. An economic benefit is available to the SAL Group if it is realisable during the life of the plan, or on settlement of the plan liabilities.

The principal actuarial assumptions used in determining the Plan liability and sensitivities were:

	SAL Group 2016	SAL Group 2015
Discount rate	3.9%	4.0%
Future salary increases	3.5%	3.5%

	0.5% increase	0.5% decrease
Discount rate ($m)	(1.0)	1.1
Future salary increases ($m)	0.8	(0.8)

Remeasurements arising from DBP comprise actuarial gains and losses, the return on plan assets (excluding interest) and the effect of the asset ceiling (if any, excluding interest). The SAL Group recognises them immediately in other comprehensive income and all other expenses related to DBP in employee benefit expenses in profit or loss.

When the benefits of a plan are changed, or when a plan is curtailed, the portion of the changed benefit related to past service by employees, or the gain or loss on curtailment, is recognised immediately in profit or loss when the plan amendment or curtailment occurs.

The SAL Group recognises gains and losses on the settlement of a DBP when the settlement occurs. The gain or loss on a settlement is the difference between the present value of the defined benefit obligation being settled as determined on the date of settlement and the settlement price, including any plan assets transferred and any payment made directly by the SAL Group in connection with the settlement.

References

Accounting Standards Board (ASB), 2007. Reporting Statement: Retirement Benefits – Disclosures. London: Accounting Standards Board. https://www.frc.org.uk/getattachment/2cdb3e84-fd0d-41f0-97be-00a85f480a9f/Reporting-Statement-Retirement-Benefits-Disclosure-January-2007.pdf (accessed 31/10/2019).

An, H., Lee, Y.W., Zhang, T., 2014. Do corporations manage earnings to meet/exceed analyst forecasts? Evidence from pension plan assumption changes. Rev. Account. Stud. 19, 698–735.

Australian Accounting Standards Board (AASB), 2019. AASB Work Program. https://www.aasb.gov.au/admin/file/content102/c3/WorkProgram_2019-04-30.pdf, accessed 31/10/2019.

Australian Prudential Regulatory Authority (APRA), 2019. Annual Superannuation Bulletin. https://www.apra.gov.au/sites/default/files/annual_superannuation_bulletin_june_2018_1.pdf, accessed 31/10/2019.

Barth, M., Beaver, W., Landsman, W., 1993. Structural analysis of pension disclosures under SFAS 87 and their relation to share prices. Fin. Anal. J. 49, 18–26.

Barth, M., Beaver, W., Landsman, W., 1992. The market value implications of net periodic pension cost components. J. Account. Econ. 15, 27–62.

Barth, M., Clinch, G., 1998. Revalued financial, tangible, and intangible assets: Associations with share prices and non-market-based value estimates. J. Account. Res. 36, 199–233.

Bergstresser, D., Desai, M., Rauh, J., 2006. Earnings manipulation, pension assumptions, and managerial investment decisions. Quart. J. Econ. 121, 157–195.

Billings, M., O'Brien, C., Woods, M., Vencappa, D., 2017. Discretion in accounting for pensions under IAS 19: using the 'magic telescope'?. Account. Bus. Res. 47, 123–143.

Blankley, A., Swanson, E., 1995. A longitudinal study of SFAS 87 pension rate assumptions. Account. Horizons 9, 1–21.

Carson, E., Simnett, R., Soo, B., Wright, A., 2012. Changes in audit market competition and the Big N premium. Audit. J. Practice Theory 31, 47–73.

Causholli, M., DeMartinis, M., Hay, D., Knechel, W., 2010. Audit markets, fees, and production: Towards an integrated view of empirical audit research. J. Account. Lit. 29, 167–215.

Chen, Y., Ge, R., Zolotoy, L., 2017. Do corporate pension plans affect audit pricing?. J. Contemp. Account. Econ. 13, 322–337.

Comprix, J., Muller, K., 2006. Asymmetric treatment of reported pension expense and income amounts in CEO cash compensation calculations. J. Account. Econ. 42, 385–416.

Comprix, J., Muller, K., 2011. Pension plan accounting estimates and the freezing of defined benefit pension plans. J. Account. Econ. 51, 115–133.

Craswell, A., Francis, J., 1999. Pricing initial audit engagements: A test of competing theories. Account. Rev. 74, 201–216.

Davis, L., Ricchiute, D., Trompeter, G., 1993. Audit effort, audit fees, and the provision of nonaudit services to audit clients. Account. Rev. 68, 135–150.

Davis-Friday, P., Folami, L., Liu, C.-S., Mittelstaedt, H., 1999. The value relevance of financial statement recognition vs. disclosure: Evidence from SFAS No. 106. Account. Rev. 74, 403–442.

Dickins, D., Higgs, J., Skantz, T., 2008. Estimating audit fees post-SOX. Curr. Issues Audit. 2, 9–18.

Dixon, D., 2013. Defined benefit a time bomb. The Australian 28/09/2013.

Easton, P., 1999. Security returns and the value relevance of accounting data. Account. Horizons 13, 399–412.

Financial Reporting Council (FRC), 2018. The audit of defined benefit pension obligations findings from 2017/18 audit quality reviews. https://www.frc.org.uk/getattachment/4fbf1bb2-930b-4032-a5be-b93aa84f06f0/Audit-of-defined-benefit-pension-obligations_v4.pdf, accessed 31/10/2019.

Francis, J., 1984. The effect of audit firm size on audit prices - a study of the Australian market. J. Account. Econ. 6, 133–151.

Glaum, M., 2009. Pension accounting and research: A review. Account. Bus. Res. 39, 273–311.
Glaum, M., Keller, T., Street, D., 2018. Discretionary accounting choices: the case of IAS 19 pension accounting. Account. Bus. Res. 48, 139–170.
Hay, D., Knechel, W., Wong, N., 2006. Audit fees: A meta-analysis of the effect of supply and demand attributes. Contemp. Account. Res. 23, 141–191.
Hann, R., Heflin, F., Subramanayam, K., 2007. Fair-value pension accounting. J. Account. Econ. 44, 328–358.
International Accounting Standards Board (IASB), 2019. Discount Rates in IFRS Standards. https://www.ifrs.org/-/media/project/discount-rates/project-summary.pdf (accessed 31/10/2019).
Li, Y., Klumpes, P., 2013. Determinants of expected rate of return on pension assets: evidence from the UK. Account. Bus. Res. 43, 3–30.
Milliman Report, 2016. Group of 100 Discount Rate. http://au.milliman.com/uploadedFiles/insight/2016/g100-discount-rate-june-2016.pdf (accessed 31/10/2019).
Naughton, J., 2019. Regulatory oversight and trade-offs in earnings management: evidence from pension accounting. Rev. Account. Stud. 24, 456–490.
Ohlson, J., 1995. Earnings, book value, and dividends in security valuation. Contemp. Account. Res. 11, 661–687.
Pinto, I., Morais, A., 2019. Pension plans assumptions: the case of discount rate. Account. Res. J. 32, 36–49.
Schelleman, C., Knechel, W., 2010. Short-term accruals and the pricing and production of audit services. Audit. J. Practice Theory 29, 221–250.
Scott, T., 1991. Pension disclosures under SFAS No. 87: theory and evidence. Contemp. Account. Res. 8, 62–81.
Severinson, C., 2008. Accounting for defined benefit plans: An international comparison of exchange-listed companies. OECD Working Papers on Insurance and Private Pensions 23.
Seow, G., 1995. A Contingent Claims Model of Corporate Pension Obligations. Decis. Sci. 26, 145–173–173.
Shin, Y.-C., Yu, K., 2016. Do investors misprice components of net periodic pension cost?. Account. Finance 56, 845–878.
Simunic, D., 1980. The pricing of audit services: Theory and evidence. J. Account. Res. 18, 161–190.
Stammer, D., 2011. Defined super benefits on the way out. Australian. 28/09/2011.
Willinger, G.L., 1985. A contingent claims model for pension costs. J. Account. Res. 23, 351–359.