CEO Pay Ratio and Culture

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Abstract

This paper studies the determinants of the relative compensation of CEO and rank-and-file employees (CEO pay ratio). We use culture dimensions developed by Hofstede (2001) to explain the cross-national CEO pay ratio disparity. First, we relate culture dimensions (power distance, individualism-collectivism, long-term orientation and indulgence-restraint) to CEO pay ratio. Second, our results suggest that power distance is positively associated with CEO-employee relative pay; individualism is positively related to CEO pay ratio; long-term orientation is positively associated with CEO–employee relative pay and indulgence is positively related to CEO pay ratio as well.

We conclude that culture dimensions give an explanation of CEO pay ratio gaps across nations. This conclusion indicates that the compensation structure in a firm carries some symbolic meanings determined by the sovereign values in a society. The corporate governance is an expression of a cognitive pattern of various cultures.

Key words: culture; CEO pay ratio

Contents

1. Introduction

"Remuneration tends to be one of the worst-managed parts of an organization's cost structure", stated by Hay Group. Constructing a suitable reward framework can help a company better attract and retain talent, focus its staff on the organization's must-win battles, and use its capital efficiently. However, the "overpayment" of Chief Executive Officers (CEOs) has always been a controversial issue. A research by AFL-CIO reports that CEOs in S&P 500 companies earn about, approximately, 347 times more than rank-and-file employees in the company in 2016 on average and the number has been increasing over years. Many press raise this issue as well. These reports make public upset. People have a perception of inequity towards corporate compensation practices. Responding to these concerns, a new rule is adopted by Securities and Exchange Commission (SEC). The new rule mandates publicly traded companies to disclose their "pay ratios," or the compensation of CEOs divided by the median compensation of employees. This new rule is a requirement under Section 953(b) of the Dodd-Frank Wall Street Reform and Consumer Protection Act. Based on the CEO pay ratios disclosed by public listed firms in 2018, we notice that there is a huge gap of CEO pay ratios among different companies. Weight Watchers International reported the highest pay ratio, which is 5908:1. In the meanwhile, Tesla and Resource Capital reported the lowest pay ratio, which is 1:1. The huge gap leads us to think about the factors that determines the CEO pay ratios.

Another popular debate about compensation is the international CEO pay gap. A lot of prior works focus on the cause of pay gap that exists between the United States CEOs and non- United States CEOs. Towers Perrin (2006) survey shows that the United States CEOs make double the pay of non-United States CEOs, approximately. Actually, the disparity also occurs in other countries. According to the report by Statista, the ratio between CEOs and average workers in 2014 varies widely across countries. The ratio in the United States is 354:1; in Switzerland, the ratio is 148:1; in Poland, the ratio turns out to be 28:1. The ratio in the United States is nearly 13 times the ratio in Poland. Financial integration and economic integration produce more and more multinational enterprises. Investigating the factors determine CEO pay ratios across countries is meaningful for corporate governance, especially for the governance of multinational corporations. Most prior research explains gaps in CEO pay ratio by economic theories such as "Board Capture theory" (Thomas 2004) and

"tournaments theory" (Henderson and Fredrickson 2001). However, we want to find another way to interpret these differences other than economic theories.

In this paper, we examine the relationship between cultural values and the CEO pay ratio. We want to interpret the CEO pay ratio gaps with the different culture in different countries. We study this question using a large firm-level panel data obtained from Orbis and BoardEX over 2013-2017. Our primary measure is (the natural log of) the compensation of the CEO relative to average ordinary employee pay, while our explanatory variables are four Hofstede's culture dimensions: power distance, individualism-collectivism, long-term orientation and indulgence-restraint. We begin our analysis by formulating four hypotheses. According to the theories raised by Adams (1965), Cowherd and Levine (1992), employees will work harder to address the perception of income inequality in a society with a high level of power distance. Thus, we expect that power distance is positively associated with CEO pay ratio as people will have less inequity aversion in a culture of high degree power distance. Our second hypothesis asserts that individualism is positively associated with CEO pay ratio since people emphasize the pursuit of self-benefit in a society with a higher degree of individualism. We also hypothesize that long-term orientation is positively associated with CEO–employee relative pay because CEO plays a more important rule in firms in long-term oriented culture compared to short-term oriented culture. Our last hypothesis posits a negative relation between indulgence and CEO pay ratio as people compare themselves less with others.

First, we reiterate that the CEO pay ratio increase with firm size. CEO pay ratio also increases when the CEO plays a role in the board. Then we discover a statistically significant relationship between CEO pay ratio and power distance, individualism-collectivism, long-term orientation and indulgence-restraint. Overall, we find that most results are consistent with our hypotheses after controlling for firm-level and country-level variables. The prediction for the effect of indulgence culture on CEO pay ratio conflicts with our empirical results.

Our results extend the existing literature in several ways. First, we identify several factors that explain the relative pay gaps across nations. This contributes to the debate in academics about the origins of such gaps. Second, this study is the first step to uncover the relationship between CEO pay ratio and culture dimensions. This will give scholars a new view to explore the pay differential between CEO and ordinary workers. Hopefully, these

results will provide more information for journalistic and policy circle. Finally, the weakness of this paper is mainly caused by data insufficiency. However, CEO pay ratio disclosure is mandated by SEC. This will improve the quality of data in certain selected countries.

The rest of the paper is organized as follows. In the next section, we cover the relevant theoretical background and develop hypotheses on the relationship between the CEO pay ratio and culture. In section 3, we discuss our sample, data and key variables. In section 4, we present our empirical test and analysis. Section 5 will give further discussion and remarks based on our empirical results. Section 6 contains conclusion.

2. Theoretical Background & Hypothesis Development

2.1. Theoretical Background

2.1.1. Determinants of Executive–Employee Relative Pay

Most prior research examined the determinants of CEO compensation. However, few papers worked on the determinants of CEO pay ratio disparity across countries. Based on these research, we choose those determinants that would affect CEO pay ratio to explain in details.

Murphy (1999) shows executive compensation practices vary with company size. As confirmed by his analysis, the levels of pay are higher and pay-performance sensitivities are lower in larger firms. Earlier literature provides a theory that linking agent's compensation to variations in his performance can help align the benefit of the agents with that of the principal. CEOs, in the view of corporate governance, are the agents of shareholders. Zhou (2000) then investigates the relationship between CEO compensation and firm performance systematically. He finds a positive relationship between each part of CEO compensation (cash compensation, stock ownership and options) and firm performance. He also finds that pay-performance sensitivity for stock ownership of a CEO is the strongest among three forms of compensation. This sensitivity varies by firms of different sizes. Sigler (2011) confirms that the size of the firm appears to be the most significant factor in determining the level of total CEO compensation, while the tenure of the chief executive officer is an another significant variable. He finds a positive and significant relationship between total CEO pay and firm performance as well. Hill and Phan (1991) suggest that tenure has an effect on the relationship between absolute compensation and firm size as well as absolute compensation

and firm risk. They explain that tenure enables CEOs to construct their influence within firms and CEOs compensation will tie to their performance more closely in this way. Tosi et al. (2000) also document that firm performance accounted for part of the variance in total CEO pay.

2.1.2. Country Culture Values

"Culture is the collective programming of the mind that distinguishes the members of one group or category of people from others." Hofstede Geert developed his four-dimensional model of differences among national cultures based on a survey about the values of people. These people worked in the local subsidiaries of one large multinational corporation. They were from more than fifty countries around the world and they were similar in all respects except nationality. The questions in the survey represented four dimensions of cultures: power distance, collectivism-individualism, femininity-masculinity, and uncertainty avoidance. (Hofstede 2010). The scores measuring national culture in respect of these four dimensions were derived from this survey. The disparity of the culture value manifested in the survey are the results of many factors including geography, history, natural resources and so on. The country culture scores were then proved to have practical vital connotations in many respects. For example, power distance is correlated with income inequality; individualism is proved to have an effect on national wealth; long-term orientation can influence savings rates in a country. Misho Minkov then extracted three more dimensions from other relevant sources which included indulgence-restraint.

2.1.3. Corporate Governance and Culture

Our main concern in this paper is the relationship between national culture values and economic systems. Culture has been proved to influence the economic system of a country in many ways. For example, Barro et al. (2003) show that stronger religious beliefs lead to higher speed economic growth of a country since religion helps to restrict specific individual behaviors that improve productivity.

In this paper, we focus on the mode of corporate governance, which is one aspect of economic systems that reflect cultural values. Many prior works have revealed this relationship in a few viewpoints. Orru (1997) argues that the powerful elite classes and alliances between the state and private businesses expressed in the corporate governance

system in Japan and Germany are caused by the history of feudalism. He explains that in "Italy and Taiwan, where the state is much weaker and family structures are stronger, modern economic organizations ride on horizontal interfirm networks with strong cooperative traits at the level of small and medium-sized business." (Orru, 1997)

Later, much empirical research confirms the relationship between corporate governance and culture. Aoki (1990) documents that Japanese firms are more likely to value the consensus among executives when they make decisions. In contrast, the United States is more hierarchical. Pedersen and Thomsen (1997) observe the relationship between national ownership structures and culture. They find that the national ownership structures are different among twelve countries in Europe, even after controlling for characteristics of companies and industries. They think that cultural differences measured by Hofstede or other factors would explain the differences in ownership structures. They also suggest that different ownership structures will influence corporate governance and business behaviors. Tosi and Greckhamer (2004) present that the influence of cultural differences could also be on organization design, managerial philosophies, management and leadership styles and motivational techniques. Aggarwal et al. (2010) find that there is a wide degree of variation in the governance attributes across countries. They argue that these differences are due to different culture and norms, which could substitute for some formal governance traits to some degree. For example, the composition of boards in Germany requires labor representative on the board while the composition of boards in the United Kingdom doesn't have that restriction. These differences in board composition are assumed to arise from different culture and will lead to differences in the form of corporate governance in different countries. Burns et al. (2015) put forward that the CEO tournament structure is influenced by cultural factors. Their study shows that the degree of power distance is positively associated with steeper tournament structures.

2.2. Hypothesis Development

Culture has been proved to influence the mode of corporate governance in many aspects, and corporate governance has been proved to influence the CEO compensation.

The study of Henderson and Fredrickson (2001) support the opinion that there is a correlation between tournament structure and CEO compensation. Tuschke and Sanders (2003) confirm the idea that agency control mechanisms are important to executive

compensation as they could change firm investment choices and then influence its performance. Fernandes et al. (2013) note that factors including ownership structure and board structure could affect the CEO compensation across countries. Then, some scholars began to link the culture directly to a compensation system in a firm.

Jonathan and Maurice (1989) raise that it is very important to understand the cultural matrix so as to understand the way in which money is viewed. Schuler and Rogovsky (1998) suggest that "national culture provided an important explanation for the variance in the utilization of different compensation practices in different countries." They prove in their study that culture dimensions proposed by Hofstede have a correlation with compensation practices in a country. For example, countries with higher levels of individualism tend to use pay-for-performance compensation practices more widely. Tosi and Greckhamer (2004) relate cultural dimensions (uncertainty avoidance, power distance, individualism, and masculinity-femininity) to several dimensions of CEO compensation (total CEO pay, the proportion of variable pay to total compensation, and the ratio of CEO pay to the lowest level employees) and conclude that the compensation structure of a firm could be seen as a manifestation of culture values. Different cultures advocate different compensation structure (Madhani 2014).

Our hypotheses relate the CEO pay ratio to four of Hofstede's cultural dimensions.

Power Distance. Power distance expresses the level to "which the less powerful members of a society accept and expect that power is distributed unequally" (Hofstede 2010).

As proposed by Kulik and Ambrose (1992), the choice of referents made by individuals is not limited to those people who share the similar stature. Employees may compare their compensation with other employees at different levels in the organization's hierarchy of a firm. The employees will have a perception of inequity when their compensation have a huge gap with others'. The fundamental issue of power distance is how to handle inequalities among people in a society. A society with a higher degree of power distance will be more likely to accept a hierarchical order. Employees in this kind of society are prone to a higher premium on organization hierarchy (Child, Markoczy 1993). Conyon and Murphy (2000) have a consistent conclusion with prior works. They compare CEO compensation across U.S. and U.K. in their study. They find that similar share option practices result in different option grants in two countries. They argue that the United States has a higher cultural tolerance for income inequality especially for those emerging from differences in effort, talent, or entrepreneurial risk-taking. That is, the United States treat excessive CEO pay as a reward for

their efforts. This society would more likely to construct a steeper tournament structure (higher CEO pay ratio). In concluding, the pay gap in a society with greater ease of power distance is larger. In contrast, a society with a lower degree of power distance tends to demand further justification for inequalities of power. These pieces of evidence lead to the following hypothesis.

Hypothesis 1. *Power distance is positively associated with CEO–employee relative pay.*

Individualism-Collectivism. Individualism-Collectivism refers to whether individuals have a preference for a loosely-knit social framework or a preference for a tightly-knit framework in society.

In many countries such as the United States, individuals are expected to look after only themselves and their immediate families.

Schuler and Rogovsky (1998) proposed that incentive compensation practices are more suitable for countries with a higher degree of Individualism. Henderson and Fredrickson (2001) proved tournament theory. The theory indicates that tournament will have a positive effect on a firm's businesses and this will lead to greater pay differentials across job levels. Dodor and Rana (2007) find that national cultural differences can predict variations in resources allocation efficiency and wealth distribution among countries. The authors' results support that individualism positively associates with GNI per capita and resource allocation efficiency. According to Adam Smith, individuals are more likely to increase total national wealth by pursuing their own interests. Thus, the degree of individualism can be related to the effectiveness of tournaments. The opposite end of Individualism is labeled collectivism. Individuals are expected to interact with their relatives or members of a particular group in high collectivism cultures. They value loyalty and harmony. Many Asian countries are typical of high collectivism degree.

In a country with a higher degree of individualism, people may put emphasis on the self-benefit rather than the group-benefit, the country then tends to have greater variation in incomes which will contribute to a higher CEO pay ratio. In contrast, the variations in incomes will be lower in the nation with a culture of collectivism as individuals are more likely to integrate their resources for the interest of the group. Therefore, we assert that the pay gap will be smaller in these countries. We hypothesize the following.

Hypothesis 2. *Individualism is positively associated with CEO–employee relative pay.*

Long-Term Orientation. This dimension mainly focuses on whether a society is normative (short-term) or pragmatic (long-term).

No prior research gave any conclusion on the relationship between CEO pay ratio and long-term orientation. According to Hofstede (2010), firms with a low score on this dimension would desire to maintain status quo and be suspected of changing. We infer that CEOs in the firms with a lower score on this dimension play a relatively less important role.

Those firms who score high on this dimension are inclined to be active to prepare for the future. Their business objective is innovation and they prefer to take a risk. CEOs in these companies are expected to play a more important role. As a result, the CEO pay ratio would be higher in these firms. Thus, we state the following hypothesis.

Hypothesis 3. *Long-term Orientation is positively associated with CEO–employee relative pay.*

Indulgence-Restraint. In a society characterized by indulgence, a satisfaction of basic and natural human desires is unrestricted and relatively free. In a society characterized by restraint, a satisfaction of human drives related to having fun is more disciplined and strict social norms are established to regulate the satisfaction.

In a society with a high level of indulgence, people will compare themselves with others less. They concern more about their own benefits and pay less attention to others benefits. In addition, as supported by Sun et al. (2018), indulgence cultural values negatively moderate the effect of Corporate Social Performance (CSP) on Corporate Financial Performance (CFP). Based on these pieces of evidence, we expect the CEO-worker pay gap to be smaller in a society of indulgence.

Hypothesis 4. *Indulgence is negatively associated with CEO–employee relative pay.*

As examined in the research of Randall and Nikolai (1998), the relationship between CEO compensation and the degree of uncertainty avoidance is less supportive. In the research of Tosi and Greckhamer (2004), femininity-masculinity is more likely to influence absolute compensation level rather than CEO pay ratio. Therefore, we decide to exclude these two dimensions in this paper.

3. Sample Selection and Data

3.*1. Dependent Variables*

The key variable in our empirical tests is the compensation of the CEO relative to average ordinary employee pay. To calculate this variable, we require data on executive compensation, the cost of employees and the number of employees.

As stated by item 402 of Regulation S-K, "all plan and non-plan compensation awarded to, earned by, or paid to the named executive officers" are required disclosure. In this case, salaries, equity-based pay (consisting of restricted stock, stock options, and performance shares) and bonuses need to be presented. Besides, the compensation data we use are all after-tax income as the compensation people actually get is really mattered. Our primary data source on the compensation of CEOs in the United States is Compustat-Capital IQ ExecuComp database while our data source on the compensation for CEOs of firms based outside the United States is BoardEX. ExecuComp contains detailed compensation information of company executives as well as their individual profile. BoardEx provides data on individual profiles of executives from quoted companies in nearly fifty countries, and it includes data on the compensation of top executives. Our sample covers 2013-2017. Next, we define average rank-and-file employee pay as the cost of employees reported in Orbis excluding annual total remunerations of CEO, divided by the number of employees. Since we obtain data from two databases, we need to match data by ISIN number. However, some companies are not listed with an ISIN number. Besides, firms are not required to disclose ordinary employee pay. Thus, our sample is limited to those firms who are listed with ISIN number and disclose their employee compensation voluntarily in Orbis. Apart from this limitation, the data on CEO compensation in some countries are not sufficient in BoardEX database. For example, we can find financial information in Orbis for Japanese firms but we can't match the information with any CEO compensation data in BoardEX. Under these limitations, our data are available for the economies Australia, Belgium, Canada, Switzerland, Germany, Denmark, Spain, France, Italy, the Netherlands, Norway, the United Kingdom, the United States and South Africa. We divide executive remunerations by average rank-and-file employee pay to compute relative pay measures. Then we construct our dependent variable as the natural log of total CEO pay ratio.

Table 1 provides the summary statistics of CEO pay ratio by year. We can observe the time trends of the CEO pay ratio. As shown in the table, the average CEO pay ratio increase in general over five years. There is a decline in 2015-2016. We think this is because SEC announced the new rule about disclosure of CEO pay ratio. Even though it is mandated in the U.S., it will still influence the supervision of corporate governance in other countries. The median of CEO pay ratio also increase in general but gradually grow slowly.

Table 1 Summary statistics for CEO pay ratio

The CEO relative pay is constructed by dividing the respective CEO compensation by average rank-and-file employee compensation. CEO pay ratio is the natural logarithm of the outcomes above. Ordinary employee pay is the total cost of employees excluding CEO pay divided by the number of employees. The sample covers 2013-2017. The table presents CEO pay ratio by year.

Year	Obs.	Mean	SD	Median
2013	545	3,10	1,52	3,06
2014	545	3,18	1,53	3,17
2015	551	3,30	1,74	3,26
2016	553	3,19	1,66	3,15
2017	569	3,44	1,85	3,23

3.2. Independent Variables

Our main outcome variables are the values of four out of six dimensions of national culture for each country, reported by Hofstede, which are power distance, individualism-collectivism, long-term orientation and indulgence-restraint.

There have been some controversies surrounding Hofstede's work. The most popular one is the criticism on cultural homogeneity. Many countries are groups of ethnic units such as China and U.S. However, in Hofstede's study, domestic population is assumed to be a homogenous whole. Hofstede may ignore the variations of the community influences and this will lead to a bias of research. Many researchers also concern the use of surveys to measure cultural differences. Many economists argue that a survey may not determine and measure cultural differences accurately. Eringa et al. (2015) test the cultural dimensions of Geert

Hofstede on a sample of international business students. The results contest many of Hofstede's findings. Hofstede (1998) argues that surveys are one method to measure culture dimensions but not the only method that is used. Jones (2007) states that the culture value remains valuable insights on culture for both scholars and practitioners. The age of data is another concern about the use of culture value. However, the cross-cultural outcomes were formulated over centuries, this will not change overnight. According to the definition of culture documented by Guiso et al. (2006), "those customary beliefs and values that ethnic religious and social groups transmit fairly unchanged from generation to generation." Consistent with this definition, Becker (1996) also notes that culture changes slowly over time. Thus, we believe that the four Hofstede dimensions are long-lived measure and can present some differences in cultures among nations.

Table 2 Summary statistics for culture value

This table presents descriptive statistics for independent variables. Power distance, Individualism, Long-term orientation and Indulgence are collected manually from Hofstede (2010) which is disclosed on Hofstede-insights website.

	N	Mean	Median	SD	Min	Max
Power distance	2772	37.48	35	7.82	18	68
Individualism	2772	77.73	71	11.15	51	91
Long-term orientation	2772	64.00	63	18.60	21	83
Indulgence-restraint	2772	54.67	48	14.07	30	71

We manually collect the data for the fourteen countries from Hofstede-insights website. As we detail above, the data of our dependent variable are difficult to assemble, and this limitation determines these fourteen countries we chose are based on data sufficiency. Table2 presents summary statistics for independent variable, culture value. The standard deviations of each dimension are relatively significant. This indicates that cultural differences are obvious across countries. France has the highest level of power distance, while Denmark has the lowest level of power distance among selected countries. The U.S. gets the highest value score on individualism, while Spain gets the lowest score on the same dimension. The countries with the highest score on Long-term orientation is Germany, while the one with the lowest score is Australia. Australia has the highest score on indulgence while Italy has the lowest score on this dimension.

3.3. Control Variables

According to prior works (e.g., Rosen, 1982; Core et al., 1999), CEO compensation can be affected by firm size, growth opportunities, operating complexity, firm performance, firm risk, and CEO–chair duality. Besides, the employees will have more outside opportunities when employee skill is high. This will lead to higher employee bargaining power. Hayes and Schaefer (1999) argue that the relative bargaining powers will mold the wage levels of the contracting parties. As a result, employee skill accounts for a great portion of the variance in executive-employee pay ratio. Therefore, to explore the interaction between cultural and CEO pay ratio, we consider two firm-level groups of potential controls: firm characteristics, workforce characteristics. As our primary variable of interest is the relationship of cultural values and CEO pay ratio, we control for country-level variables as well.

3.3.1. Firm Characteristics

We use firm size, growth opportunities, operating complexity, firm performance and firm risk as factors for firm characteristics. The natural log of sales is a proxy for firm size and operating complexity, while book-to-market ratio is a proxy for growth opportunities (Core et al. 1999). We employ ROA (using net income) as a proxy for firm performance. Firm risk is measured by the standard deviation of monthly stock returns over preceding 60 months. The data for these control variables were obtained from Orbis database for the period 2013-2017. The stock price is collected from Datastream.

3.3.2. Workforce Characteristics

Two proxies are used to represent employee skill. The first proxy is the ratio of R&D expenditures to operating revenue, based on the argument offered by Faleye et al. (2013) that firms investing in R&D require highly skilled employees both to execute R&D projects and also to increase the likelihood of successful innovation. The other proxy is the ratio of physical capital to the number of employees since capital-intensive firms are generally assumed to require higher employee skills than labor-intensive ones. Workforce education level is considered to be another measure of employee skill. However, according to the work of Faleye et al. (2013), the variable “workforce education” is not statistically significant. So we exclude this variable. Our measures of CEO characteristics are CEO tenure and CEO–

chair duality. We use a dummy to measure CEO-chair duality. The dummy equals to one when the CEO also has a position on board, zero otherwise.

Industry characteristics, which can be described as industry concentration and industry homogeneity (Faleye et al. 2013), can affect the CEO pay ratio intuitionally. However, Faleye et al. (2013) prove that the influence of industry concentration on CEO pay ratio is not statistically significant. The regression also shows that the variable "industry homogeneity" was not statistically significant in most cases and we think that this limited influence will be diversified across countries.

3.3.3. Macroeconomic Characteristics

We include two macroeconomic characteristics variables that may otherwise be related to CEO pay ratio. They are GDP per capita and corporate tax rate. The data for GDP per capita is from The World Bank DataBank. The data for corporate tax rate is collected from KPMG website.

GDP per capita is a measure of national wealth. It would influence the pay level of a country. We, therefore, include it as a country-level control variable.

Richard and Lawrence (1995) compare wage structures among twelve countries and find that the tax system would influence the CEO compensation. They conclude that CEO pay ratio will decline as marginal tax rates of CEOs increase compared to those of rank-and-file employees. Thus, we include corporate tax rate as another factor to control in our model.

Table 3 Summary statistics for control variables

Panel A presents the control variables on firm level. Book-to-market ratio is the ratio of book value of equity to market value of equity. R&D intensity is the R&D expenditures divided by operating revenue in a firm. Physical capital intensity is net physical capital per employee in thousands of dollars. Market performance is measured by return on assets, which is the ratio of net income to total assets. Firm size is the natural log of sales. Firm risk is the standard deviation of monthly stock returns over preceding 60 months. CEO tenure is the years CEO on the throne. CEO chair duality is a dummy variable. It is equal to one if CEO also serves as a board chair, zero otherwise. Panel B presents the control variables on country level. GDP per capita is in dollars.

	N	Mean	Median	SD	Min	Max
Panel A: Firm-level control variables						
Book-to-market ratio	2523	0.55	0.44	0.68	-16.95	8.85
R&D intensity	2635	3.16	0.09	7.36	0.58	43.21
Physical capital intensity	2491	71.26	35.80	281.13	-97.43	9819.44
Market performance	2762	3.66	4.23	11.10	-98.42	79.61
Firm size	2729	6.24	6.21	0.93	1.63	8.58
Firm risk	2556	0.09	0.07	0.046	0.02	0.83
CEO tenure	2383	5.24	4	5.59	0	24
CEO chair duality	2357	0.75	1	0.43	0	1
Panel B: Country-level control variables						
GDP per capita	2772	44625.53	44305.55	6046.47	5280.02	103059.2
Corporate tax rates	2772	26.93	29.55	5.95	17.77	40

Table 3 presents the descriptive statistics for both firm-level and country-level control variables. We notice that there are negative book-to-market ratios in our data. The market value of a firm is always non-negative. We think that this unusual data occurs because the book value can be negative in some firms. We also notice that the maximum value of physical capital intensity is extremely high. This indicates that net physical capital per employee is large. This may occur in the high-tech industry.

4. Empirical analysis

4.1 Determinants of CEO Pay Ratio

We start our analysis with a test in the firm-level. We want to examine the relationship between CEO pay ratio and other firm-level variables. The results are presented in Table 4. In the test, we include book-to-market ratio, R&D intensity, physical capital intensity, market performance, firm size, firm risk, CEO tenure and CEO chair duality as our firm-level variables. As discussed in section 3, we predict CEO pay ratio will increase with growth opportunities, firm size, firm risk, CEO duality and CEO tenure. We also predict the CEO pay ratio will decrease with employee skill. Dependent variable in model (1) and (2) is the

natural log of CEO pay ratio. The difference is that model (1) only includes year fixed effects while model (2) includes both country and year fixed effects.

Table 4 Determinants of CEO pay ratio

The dependent variable in the regression is the natural log of the ratio of CEO compensation to average employee compensation. The independent variables are firm-level control variables. Book-to-market ratio is the ratio of book value of equity to market value of equity. R&D intensity is the R&D expenditures divided by operating revenue in a firm. Physical capital intensity is net physical capital per employee in thousands of dollars. Market performance is measured by return on assets, which is the ratio of net income to total assets. Firm size is the natural log of sales. Firm risk is the standard deviation of monthly stock returns over preceding 60 months. CEO tenure is the years CEO on the throne. CEO chair duality is a dummy variable. It is equal to one if CEO also serves as a board chair, zero otherwise. Model (1) controls for only year fixed effect, while model (2) controls for both year and country fixed effect. Numbers in parentheses are p-values based on robust standard errors.

	Dependent variable: log(CEO-average worker relative pay)	
	(1)	(2)
Book-to-market Ratio	-0.026	0.062
	(0.062)	(0.072)
R&D intensity	0.023***	-0.015***
	(0.008)	(0.005)
Physical capital intensity	0.000	0.000
	(0.000)	(0.000)
Market performance	0.007*	0.002
	(0.003)	(0.003)
Firm size	0.688***	0.477***
	(0.075)	(0.072)
Firm risk	-1.163	-0.864
	(1.428)	(1.204)
CEO tenure	0.002	-0.005
	(0.008)	(0.007)
CEO chair duality	0.103	0.066
	(0.098)	(0.090)
Constant	-1.154**	0.576
	(0.534)	(0.569)
Country-fixed effect	No	Yes
Year-fixed effect	Yes	Yes
Observations	1,770	1,770
Adjusted R-squared	0.1968	0.4448
Number of firm	533	533

*** p<0.01, ** p<0.05, *p<0.1

In column (1), we observe that the CEO pay ratio is positively related to market performance and firm size, which is consistent with our hypothesis. We can imply that CEOs will benefit more when the firm has a better market performance. CEOs in big companies will have wider compensation gaps with ordinary employees compared to small companies. After including country fixed effects, we discover that variable "R&D intensity", as a proxy for employee skill, is statistically significant and negatively associated with CEO pay ratio. This indicates that the pay gap between CEO and ordinary employees will be narrower if employees have higher bargaining power in a firm. These outcomes are also consistent with our expectations.

4.2 The Effect of Culture on CEO Pay Ratio

We then investigate the effect of culture on CEO pay ratio. We conduct pooled OLS regression for panel data in Stata. Before we decide the appropriate analytical method for our data, we proceed as follows.

First, we apply Hausman test to choose between random effects and fixed effects. A statistically significant result indicates that fixed effects is a better method in this case. This makes sense since it is difficult to meet conditions for random effects. Then we run a fixed effect regression. However, because of the limitations on our sample, it is not possible to use fixed effects. As a result, we decide to use pooled OLS and fixed the potential problems based on the regression by estimating feasible generalized least squares (FGLS) or Panel Corrected Standard Errors (PCSE). Since we pool data across years, autocorrelation and heteroscedasticity may occur. Thus, we test for panel-level heteroscedasticity by an LR test. The result is shown in Figure1. The result indicates that there is no heteroscedasticity for our data.

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. estimates store homo

. local df = e(N_g) - 1

. lrtest hetero homo, df(`df')

Likelihood-ratio test                                 LR chi2(532)=   -552.32
(Assumption: hetero nested in homo)                   Prob > chi2 =    1.0000
```

Figure 1: Test for heteroscedasticity

Next, we continue to test for autocorrelation. Wooldridge (2002) derives a simple test for autocorrelation in panel data models. Drukker (2003) presents simulation results proving that Wooldridge's test for serial correlation in linear panel data models has good size and power properties. Even though the test requires a large size of sample, we still have confidence about the test result since there is no obvious heteroscedasticity for our data. The testing result in Stata is shown in Figure2. As the P-value is above 10%, we fail to reject the null hypothesis, which is there is no first-order autocorrelation. Therefore, we can use pooled OLS to regress our data. We control for year-fixed effect in our regression.

```
. xtserial CEOemployeeralativepay powerdistance individualism longtermorientation indulgence BookmarketRatio RDintensity
> risk CEOtenure CEOchairduality Corporatetaxrates GDPpercapita

Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
   F(  1,     267) =      2.605
         Prob > F =      0.1077
```

Figure 2: Test for serial correlation

Since we also worry about the correlation within cultural value of four dimensions, we check the variance inflation factors (VIFs). The result is shown in Figure 3. The average indicator is 8.19. We can say that multicollinearity is not an important concern. Since the indicators for indulgence and individualism are relatively high, we still use a hierarchical clustering method on a country-level in our regression to prevent potential serial correlation within country.

```
. estat vif

    Variable |       VIF       1/VIF
-------------+----------------------
  indulgence |     13.06    0.076561
individual~m |     12.51    0.079919
longtermor~n |      5.84    0.171160
powerdista~e |      1.35    0.739376
-------------+----------------------
    Mean VIF |      8.19
```

Figure 3: Test for multicollinearity

Table 5 Culture and CEO pay ratio

The dependent variable in all column is the natural log of the ratio of CEO compensation to average employee compensation. The independent variables are culture value for four dimensions. Column (1) to (4) includes one of four dimensions respectively. They are power distance, individualism, long-term orientation and indulgence respectively. In column (5), we include all four dimensions. Firm-level control variables and country-level control variables are all included in five models. Five models all control for year-fixed effect. Numbers in parentheses are p-values based on robust standard errors corrected for country-level clustering.

	Dependent variable: log(CEO-average worker relative pay)				
	(1)	(2)	(3)	(4)	(5)
Power Distance	0.013				0.047***
	(0.026)				(0.006)
Individualism		0.062***			-0.012
		(0.015)			(0.013)
Long-term Orientation			0.038***		0.024**
			(0.007)		(0.010)
Indulgence				0.060***	0.047**
				(0.012)	(0.020)
Book-to-market Ratio	-0.091	0.022	0.019	0.061	0.072
	(0.156)	(0.118)	(0.117)	(0.098)	(0.089)
R&D intensity	0.007	-0.003	-0.008	-0.007	-0.013
	(0.009)	(0.009)	(0.011)	(0.010)	(0.011)
Physical capital intensity	-0.000	-0.000	-0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Market performance	0.007	0.007	0.007	0.006	0.003
	(0.006)	(0.006)	(0.006)	(0.005)	(0.004)
Firm size	0.769***	0.612***	0.503***	0.514***	0.598***
	(0.099)	(0.089)	(0.097)	(0.093)	(0.029)
Firm risk	0.362	-0.415	-0.216	-0.425	-0.779
	(1.538)	(1.320)	(1.291)	(1.193)	(1.095)
CEO tenure	0.006	-0.005	-0.005	-0.008	-0.008
	(0.009)	(0.007)	(0.006)	(0.007)	(0.006)
CEO chair duality	0.297	0.061	0.019	-0.006	0.073
	(0.193)	(0.101)	(0.121)	(0.099)	(0.087)
Corporate tax rates	0.070	0.133***	0.101***	0.163***	0.193***
	(0.063)	(0.034)	(0.027)	(0.040)	(0.027)
GDP per capita	0.000	0.000	0.000	0.000	-0.000*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	-4.648*	-9.623***	-1.109	-7.893***	-2.991
	(2.610)	(2.254)	(1.027)	(1.497)	(1.816)
Year-fixed effect	Yes	Yes	Yes	Yes	Yes
Observations	1,770	1,770	1,770	1,770	1,770
R-squared	0.273	0.371	0.386	0.386	0.424

*** p<0.01, ** p<0.05, * p<0.1

The regression result is presented in Table 5. In column (1), we use power distance as independent variable. The coefficient of power distance is not statistically significant. However, in model (5), the coefficient is statistically significant at 1% level. This result is consistent with the hypothesis that in a country with high degree of power distance, employees treat the high CEO pay as compensation for CEO efforts, and the pay gap is larger. In column (2), the coefficient of individualism is statistically significant and positive. This is also consistent with our hypothesis. However, when we include all four dimensions as independent variables, the coefficient of individualism is no longer statistically significant. This is due to the interaction among four culture values. The coefficient of long-term orientation is significantly positive in both model (3) and model (5). This is consistent with the hypothesis. Firms in such kind of culture tend to be more innovative and CEO tend to make more efforts. CEO may get more bonus or performance shares. This will contribute to a larger pay gap. We assume the correlation between CEO pay ratio and indulgence is negative. However, in column (4) and (5), the coefficients of indulgence are both positive and statistically significant. We explain that people are more likely to be active and creative in a society with indulgence culture. This may lead to the existence of more innovative companies such as high-tech companies. As we explained before, CEOs in this kind of companies tend to play a relatively important role and may achieve more bonus as compensation for their efforts. Besides, we also think that people in a society with restraint culture are more likely to follow the hierarchy. They may be more likely to accept pay gap between high class (CEO) and themselves.

5. Discussion

Our empirical results support that the compensation structure of a firm within a society could carry certain symbolic meaning. This meaning could be a reflection of culture value.

The relative CEO-worker pay is higher in higher power distance cultures. According to Hofstede's assertion, a large power distance indicates hierarchy, and hierarchy means existential inequality. As a result, income distribution in large power distance culture will be very uneven. This is confirmed by our empirical result.

In individualism cultures, CEO pay ratio is high. In these societies, people value individual achievement and reward the achievement more. In collectivism culture, employees may always maintain a consciousness of "we" and they classify themselves and CEOs as a

team. They treasure the relationship more than tasks. They are more likely to pursue equality in a firm. This would lead to lower CEO pay ratio.

Power distance and individualism have a similar effect on CEO pay ratios. Employees have a tendency to regard the high compensation as a reward for achievements. This also supports the idea that tournament theory will be more useful in large power distance cultures and individualism cultures.

In a long-term orientation culture, companies have prone to believe that most important events will occur in the future. Companies don't think that the future market will be steady and stable. Thus, CEOs are required to deal with various circumstances. We also think that firms will attribute success to effort and failure to lack of effort. As a result, the performance of CEOs will be very important. Society will accept a higher compensation for CEOs in this culture as they take on a lot of responsibilities. This leads to a high CEO pay ratio.

The empirical results of the relationship between the CEO pay ratio and indulgence conflict with our hypothesis. In indulgence culture, CEO pay ratio is high. In restrained culture, employees would feel less personal control. They would think compensation structure as an inherent system and they give a high priority to this fixed structure. The CEO pay ratios will be lower in this culture.

6. Conclusion

High CEO pay ratio has been the subject of media publicity and political attention in recent times. The excessive CEO compensation in the U.S. is also considered a mystery. This paper provides a new thought on the determinants of CEO pay ratio gaps across nations. We relate four culture dimensions raised by Hofstede to CEO pay ratio. We find significant effects of culture on CEO pay ratio. Our results suggest that power distance is positively associated with CEO-employee relative pay; individualism is positively related to CEO pay ratio; long-term orientation is positively associated with CEO–employee relative pay and indulgence is positively related to CEO pay ratio as well.

The main limitation of this paper is data insufficiency. As the SEC require public firms to disclose their CEO pay ratios since 2017, we hope that our research will be deepened in the future as the data is easier to obtain.

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