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The relationship between salary differences and firm-level performance

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Abstract

Finding the best motivators for increasing employee productivity and determining the factors impacting firm performance has always been a crucial part of business economics. This paper complements the existing literature by revisiting the Tournament Theory and connecting firm performance and employee productivity from a new perspective.

Therefore, this research aimed to answer the question, what is the effect of the difference between executive compensation and the average salary on firm performance? Moreover, whether this effect is different on the employees' productivity. This paper gives relevant insights into the firms' tournament value and how wage dispersion affects the companies' financial performance nowadays.

Using data from public companies in the United States, empirical research was conducted to examine the research question. The results showed a positive and statistically significant association between wage dispersion and firms' financial performance. On the other hand, findings do not support the presumption that wage dispersion affects the firm performance directly through employee productivity.

Contents

1 Introduction

Compensation and salary have a critical role in modern society. It is impossible to avoid using money in everyday life. People, firms, and even governments need money to cover their expenses.

Every person has their own desire, and they work to fulfill these (Cross Ogohi, 2019). One of the most important questions for companies, that how much they should pay their employees as a salary, so their productivity would be the highest, but the firm still generates enough profit to stay in the market. Many economists tried to solve this problem from many different perspectives. A well-known theory related to this topic is Lazear's and Rosen's Tournament Theory from 1981. This theory views wages as incentive contracts that encourage employees to put more effort into their work. In real life, the traditional economic perspective that looks at salaries as an equivalent of the worker's productivity does not work. If companies pay out the revenue to the employees that each of them produces, the company will not make a profit, so it cannot invest in its operations and stay in business for long. Therefore, organisations need to create a system where the employees' needs are met, they are motivated to work, and the company still produces positive profits. The chosen solution to this cost-benefit problem can make a difference between successful and unsuccessful companies. Thus, it cannot be neglected.

The economic relevance of this topic relies on the companies' profit maximization incentive (Lazear & Oyer, 2007). If companies could find the optimal compensation level, which motivates people to always give their personal best, this could help them achieve the ideal profit maximum. It is proven that employees' performance and productivity contribute to the final performance and productivity of the organizations (Afshan, Chakrabarti & Balaji, 2014). Thus, it has high strategic relevance for companies to know how much the disparity between the salary levels affects the firm performance and productivity. How much attention should they give to this?

The productivities of firms are an essential factor in many strategical decisions. A company's productivity can determine its whole existence and its operating locations. Productivity determines whether a firm can enter a market or not, or stays in business or not (Li & Ye, 2021) (Rasekhi & Mojdeh, 2013). Without sufficient productivity, a company will not be able to compete with the others in the market, so it is crucial for profitability and competitiveness. Furthermore, firms are recognized as one of the most important drivers of economic well-being both at the regional and national levels (Backman, 2014). Thus, it is necessary to know how firms can improve their productivity and what factors influence it. Consequently, it has an economic relevance to see whether the differences between compensations at different levels at a firm actually make a difference in firm-level productivity. Based on the Tournament Theory, if the salary differences are bigger between the different hierarchy levels, the workers will put more effort into reaching said level, which increases their individual productivity. Therefore, it would make sense to expect the whole company's productivity to increase too. Several researchers examined this connection between employee productivity and firm performance, and the overall main conclusion is that each researcher found a positive and significant relationship between individual productivity and firm productivity (De La Fuente et al., 2011) (Conti, 2005) (Afshan et al., 2014).

Although there is existing literature that connects the relationship between the Tournament Theory and the worker's individual productivity with the performance of companies, this research differs from them in the used firm performance measure, in the covered period, and in the used theoretical framework. Whereas previous researchers used stock prices, productivity measures, or sales revenue, this paper looks at the impact of wage disparities on the firm's operating revenue, which is an indicator of the success of the organization's main activity. Moreover, this research uses data until 2022, so the theory's validity can be tested in a new light. Several trends changed in the last twenty-thirty years, so revisiting the question is recommended. Lastly, this paper studies the drivers of firm performance in a model that mainly focuses on the characteristics of the companies, not on the industrial characteristics, like, for example, Anos-Casero's and Udomsaph's (2009) research.

From a strategic perspective, finding a connection between the factors affecting workers' and firms' performance is vital. This paper aims to connect these topics in a modern light and provide relevant insights into how wage disparity affects firms' performance.

Therefore, this study's research question explores the effect of the difference between executive compensation and the average salary on the firm's operating revenue. Moreover, is this effect different than on the employees' productivity?

These questions were examined by an empirical research method (Fixed Effects estimation technique) using secondary data from public companies in the United States. The data was collected from several databases, such as Compustat North America and Execucomp. To exploit all the potential of the mentioned databases, data from 13 consecutive years (from 2010 to 2022) was included in the final dataset.

The research finds evidence that the difference between executive compensation and average salary at a company is positively associated with the performance of the firms. However, based on the results, it cannot be said that this effect would be smaller on the firm performance than on the employees' productivity. The results are relatively robust from the perspective of firm performance and economic sectors. Moreover, the inclusion of data from the pandemic does not modify the results statistically. The paper proceeds as follows. The next section reviews the existing literature in this field. Sections 3 and

4 describe the data used for the empirical analysis and methodology, respectively. Then, section 5 presents the results and their possible implications of the conducted research. The executed robustness checks and their results are described in section 6, and section 7 and 8, discuss the results and their economic relevance and concludes the findings of this paper.

2 Related literature

This paper is related to a rich body of literature on the relationship between firms' productivity and employees.

Employees and organisations usually have opposing interests. In consequence, the effort the employee puts into his or her work has costs for the employee but benefits for the firm. However, these costs can be compensated by the firms, so it would be beneficial for the employees to put that effort into their work (Lazear & Oyer, 2007). Therefore, there is substantial literature about incentives that can motivate employees to increase their effort.

One of the most famous theories is the Tournament Theory, created by Lazear and Rosen in 1981. Here, wages are viewed as incentives that encourage workers to increase their effort and productivity. The theory models promotions as a relative game. It shows that the compensation at one level in the firm not only motivates the employees at that particular level but it motivates those at lower levels, too. The three basic principles of this theory are that the prizes (compensations) are fixed beforehand and depend on relative performance, the more significant the difference between the salaries at different levels, the more effort workers at lower levels put into their performance, and lastly, the difference between the wages should be optimal, and not greater than the additional output generated by the employee (Lazear & Oyer, 2007).

This theory is highly popular among economists, and many tried to empirically test its validity.

Eriksson (1999) reports a positive and statistically significant relationship between the variation of the pay spread of managers and the sales levels. DeVaro (2006) used recent hires and their initial promotions in his sample to test the validity of Lazear's and Rosen's theory. Not only was he able to empirically support the Tournament theory, but he showed that relative performance matters more in determining promotions than the previous literature suggested.

Before DeVaro, Ehrenberg and Bognanno (1990) proved that spreads between prize values actually affect participating people's performance, and then later Knoeber and Thurman, in (1994), empirically proved that those disparities between prize values affect people's performance outputs too.

Heyman, in his paper from (2005), examined the validity of the Tournament theory from a managerial perspective. He conducted a study using data on around 10 000 managers and found a positive and significant association between pay dispersion and profits for executives and managers, too (Heyman, 2005). The same was reported by Lee, Lev, and Yeo (2008), who found that stock performance is also positively associated with the dispersion of management compensation.

On the other hand, a laboratory experiment in 1987 showed that, even though the Tournament Theory is generally true, fewer people increase their effort due to higher prizes than the theory would suggest (Bull, Schotter & Weigelt, 1987). Furthermore, suppose a relatively small number of positions are available at the next hierarchy level. In that case, it has a negative effect on the employees' incentive to reach that level because they think their chances are very slim. In addition, if workers can expect large raises frequently (e.g., every year or every two years), this also negatively impacts their effort to get to the next level in the hierarchy (Lazear & Oyer, 2007).

Besides the previous findings, Backes-Gellner and Pull (2013) tested the robustness of this theory in a heterogeneous situation. The results support their intuition, which predicted that the Tournament Theory is only effective when employees are homogeneous. In the context of employee heterogeneity, the performance is lower; however, the incentives may still work for subgroups of homogenous employees.

2.1 Firm productivity

Based on the reasons mentioned in the Introduction, it is important to know how productive our company is. However, what is productivity? Productivity is a relationship between physical inputs and outputs. The main goal of the companies is to create as many units of output per unit of input as possible (Chew, 1988). In other words, be as productive as they possibly can.

Many external and internal factors influence company productivity, such as infrastructure quality, financial development, human capital, market competition, organisational structure, and governance (Anos Casero & Udomsaph, 2009). But as every person is slightly different, there are some variations between different types of companies regarding the main drivers of their productivity. According to a study from 2006, in small and medium-sized firms, the main factors that influence productivity are the age of the business, the variety of promotional methods used, and the source of finance employees (Wood, 2006). In his book from 2014, Backman emphasises the importance of certain internal factors related to human capital, like the knowledge and personal qualities of the employees.

There is extensive literature on the relationship between human capital and firm productivity (De La Fuente et al., 2011) (Conti, 2005). Several researchers studied this topic from several different perspectives, such as the connection between wages and productivity or between education and productivity. However, one of the main conclusions found in each of these studies is the assumption that by increasing the employees' productivity, one can increase the firm's productivity too. To provide an empirical background for this assumption, a study conducted in 2014 in India found evidence of a significant association between employee productivity and firm performance. The authors used two measures RPE (revenue per employee) and PPE (profit per employee), to measure organizational productivity in two industries (chemical and IT industries) (Afshan et al., 2014). Their finding justifies the common presupposition that a positive relationship exists between individual productivity and firm performance.

Krekel, Ward, and De Neve (2019) found a high correlation between employee satisfaction and individual and firm-level productivity and profitability. Their analysis shows that this positive correlation between firm productivity and employee satisfaction is especially high in certain industries, such as finance, retail, services, and manufacturing. Therefore, a question arises: If there is a strong association between employee productivity and firm performance, and employee productivity can be increased by higher salary differences between the different hierarchy levels at a company, is it possible that the same factor can increase firm productivity and performance?

The following two hypothesises of this paper will examine this question:

H1: The difference between the average salary and the executive compensation has a positive and statistically significant effect on the firm's operating revenue.

H2: The difference between the average salary and the executive compensation has a smaller effect on the firm performance than on the employees' productivity.

The first hypothesis takes a more general approach and explores whether the same factor that increases employee productivity would still increase the firm performance. By testing this hypothesis, we can produce empirical evidence that the difference between average salary and executive compensation indirectly impacts the productivity and performance of the firm. Therefore, professionals should consider this factor when making decisions related to salary levels.

The second hypothesis complements this idea by studying the difference between the magnitudes of this effect on employee productivity and on firm performance. The results related to this hypothesis can show how much impact spills over from motivating the employees by this method to the firm level. Thus, it can help determine how much attention we should pay to compensation differences from a firm perspective. Because even if there is a statistically proven impact on firm performance, it does not mean that the impact is high enough to be considered by executives when making decisions.

2.2 Measuring firm productivity and performance

There are several ways to measure firm-level productivity, but maybe the most common measures are related to invested capital or labour. Some measures, called "single factor productivity measures", only take into account one of the previous factors (because it makes the calculations easier), but others, like "total factor productivity" (TFP), sometimes called "multifactor productivity measures", are trying to combine the capital and labour productivity to get an overall measure. The problem with single factor productivity measures is that, even though they are easy to calculate and interpret, the calculated productivity levels are affected by the magnitude of use of the excluded inputs. Therefore, two organisations can have different labour productivity levels even though they use the same technology if one uses much more capital than the other (Syverson, 2011).

On the other hand, TFP measures how productive a business is by calculating its cost efficiency with the growth and elasticity of capital and labour and with the total growth of the company (Gal, 2013) (Pureza & Vaidya, n.d.). Subsequently, the differences between TFP measures shows the variation in the number of output produced from a fixed amount of inputs. Thus, organisations with higher TFP values will produce more outputs with the exact same set of inputs than another organisation with a lower TFP value (Syverson, 2011).

In the table below are some examples of the most common productivity measures.

In the second and third columns, we can see single factor productivity measures (only considering either the labour or the capital as an input). In the fourth and fifth columns are some multifactor productivity measures (they consider both the labour and the capital inputs simultaneously). Schreyer (2013) groups these measures to see how effective the company is in generating either outputs or added-values (Schreyer et al., 2001). It depends on the research question in focus and on the available data which measure should be applicable in different situations.

There are several econometric models out there which intend to capture the true productivity and production functions of firms. However, most of them do not correct for the possible correlation between the input levels and the unobserved firm-level production shocks. A problem arises when there is a correlation between the factors (labour, capital, and material) and the errors in the dataset. Meaning that a firm may be able to modify the previously decided factor input levels if it recognizes a productivity shock soon enough. Thus, in these cases, the error term would be correlated with the factors in the Cobb-Douglas production function, leading to incorrect, biased estimates because it violates the assumptions of the OLS estimation technique.

To overcome this issue, Olley and Pakes (1996) developed an estimation technique that uses the firm's investment decision to proxy for unobserved productivity shocks. However, this model only produces consistent and unbiased estimates if there is a strictly monotonous relationship between the proxy and the output. Thus, the intermittent investment of companies will not be included in the estimation, which leads to bias. For example, organisations, which only make intermittent investments, will be taken into account as they do not have any investments and will be cut from the estimation because the monotonicity condition does not hold for these organisations (Anos Casero & Udomsaph, 2009).

Levinsohn and Petrin (2003) build on Olley's and Pakes's (1996) estimation technique to create an estimation technique for firm productivity, which accounts for the effect of intermediate investments on the companies' production. This new estimation technique uses intermediate inputs as a proxy, which has two benefits. One, if the data contains mostly firms that use intermediate inputs, like electricity and material, which is very common in real life. Second, intermediate inputs can provide a link between the estimation strategy and the economic theory (Levinsohn & Petrin, 2003).

Besides the productivity measures, there are other ways to grasp how well an organisation performs. Many times, due to unavailable data, it is impossible for researchers to calculate an actual and good productivity measure for the participating companies, especially when they are using secondary data. Therefore, they commonly use simple financial measures that are often available for most companies.

Information from financial statements is widely used among managers to make decisions and evaluate the organization's position. With the help of these financial measures, it is easy to determine how the business is doing financially, and it gives a nice overview of the income and expenses during a set period (Cote, 2020). Thus, many researchers also use these financial measures, such as revenue and operating revenue, for empirical analysis. However, although these measures are widely used, it is important to acknowledge that they are not measuring the companies' productivity but their financial performance. They are not a very clean measure but more like a general overview of the performance. Therefore, to receive unbiased results, it is essential to understand how these measures are calculated and what exactly they are measuring. For the purpose of this research, operating revenue will be a measure of firm productivity because it describes the performance of the organisation's main business activity. Thus, as its name refers, it measures the financial performance of the primary operations and it does not include all incomes such as the total revenue. So the results will not be affected by other non-primary revenues, such as sales of factories or other activities not connected to the main business activity.

2.3 Employee motivation and productivity

Considering that there is a proven association between firm performance and employee productivity, it is essential to determine the influencing factors of employee motivation and productivity. Since businesses exist, employers are trying to figure out how they can motivate their employees to work faster, better, and more effectively. Thus, there is a rich literature on motivational theories and techniques.

Everyone is a bit different than the others, which results in the perfect motivational method being different among employees (Bawa, 2017). On the other hand, several economists identified general motivational drivers for different employee groups.

One of the most famous theories in classical motivational literature is probably the Hierarchy of Needs Theory by Abraham Maslow. Maslow identified five different groups of employee needs, physiological, safety and security, social, esteem or ego, and self-actualization. According to the theory, these needs hierarchically follow each other in such a way that the lower-level needs must be satisfied before one can move further up in the hierarchy pyramid (Maslow, 1943). So, if an employee's physiological needs are not satisfied, he/she cannot be motivated by higher job security or social recognition.

Another incredibly famous theory is the Two Factor Theory by Frederick Herzberg. In this theory, Herzberg identified "motivators," which are intrinsic factors, like drive for achievement, and "hygiene factors," which are extrinsic factors, like salary and benefits (Herzberg, 1966). Later many empirical studies were conducted to test these theories, and generally, the results supported the main theoretical ideas. For example, a study from 2013 supports Herzberg's theory by showing that in Nigerian manufacturing companies pay, performance bonus recognition, and praise were significantly related to company and employee performance (Sajuyigbe, Olaoye & Adeyemi, 2013). However, at the same time, another study from 1999 shows that non-financial rewards in motivation are primarily popular among knowledge, technology-based, and high-paying jobs and sectors (Armstrong & Brown, 1999), which supports Maslow's theory of motivation.

Due to the fact that the successful motivators differ among different employee groups, the same size of salary increase probably has a different effect in different industries, which leads to the question of whether the different levels of compensation difference between the hierarchy levels at an organization have the same effect in all industries. Moreover, do the higher compensation differences lead to higher overall firm productivity in knowledge and technology-based industries?

Outside of the theoretical framework, there are several techniques, that aim to improve employees' motivation and performance, implemented by organizations.

One of the most commonly adopted techniques among organisations is the different employee motivational incentive programs. Employers attempt to increase employees' motivation by rewarding productive employees to reinforce favorable behavior (Cross Ogohi, 2019).

Incentives are rewards granted accordingly to achievements of specific results. Through this, the organizations hope to stimulate their workers for greater action and higher achievements. These incentives can be financial as well as non-financial. There are many financial and non-financial motivational techniques, but we will not talk about all of them because it is not the subject of the research question. This paper will mainly focus on a company's average salary and the executives' total compensation. Calculating the difference between these two compensations shows how the disparity between compensation levels impacts firm performance. Is the effect consistent with the Tournament Theory?

2.4 Employee productivity measures

Using measures of employee productivity for empirical studies is always hard because even though employers usually collect information about their workers' productivity and performance, these are not available in most public databases (Holzer, 1990). Therefore, researchers usually have to use some kind of general proxy for this measure instead of the actual data. These measures should capture the companies' capabilities on how good they are at using raw materials and turning them into goods and services (Chew, 1988). In this case, how efficiently can the company use its labour force? How much output is generated by an employee?

Alternative labor productivity measures can be calculated by dividing the output by the hours worked by the employees or the number of employees (Syverson, 2011). Generally, in the case of secondary data, the ratio of the output and the number of employees is a commonly used solution as a proxy for employee productivity.

The output can be either total revenue, operating revenue, EBIT, EBIDTA, or any other financial income measure depending on the goal of the research. For example, Feng, Hardin, and Wu, in their paper from (2022), used revenue per employee as an alternative employee productivity measure, but profit per employee is also a widely used alternative. In this research, operating revenue per employee will be used as a measure for employee productivity. This way, we can calculate how much revenue is coming from the organisation's main business activity per employee. In other words, what is the average productivity of the workers related to the firm's operations?

2.5 Compensation techniques

As mentioned in the introduction, everyone is working to fulfill their needs and desires. These desires can be self-actualization related or more materialistic. Generally, the more materialistic needs can be fulfilled if the individual has money to pay for the desired thing, like an object or an experience. Ohogi (2019) finds in his study that pay incentives significantly correlate with employee productivity, but based on Maslow's theory, these financial rewards are more important for employees who are just starting their carrier and people with considerably low salaries because for them the physiological needs for food, clothing, and accommodation are most dominant from all (Bawa, 2017). Therefore, compensation for the employees' work is essential. There are two main types of compensation: direct and indirect compensation.

Direct compensation is a financial form of compensation where the employees directly receive money for their work and effort. Such compensations are like the traditional salary (annual or monthly salaries), the hourly wage, commission (money received based on a predetermined target), and bonuses. In contrast, indirect compensations can be financial or non-financial, but in both cases, the employees do not receive money directly from it. In most cases, these compensations have financial value, but they cannot be turned into cash directly. Indirect compensations are equity packages (the employee receives ownership in the company through shares or stocks), stock options (the employee can purchase a fixed number of shares but will not have ownership in the company), benefits (such as health insurance, pension funds, life insurance), or other non-monetary compensations like flexible working hours, parental leave, childcare, and company cars or electronic devices (Shani, n.d.). Unfortunately, the available data does not allow to control for these factors in this study. Thus, only the paid salaries will be part of the estimation models.

Fixed and flexible salaries are different kinds of direct compensation methods which firms often use. Fixed salaries refer to predetermined direct compensations, and the employer pays the employee every month. Some see this as a "traditional salary" because it was a commonly used compensation method for decades.

In the last few decades, variable (flexible) compensation methods have become increasingly popular. These are essentially based on the principle that the employee's salary should be according to their performance. Still, the traditional fixed salary method is also widely accepted and used (Burke & Hsieh, 2006). Burke and Hsieh, in their paper from 2006, examined the optimal compensation scheme for maximum productivity, and according to their findings, the best choice would be a mix of the variable and fixed compensation methods.

Overall, the main takeaway from this study's perspective is that several researchers in several different research settings found proof that salary and compensation have a strong and positive effect on employees' productivity and performance (Nagaraju & Pooja, 2017) (Calvin, 2017).

However, this raises the question of whether the level of salary or the differences between the salary levels have a stronger impact on the employees' productivity. Furthermore, which factor has a higher impact on the firms' productivity and performance? Where should companies put more emphasis? Which factor has greater importance at the firm level?

The third hypothesis explores this question.

H3: The difference between the average salary and the executive compensation has a smaller effect on the firm performance than the absolute average salary change.

By testing this hypothesis, we can compare which of the previously mentioned factors has a higher impact on firm performance. The results can help professionals prioritize among factors when trying to maximize capital gains with limited resources. In an ideal world, companies would not have to choose between which factors to invest in because they can optimize all of them. Unfortunately, in real life, this is close to impossible because there are always some resource limitations that create a barrier to setting all factors at the optimal level. Therefore, it is vital to be familiar with the size of these factors' impact on the firm's performance.

3 Data

The data for this analysis comes from three different databases. First, the different companies' financial information comes from the Compustat North America database. Second, the executive information for the different companies comes from the Compustat Execucomp database, and lastly, the data for some country-specific control variables come from the OECD database.

S&P Global Market Intelligence is the data collector company for the Compustat databases. They provide comprehensive fundamental financial information about firms worldwide, sector-specific performance metrics, and historical data for academic, business, and government use (*Home - S&P Global Market Intelligence*, n.d.).

The Compustat North America database consists of fundamental and market information on active and inactive publicly held companies dating back from the 1950s. It provides more than 300 annual and 100 quarterly Income Statement, Balance Sheet, Statement of Cash Flows, and supplemental data, such as aggregates, industry segments, market prices, and earnings (*North America - Compustat*, n.d.). On the other hand, the Compustat Execucomp database provides executive information, such as compensations, collected directly from each company's annual proxy (*Execucomp - Compustat*, n.d.).

To test the hypotheses, merged the available data from the North America and Execucomp databases were merged, and the inactive companies were filtered out. Furthermore, a few companies needed to be dropped for the following reasons. Those companies were excluded, where the essential information was missing to test the hypotheses. This included companies where the operating revenue, the salary expenses, or the number of employees were missing value. Moreover, companies were dropped, where these essential variables had taken on values that cannot be interpreted normally. This refers to companies with negative salary expenses and a negative number of employees. Since these abnormal values cannot be interpreted outside of unusual hypothetical situations, they would just lead to inaccurate, biased estimates.

After these steps, 314 companies remained in the dataset, of which 298 are located in the U.S., and the rest are located in either Canada, Ireland, Bermuda, Switzerland, the U.K., or the Netherlands. If the dataset had been left like that, that would lead to a strong bias towards the U.S. companies and would not be representative of the other regions. Thus, those 16 companies that are not located in the United States were also dropped so that the results can be accurate and representative of that country.

3.1 Firm sizes

The distribution of companies by size in the dataset is a bit different than the historical average in the United States (Appendix 1.), but this can be explained by the fact that the Compustat only includes public companies. Therefore, it is natural that in the dataset, the shares of big and medium-sized companies are a little bit higher, and the shares of micro and small companies are a bit lower than in the historical data. Moreover, since the largest difference is less than six percentage points, the sample can be considered representative of the U.S. economy.

3.2 Industries and Economic sectors

As for industrial distribution (Appendix 2.), the same cannot be said. Half of the sample comes from the Finance and Insurance economic sector (NAICS code 52), and the rest is divided between 14 other sectors. Even though this economic sector is one of the industries with the biggest revenue in the country, its share of the sample is overpowering.

Let's look at the share of the exact industries (six-digit NAICS code) in the sample (Appendix 3.). We can see that Commercial Banking has the biggest (35%) share of all, and the other industries have a fairly even representation in the sample. To correct for the possible bias coming from this sample problem, a robustness check will be carried out to see whether the results still hold if we exclude the companies from this industry from the sample.

3.3 Panel Data

To explore all the opportunities provided by the original databases, my dataset consists of information from 2010 until 2022. This way, it is possible to analyse not just the static effect of the wage levels on the firm's productivity but also the effect of the dynamic changes.

In the panel dataset, the observations will be clustered by company id, and the 13 waves will be represented by the years (from 2010 until 2022) since the original data was collected from annual statements. The dataset is unbalanced, but the attrition is random [1] Therefore, it does not affect the research outcomes.

Table 1: Panel Data

Time period:	2010 - 2022		
Number of companies:	298		
Location:	USA		
Number of waves:	No. of companies	%	Cumulative %
1	2	0.67%	100.00%
2	6	2.01%	99.33%
3	5	1.68%	97.32%
4	7	2.35%	95.64%
5	11	3.69%	93.29%
6	5	1.68%	89.60%
7	6	2.01%	87.92%
8	15	5.03%	85.91%
9	5	1.68%	80.87%
10	9	3.02%	79.19%
11	10	3.36%	76.17%
12	47	15.77%	72.82%
13	170	57.05%	57.05%

4 Research method

It is crucial to find the appropriate research method and model to examine the true effect of the difference between executive compensation and the average salary on the firm's performance.

[1]The results of the attrition test are presented in Section 6.1.

As mentioned in Section 2, there are several different ways to measure the companies' performance and productivity. Initially, I wanted to estimate the companies' Total Factor Productivity for the analysis, but this turned out to be impossible due to the lack of information available on the companies' material costs. To calculate TFP, both the Levinsohn & Petrin and the Olley & Pakes methods require a proxy for intermediate investments to avoid the possible correlation between the error term and the control variables in the models. The material costs (or electricity costs) are commonly used as a proxy for these investments. Although, in the final dataset, only 60 companies reported material costs, eliminating the possibility of using TFP as a dependent variable in the estimations.

Using other single factor productivity measures would also lead to biased results by definition due to the companies' ability to correct for the production shocks by modifying the previously decided factor input levels. Therefore, it was decided to use simple financial measures to capture the companies' performance and to see the robustness of the estimated results. Thus, the models will be re-estimated with similar financial firm performance measures.

On this account, operating revenue was chosen as a measure of company performance, and operating revenue per employee as a measure of employees' productivity. Operating revenue is an important fundamental because it shows how much income the firm can generate from its business operations. It is a nice measure that represents how well the organisation performs in its main activity. Moreover, operating revenue per employee is a commonly used proxy for measuring employees' productivity.

Thus, the two estimation models will look like this:

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_i X_{it} + \alpha_i + \epsilon_{it} \tag{1}$$

$$Oprev_{it} = \beta_0 + \beta_1 DiffExecSalary_{1it} + \beta_i X_{it} + \alpha_i + \epsilon_{it} \tag{2}$$

$$Oprev\_emp_{it} = \beta_0 + \beta_1 DiffExecSalary_{1it} + \beta_i X_{it} + \alpha_i + \epsilon_{it} \tag{3}$$

Where *Oprev* represents the firm's operating revenue in thousand US dollars, *Oprev_emp* represents the operating revenue per employee also in thousand US dollars, and DiffExecSalary represents the difference between the average salary and the executive compensation at a company.

Since I am using panel data, it is improbable that a (pooled) OLS model will be unbiased. Pooled OLS will only generate unbiased estimates if we can verify that the Zero Conditional Mean Assumption holds. This includes that in panel data, both individual unobserved heterogeneity and idiosyncratic shock are uncorrelated with the independent variable in the model. However, this is unlikely since there are unobserved factors.

Besides, pooled OLS will only be an efficient technique if the error terms are also uncorrelated with each other. In the case of panel data, this is highly unlikely because there is a high chance that the error terms of different observations in the same unit (company, in this case) are correlated.

Therefore, logically a Random Effects or a Fixed Effects estimation technique would generate more accurate results. Random Effects uses both between and within variations from the data. Therefore it is preferable when there is serial correlation between the error terms, but the Zero Conditional Mean Assumption holds. On the other hand, Fixed Effects only uses within variation, which means it is a better technique when the source of the bias is the time-invariant error term. Since it is hard to argue logically which is the better method in this case, a Hausmann test and a Correlated Random Effects model were conducted to determine the better technique. The results of the tests can be seen in Table 2.

Table 2: Goodness of fit

Goodness of Fit - Random Effects or Fixed Effects				
Dependent variable:	Oprev		Oprev_emp	
	(1)	(2)	(3)	(4)
Hausmann test:				
chi2	6427.830	6614.730	85.280	-17.060
P-value	0.000	0.000	0.000	-
Correlated random effects:				
chi2	185.110	184.930	40.710	41.730
P-value	0.000	0.000	0.000	0.000

Because the p-value is smaller than 0.01 in all cases, the Fixed Effects estimation technique is the preferred method over the Random Effects. Thus, from now on, Fixed Effects will be the final technique to test the hypothesises.

$$Y_{it} = \beta_0 + \beta_1 X_{1it} + \beta_i X_{it} + \epsilon_{it} \tag{4}$$

$$Oprev_{it} = \beta_0 + \beta_1 DiffExecSalary_{1it} + \beta_i X_{it} + \epsilon_{it} \tag{5}$$

$$Oprev\_emp_{it} = \beta_0 + \beta_1 DiffExecSalary_{1it} + \beta_i X_{it} + \epsilon_{it} \tag{6}$$

4.1 Variables and correlations

As mentioned above, the variable measuring the firm productivity will be the operating revenue. This is the dependent variable for testing the first and the third hypothesises. The operating revenue is widely accepted, as a proxy, for measuring the productivity of organizations. To test the second hypothesis, another dependent variable is needed, which will be the operating revenue per employee. This will measure the employees' productivity.

The difference between the executive compensation and the average salary at the company will be the independent variable in the regressions. For this variable, first, the average salary at a company was calculated for each year by dividing the total salary and wage expenses by the number of employees at the company. Second, the average executive compensation at the company was also calculated, then the average salary was subtracted from the average executive compensation to get the difference.

Unfortunately, the total salary expenses are equal to the total staff expenses in the Compustat North America database. Thus, there is no information available about the expenses related to other compensations, like cafeteria and pension, related to the employees. Therefore, it was only possible to use the average salary at a company for the calculations. However, at the same time, it was not the goal to limit the analyses by only including the reported executive salaries. It is a well-known fact that other compensations, like bonuses and shares, represent a huge share of the total executive compensation. It would lead to inaccurate results if the other executive compensation forms were omitted from the calculations.

Also, important variables in the regressions will be those that capture the effect of dynamic changes in the average salaries. To explore all the possible effects, two variables were created that capture the change over time in that characteristic. There will be a variable that encapsulates the absolute change (in thousand US dollars) from the previous year, the average salary at a company. As well as, with the same logic, there will be one variable that measures the relative change (in percentage) compared to the previous year for the previously mentioned variable.

Besides these, the estimation models will include more control variables (Appendix 4), mostly just variables already existing in the Compustat databases. The two exceptions are the Inflation and the Investment_ch variables. The Inflation variable shows the annual inflation rate of the United States, and it was collected from the OECD database.[2] On the other hand, the Investment_ch variable originates from the Compustat North America database. It represents the annual change in investments in a company. This item includes the change in long-term investments, investments in unconsolidated subsidiaries, and long-term investments combined with short-term investments. A one-year lag was incorporated into this variable because it is most likely that the increase or decrease of these investments will affect the firm's productivity later than it was reported in the financial statements. For example, an investment in a new factory or in a new technology will only affect

[2]Besides the inflation rate, also other country-specific control variables were collected, but these were omitted from the final model because they caused multicollinearity.

productivity once it has been put in use. So, the factory was opened, operations started there, and the new technology was implemented successfully. Therefore, it is only logical if I put a lag into the variable, and the investment change of the previous year (T-1) will be used in the model at time T.

Table 3: Descriptive statistics

Variable	No. Obs.	Mean	Std. dev.	Min	Max
Oprev	3323	7750344.00	1.86E+07	147.00	1.55E+08
Oprev_emp	3323	837.34	3544.27	1.40	83515.05
AvgSalary	3323	129.66	415.32	4.64	12956.67
AvgSalary_chUSD	3019	5.80	116.40	-1098.33	5249.26
AvgSalary_chperc	3019	4.29	16.75	-82.58	521.04
DiffExacSalary	3323	3065.92	3457.67	-11794.79	34262.74
NAICS	3323	520038.20	89381.28	722.00	722513.00
Emp	3323	23.96	62.37	0.00	577.00
Capx	3303	307.72	903.07	0.00	10612.20
Inflation	3323	2.32	1.78	0.12	8.00
Tax	3323	312.21	1483.35	-45415.00	29388.00
Dividends	3321	419.52	2191.89	-255.46	85419.00
Investment_ch	3080	9991.35	45638.02	0.00	766699.00
EBIT	3323	2536.56	10078.31	-11387.00	130622.00
Gross Profit	3323	3782.99	13037.22	-4953.00	130905.00

5 Results

Based on the results presented in the Methodology section, Fixed Effects model, with robust and clustered standard errors[3], was used to test the hypothesises of this paper. Table 4, shows the results of the regressions.

Table 4: Hypothesis testing

Hypothesis testing - Fixed Effects								
	Oprev				Oprev_emp			
	(1)		(2)		(3)		(4)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DiffExacSalary	295.940	0.000	288.685	0.000	-0.036	0.222	-0.042	0.210
AvgSalary_chUSD	474.311	0.005	-	-	1.226	0.002	-	-
AvgSalary_chperc	-	-	13453.500	0.001	-	-	5.411	0.126
Inflation	275012.500	0.000	274028.700	0.000	14.364	0.306	13.494	0.345
Emp	63350.040	0.02	64542.990	0.015	-0.360	0.137	0.123	0.821
Capx	2673.333	0.000	2666.367	0.000	0.044	0.008	0.043	0.008
Tax	250.985	0.409	249.219	0.411	-0.022	0.298	-0.021	0.319
Dividends	338.271	0.232	337.977	0.232	0.008	0.745	0.009	0.724
Investment_ch	-0.041	0.997	-0.028	0.998	-0.003	0.002	-0.003	0.002
Constant	3605778.000	0.000	3549786.000	0.000	940.432	0.000	933.541	0.000
sigma_u	14123870.000		14117061.000		2752.908		2772.575	
sigma_e	2789678.200		2780994.400		2070.354		2072.847	
rho	0.962		0.963		0.639		0.641	
Number of obs.:	3000		3000		3000		3000	
Number of groups:	296		296		296		296	

This was the first hypothesis:

*"**H1:** The difference between the average salary and the executive compensation has a positive and statistically significant effect on the firm's operating revenue."*

Let us look at the coefficient of the independent variable (*DiffExecSalary*). We can see that the difference between the average salary and the executive compensation at a company has a positive and statistically significant effect on the company's operating revenue. Based on the results, if the measured difference is higher by one thousand US dollars, the company's operating revenue will increase by around 290 thousand US dollars on average if we keep everything else fixed. Moreover, the p-value of this variable also shows that this effect is statistically significant at 1% significance level. Therefore, we found statistical evidence to support the first hypothesis.

On the other hand, this is not the situation with the second hypothesis.

*"**H2:** The difference between the average salary and the executive compensation has a smaller effect on the firm productivity than on the employees' productivity."*

[3]The standard errors were clustered by company

In the third and the fourth regressions, where the dependent variable is the operating revenue per employee, the independent variable (*DiffExecSalary*) has no statistically significant effect on the dependent variable. The estimated effect of the difference between the average salary and the executive compensation at a company on the employees' productivity is not significantly different from zero. The p-value of this variable is higher than 0.1 in both cases, which means that the estimated effect is not significant at any well-known significance level. Hence, the research could not find supportive evidence for the second hypothesis.

This also implies that the relationship between the *DiffExecSalary* and the company's operating revenue is not causal. The reasoning, which argues that the *DiffExecSalary* influences the companies' performance through the increased productivity of the employees, is flawed and not supported by the results. Although, since the effect of this difference between compensation levels has such a strong and significant effect on the operating revenue, it is reasonable to believe that either there is some other powerful factor that drives the companies' performance or there is reverse causality between these two variables. It is possible that contrary to the original belief, the higher the operating revenue, the higher the level of executive compensation. This would explain why even though the difference between the average salary and the executive compensation does not affect the employees' productivity, but there is a relationship between that and the firm's operating revenue.

However, based on the presented results above, the research also found supporting evidence for the third hypothesis.

*"**H3:** The difference between the average salary and the executive compensation has a smaller effect on the firm performance than the absolute average salary change."*

The results from the first model show that the coefficient of the *AvgSalary_chUSD* is substantially higher than the coefficient of the *DiffExecSalary*, and both estimates are statistically significant at 1% significance level. The interpretation of the results is the following. If the difference between the executive compensation and the average salary at a company increases by 1000 US dollars, the operating revenue of the company will also increase by 296 thousand dollars on average, ceteris paribus. On the contrary, if the average salary change increases by 1000 US dollars, the operating revenue of that company will also increase by 474 thousand dollars on average, ceteris paribus. Therefore, the third hypothesis was supported by the findings of this study.

Moreover, the estimated coefficient of the *AvgSalary_chperc* shows that not only the absolute but also the relative average salary change has a positive and statistically significant effect on the firm's operating revenue. The result means that if the average salary change from year-to-year increases by 1%, the operating revenue will also increase by 13 453.5 thousand US dollars on average, ceteris paribus. And this effect is also significant at 1% significance level. However, as the interpretations show, the coefficients of *AvgSalary_chUSD* and *AvgSalary_chperc* cannot be compared since one variable is in thousand units and the other in percentages. Thus, one percentage can mean one US dollar or 1000 Us dollars, too, depending on the level of the average base salary in the previous year. So, the difference in the magnitude of the two variables that represent the average salary change can be explained by the different measurement units.

On the other hand, an interesting result can be observed in models 3 and 4. While the *AvgSalary_chUSD* still has a significant effect on the dependent variable in model 3. In model 4, the opposite is true for the variable *AvgSalary_chperc*. Therefore, the interpretation of the results shows that employees are much more likely to increase their effort and productivity based on the absolute level of the salary increase rather than based on the relative salary increase. Thus, it is much more important for the employees how much more money they get in absolute terms as a result of a salary raise rather than how many percentages the raise is compared to their previous salary.

Another not expected result is that the change in the investment level of the previous year has no statistically significant effect on the operating revenue. The p-values for this coefficient in the first and second regressions are interestingly high, almost equal to 1. My presumption was that an increase in the level of investment would increase the operating revenue in the following year because investments are usually made to improve the organisation's performance in some way.

Besides the previous results, Table 4 also presents evidence that shows the inflation rate has a high positive and significant effect on the firm's operating revenue but not on employee productivity. Similarly, the number of employees also positively affects the firm's financial performance on a 5% significance level.

The level of capital expenditure at a company impacts both the total operating revenue and the operating revenue per employee. If the capital expenditure increases by 1 million US dollars, the company's operating revenue will also increase by 2.6 million US dollars on average, ceteris paribus. This effect is statistically significant at 1% significance level. The effect on employee productivity is much lower but still positive and significant at 1%.

6 Robustness check

The estimated results from the previous chapter were tested through three robustness checks. These tests are important for verifying how much the results and the interpretations can be generalized. They can tell us if our results are sensitive to small situation changes in the model. For example, in this case, do the results only hold if we are talking about the operating revenue of the firm, or can we draw conclusions about the firm's overall financial performance?

6.1 Attrition test

The first test focused on the quality of the data. Good data is essential for getting robust and accurate results. Therefore, an attrition test was conducted to see if the data sample potentially caused biased estimates.

The dataset consists of 3,323 observations from 298 companies in those thirteen years. As can be seen in Table 1 (in Section – Data). the dataset is unbalanced, but 57% of the companies participate in all waves, and almost 80% of the companies participate in at least ten waves out of thirteen. Organisations are founded every day, just as organisations go bankrupt as often too. Therefore, it is unrealistic to expect a perfect dataset where all companies are participating in all waves.

On the other hand, if the companies are dropping out of the sample in a recognisable pattern, that can lead to biased estimates. Thus, it is essential to evaluate whether the attrition in the sample is happening randomly or if some sub-groups are more likely to drop out than others. To see whether this attrition affects the outcome of the analysis, a test was completed, which checks whether participating in the next wave correlates with the dependent variables. Three methods can be used to check whether the attrition in the sample is random, but only the "Next wave" method can be applied with the Fixed Effects estimation technique. As Table 5. shows, the next_wave variable has no statistically significant effect on the dependent variables in either model. Therefore, it can be concluded that the attrition in the sample is random and will not induce bias in the estimation results.

Table 5: Attrition test results

Attrition test - Next wave								
Dependent variable:	**Oprev**				**Oprev_emp**			
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
next_wave	-67223.840	0.780	-101329.900	0.678	62.031	0.525	65.875	0.463
DiffExacSalary	295.667	0.000	288.235	0.000	-0.036	0.225	-0.042	0.213
AvgSalary_chUSD	478.144	0.005	-	-	1.222	0.002	-	-
AvgSalary_chperc	-	-	13500.310	0.001	-	-	5.381	0.125
Inflation	266913.500	0.000	261815.200	0.000	21.838	0.093	21.434	0.100
Emp	63370.370	0.019	64577.800	0.015	-0.379	0.126	0.100	0.848
Capx	2671.572	0.000	2663.697	0.000	0.045	0.007	0.045	0.006
Tax	251.203	0.408	249.547	0.411	-0.022	0.295	-0.021	0.316
Dividends	338.362	0.232	338.116	0.232	0.008	0.748	0.009	0.728
Investment_ch	-0.037	0.997	-0.021	0.998	-0.003	0.002	-0.003	0.002
Constant	3686366.000	0.000	3671128.000	0.000	866.069	0.000	854.656	0.000

6.2 Dependent Variable

The first test aimed to check whether the results hold even with different dependent variables. The new variables are similar to the operating revenue, but they are still different financial measures regarding their calculation methods and meaning. As previously mentioned in Section 2, other widely accepted financial measures of company performance are Earnings Before Interest and Taxes (EBIT) and Gross Profit. Therefore, the same models were estimated as in Table 4, however, the dependent variable was replaced with these financials. These results can be found in Appendix A6.

If we look at the estimates of the independent variable (*DiffExecSalary*), we can see that in all of the models, it has a statistically significant effect at a 5% significance level on the different dependent variables. The direction of the effect is also the same in all models; only the magnitude is different. This can be easily explained by the fact that the average salary difference from the executive compensation level has the strongest effect on the operating revenue because that is the most reliant financial on labour input. Both Gross Profit and EBIT include non-operating incomes, which are usually not that dependent on the labour input. They mostly refer to other income sources, such as the stock market and real estate deals. The estimates of the other variables are also very similar to the original results. The significance levels are almost exactly the same everywhere, and the direction and the magnitude of the effects are also vastly similar to the first models. The only exceptions are employment and the capital expenditure. In the third and fourth regressions, the magnitude of the impact of the level of capital expenditure on EBIT is much lower than on the other dependent variables, even though the coefficients if statistically significant at 1% significance level in all models. The explanation for this relies on the previous argument that the value of EBIT incorporates more different income sources other than just the operating income. Therefore, the level of capital expenditure is less significant than in the other models. Interestingly, in the same model, the significance of the number of employees also highly differs from the other regressions. The results do not show a statistically significant effect of this variable on EBIT. Moreover, in the last two models, the estimates indicate that the number of employees has a less significant effect also on the Gross Profit than on the operating revenue.

Appendix A7 shows the results of the same robustness check but for the models estimating the employees' productivity. Here, the results of the new regressions are similarly in line with the original results, as in Appendix A6. Even though the direction and the significance levels of the estimated effects are close to each other, the magnitudes slightly differ across the models.

However, if we look at the estimated effect of the independent variable, we can observe the same trend as above. The difference between the average salary and the executive compensation has the highest effect on the operating revenue per employee because that relates to the organization's main business activity. The same can be said about the other variables related to average salary.

Overall, the conclusion is that the main estimates of this study are relatively robust, especially in Appendix A6. Based on this robustness check, the results of the independent variable can be interpreted not just on the firm's operating revenue but it gives us an idea on how that difference would affect the company's general financial performance.

6.3 Industrial distribution

The third robustness test was designed to determine whether the original results can be generalized for all industries in the sample or whether the high number of observations from the Commercial Banking industry (NAICS code 522110) has a distorting influence on the estimates. In this test, the original results were compared with a subsample where the observations from that industry were excluded. The results of this test can be found in Appendix A8. and Appendix A9.

The reported results in Appendix A8., show that the significance level, the direction, and the magnitude of the estimated coefficients in the two samples are fairly similar. Therefore, I performed a t-test for all variables to see whether the estimated magnitudes are statistically similar too. The results showed that the estimates of all variables, even though they are seemingly similar, they differ statistically. However, this statistical difference is not enough evidence to say that the estimated results are altogether incorrect. The level of significance and direction in all cases are the same as in the original models. Only the effect size is impacted slightly by the exclusion of the Commercial Banking Industry. Thus, when considering the overall implications and conclusions of the research, the results are not being diverted by the high share of that one specific industry.

In Appendix A9., seemingly, there are more variations between the results from the two samples by comparing the magnitudes and the significance levels of the variables in the models. Similarly to the previous comparison, the results of the t-test show that all of the estimates are statistically different from their pair from the other sample, except the investment change from the previous year. Although, again, the directions and the significance levels are the same for all factors, which results in the overall implications and conclusions are not different from the original ones.

Thus, it is safe to say that the high number of observations from industry 522110 is not causing bias in the results. We can draw general conclusions about the US companies without limiting the interpretations only to the Commercial Banking industry.

6.4 Covid-19

The fourth and last robustness test was designed to filter out the effects of COVID-19 from the results. COVID-19 started at the end of 2019 but became a worldwide problem in the first half of 2020. It was such a big shock to the economy that the world is still recovering from the adverse economic side effects of the pandemic. Countless people lost their job, and many companies needed to shut down their production lines and services due to health hazards. During these shocks, companies and employees tried to survive by adapting to the situation. Therefore, COVID-19 may impact our results, and the estimations did not quite capture the actual effect between our independent and dependent variables. To investigate whether the pandemic causes a bias in our estimates, the regressions from the Results section were re-estimated again with another subsample that excludes the years impacted by COVID-19. This means that the subsample only contains observations from 2010 until 2019. The results of this test can be found in Appendix A10. and Appendix A11.

In Appendix A10. we can see the regressions where the dependent variable is the company's operating revenue. From this table, we can notice that all of the statistically significant coefficients in the new subsample have the same direction and significance level compared to the original models. The estimated coefficients of *DiffExecSalary*, *Tax*, and *Dividends* are statistically the same as their original pairs, but this cannot be said about the rest of the coefficients.

In Appendix A11, those results can be found, where the dependent variable is the operating revenue per employee. In this comparison, the directions of the coefficients are the same, and the magnitudes are also quite similar; however, there is some variation between the significance levels. Thus, a repeated t-test showed almost the same as before. All of the estimates are statistically different from each other. However, similarly to earlier, this difference does not change the general conclusions and implications.

Overall, this robustness check showed that the original results were not significantly affected by the economic shock caused by COVID-19. Even though it was possible to detect some impact, the main results generally stayed the same throughout the whole model. Only the size of the effects changed slightly, but this was expected. The models with the operating revenue per employee as a dependent variable stayed statistically the same in the subsample as the original models. This shows that the difference in the firm performance results comes from a source other than the employees' productivity change.

7 Discussion

The primary purpose of this study is to find the effect of the difference between the average salary and the executive compensation on the company's operating revenue and to explore whether this effect different on the employees' productivity. These questions were tested through three hypothesises, from which the first and the third hypothesises were supported by the results and the second one was not. Therefore, this research found empirical evidence that the difference between the average salary and the executive compensation significantly affects the company's operating revenue and performance. However, based on the findings, the absolute average salary change has an effect with a higher magnitude than wage disparity. Furthermore, the employee's productivity is more likely to be impacted by the absolute average salary change at the firm than the previously mentioned difference. This can be caused by several factors. For example, it is possible that the cumulative effect is more significant than separately. Therefore, at the firm level, we can measure a statistically significant and strong effect, but not at the individual level. But this would also mean that the impact would differ among small and large companies. This could be a topic for further research.

Unfortunately, the study was not able to prove a causal relationship between the company's performance and the gap between executive compensation and the average salary. Based on the results, the possibility of reverse causality cannot be ruled out, so the results only indicate a strong association between the dependent and independent variables. Potentially, a correct instrumental variable, like the number of hierarchy levels at the company, could help resolve the endogeneity. Sadly, none of the datasets contain information about this firm characteristic. Therefore, it is up for further research to examine the direction of the relationship between operating revenue and wage dispersion in firms.

Also, Fixed Effects estimates will only be unbiased if the idiosyncratic error (ϵ_{it} – time-varying component of the error term) is uncorrelated with X_{it} at any time point. Even though it is unlikely that this assumption does not hold, it cannot be tested. All of the tests that were carried out show that the Fixed Effects estimation technique is preferred over anything else, but it is still probable that the idiosyncratic error correlates with X_{it}. In this case, the estimates are not accurate due to the bias caused by the time-varying error term. This is a limitation that needs to be addressed, even if it cannot be solved.

Furthermore, the data used for the research is only limited to the public organisations in the United States. It is possible that the results would slightly differ for private companies and that the association between the studied factors would be highly different in third-world countries. A future empirical study focusing on a culturally highly different region or on private companies would nicely complement the results of this paper.

Moreover, as previously discussed in the literature review, there are many ways of compensation, but this research could only incorporate the paid salaries of employees in the empirical model. The companies did not report any other compensation costs even though it is a common technique to give other benefits besides the monthly salaries to make the compensation package more competitive. Therefore, we cannot differentiate between employees who get substantially high indirect or non-monetary compensations and employees who get zero or minimum benefits next to their wages.

Besides these, a paper that explores the effect of the difference between the average salary and the executive compensation on the companies' productivity could solve the question of reverse causality in this model.

Lastly, extended research about the companies in different industries could shed light on which industries are more sensitive to this factor and where managers should pay more attention to this compensation difference in order to maximize profits.

To summarize, this research has several limitations, but most of them come from the imperfections of the available data. As described in Section 3, it is hard to find good quality data to research this topic, partly because executive information is many times not accessible to outsiders and partly because not companies usually only report data about what they are required. Therefore, the available information is limited, and solutions to work around this issue are resource-demanding. A solution would be to recollect the data with the appropriate questions; however, due to the lack of resources of the author to retrieve this data, some concessions were made.

8 Conclusion

In conclusion, this paper gives relevant insights about the firms' tournament value and how wage dispersion affects the companies' financial performance nowadays. The research aimed to answer the question, what is the effect of the difference between executive compensation and the average salary on the firm's operating revenue? And whether this effect is different on the employees' productivity.

The results showed a statistically significant and positive association between the difference between executive compensation and the average salary at a company and the operating revenue and, overall, the firm's financial performance. Therefore, the first hypothesis was supported by the estimated results. Due to the endogeneity in the model, there is no evidence of a causal relationship between these two factors, but this question can be examined in future research. On the other hand, the conducted study could not find evidence that would support the second. However, the results also support the third hypothesises, that the absolute salary difference has a higher effect on operating revenue than the difference between executive compensation and average salary.

The estimated models pointed out that, similarly to the absolute average salary change, the relative salary change from year-to-year, also has a positive and significant effect on the firm's financial performance. Although, this cannot be said about employee productivity. The estimates shed light on the fact that the relative salary change has no statistically significant effect on employee productivity. Therefore, the workers can be more motivated by increasing their salary with a predetermined amount of money than just giving raises relatively compared to the previous wage level. However, the research did not determine the optimal level of raise.

Overall, the results are relatively robust from both firm performance measures and industrial perspectives. Furthermore, the performed robustness test confirmed that the recent global pandemic (Covid-19) did not significantly alter the firms' and workers' behaviour and preference related to the studied topic. The results and generally the same if the years related to the pandemic are omitted from the sample than when they are not. There are some variations between the original and the subsample results, but these effects do not divert the general conclusions of the model.

To conclude, even though the research has some limitations due to the available data, it has relevant and significant results from both academic and strategic perspectives.

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A Appendix

Table A1: Distribution by size

Number of employees	Number of companies	Distribution among the companies	Historical average distribution (companies)	Distribution among the observations
0 - 9	214	61.85 %	67.02 %	67.71 %
10 - 49	82	23.70 %	24.69 %	20.28 %
50 - 249	39	11.27 %	6.71 %	9.66 %
250 -	11	3.18 %	1.58 %	2.35 %
Total	346	100.00 %	100 %	100.00 %

Table A2: Distribution by Economic sector

Economic Sector	Sector code	No.	%
Mining, Quarrying, and Oil and Gas Extraction	21	2	0.556%
Construction	23	3	0.833%
Manufacturing	31 - 33	15	4.167%
Wholesale Trade	42	5	1.389%
Retail Trade	44 - 45	3	0.833%
Transportation and Warehousing	48 - 49	29	8.056%
Information	51	10	2.778%
Finance and Insurance	52	181	50.278%
Real Estate and Rental and Leasing	53	6	1.667%
Professional, Scientific, and Technical Services	54	7	1.944%
Administrative and Support and Waste Management and Remediation Services	56	5	1.389%
Educational Services	61	1	0.278%
Health Care and Social Assistance	62	10	2.778%
Arts, Entertainment, and Recreation	71	1	0.278%
Accommodation and Food Services	72	20	5.556%
Total		360	100.000%

Table A3: Distribution by Industry code

NAICS code	No. Obs.	No. Companies	Percentage
722	8	1	0.335%
2111	4	1	0.335%
3113	4	1	0.335%
5222	8	1	0.335%
5311	12	1	0.335%
213112	5	1	0.335%
236117	12	2	0.671%
237310	12	1	0.335%
325199	13	1	0.335%
325412	2	1	0.335%
325414	29	3	1.006%
325992	3	1	0.335%
331110	11	1	0.335%
333120	5	1	0.335%
333242	9	1	0.335%
334419	2	1	0.335%
334511	2	1	0.335%
334515	6	1	0.335%
336411	2	1	0.335%
336999	13	1	0.335%
423430	30	3	1.006%
423450	3	1	0.335%
424720	12	1	0.335%
441110	13	1	0.335%
449110	5	1	0.335%
459999	12	1	0.335%
481111	116	10	3.355%
482111	39	3	1.006%
484110	13	1	0.335%
484121	71	6	2.013%
484122	51	4	1.342%
484230	13	1	0.335%
488510	26	2	0.671%
492110	25	2	0.671%
512131	13	1	0.335%
513110	36	3	1.006%
515120	11	1	0.335%
517111	2	1	0.335%
518210	6	1	0.335%
519130	15	3	1.006%
522110	1314	107	35.90%
522120	22	2	0.671%

Table A3: Distribution by Industry code (continued)

NAICS code	No. Obs.	No. Companies	Percentage
522180	90	7	2.348%
522210	49	4	1.342%
522291	18	2	0.671%
522292	13	1	0.335%
522294	13	1	0.335%
522298	12	1	0.335%
522299	25	2	0.671%
522320	57	5	1.677%
523110	29	3	1.006%
523120	20	2	0.671%
523150	38	3	1.006%
523160	13	1	0.335%
523210	50	4	1.342%
523920	60	5	1.677%
523930	13	1	0.335%
523940	110	9	3.020%
523999	25	2	0.671%
524113	32	3	1.006%
524114	21	2	0.671%
524126	24	4	1.342%
524127	25	2	0.671%
524210	39	3	1.006%
525990	34	4	1.342%
531110	7	1	0.335%
531120	13	1	0.335%
531390	13	1	0.335%
532111	4	1	0.335%
532120	1	1	0.335%
541213	10	1	0.335%
541214	12	1	0.335%
541330	10	1	0.335%
541519	5	1	0.335%
541614	8	1	0.335%
541810	13	1	0.335%
541860	12	1	0.335%
561311	25	2	0.671%
561320	13	1	0.335%
562111	16	2	0.671%
611210	13	1	0.335%
621111	13	1	0.335%
621340	13	1	0.335%
621610	12	1	0.335%
622110	57	5	1.677%

Table A3: Distribution by Industry code (continued)

NAICS code	No. Obs.	No. Companies	Percentage
622210	12	1	0.335%
622310	13	1	0.335%
713210	8	1	0.335%
722511	140	12	4.026%
722513	60	7	2.348%
Total	3323	298	100%

Table A4: Variables

Variable	Description	Unit
Oprev	Operating Revenue	in thousand USD
Oprev_emp	Operating revenue per employee	in thousand USD
AvgSalary	Average salary at a company	in thousand USD
DiffExacSalary	The difference between the average executive compensation and the average salary at a company	in thousand USD
Emp	Number of employees	in units
AvgSalary_chUSD	Average salary change at a company compared to the previous year	in thousand USD
AvgSalary_chperc	Average salary change at a company compared to the previous year	in percantage
Capx	Capital Expenditure	in million USD
NAICS	NAICS industry code	six-digit code
Inflation	The level of inflation in the USA in different years	in percantage
Tax	Income tax - Total	in million USD
Dividends	This variable represents the total amount of stock dividents, other than stock dividends, declared on all equity capital of the company, based on the current year's net income. It is the sum of common, preferred and other dividents.	in million USD
Investment_ch	The change of the value of investments at T-1	in million USD
EBIT	"Earnings Before Interest and Taxes" This item is the sum of Sales - Net sales minus Cost of Goods Sold minus Selling, General & Administrative Expense minus Depreciation/Amortization."	in thousand USD
Gross Profit	This item includes Net sales minus Cost of Goods Sold	in thousand USD

Table A5: Correlations between the variables

		Correlation table											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Oprev	1.0000											
2	Oprev_emp	0.2468	1.0000										
3	AvgSalary	-0.0027	0.2457	1.0000									
4	AvgSalary_chUSD	-0.0103	0.1102	0.5294	1.0000								
5	AvgSalary_chperc	-0.0210	0.0172	0.0614	0.2042	1.0000							
6	DiffExacSalary	0.5691	-0.0411	-0.0615	-0.0643	0.0120	1.0000						
7	Emp	0.6247	-0.0566	-0.0420	-0.0124	-0.0235	0.4272	1.0000					
8	Capx	0.4245	-0.0372	-0.0151	-0.0091	-0.0127	0.3759	0.5130	1.0000				
9	Inflation	0.0509	-0.0061	0.0104	-0.0181	0.0085	0.0935	0.0191	0.0183	1.0000			
10	Tax	0.4584	-0.0130	0.0044	-0.0027	-0.0092	0.4035	0.3364	0.1820	0.0286	1.0000		
11	Dividends	0.5844	0.2108	0.0069	-0.0060	-0.0205	0.2450	0.2262	0.0811	0.0274	-0.1667	1.0000	
12	Investment_ch	0.6882	0.1447	0.0043	-0.0052	-0.0180	0.3138	0.2780	0.0773	0.0931	0.3924	0.5187	1.0000

Table A6: Robustness check - Dependent variable (A)

Robusness check - Dependent variable												
	Oprev				**EBIT**				**Gross profit**			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DiffExacSalary	295.940	0.000	288.685	0.000	124.281	0.017	123.237	0.018	171.679	0.019	169.743	0.020
AvgSalary_chUSD	474.311	0.005	-	-	153.039	0.003	-	-	227.757	0.004	-	-
AvgSalary_chperc	-	-	13453.500	0.001	-	-	1322.288	0.124	-	-	2857.668	0.047
Inflation	275012.500	0.000	274028.700	0.000	82731.230	0.000	82585.770	0.000	113057.000	0.000	112789.900	0.000
Emp	63350.040	0.02	64542.990	0.015	2779.429	0.373	2896.983	0.349	11106.570	0.089	11360.330	0.078
Capx	2673.333	0.000	2666.367	0.000	953.338	0.000	952.857	0.000	1224.005	0.000	1222.768	0.000
Tax	250.985	0.409	249.219	0.411	449.478	0.043	449.441	0.043	482.356	0.037	482.144	0.037
Dividends	338.271	0.232	337.977	0.232	588.175	0.000	588.237	0.000	641.204	0.001	641.250	0.001
Investment_ch	-0.041	0.997	-0.028	0.998	-4.121	0.667	-4.119	0.667	0.049	0.997	0.053	0.966
Constant	3605778.000	0.000	3549786.000	0.000	1256188.000	0.000	1252292.000	0.000	1905560.000	0.000	1895585.000	0.000
sigma_u	14123870.000		14117061.000		8117112.000		8116933.800		10529193.000		10527723.000	
sigma_e	2789678.200		2780994.400		1309535.800		1309457.800		1527812.600		1527267.400	
rho	0.962		0.963		0.975		0.975		0.979		0.979	
Number of obs.:	3000		3000		3000		3000		3000		3000	
Number of groups:	296		296		296		296		296		296	

Table A7: Robustness check - Dependent variable (B)

Robusness check - Dependent variable												
	Oprev_emp				**EBIT_emp**				**Gross profit_emp**			
	(1)		(2)		(3)		(4)		(5)		(6)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DiffExacSalary	-0.036	0.222	-0.042	0.21	-0.009	0.353	-0.010	0.336	-0.005	0.591	-0.007	0.537
AvgSalary_chUSD	1.226	0.002	-	-	0.318	0.005	-	-	0.369	0.002	-	-
AvgSalary_chperc	-	-	5.411	0.126	-	-	0.844	0.247	-	-	0.990	0.196
Inflation	14.364	0.306	13.494	0.345	11.756	0.002	11.562	0.002	14.810	0.000	14.584	0.000
Emp	-0.360	0.137	0.123	0.821	-0.064	0.589	0.011	0.943	-0.135	0.29	-0.046	0.792
Capx	0.044	0.008	0.043	0.008	0.017	0.019	0.017	0.019	0.020	0.015	0.020	0.015
Tax	-0.022	0.298	-0.021	0.319	-0.008	0.344	-0.008	0.363	-0.008	0.348	-0.008	0.370
Dividends	0.008	0.745	0.009	0.724	0.042	0	0.043	0.000	0.043	0.000	0.043	0.000
Investment_ch	-0.003	0.002	-0.003	0.002	-0.004	0.001	-0.004	0.001	-0.004	0.001	-0.004	0.001
Constant	940.432	0.000	933.541	0.000	294.664	0.000	295.503	0.000	368.256	0.000	369.177	0.000
sigma_u	2752.908		2772.575		1215.233		1218.157		1214.189		1217.965	
sigma_e	2070.354		2072.847		495.124		496.184		503.058		504.454	
rho	0.639		0.641		0.858		0.858		0.853		0.854	
Number of obs.:	3000		3000		3000		3000		3000		3000	
Number of groups:	296		296		296		296		296		296	

Table A8: Robustness check - Industrial distribution (A)

Robusness check - Industrial distribution								
Oprev	**Original**				**Without NAICS 522110**			
	(1)		(2)		(3)		(4)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DiffExacSalary	295.940	0.000	288.685	0.000	248.833	0.001	242.145	0.002
AvgSalary_chUSD	474.311	0.005	-	-	436.317	0.006	-	-
AvgSalary_chperc	-	-	13453.500	0.001	-	-	13054.880	0.002
Inflation	275012.500	0.000	274028.700	0.000	392625.400	0.000	388465.500	0.000
Emp	63350.040	0.02	64542.990	0.015	51925.020	0.028	53163.620	0.021
Capx	2673.333	0.000	2666.367	0.000	3661.124	0.000	3646.058	0.000
Tax	250.985	0.409	249.219	0.411	290.758	0.692	287.680	0.632
Dividends	338.271	0.232	337.977	0.232	283.280	0.511	281.983	0.513
Investment_ch	-0.041	0.997	-0.028	0.998	-9.976	0.3	-9.937	0.303
Constant	3605778.000	0.000	3549786.000	0.000	3930681.000	0.000	3887317.000	0.000
sigma_u	14123870.000		14117061.000		14028241.000		8116933.800	
sigma_e	2789678.200		2780994.400		3042291.100		1309457.800	
rho	0.962		0.963		0.955		0.975	
Number of obs.:	3000		3000		1813		1813	
Number of groups:	296		296		189		189	

Table A9: Robustness check - Industrial distribution (B)

Robusness check - Industrial distribution								
Oprev_emp	**Original**				**Without NAICS 522110**			
	(1)		(2)		(3)		(4)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DiffExacSalary	-0.036	0.222	-0.042	0.21	-0.044	0.210	-0.051	0.200
AvgSalary_chUSD	1.226	0.002	-	-	1.217	0.002	-	-
AvgSalary_chperc	-	-	5.411	0.126	-	-	6.339	0.165
Inflation	14.364	0.306	13.494	0.345	7.269	0.77	4.291	0.868
Emp	-0.360	0.137	0.123	0.821	-0.415	0.1	0.183	0.783
Capx	0.044	0.008	0.043	0.008	0.076	0.013	0.072	0.017
Tax	-0.022	0.298	-0.021	0.319	-0.062	0.125	-0.061	0.138
Dividends	0.008	0.745	0.009	0.724	-0.023	0.508	-0.022	0.531
Investment_ch	-0.003	0.002	-0.003	0.002	-0.005	0.000	-0.005	0.000
Constant	940.432	0.000	933.541	0.000	1322.336	0.000	1321.858	0.000
sigma_u	2752.908		2772.575		3450.751		3474.435	
sigma_e	2070.354		2072.847		2671.648		2674.426	
rho	0.639		0.641		0.625		0.628	
Number of obs.:	3000		3000		1813		1813	
Number of groups:	296		296		189		189	

Table A10: Robustness check - Covid-19 (A)

Robusness check - COVID-19								
Oprev	**Original**				**Without 2020-2022**			
	(1)		(2)		(3)		(4)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DiffExacSalary	295.940	0.000	288.685	0.000	175.444	0.008	168.821	0.011
AvgSalary_chUSD	474.311	0.005	-	-	254.251	0.444	-	-
AvgSalary_chperc	-	-	13453.500	0.001	-	-	9671.942	0.005
Inflation	275012.500	0.000	274028.700	0.000	253871.300	0.003	250542.500	0.003
Emp	63350.040	0.02	64542.990	0.015	42352.330	0.0029	43601.190	0.022
Capx	2673.333	0.000	2666.367	0.000	2064.511	0.000	2060.358	0.000
Tax	250.985	0.409	249.219	0.411	-237.693	0.208	-236.830	0.209
Dividends	338.271	0.232	337.977	0.232	-44.720	0.805	-43.555	0.810
Investment_ch	-0.041	0.997	-0.028	0.998	-27.111	0.177	-27.224	0.174
Constant	3605778.000	0.000	3549786.000	0.000	5144452.000	0.000	5104290.000	0.000
sigma_u	14123870.000		14117061.000		16526830.000		16507791.000	
sigma_e	2789678.200		2780994.400		2325058.600		2318964.000	
rho	0.962		0.963		0.981		0.981	
Number of obs.:	3000		3000		2293		2293	
Number of groups:	296		296		292		292	

Table A11: Robustness check - Covid-19 (B)

Robusness check - COVID-19								
Oprev_emp	**Original**				**Without 2020-2022**			
	(1)		(2)		(3)		(4)	
	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value	Coefficient	P-value
DiffExacSalary	-0.036	0.222	-0.042	0.21	-0.011	0.486	-0.014	0.429
AvgSalary_chUSD	1.226	0.002	-	-	1.262	0.517	-	-
AvgSalary_chperc	-	-	5.411	0.126	-	-	6.958	0.193
Inflation	14.364	0.306	13.494	0.345	29.091	0.747	28.706	0.747
Emp	-0.360	0.137	0.123	0.821	-0.553	0.055	0.320	0.703
Capx	0.044	0.008	0.043	0.008	0.033	0.001	0.031	0.004
Tax	-0.022	0.298	-0.021	0.319	-0.043	0.154	-0.043	0.165
Dividends	0.008	0.745	0.009	0.724	-0.014	0.588	-0.014	0.611
Investment_ch	-0.003	0.002	-0.003	0.002	-0.003	0.162	-0.003	0.167
Constant	940.432	0.000	933.541	0.000	884.710	0.000	852.376	0.000
sigma_u	2752.908		2772.575		3107.616		3117.923	
sigma_e	2070.354		2072.847		2143.602		2141.957	
rho	0.639		0.641		0.678		0.679	
Number of obs.:	3000		3000		2293		2293	
Number of groups:	296		296		292		292	