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Is performance affected by the CEO-Employee pay gap?
Evidence from Australia
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Abstract

It is argued that pay inequality between CEOs and employees impacts employee performance, although empirical studies are inconsistent about the directionality of the effect. This paper shows that seemingly contradictory predictions of sociological and economic perspectives about the impact of pay inequality are more complementary than contradictory. Using data from a sample of public companies over the period 2004-2019, we show that pay inequality attributed to individuals' skills, company characteristics, and labour market is positively associated with employee performance. However, this positive impact on employee performance declines at high levels of pay disparity. In addition, pay inequality based on other unknown factors has a negative impact on employee performance.

1. Introduction

The pay gap between executives and employees has become an indicator of pay inequality between top and bottom income levels [1] and has attracted considerable attention from news media, regulators, and researchers. International news and business articles recommend that regulators reduce the pay inequality driven by executives' pay growth. Hence, the issue of pay inequality has led to mandatory financial disclosure from regulators. US and UK publicly listed firms have been obliged to disclose the ratio of their CEO's compensation to median employee pay from 2017 and 2019, respectively. Recently released reports recommend similar disclosures for Australian public firms, although pay inequality in Australia is still below that of countries such as the US and the UK. In the top 100 publicly Australian listed firms (ASX100), the gap between average CEO compensation and average weekly earnings rose from a multiple of 15.3 in 1993 to 51.4 in 2008, driven by the real growth in CEO compensation over this period (Baker & Denniss, 2010; Productivity Commission, 2009). To improve the accountability of executive pay, the Australian Government introduced the Remuneration Amendment Act, named the "two-strike rule", effective from Jul. 1, 2011.[2] Following the introduction of this rule, pay inequality fluctuated between 69.1 and 59.7 between 2012 and 2019.[3] While the 'two strikes' rule has moderated CEO pay rises[4], further policy interventions, such as CEO-employee pay inequality disclosure, could be effective.

In addition to the news media and regulators, researchers have recently joined the debate by positing that pay inequality, as the ratio of CEO compensation to average employee pay, impacts employee and firm performance (Faleye, Reis, and Venkateswaran 2013; Rouen 2020). However, its effect remains ambiguous (Conroy et al. 2014). Some scholars find that pay inequality is positively associated with employee and firm performance (Banker, Bu, and Mehta 2016; Faleye et al. 2013; Mueller, Ouimet, and Simintzi 2017). This result is interpreted as consistent with Tournament Theory (Lazear & Rosen, 1981) and Expectancy Theory (Lawler 1981), which assert that pay inequality motivates employees to work harder to gain higher compensation. However, other studies show a negative relationship between pay inequality and performance (Bebchuk, Cremers, and Peyer 2011; Cowherd and Levine 1992). These results are consistent with Equity Theory (Adams 1965) and Relative Deprivation Theory (Crosby 1984; Martin and Murnighan

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[1] The world scope data illustrates that the global income share of the top 1% increased from 16% in 1980 to 22% in 2000. Then, it declined slightly to 20% by 2016. However, the income share of the global bottom 50% has fluctuated around 9% since 1980.

[2] This rule included a provision that shareholders can vote to spill a board and force fresh elections if there have been 'no' votes of 25 per cent or more recorded against the remuneration report at two consecutive annual general meetings of the company.

[3] Average CEO compensation to average weekly earnings from Australian Bureau of Statistics (ABS), 'Table 2. Average Weekly Earnings, Australia (Dollars)—Seasonally Adjusted'. Full-time adult average weekly ordinary time earnings seasonally adjusted.

[4] There is evidence that similar 'say on pay' provisions in other countries have had a similar effect (Richardson, 2018).

1981), arguing that employees compare their outcomes with others and feel a sense of inequity and deprivation if their outcome falls short of what they deserve.

Scholars (Conroy et al. 2014; Rouen 2020; Trevor, Reilly, and Gerhart 2012) argue that contradictory empirical findings in previous studies can be attributed to undermining the determinants of pay inequality. In other words, they examine the impact of observed pay inequality without considering the impact of CEO and employee inputs (e.g., effort, responsibility, and skill), firm characteristics, and labour market on pay inequality. By considering these factors, both perspectives seem compatible with each other (Rouen 2020). Pay inequality related to these factors may motivate employees to perform better, consistent with economic perspectives. In contrast, pay inequality attributed to unknown factors may lead to detrimental activities such as quitting the company or shirking, consistent with the sociological perspective. Two seminal studies, by Trevor et al. (2012) and Rouen (2020), focus on this argument. In the sports setting, Trevor et al. (2012) assert that horizontal pay disparity explained (unexplained) by players' performance has a positive (negligible or slightly negative) impact on team performance. Rouen (2020) extends the Trevor et al. (2012) approach to pay inequality in organisational settings. He concludes that pay inequality created by explained (unexplained) compensation is positively (negatively) related to future firm performance.

Existing research offers little clear guidance about the consequences of pay inequality on employee performance. However, employee performance provides significant insights into evaluating how pay inequality affects employees' incentives and behaviour (Faleye et al. 2013). Furthermore, although Tournament Theory is conceptualised as a contest with an optimal prize that can maximise an employee's output (Connelly et al. 2014; Lazear and Rosen 1981), examination of the threshold of pay inequality is almost absent from the literature. This paper aims to extend the integration of the contradictory perspective approach into the relationship between pay inequality and employee performance by answering three questions. First, what is the overall impact of pay inequality within the firm on employee performance? Second, can distinguishing between pay inequality explained by individuals' skills, firm characteristics, and labour market (pay equity) and unexplained pay inequality (pay inequity) reconcile the sociological and economic perspectives? If yes, what impacts has each of them had on employee performance? Finally, is there an optimum point for pay equity that maximises employee performance?

To conduct our investigation, we analyse a sample of all Australian listed companies that meet the data availability restrictions from 2004 to 2019. Pay inequality is measured as the natural log of the ratio of total CEO compensation to average employee pay. Our empirical analysis is divided into two parts. In the first part, the determinants of pay inequality are examined. Pay equity is defined as predicted pay inequality by our model and pay inequity as the model's residual. In the second part, we investigate the impact of pay inequality on employee performance. Our results show that employee performance is negatively associated with pay inequality. Then, we conduct further analysis based on the decomposition of pay inequality into pay equity and pay inequity.

We find that pay inequity has a strongly negative impact on employee performance. In addition, there is an inverted U-shaped relationship between pay equity and employee performance. Our results suggest that both economic and sociological perspectives can be supported by considering the role of inputs in our analysis.

Our study contributes to the academic literature on pay inequality and has implications for financial regulators and managers. First, we extend the existing approach (see Trevor et al. 2012) to the relationship between vertical pay disparity and employee performance in an organisational setting. Second, we extend the empirical studies on Tournament Theory in organisational settings by illustrating that neither very high nor very low pay equity can motivate employees to increase their performance, and that there is a threshold. Third, although pay inequality in Australia has gained some media attention recently, there is no evidence that pay inequality impacts employee performance in Australia, according to the existing literature. Finally, our findings can help managers design a compensation system. They also suggest to regulators that CEO pay ratio disclosure per se without providing an equity context may lead to misinterpretation.

The remainder of this paper is structured as follows. The following section provides the literature review and develops the key hypothesises. The methodology is discussed in section 3, followed by our sample selection and empirical analysis in sections 4 and 5, respectively. The last section provides conclusions.

2. Literature review and hypothesis development

Individuals in an organisation are paid differently, and these differences influence their attitudes and performance. These pay differences are categorised into three types: vertical pay disparity, defined as pay differences across hierarchy levels in a corporation; horizontal pay disparity, defined as pay differences among people holding the same job; and overall pay disparity, which combines both vertical and horizontal pay disparity (Gupta, Conroy, and Delery 2012). Wade, O'Reilly, and Pollock (2006) find evidence that CEOs' pay is a salient reference for employees in determining the fairness of their pay. Thus, the pay disparity between the CEO and the average employee impacts employees' reactions to their compensation. This study concentrates on pay inequality as a type of vertical pay disparity. However, the literature review includes broader vertical pay disparity (between different hierarchy organisation levels) and critical horizontal pay disparity studies for more elaboration.

2.1. Theoretical background

The impact of pay disparity in an organisation has been conceptualised from both sociological and economic perspectives (Conroy et al. 2014). The sociological standpoint, mainly Equity Theory and Relative Deprivation Theory, predicts that pay disparity negatively impacts employee performance (Faleye et al. 2013). Equity Theory states that individuals judge the fairness of their exchange relationships with their organisation by comparing the ratio of their inputs (e.g., ability, intelligence, education, effort) into the exchange to their outcome (e.g., compensation, security,

promotion) with others' ratios (Adams 1965; Homans 1974; Walster, Berscheid, and Walster 1973). Inequity exists when individuals' perceived ratios of inputs to outcomes are inconsistent with those of others. Therefore, individuals attempt to reduce inequity by changing their perceptions of their own or their reference group's inputs and outcomes, altering their actual inputs or outcomes, or leaving their companies (Cowherd and Levine 1992). Similarly, the Relative Deprivation Theory argues that people feel relatively deprived when they have received less than what they deserve relative to their references. Their experience of deprivation leads to lower satisfaction and quitting the job (Levine 1991).

On the other hand, the economic perspective argues that pay disparity positively impacts employees' motivation and leads to better performance (Conroy et al. 2014). Tournament Theory and Expectancy Theory are two significant theories in this perspective that explain how employees can be induced to perform better by larger pay disparity. Tournament Theory assumes that greater pay disparity between hierarchy levels in a corporation puts employees in competition for the prize of ultimate pay at the CEO level. Consequently, lower-level employees are motivated by the higher pay at higher organisation levels and exert increased effort to climb the corporate ladder. Similarly, the Expectancy Theory argues that employee's motivation stems from the interplay among three factors, and all three must be strong. Employees must want an outcome such as pay, believe that increased effort will lead to the required performance level, and believe that performance will lead to the desired outcome. Then, they will be motivated to perform.

Both perspectives are applicable in vertical pay disparity. Top executives are likely to serve as a vital referent for lower-level employees in determining whether their pay is fair, because executives' actions are salient to organisational participants (Shin et al. 2015; Wade, O'Reilly, and Pollock 2006). Hence, the sociological perspective is critical in studying vertical pay disparity (Cowherd and Levine 1992; Gupta et al. 2012). Concerning the economic perspective, Tournament Theory is mainly designed for vertical pay disparity between hierarchy organisation levels (Gupta et al. 2012). The expectancy theory is primarily applied in horizontal pay disparity, but it can be extended to vertical pay disparity (Conroy et al. 2014).

2.2. Empirical background

Some studies support sociological perspectives in examining the impact of pay disparity to argue that large pay disparity leads to perceptions of inequity and lower employee morale (Akerlof and Yellen 1990; Chen and Sandino 2012; Corneliben, Himmler, and Koenig 2011). For example, some studies illustrate that pay disparity among employees increase absenteeism (Mahy, Rycx, and Volral 2016) and is associated with higher turnover among lower-paid staff (Bloom and Michel 2002; Jia et al. 2014; Messersmith et al. 2011; Shaw and Gupta 2007; Wade et al. 2006). It has been shown that vertical pay disparity is detrimental to firm performance (Bebchuk et al. 2011; Chen, Huang, and Wei 2013; Cowherd and Levine 1992). In contrast, other studies uncovered evidence favouring the economic perspective that large pay disparity between hierarchy levels in an organisation provides incentives for lower levels to increase effort and performance

(DeVaro 2006; Ehrenberg and Bognanno 1990; O'Reilly et al. 1993), and eventually benefits firm performance (Banker et al. 2016; Heyman 2005; Kale, Reis, and Venkateswaran 2009; Lallemand, Plasman, and Rycx 2004; Lee, Lev, and Yeo 2008; Mueller et al. 2017).

Although most empirical studies have focused on disparity among executives (or supervisors and their direct reports), recent studies examining the pay disparity between the CEO and the employee have yielded contradictory results (Rouen 2020). According to Kulik and Ambrose (1992), regardless of the reference group (upper level or same level), individuals feel inequity if they perceive that the ratio of their inputs to outcomes is unequal to their referents. In addition, employees are likely to use CEO pay as a reference in determining the fairness of their compensation, since CEO actions are salient to organisation participants and detailed information on CEOs' pay is accessible from public sources (Wade et al. 2006). Hence, high pay inequality between CEO and employee can lead to a feeling of inequity. High pay inequality may create negative emotions among employees, leading to job dissatisfaction, lower employee productivity (Pfeffer 2007) and lower firm performance (Shin et al. 2015). However, Faleye et al. (2013) find that employee productivity increases with pay inequality when the firm has fewer well-informed employees. They also find that firm value and operating performance both increase with pay inequality.

2.3. The elaboration of contradictory perspectives

Recent studies argue that sociological and economic perspectives are more complementary than contradictory (Ridge, Aime, and White 2015; Shin et al. 2015). Therefore, they attempt to introduce a complementary approach. The first approach asserts a non-linear relation between pay disparity and outcome rather than a linear one. As a result, some studies illustrate a U-shaped relationship when examining the impact of pay disparity among workers (Grund and Westergaard-Nielsen 2008; Mahy, Rycx, and Volral 2011), or pay disparity between CEO and top management teams, on firm performance (Ridge et al. 2015). Alternatively, other studies find an inverse U-shaped relationship between CEO-employee pay disparity (Dai, Kong, and Xu 2017) or pay differences among employees (Mahy et al. 2011; Winter-Ebmer and Zweimüller 1999) and employee performance. Shin et al. (2015) do not support a non-linear relationship between firm performance and CEO-employee pay disparity. Although evidence suggests that the relationships between pay disparity and outcomes may be non-linear, contradictory findings in these studies make general conclusions difficult.

The second approach argues that contradictory findings in prior studies stem from overlooking individuals' inputs in their compensation (Conroy et al., 2014; Gupta et al., 2012; Shin et al., 2015; Trevor et al., 2012), which is incompatible with critical assumptions in both perspectives. Therefore, some studies use control variables that explain employees' inputs (such as their talent and previous pay) in their models (Gerhart & Rynes, 2003). However, this procedure removes sources of pay disparity and is thus a sub-optimal approach (Gupta et al., 2012). Other studies argue that pay disparity related to legitimate reasons leads to higher productivity, consistent

with economic perspectives. However, pay disparity for illegitimate reasons is unlikely to yield these benefits. Following this approach, it has been shown that pay-performance disparity is positively related to performance (Kepes et al., 2009; Shaw et al., 2002). Some studies also examine the impact of pay inequity. For example, Shin et al. (2015) and Faleye et al. (2013) model the determinants of vertical pay disparity and estimate unexplained vertical pay disparity as the residual of their model.[5] Shin et al. (2015) find a negative relationship between absolute pay inequity and future firm performance. However, Faleye et al. (2013) do not find any significant relationship between pay inequity and employee performance.

Two studies attempt to consider both pay equity and inequity in their examination. Trevor et al. (2012) study horizontal pay disparity within interdependent sport teams and find that teams with high pay disparity created by variation in the individual performance of team members have higher team performance, while team performance reduces at high levels of pay disparity. He also shows that pay disparity unexplained by individual performance has a negligible or slightly negative impact. Rouen (2020) separates the component of CEO and employee compensation explained by their inputs and economic factors. He defines pay disparity as the ratio of predicted CEO pay to expected average employee pay and unexplained pay disparity as the difference between the actual pay disparity and the calculated pay disparity. He finds robust evidence of a negative (positive) relation between unexplained (explained) pay disparity and future firm performance. Therefore, the role of inputs in measuring pay inequality should be demonstrated. In the absence of such a demonstration, the impact of pay inequality on performance could lead to an invalid approach to applying those theories (Rouen 2020).

2.4. The impact of pay inequality on employee performance

As argued, pay inequality per se is an insufficient proxy for testing the sociological and economic perspectives. Therefore, this study focuses on pay inequity and pay equity impacts on employee performance rather than pay inequality. Consistent with the sociological perspective, we expect that pay inequity negatively influences employee performance. This leads to the first hypothesis, as follows:

H1: Pay inequity has a negative association with employee performance.

With regard to the previous studies, it is expected that pay equity positively relates to employee performance. However, a critical idea underlying Tournament Theory is the presence of optimal pay disparity, which is the level that can maximise employees' performance in a contest (Lazear and Rosen 1981). If pay disparity is too small, contestants are not encouraged to compete, so the total productive output of the tournament drops. However, a high prize spread can also be detrimental because it induces high effort that contestants cannot sustain (Connelly et al. 2014).

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[5] Although the main argument of both studies was the impact of simple vertical pay disparity on performance, they also examine the impact of the residual (*PayInequity*) on firm performance (Shin et al., 2015) and employee performance (Faleye et al., 2013).

Therefore, Tournament design involves strategically choosing optimal pay disparity spreads that maximise the productive output of the tournament. The empirical literature rarely refers to the existence of an optimum point for pay equity. For example, Brown, Sturman, and Simmering (2003) assert that pay disparity clearly explained by inputs may be seen as inequitable and detrimental when it is large. Trevor et al. (2012) also find that the positive impact of horizontal pay disparity, which is explained by their inputs, on team performance, is attenuated at high levels of such dispersion. This argument leads to our second prediction:

> H2: Pay equity has an inverted U-shaped association with employee performance

3. Methodology

Given our argument, pay inequality per se is not a reliable measure for examining its impact on performance. There is a need to consider the determinants of pay inequality to separate pay inequity from pay equity. First, this section describes our model to measure pay inequality explained by CEO's and employees' skill, company characteristics, and labour market. Therefore, we disentangle the components of each firm-year pay equity from pay inequity. Second, the model for examining the impact of the key pay ratios (pay inequality, pay equity and pay inequity) on employee performance is explained.

3.1. Breaking down pay inequality into pay equity and pay inequity

Following the empirical studies approach (e.g., Faleye et al., 2013; Shin et al., 2015), we model pay inequality based on CEOs' and employees' skills, company characteristics and labour market, as in equation 1. Pay equity is the predicted pay inequality in each firm-year, while the error term ε captures pay inequity and represents the deviation from the expected pay inequality.

$$
\begin{aligned}
Pay\ Inequality_{i,t} \\
= \alpha + \sum_{a} \beta_a CEO\ Skills_{i,t} \\
+ \sum_{b} \beta_b Employees\ skills_{i,k,t} + \sum_{a} \beta_a Company\ charactristics_{i,t} \\
+ \sum_{b} \beta_b\ Labour\ market_{j,k,t} + Region\ Fixed\ Effects_k \\
+ Industry\ Fixed\ Effects_j + Year\ Fixed\ Effects_t + \varepsilon_{i,t} \quad (1)
\end{aligned}
$$

In the above equation, pay inequality is calculated using the natural logarithm of the ratio of the total CEO compensation to the mean employee pay during the fiscal year.[6] Industries are

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[6] We used total CEO remuneration to forecast expected CEO remuneration for two reasons. Firstly, our sample is not limited to large corporations where the executive's salary is broken down into fixed salary, non-cash benefits and contingent benefits normally in the form of bonuses. Secondly, in cases of CEOs' salary breakdown availability, there are a large number of zero bonuses. Labour expenses also include wage and salaries, superannuation and share-based payments.

defined using a two-digit Global Industry Classification Standard (GICS) code. Subscript i is the firm identifier, j is the industry identifier, k is the region identifier, and t is the fiscal year.

Highly skilled CEOs are required in larger firms with more complex operations, greater growth opportunities, and higher performance (Core et al., 1999). Firm size (*LnRevenue*), firm age (*LnAge*) and book to market ratio (*BTM*) are included to measure the complexity of a firm's operation and growth opportunities. In addition, the CEO's compensation is an increasing function of firm performance based on standard agency models. Firm performance is measured using the accounting return on asset (*ROA*), and annual stock return (*Ret*) (Core et al., 1999). Furthermore, it is expected that firms with noisier environments, computed by the standard deviation of common stock returns over the prior five years (*RetVar*), provide higher incentives to attract talented managers (Bloom & Michel, 2002; Core et al., 1999). In addition, the capital structure (*Leverage*), measured by total long-term debt scaled by the total asset, is included to control pay inequality. *Leverage* may be negatively associated with compensation because it decreases companies' ability to make their payroll. However, leverage can be positively correlated with compensation since potential bankruptcy costs arising from high leverage should be compensated by higher pay (e.g., Berk et al., 2010; Chemmanur et al., 2013). Therefore, the sign of its impact on pay inequality is not predicted (Rouen, 2020; Shin et al., 2015).

Furthermore, executives' incomes increase with their bargaining power over board members, and their bargaining power decreases with effective corporate governance (Core et al., 1999). The CEO has higher bargaining power when the CEO is the board chair (*IsCEOChair*) (Core et al., 1999; Faleye et al., 2011; Yermack, 1996) because they are more entrenched, more experienced or more talented (Faleye et al., 2013). Board tenure (*BoardTenure*) and the percentage of independent board members on the compensation committee (*IndCommittee*) are also included in the model. We expect a positive relationship between these variables and corporate governance effectiveness.

Employees' skill is measured by three ratios including, R&D intensity (*RDIntensity*), physical capital intensity (*PPTIntensity*) and workforce education (*Education*) (Faleye et al., 2013). These three ratios consider two different factors for the presence of highly skilled employees in the firm: task-based reasons such as executing R&D projects and operating high capital; and individual-based reasons, including knowledge levels. To put it differently, Firms with high R&D projects require highly skilled employees to execute those projects (Faleye et al., 2013; Toner, 2011). Additionally, capital-intensive firms with high net property, plant and equipment per employee need highly skilled employees to operate them. We use workforce education to measure the level of human capital (Barro, 2001)[7].

In addition, labour market variables, which influence employees' bargaining power over executives, are included. Industry concentration (*IndConcentration*) measured using the revenue-

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[7] This variable is calculated at the regional level because of data limitations.

based Hirschman–Herfindahl index over Datastream firms in the two-digit GCSI industry[8], determines market competitiveness. A highly concentrated industry shows a monopoly, which decreases employees outside opportunities and bargaining power. In addition, employee unionisation (*Union*), the percentage of employees who are members of a trade union in each region[9], unemployment rate (*UnemploymentRate*), and vacant job ratio (*VacantJob*)[10] are included. We expect that bargaining power increases with employee unionisation and decreases with industry concentration, unemployment rate and vacant job ratio.

3.2. The impact of pay ratios on employee performance

By following Faleye et al.'s (2013) equation, we examine the impact of key pay ratios (pay inequality, pay equity and pay inequity) on employee performance using the following multivariate regression.

$$
\begin{aligned}
Employee\ &Performance_{i,t} \\
&= \alpha + \beta_1 PayRatio_{i,t} + \beta_2 LnAveEmployeePay_{i,t} + \beta_3 Education_{k,t} \\
&+ \beta_4 PPEIntensity_{i,t} + \beta_5 IndConcentration_{j,t} + \beta_6 Union_{k,t} \\
&+ \beta_7 CEOTenure_{i,t} + \beta_8 LnRevenue_{i,t} + \beta_9 Leverage_{i,t} \\
&+ Region\ Fixed\ Effects_k + Industry\ Fixed\ Effects_j \\
&+ Year\ Fixed\ Effects_t + \varepsilon_{i,t} \quad (2)
\end{aligned}
$$

where subscripts are defined as in the previous equation. Employee performance is measured as Total Factor Productivity (TFP) and the natural logarithm of revenue per employee (SLE). The primary variable of interest is *PayRatio*, which is either pay equity, pay inequity or pay inequality. The later discussion can then include pay inequality to make comparisons with previous studies. Similar to prior studies, we control other factors affecting employee performance, including employees' skills, outside employees' opportunities, and firm characteristics. We expect that employee performance increases with skill, measured by PPE intensity (*PPTIntensity*) and Employee Education (*Education*), and outside opportunities, measured by Industry concentration (*IndConcentration*) and employee unionisation (*Union*)[11]. We also control for the impact of the average employee compensation (*LnAveEmployeePay*), CEO experience (*CEOTenure*), firm's size (*LnRevenue*) and capital structure (*Leverage*). Finally, the regression includes year, two-digit

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[8] Revenue is trimmed at the 5 and 95 percentiles to remove the effect of outliers in the calculation of the Hirschman–Herfindahl index.

[9] The trade union members data are collected from the Australian Bureau of Statistics (ABS), which are presented at regional level.

[10] Another proxy, considered in the literature as a proxy of outside opportunity, is industry homogeneity. It is calculated as the mean partial correlation between a firm's return and an equally weighted industry index. In this study, this variable is not included because the lack of data on an equally weighted GICS industry index.

[11] Union may have a positive or negative impact on employee performance (Faleye et al., 2013).

GICS industry, and region fixed effects. Appendix A defines all variables used in our empirical analysis.

Total Factor Productivity (*TFP*) is calculated following Faleye et al. (2006), where it is assumed that the firm's production function follows the Cobb-Douglas formula:

$$Y_{i,t} = A\, L_{i,t}^{\beta_j}\, K_{i,t}^{\alpha_j} \quad (3)$$

$Y_{i,t}$ is the revenue, $L_{i,t}$ is the number of employees, and $K_{i,t}$ is the net property, plant, and equipment of firm i in fiscal year t in industry j.[12] We transformed the above equation by taking the natural logarithm of both sides. We estimate a separate regression for each two-digit GICS industry group for all Datastream firms to control industry heterogeneity. Each regression includes a year-fixed effect, and the standard error is corrected by firm-level clustering. Finally, *TFP* is measured as the residual of the following equation.

$$y_{i,t} = a_{i,j,t} + \beta_j\, l_{i,t} + \alpha_j\, k_{i,t} + \varepsilon_{i,t} \quad (4)$$

TFP defines employee performance as the portion of firm productivity that is unaffected by capital. For robustness purpose, this study considers an additional employee performance proxy, measured as the natural logarithm of the revenue per employee (*SLE*) (Cronqvist et al., 2009). However, this measure captures productivity at the most basic level (Faleye et al., 2013).

Our model may face the challenge of potential endogeneity bias that drives the effect of pay ratios on employee performance. Noting the possibility of persistence in employees' performance due to the current value being related to its previous value, we use a dynamic estimator such as the two-step "system generalised method of moments (SGMM)" (Arellano & Bond, 1991; Arellano & Bover, 1995) with robust standard errors. to capture the dynamic behaviour. Furthermore, SGMM controls for unobserved heterogeneity, endogeneity problems arising from simultaneity, reverse causality, or mismeasurement of variables that may bias estimates. These strategies are further explained in the empirical analysis section.

4. Sample and Data

Our sample includes Australian Securities Exchange (ASX) firms and Australian regional labour market data collected from three databases: Thomson Reuters Datastream (TRD), MorningStar (DatAnalysis), and Australian Bureau of Statistics (ABS). TRD provides detailed annual reports and stock market data. Other detailed company information (such as an address, industry group) is available in DatAnalysis. ABS covers a wide range of macroeconomic data by region and industry in Australia. All three databases are merged, as discussed below, to develop a final firm-year dimensional database used in this study.

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[12] Beta and alpha are heterogenous across industries.

Most of the variables are collected from TRD and ABS. TRD includes our variables of interest in this research: CEO compensation and employees' average compensation. CEO's compensation is defined in the TRD database as the highest remuneration in the firm[13]. Employees' average compensation is calculated as the ratio of wage and salaries expenses minus the highest remuneration to the number of employees minus one [14]. Since these two variables are our key variables, the firms in our initial sample are restricted to those with at least one observation of the highest remuneration package or wage and salaries expenses from 2004 to 2019. This step yields a list of 2845 companies listed in ASX from 2004 to 2019. Then, financial data are collected from 2004 to 2019 for all 2845 firms. In addition, regional and industry-level data on Australia's economy, labour, population, and education are collected from ABS.

In order to merge TRD and ABS databases, industry groups and the state of incorporation identifiers are required for all firms. However, there are two issues. First, the state of incorporation for all companies and the two-digit GICS codes[15] is not available in TRD. To address this problem, DatAnalysis is employed. The country of incorporation, registered office state and GICS for all companies are retrieved from DatAnalysis. Then, the missing values of the country of incorporation and registered office state in TRD are completed using data from DatAnalysis. This process leads to 2649 firms being incorporated in Australia. In addition, we merge a two-digit GICS industry code to our sample based on the company name. The two-digit GICS industry code was not reported for 26 companies. This process reduces the number of our companies to 2623.

The second issue is that the industry identifiers differ in DatAnalysis and ABS. The former uses GICS and the latter ANZSIC. Thus, merging our sample and the ABS database creates another challenge. To solve this problem, we relate each two-digit GICS industry code to a two-digit ANZSIC code. If an exact match is not possible for the two-digit ANZSIC code, we use the broadest level of ANZSIC code that potentially maps to the GICS industry code. Appendix B illustrates the industry map. Given these steps, our initial sample leads to 2623 unique firms incorporated in Australia from 2004 to 2019.

Unfortunately, TRD does not provide complete compensation data for CEOs. Therefore, our sample is limited to those observations in our initial sample that covered CEO Compensation, total senior executive compensation or board member compensation. [16] Consequently, we lose a significant proportion of the observations obtained from Datastream, resulting in a final sample of 547 unique firms over the period 2004-2019. Then, all the continuous variables in our sample data

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[13] CEO compensation is reported in TRD based on the US dollar. Therefore, we also collect the USD/AUD currency rate from TRD. We calculate CEO compensation in AUD by multiplying CEO compensation in USD by the currency rate in the fiscal date of each firm-year.

[14] If number of employees is missing, we use the employee numbers from the previous year

[15] The Australian stock exchange (ASX) uses the GICS method for categorising companies.

[16] We also consider total senior executive compensation or board member compensation to check later that it is possible to manually collect data on CEOs. If we restrict the search to CEOs the number of observations was 543 unique firms and 3882 observations.

are trimmed at the 1 per cent and 99 per cent levels to minimise the effect of any outliers.[17] Following all adjustments, the sample size reduces to 2132 firm-year observations (385 unique firms) in our first regression (see Table 4).

5. Empirical analysis

This section begins with the summary statistics of all variables. It follows by estimating pay equity and pay inequity according to equation 1. We then discuss and test our hypotheses on the relationship between pay ratios and employee performance.

5.1. Descriptive statistics

Table 1 presents the mean and median for pay inequality over years, industries, and regions. As shown in panel A, the median (mean) of pay inequality increased from 34.9 (50.94) to 47.64 (88.47) from 2004 to 2007 (before the GFC). After the GFC, pay inequality gradually declined and reached 18.31(38.82) in 2010. Since 2011, pay inequality has been more stable. [18] In addition, the median of pay inequality is higher in banking, insurance, transportation, and retail industries, where the CEO earns about 49, 41, 36 and 35 times more than the average employee, respectively (Table 1, panel B). Comparing pay inequality over different regions in Australia shows that two states, New South Wales and Victoria, have the highest median pay inequality with respective values of 26.10 and 28.69 (Table 1, panel C). Our sample does not show the pay inequality reported in the media. This discrepancy exists mainly as a consequence of our measure of pay inequality. Because of the lack of executives' compensation data, our average employee pay includes executive salaries. This leads to a higher average employee pay and lower pay inequality.

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[17] The outliers in variables may render the distribution non-normal, affecting the descriptive statistics.
[18] The trend of pay inequality in our sample is consistent with the Productivity Commission's report in 2009 and the Australian Council of Superannuation Investors (ACSI) report in August 2020.

Table 1 Pay Inequality over years, industries, and regions

Panel A: Pay inequality over years

Year	Number of firms	Mean	1st Quartile	Median	3rd Quartile
2004	30	50.94	16.34	34.90	65.00
2005	36	50.45	22.18	43.33	65.35
2006	51	69.20	29.42	50.54	78.19
2007	56	88.47	31.16	47.64	79.34
2008	67	70.76	28.36	42.07	82.47
2009	137	45.62	10.59	26.13	54.82
2010	194	38.82	6.58	18.31	46.14
2011	205	50.73	6.64	21.54	47.63
2012	217	42.14	8.39	22.72	48.22
2013	236	33.97	7.47	19.52	36.96
2014	237	33.24	7.10	16.64	40.80
2015	256	35.03	7.68	18.77	41.74
2016	269	32.93	9.25	18.81	35.97
2017	281	35.02	10.17	19.31	41.00
2018	284	33.71	9.86	20.14	38.01
2019	274	37.21	9.33	19.50	35.93

Panel B: Pay Inequality over different industries

Industry	Number of firms	Mean	1st Quartile	Median	3rd Quartile
Semiconductors & Semiconductor Equipment	14	5.64	3.25	5.27	6.71
Technology Hardware & Equipment	18	10.89	9.48	10.72	12.11
Household & Personal Products	17	15.79	10.04	14.66	17.03
Software & Services	116	16.07	6.93	12.58	19.49
Consumer Durables & Apparel	26	19.87	10.11	12.18	14.27
Utilities	63	20.47	4.00	12.01	33.93
Pharmaceuticals, Biotechnology & Life Sciences	75	21.67	4.09	7.33	15.79
Diversified Financials	168	21.88	8.83	18.85	26.52
Energy	250	23.14	4.15	10.68	27.10
Media & Entertainment	107	28.03	12.38	20.21	35.22
Commercial & Professional Services	150	30.64	9.18	17.35	46.57
Real Estate	148	35.93	12.47	24.66	51.11
Consumer Services	171	36.02	12.38	23.41	50.09
Automobiles & Components	19	36.67	4.84	8.74	27.09
Telecommunication Services	45	39.62	17.45	32.90	58.62
Capital Goods	168	45.67	8.65	19.44	41.03
Insurance	49	47.59	35.79	41.00	64.43
Transportation	90	49.67	25.17	36.16	66.51
Health Care Equipment & Services	126	50.03	15.52	25.51	58.50
Materials	651	50.39	7.78	23.28	54.06
Banks	100	59.00	28.03	49.94	82.15
Retailing	147	60.81	21.23	35.03	59.29
Food, Beverage & Tobacco	76	68.23	10.36	16.46	30.89
Food & Staples Retailing	36	76.83	20.62	34.91	138.48
Banks	100	59.00	28.03	49.94	82.15

Panel C: Pay Inequality over regions

Region	Number of firms	Mean	1st Quartile	Median	3rd Quartile
NSW	1006	43.79	13.72	26.10	51.42
VIC	729	44.88	12.70	28.69	58.60
QLD	351	24.55	7.69	16.74	27.66
SA	100	19.91	10.13	14.24	23.60
WA	615	40.44	5.68	10.69	28.50
TAS	17	55.67	11.90	14.90	27.87
NT	12	2.44	2.12	2.25	2.91

Table 1 presents the summary statistics of pay inequality over year, industries, and regions. Pay Inequality is calculated as CEO compensation to average employee compensation. Panel A reports summary statistics of pay inequality over 2004-2019. Panel B reports summary statistics of pay inequality in different industries. Panel C reports summary statistics of pay inequality in different regions. Pay inequality is trimmed at 1 per cent and 99 per cent.

Table 2 provides descriptive statistics for all variables in this study. The mean and the median of pay inequality are about 3.018 and 3.054.[19] Turning to employee performance, the mean (median) of total factor productivity (*TFP*) and revenue per employee (*SLE*) is 0.372 (0.229) and 6.175 (6.205). With regard to corporate governance, we find that about 10% of our sample firms have dual CEO Chairman positions. On average, 82% of the compensation committee members are independent board members.

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[19] Unlogged pay inequality is equal to 20.45 and 21.20. Therefore, we use the natural log of pay inequality in our analyses to reduce the influence of outliers.

Table 2 Summary statistic of all variables

Variable	Obs	Mean	S.D.	Min	1st Quartile	Median	3rd Quartile	Max
Pay inequality	2830	3.018	1.143	0.307	2.222	3.054	3.804	6.790
Pay equity	2132	3.000	0.707	-0.007	2.552	3.024	3.513	5.280
Pay Inequaity	2132	0.000	0.877	-2.875	-0.553	-0.037	0.472	3.891
TFP	3454	0.372	1.175	-3.515	-0.360	0.229	1.084	4.349
SLE	3472	6.175	1.387	-0.324	5.456	6.205	6.969	10.217
LnAveEmployeePay	2937	11.511	0.987	7.494	11.075	11.524	11.927	15.143
LnRevenue	3864	5.893	2.542	-2.364	4.950	6.203	7.554	10.833
BTM	3892	0.760	0.658	-0.102	0.326	0.585	0.980	4.348
LnAge	3924	2.543	0.878	-0.587	2.103	2.613	3.141	4.208
ROA	3879	2.234	15.931	-87.400	-0.510	5.230	9.870	46.880
Ret	3780	0.010	0.479	-1.696	-0.215	0.068	0.285	1.342
STDRet	3445	0.134	0.072	0.038	0.080	0.115	0.176	0.435
Leverage	3947	15.866	15.148	0.000	0.294	13.526	26.066	71.935
IsCEOChair	4032	0.105	0.307	0.000	0.000	0.000	0.000	1.000
CEOTenure	3460	5.835	2.705	0.880	4.000	5.395	7.150	16.060
BoardTenure	3886	5.824	2.752	0.880	3.940	5.380	7.160	16.060
IndCommittee	3848	82.662	23.797	0.000	67.000	100.000	100.000	100.000
PPEIntensity	3491	2.565	8.037	0.000	0.029	0.135	1.056	83.402
RDIntensity	3964	0.456	2.095	0.000	0.000	0.000	0.000	21.252
IndConcentration	4001	0.094	0.103	0.023	0.036	0.065	0.108	1.000
Education	4032	19.880	3.014	11.327	17.446	19.834	22.228	24.845
Union	4032	13.967	2.375	10.419	12.157	13.710	15.860	22.263
Unemployment	4032	5.390	0.666	2.962	4.825	5.376	5.897	7.697
VacantJob	4032	2.153	1.160	0.316	1.305	1.851	2.653	5.231

Table 2 presents summary statistics for the main variables in our samples. Continuous variables are trimmed at 1 per cent and 99 per cent.
All variables are defined in Appendix A.

Table 3 presents the Pearson correlation matrix for the firm-level and labour market variables. With regard to the pay ratios, there is a strong positive relation between pay inequality and pay equity at 0.62. Similarly, the correlation between pay inequality and pay inequity is significantly positive at 0.78. However, the correlation between pay inequity and pay equity is slightly negative, consistent with prior research (Rouen, 2020). In addition, higher mean employee pay is associated with lower pay ratios. As we expected, there is a positive correlation between firm size (*LnRevenue*), firm performance (*ROA* and *Ret*) and pay inequality. Unsurprisingly, pay inequity is not highly correlated with our control variable. Consistent with our hypotheses H1 and H2, there is a positive correlation between pay equity and *TFP* (*SLE*) at 0.08 (0.22) and a negative correlation between pay inequity and *TFP* (*SLE*) at -0.35 (-0.38). As is shown, none of the variables is highly correlated, and the most significant correlation coefficient is 0.58 between *Union* and *Education*.

Table 3 Correlation Matrix

Panel A: from variable Pay inequality to STDRet

	1	2	3	4	5	6	7	8	9	10	11	12
1-LnPayGap	1.00											
2-ExpGap	0.6273*	1.00										
3-UnexpGap	0.7788*	0.00	1.00									
4-TFP	-0.2112*	0.0793*	-0.3491*	1.00								
5-SLE	-0.1109*	0.2192*	-0.3830*	0.6890*	1.00							
6-LnAverageEmployee	-0.6437*	-0.2353*	-0.6805*	0.3467*	0.4827*	1.00						
7-LnRevenue	0.5104*	0.7955*	0.00	0.1441*	0.4057*	-0.1147*	1.00					
8-BTM	-0.1220*	-0.2095*	0.00	0.0490*	0.0463*	0.00	-0.0703*	1.00				
9-LnAge	0.1360*	0.2575*	0.00	0.0472*	0.0533*	-0.01	0.1117*	0.0590*	1.00			
10-ROA	0.1666*	0.2456*	0.00	0.1075*	0.2237*	-0.0713*	0.3704*	-0.2926*	-0.0480*	1.00		
11-Ret	0.0794*	0.1101*	0.00	0.0367*	0.0670*	-0.02	0.1059*	-0.4497*	-0.02	0.3545*	1.00	
12-STDRet	-0.3006*	-0.4466*	0.00	0.02	-0.2614*	0.0391*	-0.5832*	0.1886*	-0.1237*	-0.3583*	-0.1482*	1.00
13-Leverage	0.1995*	0.3076*	0.00	-0.1393*	0.1242*	-0.0535*	0.3242*	-0.0468*	-0.0625*	0.1128*	0.01	-0.2849*
14-IsCEOChair	-0.02	0.00	0.00	0.0368*	0.00	-0.03	-0.0414*	-0.0381*	0.0549*	0.0367*	-0.02	0.03
15-CEOTenure	-0.02	-0.04	-0.02	0.00	-0.03	-0.02	0.0980*	-0.0481*	0.2735*	0.1240*	0.03	-0.2253*
16-BoardTenure	-0.01	-0.04	0.00	0.00	-0.01	-0.02	0.1098*	-0.0556*	0.2687*	0.1188*	0.0370*	-0.2210*
17-IndCommittee	0.0774*	0.1061*	0.00	0.02	0.1088*	0.1010*	0.1910*	-0.03	0.0686*	0.0721*	0.00	-0.1925*
18-PPEIntensity	-0.2008*	-0.3430*	0.00	0.1149*	0.2859*	0.3669*	-0.2152*	0.1553*	-0.01	-0.0558*	-0.0529*	0.1377*
19-RDIntensity	-0.0697*	-0.0882*	0.00	0.01	-0.0993*	0.03	-0.0957*	-0.1420*	0.02	0.02	0.03	0.03
20-IndConcentration	0.03	0.0834*	0.00	-0.0860*	0.0335*	0.01	0.1534*	-0.1109*	0.03	-0.01	0.0350*	-0.1634*
21-Education	0.0446*	0.1347*	0.00	-0.0625*	-0.0492*	-0.01	0.01	-0.0745*	0.01	0.00	0.0447*	-0.1984*
22-Union	0.1924*	0.2767*	0.00	-0.0650*	0.0778*	-0.0643*	0.2521*	-0.0618*	-0.0625*	0.1503*	0.0401*	-0.1339*
23-Unemployment	-0.02	-0.03	0.00	0.0514*	-0.0395*	-0.0529*	-0.02	0.0950*	0.00	-0.0731*	0.03	-0.0472*
24-VacantJob	-0.03	-0.01	0.00	0.1467*	0.0466*	0.0718*	-0.1851*	0.03	0.0671*	-0.0781*	-0.0995*	0.3269*

Panel B: from variable Leverage to VacantJob

	13	14	15	16	17	18	19	20	21	22	23	24
13-Leverage	1.00											
14-IsCEOChair	-0.0464*	1.00										
15-CEOTenure	0.00	0.1813*	1.00									
16-BoardTenure	-0.01	0.1833*	1.0000*	1.00								
17-IndCommittee	0.0787*	-0.0785*	-0.01	0.00	1.00							
18-PPEIntensity	0.02	0.01	-0.1055*	-0.1129*	-0.02	1.00						
19-RDIntensity	-0.0628*	0.02	0.0987*	0.0910*	0.02	-0.0696*	1.00					
20-IndConcentration	0.0496*	-0.0397*	0.0669*	0.0723*	0.0483*	-0.0803*	0.1274*	1.00				
21-Education	0.0328*	-0.0344*	0.02	0.02	-0.0469*	-0.0696*	0.0921*	0.0616*	1.00			
22-Union	0.1364*	-0.03	0.01	0.01	0.1289*	-0.02	0.01	0.1371*	-0.5516*	1.00		
23-Unemployment	0.03	-0.03	0.01	0.00	-0.0547*	-0.0604*	-0.01	-0.02	0.0498*	-0.0840*	1.00	
24-VacantJob	-0.2469*	0.0386*	-0.1198*	-0.1240*	0.0400*	0.1440*	-0.1034*	-0.1717*	-0.2776*	0.0440*	-0.3249*	1.00

* Indicates significance at 5 per cent.

Table 3 presents Pearson correlations for the main variables in our samples. Continuous variables are trimmed at 1 per cent and 99 per cent.

All variables are defined in Appendix A.

5.2. The determinants of pay inequality

Table 4 reports the result of implementing the model described in equation 1. These variables explain 37.6% of the variation in pay inequality (adjusted r-squared of 37.6%). Consistent with our expectation, the variables are significantly related to pay inequality with the predicted signs. The regression includes the year, two-digit GICS industry, and region fixed effect. The standard errors are clustered at the firm level. All continuous variables are trimmed at the 1st and 99th percentile to minimise the impact of any potential outliers.

Table 4 The determinants of pay inequality

	Predicted Sign	Pay inequality	
		Coefficient	Standard Error
LnRevenue	+	0.174 ***	0.025
BTM	-	-0.129 **	0.062
LnAge	+	0.245 ***	0.066
ROA	+	-0.001	0.002
Ret	+	0.011	0.059
Ret Var	+	0.455	0.859
Leverage	+/-	0.009 ***	0.002
IsCEOChair	+	0.171	0.185
BoardTenure	-	-0.038 ***	0.014
IndCommittee	-	-0.003 *	0.002
PPTIntensity	-	-0.047 ***	0.008
RDIntensity	-	-0.023	0.015
Education	-	0.073	0.1
IndConcentration	+	-0.000	0.000
Union	-	-0.009	0.038
UnemploymentRate	+	0.128 **	0.057
VacantJob	+	0.105 **	0.051
Constant		0.714	1.949
Year Fixed Effects		Yes	
Industry Fixed Effects		Yes	
Region Fixed Effects		Yes	
Firm-level clustering standard error		Yes	
Observation		2132	
Firms		385	
Adjusted R^2		0.376	

*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.
Table 4 presents the result of regression model used to explain pay inequity. Pay inequality is measured as the natural log of the ratio of total CEO compensation to average employee pay. The regression includes region, industry, and year fixed effects. Continuous variables are trimmed at 1 per cent and 99 per cent. Robust standard errors are clustered at the firm level. All variables are defined in Appendix A.

The result confirms that pay inequality increases with CEO's skill and decreases with corporate governance effectiveness. Proxies for CEO's skills such as *LnRevenue*, *LnAge* and Inverse *BTM* have a significant positive relation with pay inequality. Moreover, pay inequality increases with a firm's leverage. Regarding corporate governance effectiveness, the coefficients

BoardTenure and *IndCommittee* are negative and significant at 1% and 10%, respectively. In addition, the coefficient of *IsCEOChair* is marginally positive at 10% significance.

On the other hand, the result shows that higher employees' skills and outside opportunities reduce pay inequality. For example, employees' skill measured by *PPTIntensity* is significantly and negatively associated with pay inequality. In contrast, the unemployment rate and the percentage of vacant jobs have a significant positive relationship with pay inequality by decreasing employees' bargaining power. Therefore, the model defines pay inequality appropriately. Hence, we use the predicted pay inequality to capture pay equity and the residual, the deviation from predicted pay inequality, to capture pay inequity in the next section.

5.3. The effect of pay ratios on employee performance

Table 5 presents the model's result using equation 2, examining the relationship between pay ratios and employee performance. First, we focus on the association between pay inequality and employee performance. As shown, in both columns (1) and (5), the coefficient is negative and highly significant (p-value less than 0.01). Then, we examine whether there is a positive (negative) relationship between pay equity (pay inequity) and employee performance. The coefficients of pay equity are not significant in either column (2) or column (6). Consistent with hypothesis H1, we find a negative and significant (p-value less than 0.01) relationship between pay inequity and employee performance in columns (3) and (7). We repeat our regression by including both pay equity and pay inequity in the equation (columns (4) and (8)). The coefficient of pay inequity remains negative and highly significant (P-value =0.00). However, pay equity turns more significantly negative in columns (4) and (8).

We also control the possible effect of other factors on employee performance. As expected, the coefficient of *LnAveEmployeePay* and *LnRevenue* are mostly significantly positive. With regard to employees' skill, *PPEIntesity* is significantly positive when we use *SLE* as a measure of employee performance. The consistent finding is that highly skilled employees have higher productivity. In addition, the results show that productivity is higher in concentrated industries. One explanation is that employees increase their performance to secure their careers because there is less outside opportunity for employees in highly concentrated industries. On the other hand, the company does not want to lose their employees because there are not enough potential employees in the market. Therefore, the company also motivates its employees to achieve higher productivity. Our results show no significant relationship with other variables.

	Predicted Sign	TFP				SLE			
		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Pay Inequality	+/-	-0.346***				-0.305***			
		(0.0000)				(0.0000)			
Pay Equity	+		-0.295*		-0.490***		-0.101		-0.283*
			(0.0821)		(0.0032)		(0.5355)		(0.0726)
Pay Inequity	-			-0.309***	-0.345***			-0.302***	-0.323***
				(0.0000)	(0.0000)			(0.0000)	(0.0000)
LnAveEmployeePay	+	0.150**	0.471***	0.219***	0.165**	0.343***	0.616***	0.358***	0.327***
		(0.0322)	(0.0000)	(0.0041)	(0.0332)	(0.0000)	(0.0000)	(0.0000)	(0)
Education	+	-0.011	-0.067	-0.100	-0.057	0.053	-0.041	-0.057	-0.032
		(0.9101)	(0.5417)	(0.3317)	(0.5801)	(0.5899)	(0.6944)	(0.5655)	(0.7547)
PPEIntensity	+	0.001	-0.017	0.010	-0.009	0.0630***	0.0539***	0.0724***	0.0615***
		(0.8923)	(0.1942)	(0.3583)	(0.4946)	(0.0000)	(0.0002)	(0.0000)	(0.0000)
IndConcentration	-	1.357*	1.199	1.102	0.973	1.108***	1.068**	0.933*	0.857*
		(0.0704)	(0.1861)	(0.2416)	(0.2875)	(0.0033)	(0.0287)	(0.0523)	(0.0727)
Union	+/-	0.0694**	0.054	0.031	0.046	-0.017	-0.026	-0.043	-0.034
		(0.0271)	(0.14)	(0.3779)	(0.1923)	(0.5248)	(0.439)	(0.1893)	(0.2966)
CEOTenure	+	-0.002	0.001	0.006	-0.004	-0.008	-0.002	-0.002	-0.007
		(0.8632)	(0.923)	(0.6378)	(0.7262)	(0.4779)	(0.8751)	(0.9004)	(0.5863)
LnRevenue	+	0.294***	0.275***	0.234***	0.324***	0.401***	0.342***	0.333***	0.385***
		(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.000)	(0.000)	(0.000)	(0.0000)
Leverage	+/-	-0.011***	-0.009***	-0.013***	-0.008***	-0.004	-0.002	-0.004	-0.002
		(0,0000)	(0.0028)	(0,0000)	(0.0042)	(0.1491)	(0.4617)	(0.1394)	(0.565)
Constant		-2.874	-4.565**	-1.892	-0.799	-0.154	-1.214	1.706	2.339
		(0.1414)	(0.0407)	(0.3911)	(0.7192)	(0.9336)	(0.5485)	(0.4186)	(0.2614)
Observation		2356	1932	1932	1932	2364	1938	1938	1938
Firms		409	368	368	368.000	409	368	368	368
Adjusted R2		0.442	0.441	0.462	0.469	0.626	0.585	0.604	0.606
Root MSE		0.813	0.815	0.799	0.794	0.751	0.771	0.753	0.751

*, **, *** Indicate significance at the 10%, 5% and 1% levels, respectively.

Table 5 reports the relation between pay ratios and employee performance. Employee performance is measured as SLE, the natural log of revenue per employee, and TFP, the residual of industry-specific Cobb–Douglas production functions. Pay Inequality is measured as the natural log of the ratio of total CEO compensation to average employee pay. Pay Equity is the predicted pay inequality in each firm-year and Pay Inequity is the residual of equation 1. Each regression includes region, industry, and year fixed effects. Continuous variables are trimmed at 1 per cent and 99 per cent. P-values are reported in parentheses based on robust standard errors clustered at the firm level.

All variables are defined in Appendix A.

Different models are applied to alleviate econometric concerns in our primary model (see Table 6). The first concern may be the existence of firm heterogeneity in our sample. To address this issue, we include firm fixed effects to control for time-invariant firm characteristics that may affect employee performance (reported in column FFE). The second and the most critical concern is the simultaneity problem because compensation decisions and employee performance are jointly determined. Therefore, the causality may run in both directions, from pay ratios to employee performance and vice versa. To consider this issue, we use three additional regressions. First, we regress employee performance on the first lag of pay ratios rather than contemporaneous pay ratios.

Second, we use employee performance at year *t+1* rather than year t.[20] Third, we estimate a regression of the changes in employee performance on the changes in pay ratios (reported in column Delta). The last concern is omitted-variable bias. To cover this problem, we include employee performance at year *t-1* in our model to control omitted variables (reported in column Dynamic). However, this method causes autocorrelation and endogeneity problems.

The appropriate way to control the endogeneity problem arising from reverse causality or a systematic measurement error on the explanatory variables is to use instrumental variables that are not subject to reverse causality for the variable of primary interest, pay ratios. Therefore, we address the endogeneity problem as best as we can using the two-step SGMM with robust standard errors. The SGMM estimator also controls unobserved heterogeneity and dynamics in the system by using a lagged dependent variable. SGMM contains both a level equation and a first differences equation that are jointly estimated as a system. For the level equation, lagged first differences of pay ratios and firm-level ratios are used as instruments in our estimation. The level equation also uses the lagged values of employee compensation, CEO tenure and industry-level and region-level ratios as their instrument. In contrast, the first differences equation uses the second lagged values of pay ratios and firm-level ratios as instruments. It also uses first differences of second lagged of other regressors as their instrument. The first-order autocorrelation, second-order autocorrelation, Hansen test of over-identification, and difference-in-Hansen tests of exogeneity of instruments are also reported. The SGMM estimates are most reliable, and our conclusions are based on this.

Table 6: Pay ratios and employee performance

Panel A: Pay inequality and employee performance

	Total factor productivity (TFP)				Ln (revenue per employee) (SLE)			
	FFE	Delta	Dynamic	SGMM	FFE	Delta	Dynamic	SGMM
Lag.TFP			0.751***	0.549***				
			(0.000)	(0.000)				
Lag.SLE							0.631***	0.531***
							(0.000)	(0.000)
Pay Inequality	-0.181***		-0.111***	-0.181**	-0.144***		-0.146***	-0.224**
	(0.000)		(0.0001)	(0.0417)	(0.000)		(0.000)	(0.0121)
Changes. Pay Inequality		-0.166***				-0.256***		
		(0.000)				(0.000)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	2356	1924	2059	1841	2364	1935	2074	1853
Firms	409	361	376	348	409	362	379	350
Adjusted R2	0.353	0.076	0.807	-	0.717	0.101	0.832	-
Root MSE	0.403	0.487	0.471	-	0.300	0.535	0.494	-
Number of Ins				187				187
Arellano-Bond test for AR(1)				0.000				0.000
Arellano-Bond test for AR(2)				0.433				0.543
Hansen test of over-identification				0.246				0.437
Difference-in-Hansen tests of exogeneity				0.501				0.304

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[20] We do not tabulate the regression result of employee performance on the first lag of pay ratios and the regression result of employee performance at year t+1 on all regressors at time t to conserve space, but they are available upon request.

Table 6 (continued)

Panel B: Pay inequity and employee productivity

	Total factor productivity (TFP)				Ln (revenue per employee) (SLE)			
	FFE	Delta	Dynamic	SGMM[21]	FFE	Delta	Dynamic	SGMM
Lag.TFP			0.752***	0.613***				
			(0.000)	(0.000)				
Lag.SLE							0.651***	0.602***
							(0.000)	(0.000)
Pay Inequity	-0.122***		-0.0958***	-0.134*	-0.111***		-0.136***	-0.176**
	(0.0016)		(0.0003)	(0.0964)	(0.0001)		(0.000)	(0.0294)
Changes. Pay Inequity		-0.211***				-0.307***		
		(0.000)				(0.000)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1932	1491	1733	1577	1938	1499	1743	1585
Firms	368	305	342	317	368	307	344	318
Adjusted R2	0.369	0.106	0.816	-	0.706	0.145	0.834	-
Root MSE	0.380	0.433	0.459	-	0.282	0.463	0.481	-
Number of Ins				179				183
Arellano-Bond test for AR(1)				0.000				0.000
Arellano-Bond test for AR(2)				0.504				0.928
Hansen test of over-identification				0.616				0.380
Difference-in-Hansen tests of exogeneity				0.710				0.551

Panel C: Pay equity and employee productivity

	FFE	Delta	Dynamic	SGMM	FFE	Delta	Dynamic	SGMM
Lag.TFP			0.760***	0.727***				
			(0.000)	(0.000)				
Lag.SLE							0.664***	0.592***
							(0.000)	(0.000)
Pay equity	-0.339*		-0.173***	-0.690***	0.029		-0.131	-0.389
	(0.0643)		(0.0081)	(0.0085)	(0.8284)		(0.1013)	(0.1477)
Lag.Pay equity								
Changes.Pay equity		0.408**				0.431*		
		(0.0125)				(0.0683)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1932	1491	1733	1577	1938	1499	1743	1585
Firms	368	305	342	317	368	307	344	318
Adjusted R2	0.365	0.057	0.815	-	0.701	0.040	0.831	-
Root MSE	0.382	0.444	0.461	-	0.285	0.490	0.486	-
Number of Ins				183				183
Arellano-Bond test for AR(1)				0.000				0.000
Arellano-Bond test for AR(2)				0.631				0.930
Hansen test of over-identification				0.395				0.622
Difference-in-Hansen tests of exogeneity				0.431				0.742

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[21] SGMM, in this column, is different from what is explained in the text. The only difference is that the first differences equation uses the first differences of the third lagged average employee compensation as an instrument.

Panel D: Pay inequity and pay equity and employee productivity

	FFE	Delta	Dynamic	SGMM[22]	FFE	Delta	Dynamic	SGMM
Lag.TFP			0.748*** (0.0000)	0.611*** (0.0000)				
Lag.SLE							0.649*** (0.0000)	0.576*** (0.0000)
Pay equity	-0.442** (0.0155)		-0.244*** (0.0005)	-0.555*** (0.0096)	-0.053 (0.6872)		-0.222*** (0.0081)	-0.472* (0.0724)
PayInequity	-0.144*** (0.0002)		-0.117*** (0,000)	-0.180** (0.0188)	-0.114*** (0.0000)		-0.154*** (0.0000)	-0.227*** (0.0021)
Changes.Pay equity		0.273* (0.0827)				0.232 (0.3237)		
Changes.PayInequity		-0.197*** (0.0000)				-0.294*** (0.0000)		
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1932	1491	1733	1577	1938	1499	1743	1585
Firms	368	305	342		368	307	344	
Adjusted R2	0.376	0.114	0.818		0.706	0.150	0.835	
Root MSE	0.378	0.431	0.457		0.282	0.461	0.479	
Number of Ins				203				207
Arellano-Bond test for AR(1)				0.000				0.000
Arellano-Bond test for AR(2)				0.552				1.000
Hansen test of over-identification				0.580				0.577
Difference-in-Hansen tests of exogeneity				0.475				0.819

*, **, *** indicate significance at the 10%, 5% and 1% level, respectively.
Table 6 present the impact of pay ratios on employee performance. Employee performance is measured as SLE, the natural log of revenue per employee, and TFP, the residual of industry-specific Cobb–Douglas production functions. Panel A shows the impact of pay inequality on employee perfromance. Pay Inequality is measured as the natural log of the ratio of total CEO compensation to average employee pay. Panel B shows the impact of pay inequity on employee performance. Pay Inequity is the residual of equation 1. Panel C shows the impact of Pay Equity on employee performance. Pay Equity is the predicted pay inequality in each firm-year according to equation 1. Panel D shows the impact of pay inequity and pay equity on employee performance. The regression in all but the FFE column includes region, industry, and year fixed effects. The regression in the FFE column includes firm fixed effect and year fixed effects. In column Delta we regress the changes in TFP or SLE on changes in pay ratios. In column Dynamic we add the lag of TFP or SLE into our model. In the SGMM column the result of SGMM estimation is reported. Continuous variables are trimmed at 1 per cent and 99 per cent. P-values are reported in parentheses based on robust standard errors clustered at the firm level.
All variables are defined in Appendix A.

Table 6, panel A confirms our prior results in columns (1) and (4) of Table 5. It demonstrates that increasing pay inequality is perceived as unfair income distribution, leading to a negative effect on employees' performance. However, our result contrasts with Faleye et al.'s (2013) result, with no significant relationship between pay inequality and employee performance in the US. One explanation may be the difference in calculating average employee pay. Faleye et al. (2013) measure the average employee pay as total labour expenses less total executive compensation divided by the number of employees. In contrast, we calculate it as total employee expenses less

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[22] SGMM, in this column, is different from what explained in the paper. The only difference is that the first differences equation uses the first differences of the third lagged average employee compensation as a instrument.

total CEO pay divided by the number of employees minus one[23]. The second explanation may be the difference in the context of the experiment. Equity and Relative Deprivation theories assert that the impact of pay inequality can be different in different samples, in which employees have different norms or values.[24] Australia is one of the wealthiest countries globally [25], and it is widely regarded as an egalitarian country where the principle of a "Fair Go" is strongly supported by the community and all political parties (Saunders & Wong, 2013). The Labour Party is Australia's oldest political party, established federally in 1901. Australian political leaders continue to stress the importance of the "Fair Go" in defining what Australia stands for as a nation. Moreover, several studies (e.g., Chesters, 2010; Meagher & Wilson, n.d.) examined Australian attitudes towards income inequality and found that most Australians believe that income inequality between the lowest and highest income levels is significant. Therefore, it would be anticipated that the sociological perspective is more dominant in Australia.

Table 6 panel B provides further evidence of the negative and significant relationship between pay inequity and employee performance, consistent with our hypothesis. It means that employees negatively (positively) react to pay inequity, which is higher (lower) than reasonable pay inequality. It shows that employees respond differently to pay inequity that is in their favour than that which is not. To clarify, employees perceive negative pay inequity as favourable pay inequality because the pay inequality is less than a reasonable amount. So, the negative coefficient of pay inequity illustrates that moving from favourable pay inequality to reasonable pay inequality decreases employees' performance. In contrast, positive pay inequity is interpreted as unfavourable pay inequality since the pay inequality is more than a reasonable amount. In this situation, increasing pay inequity from zero to a positive amount leads to reduced employee performance. Hence, employees have higher performance in the presence of favourable pay inequity rather than unfavourable pay inequity.

Table 6, panel C shows mixed results for the association between pay equity and employee performance. Regarding TFP as a proxy of employee performance, the coefficient of pay equity is either highly significantly negative (Lag, Lead, Dynamic, SGMM) or highly significantly positive (Delta). Focusing on *SLE* as a measure of employee performance, we cannot find a significant impact of pay equity on employee performance in the system GMM model. Therefore, the impact of pay equity on employee performance is ambiguous. In addition, Table 6 panel D shows the further examination of our regression when both pay equity and pay inequity are included. In all columns, there is a negative and significant relation between pay inequity and employee performance. However, the relationship between pay equity and employee performance remains unclear.

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[23] We use a different method because of the lack of information on executive compensation and the number of executives in TRD and DatAnalysis.

[24] These theories indicate that social dictates can affect what society tells individuals, what they are entitled to and what they find desirable.

[25] Global wealth report 2019, Research institute, October 2019

5.4. Examining a non-linear relationship between pay equity and employee performance

In the previous section, we examine the linear relation between pay ratios and employee performance. The analysis illustrates that pay inequality and pay inequity negatively affect employee performance, while the result for pay equity is unclear. As discussed under hypothesis 2, this section investigates whether pay equity has a non-linear relationship with employee performance, based on Tournament Theory. Table 7 shows that the coefficient estimates of squared pay equity and pay equity are significantly negative and positive, creating an inverse U-shaped relation between pay equity and employee performance. The finding does not change in the system GMM model.[26] However, the value of the turning point slightly decreases. This result supports the view that there is a non-linear relationship between pay equity and employee performance, and there is an optimum level of pay equity. Therefore, a pay equity level that is too high or too low is sub-optimal in terms of employee productivity. This result suggests that a reward system that is linked to individuals' inputs can increase employee performance. However, the non-linear relationship indicates that increasing pay equity above the turning point may lead to lower employee productivity. Therefore, it is essential for managers to consider the current level of pay equity in their company before deciding to increase it.

We also examine the non-linear relationship between two other pay ratios (pay inequality and pay inequity) and employee performance.[27] The results do not indicate a non-linear association between these two ratios and employees' performance. The coefficient of pay inequality is significantly negative, and the coefficient of the square term of pay inequality is significantly positive. However, its turning point (minimum point) exceeds the maximum pay inequality in our sample. Similar to our analysis on pay inequality, the coefficient of pay inequity is significantly negative, and the coefficient of the square term of pay inequity is significantly positive. Nevertheless, we find that there is an extreme turning point at the 95th percentile. Hence, our analysis shows an inverse U-shaped relationship between pay equity and employee performance and a linear negative relationship between other ratios, pay inequality and pay inequity, and employee performance.

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[26] As in the previous analysis, we also regress employee performance on the lag of our independent variables, and employee performance at year *t+1* on all regressors at time *t*. Our results remained similar and significant.

[27] We do not tabulate these results to conserve space, but they are available upon request.

Table 7: non-linear relationship between pay equity and employee productivity

	TFP				SLE			
	Primary1	SGMM1	Primary2	SGMM2[28]	Primary3	SGMM3	Primary3	SGMM4
Lag.TFP		0.647***		0.650***				
		(0.000)		(0.0000)				
Lag.SLE						0.536***		0.539***
						(0.000)		(0.0000)
Pay equity	2.207***	1.037**	1.775***	0.820**	2.887***	1.078**	2.513***	0.749**
	(0.000)	(0.0499)	(0.0002)	(0.0418)	(0.000)	(0.0122)	(0.0000)	(0.0330)
Squared Pay equity	-0.400***	-0.246***	-0.357***	-0.210***	-0.480***	-0.214***	-0.442***	-0.188***
	(0.000)	(0.001)	(0.0000)	(0.0012)	(0.000)	(0.0001)	(0.0000)	(0.0002)
Pay inequity			-0.288***	-0.107			-0.250***	-0.187**
			(0.0000)	(0.1371)			(0.0000)	(0.0100)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observation	1932	1577	1932	1351	1938	1585	1938	1355
Firms	368	317	368	281	368	318	368	283
Adjusted R2	0.482	-	0.501	-	0.636	-	0.648	-
Root MSE	0.784	-	0.770	-	0.722	-	0.710	-
Number of Ins		207		231		207		231
Arellano-Bond test for AR(1)		0		0.000		0		0
Arellano-Bond test for AR(2)		0.529		0.548		0.97		0.996
Hansen test of over identification		0.424		0.689		0.792		0.775
Difference-in-Hansen tests of exogeneity		0.501		0.798		0.895		0.935
Turning Point	2.7560	2.1047	2.484	1.9513	3.0086	2.5223	2.840	1.9888
Percentile that the turning point belongs	33	-	20	-	47	-	38	-
Lower-bond slope	2.2125	1.0407	1.7800	0.8230	2.8931	1.0808	2.5186	0.7513
Lowerbond p-value	0.0000	0.0248	0.000	0.208	0.0000	0.0061	0.000	0.164
Upperbond slope	-2.0214	-1.5651	-1.998	-1.3993	-2.1793	-1.1785	-2.15846	-1.2392
upprbond p-value	0.0000	0.0000	0.000	0.000	0.0000	0.0000	0.000	0.000
P-value /utest	0.0000	0.0248	0.0001	0.028	0.0000	0.0061	0.000	0.0164

*, **, *** indicate significance at the 10%, 5% and 1% level, respectively.

Table 6 present the non-linear relationship between pay equity and employee performance. Employee performance is measured as SLE, the natural log of revenue per employee, and TFP, the residual of industry-specific Cobb–Douglas production functions. Pay Equity is the predicted pay inequality in each firm-year according to equation 1 and Pay Inequity is the residual of equation 1. The regression includes region, industry, and year fixed effects. In the SGMM columns the result of SGMM estimation is reported. Continuous variables are trimmed at 1 per cent and 99 per cent. P-values are reported in parentheses based on robust standard errors clustered at the firm level.

All variables are defined in Appendix A.

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[28] SGMM2 and SGMM4 are different from what is explained in the paper. The only difference is that the level equation uses the second lagged values of employee compensation, CEO tenure and industry-level and region-level ratios as their instrument.

6. Limitations and future study directions

Our results should be viewed in light of their potential limitations. First, we assume that employees are aware of their CEO's compensation and that the CEO's pay is a reference against which to evaluate their compensation. Although we do not directly test this assumption, the regulators and business press focus on executive compensation, experimental studies on CEO pay ratio, and the strength of our findings illustrates the reasonable nature of this assumption. A related limitation is that our study is limited to vertical pay disparity. However, individuals compare their compensation using a variety of referents. Therefore, a future avenue for research would be comparing the impact of different types of pay disparity and investigating the overall effect of pay disparities. Second, sociological theories depend on individuals' perceptions of inputs and outcomes, which contribute to their reactions (Gupta et al., 2012). However, we do not assess employees' perceived inputs and outcomes in this study. Following Adams (1963), we assume that employees consider their effort as input and monetary reward as an outcome. Therefore, future research might explore how other perceived outcomes (such as a high-quality working environment) moderate the effect of compensation disparity on performance.

A further limitation is the lack of publicly available data. Therefore, our measure of pay inequity probably will, at least to some degree, be associated with compensation based on factors that we were unable to detect. Despite this limitation, results consistent with previous research support our conceptual and empirical modelling of pay equity and inequity. A related limitation is that our result is based on Australian listed firms, where there is a strong emphasis on egalitarianism. Hence, our findings may not hold in a cross-cultural setting with varying degrees of pay disparity and inequity aversion. Therefore, another avenue for future research would be to investigate whether cultural views on compensation influence this relationship. A final limitation is that we assume all employees in different working places react homogeneously to pay disparity. It is still unknown whether individuals with different characteristics in various jobs and working environments have the same reaction to pay equity and pay inequity. Developing appropriate conceptual models for investigating this question will be another future research area. Given these limitations, we suggest our study does provide new insight into the accumulating research on pay dispersion and supports the notion that such research is vital for understanding how to design compensation systems properly.

7. Conclusion

Using a dataset of Australian listed companies, we study how within-firm pay inequality between CEO and employee relates to employee performance and whether breaking down pay inequality into pay equity and pay inequity can provide an appropriate basis for integrating sociological and economic perspectives. We find that higher pay inequality is significantly associated with lower employee productivity, indicating that the sociological perspective is dominant in our sample. In order to separate pay inequality from pay equity, we estimate pay inequality according to CEOs' and employees' inputs, company characteristics and labour market. Consistent with our expectations, we find that pay inequality is positively related to

CEOs' skills but negatively associated with employees' input and outside opportunities, as well as corporate governance effectiveness. In addition, we find that pay inequity, which is an unexplained part of pay inequality, is negatively related to employee performance, consistent with the sociological perspective. However, the relationship between pay equity and employee performance is not clear. We examine the possibility of a non-linear pay equity impact. Our results suggest that, at least in our sample, at a higher level of pay equity, increased pay equity diminishes employee performance. In fact, we find an inverted U-shaped relationship between pay equity and employee performance.

Our findings extend the previous integrated approach to the relationship between vertical pay disparity and employee performance in an organisation setting. In general, our results suggest that employees exhibit higher performance where there is a small level of pay inequity and a large amount of pay equity. However, it should be noted that increasing pay equity beyond a specific threshold tends to decrease employee performance. In addition, our findings have managerial implications for the design of compensation between hierarchical levels. We believe that a pay system based on individuals' input into the workplace can effectively motivate employees and increase their performance. However, employees need to be aware of and convinced about the accuracy of the pay system. Managers should consider the current level of pay equity in their company before deciding to increase pay equity. Our non-linear analyses indicate that more pay equity may create few or no organisation-level advantages for companies that already have high pay equity. Our findings also have implications for regulators. They suggest that CEO pay ratio disclosure per se, without putting it into an equity context, will lead to misinterpretation. Without detailed knowledge of employees' and CEOs' input, financial statement users may interpret the CEO pay ratio with insufficient information. We believe disclosure of relevant information about workforces can help financial statement users to more accurately judge the effect of pay structure on performance.

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Appendix A: Definition of Variables

Variables	Definition	Source
Pay Ratio:		
PayInequality	The natural logarithm of (CEO Compensation / average employee compensation)	Author's calculation
Pay equity	Predicted pay inequality between CEO and employees by equation (1)	Author's calculation
PayInequity	The residual of equation (1) shows the deviation from pay equity	
CEO compensation	CEO compensation is total compensation, including short-term pay (e.g. salary and fees, accrued bonus), post-employment benefits (e.g., superannuation) and share-based payment rights.	Datastream
LnAveEmployeePay	The natural logarithm of Employee benefits (Wages and salaries, superannuation, share-based payments) minus CEO compensation divided by the number of employees minus one	
CEO's Barganing Power:		
LnRevenue	The natural log of total sales in millions of dollars,	Datastream
BTM	Book value of equity /(share price * total shares outstanding)	Datastream
LnAge	Natural log of (current fiscal date – listing date) per year	
Ret	Log (return during the fiscal year)	Datastream
ROA	(Net Income + (Interest Expense on Debt-Interest Capitalized) * (1-Tax Rate)) / Average of Last Year's and Current Year's Total Assets * 100	Datastream
STDRet	Rolling 60-month standard deviation of returns,[29]	
STDROA	Rolling 5-year standard deviation of returns,[30]	
Leverage	Total long-term debt scaled by the total assets	Datastream
BoardSize	The total number of board members at the end of the fiscal year	Datastream
IsCEOBoard	An indicator equal to 1 if the CEO is a board member and 0 otherwise	Datastream
IsCEOChair	An indicator equal to 1 if the CEO is the chairman of the board and 0 otherwise	Datastream
BoardTenure	The average number of years that each board member has been on the board.	Datastream
IndCommittee	Percentage of independent board members on the compensation committee as stipulated by the company	Datastream
Employee Bargaining Power:		
RDIntensity	Research and development expenses scaled by total asset, assumed equal to zero when R&D is missing in Datastream.	Datastream
PPTIntensity	Net property, plant and equipment per employee in millions of dollars.	Datastream
Education	The percentage of the population with at least a bachelor's degree in each region in each year.	
IndConcentration	The sales-based Herfindahl index calculated based on all Datastream firms in the same industry. Revenue is trimmed at the 5 and 95th percentiles.	
Union	The percentage of employees who are members of trade unions in each region in each year.	ASB
UnemploymentRate	The percentage of those looking for a job in the labour force in each region in each year .	ASB
VacantJob	The ratio of vacant jobs to total jobs in each industry in each year.	ASB

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[29] Calculated if the data were available for at least 36 months.
[30] Calculated if the data were available for at least 36 months.

Appendix B: Industry map to join GICS to ANZSIC

GICS IndustryGroup (two-digit)	ANZSIC code
Materials	Mining (B)
Energy	Oil & gas extraction (07)
Real Estate	Property operators & real estate services (67)
Software & Services	Computer system design & related services (70)
Capital Goods	Construction (E)
Diversified Financials	Finance (62)
Retailing	Retail trade (G)
Consumer Services	Accommodation and food services (H)
Commercial & Professional Services	Professional, scientific & technical services (except computer design) (69)
Health Care Equipment & Services	Health care and social assistance (Q)
Food, Beverage & Tobacco	Food product manufacturing (11)
Media & Entertainment	Information media and telecommunications (J)
Pharmaceuticals, Biotechnology & Life Sciences	Basic chemical & chemical product manufacturing (18)
Utilities	Electricity, gas, water and waste services (D)
Transportation	Transport, postal and warehousing (I)
Banks	Finance (62)
Insurance	Insurance & superannuation funds (63)
Telecommunication Services	Telecommunications services (58)
Food & Staples Retailing	Food retailing (41)
Household & Personal Products	Other services (S)
Technology Hardware & Equipment	Information media and telecommunications (J)
Consumer Durables & Apparel	Textile, leather, clothing & footwear manufacturing (13)
Semiconductors & Semiconductor Equipment	Other services (S)
Automobiles & Components	Other services (S)