國立政治大學經濟學系

碩士論文

分紅費用化與資源錯置：以台灣電子產業為例

Misallocation Caused by Non-Expensed Stock Bonus: Evidence from Taiwanese Electronics Industry

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中 華 民 國 110 年 07 月

DOI:10.6814/NCCU202100891

摘要

現今台灣電子業在全球供應鏈中扮演重要角色，早期利用股票分紅獎酬制度留任科技人才奠定了台灣電子業領先地位的基礎。然而，有利於施行股票分紅的優惠會計政策亦因損害投資人權益而為人詬病，盛行二十餘年的股票分紅獎酬制度於 2008 年隨著員工分紅費用化制度的實施走入歷史。本研究利用 2002 年至 2019 年之所有電子業上市上櫃企業資料，計算台灣電子業內的資源錯置程度，並進一步討論 2008 年前後電子業內勞動市場扭曲程度的變化。

本研究結果顯示高股價的公司於 2008 年前得以較低的單位勞動成本雇用勞工，而高生產力的公司於 2008 年後得以較低的單位勞動成本雇用勞工。員工分紅費用化終止了資本市場對於高股價公司的不當補貼，並降低勞動市場的扭曲，使人力資源流入高生產力的公司。

關鍵字：員工分紅、員工分紅費用化、資源配置扭曲

DOI:10.6814/NCCU202100891

Abstract

Taiwan's advanced technology, from manufacturing to packaging and testing, plays an important role in the supply chain of the international semiconductor products industry. Taiwan's leading role in the international supply chain of high-tech industry can be traced back to the 80s, during which stock bonuses were a critical stimulant. However, the accounting standard favorable for using for such bonuses became anachronistic after a few decades, and was amended in 2008. The current study utilizes a theoretical framework to compute the misallocation effects of labor inputs by issuing stock bonuses before the accounting standard changed. The data are retrieved from the publicly listed companies in the electronics industry traded on the Taiwanese Stock Exchange (TWSE) and Taipei Exchange (TPEx). The results show that companies with a higher share price confronted a lower labor cost before 2008, and companies with higher productivity faced lower labor costs after 2008. This implies that the subsidy to companies having a higher share price was suspended after 2008, and the labor distortion also decreased after the regulatory reform.

Keywords: Resource misallocation, Distortions, Expensing employee stock bonus

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Chapter 1. Introduction

Over the past decades, broad-based employee stock ownership (ESO) has been a prevalent profit-sharing scheme in industrialized countries. For instance, ESO is often adopted by start-up companies in the technology field due to the difficulty in monitoring their employees. There are several mechanisms to execute an ESO program, such as implementing an employee stock ownership plan (ESOP),[1] setting up funds for employee share ownership trusts (ESOT),[2] and giving employees stock options as a part of their compensation (Freeman, Blasi, and Kruse, 2010). Despite its extra cost, there are some benefits of conducting ESO. To name a few, ESO provides employee incentives for more effort, information sharing, and cooperation that could promote a high-performance culture. Besides, ESO also lowers employee's separation rate and motivates employees' devotion to their designated work (Blasi, Kruse, and Freeman, 2018).

Many studies have examined the effects of ESO on firm performance due to ESO's wide application (Ismiyanti and Mahadwarth, 2017; Kang and Kim, 2019; Pendleton and Robinson, 2010). However, mixed results appear in those studies. On one hand, some employers want to motivate employees through ESO. The effects of ESO could be weak due to the principal–agent problem or free-rider problem. On the other hand, some other employers use ESO for non-incentive purposes, because employers are constrained by tight liquidity and need to save cash by issuing new shares in return for lower wages (Kim and Ouimet, 2014).

Since the early eighties, many firms in the Taiwanese electronics industry have used

[1] ESOP is an employee benefit plan that transfers company stock ownership to employees.
[2] ESOT is an indirect employee ownership program that holds shares in a trust for employees.

DOI:10.6814/NCCU202100891

employee stock bonuses (ESB) to share profit with their employees. ESB plans are similar to employee stock options, which are widely used by high-tech companies in the United States.[3] Furthermore, before 2008, ESB that a firm issued were valued at par value per share in its financial statement, but the actual value of the ESB, from the employee's perspective, should be denominated in the market price. In other words, firms with higher share prices could pay their employees at a lower cost. The loose accounting standards gave rise to the abuse of ESB by plenty of high-tech firms in Taiwan. With multiple concerns, the authority revised the favorable accounting standards in 2008. The reform heavily raised the cost of conducting ESB and led to a rapid extinction of ESB.

The lower real wage expense accrued in financial statements may explain why high-tech firms had used ESB for wage payment. Companies with a higher share price could enjoy a higher subsidy in labor input paid by the capital market. However, higher share prices do not necessarily promise higher productivity. Thus, this labor wedge, acting as a wage subsidy, would distort the labor market. Restuccia and Rogerson (2008) show that inefficient matching between production resources across firms that differ in firm-level productivity may damage industry aggregate productivity. This misallocation channel, which distorts how factors of production are allocated among incumbent producers, is one of the main channels that affect an industry's productivity (Restuccia and Rogerson, 2017). Hsieh, Hurst, Jones, and Klenow (2019) also show that eradication of labor market distortions would improve the aggregate growth in America by roughly 40%. Therefore, the current article suggests that the loose accounting standards of ESB before 2008 could worsen labor market distortions. Firms with higher

[3] An employee stock option is a contract granted by the company stipulating that its employees could purchase the company's stock at a specified price. However, employees could acquire the company's stock without payment in ESB plans.

DOI:10.6814/NCCU202100891

share prices could pay their employees at a lower cost; that is to say, a within-industry input price difference could exist after firm-level physical productivities were controlled for.

The current study attempts to bridge the link between expensing employee bonuses in 2008 and change in labor market distortions. A theoretical model is constructed by adapting the distortion measurement in Hsieh and Klenow (2009). We use the data of all listed companies in the Taiwanese electronics industry to compute the changes in labor market and capital market distortions from 2002 to 2019. We also measure the marginal output effect of labor distortion and capital distortion for each year. Finally, we discuss some policy suggestions.

The rest of the current study is organized as follows: Chapter 2 provides a review of the literature and the policy background of ESB. Chapter 3 introduces a theoretical framework on resource misallocation. Chapter 4 presents the data we used and our empirical methods. Chapter 5 provides empirical results. Finally, Chapter 6 presents the conclusions of the current study and subsequent research recommendations.

DOI:10.6814/NCCU202100891

Chapter 2. Review on Literature and Policy

2.1 Literature Review

The current study is related to several strands of the literature. The first part is the literature spent on developing measurements of resource misallocation existing at the aggregate level. The second branch of the literature examines the effects driven by resource misallocation of selection mechanisms. Finally, the current study also probes the literature that examines the effects of expensing employee bonuses on firm performance starting from 2008.

The first part of the literature is devoted to the development of measurement of resource misallocation. Restuccia and Rogerson (2017) summarize three main channels affecting industry-level productivities. First, the technology channel reflects the values of producer-level productivity that can lead to the dynamics of productivity in the aggregate sense. Second, the selection channel reflects the choice of which producers should operate, for example, the survival of the fittest caused by the process of exit and entry. The last is the misallocation channel, which reflects scarce production inputs being allocated to incumbent industry producers with heterogeneous productivity. The current study follows the third channel closely and investigates the effect of the change in policy on expensing employee bonuses in 2008. Specifically, labor distributions vary before and after the change in policy.

In the field of misallocation across heterogeneous firms, Restuccia and Rogerson (2008) argue that mismatch between production inputs and firms with heterogeneous productivities may damage industry-level productivity. They show that variated factor

DOI:10.6814/NCCU202100891

prices instead of a flat equilibrium input price can lead to loss of aggregate output.[4] Hsieh and Klenow (2009) formally develop the quantitative measure on misallocations and apply the misallocation measure to establishment-level data in the US, India, and China. Their results show that hypothetically reallocation would at most spur manufacturing output amounts to increase 30%–50% in China and 40%–60% in India. Following studies construct models of misallocation with capital market imperfections, such as Banerjee and Moll (2010), Midrigan and Xu (2014), and Moll (2014). The current study ideally approves that the input distortions may make room for the improvements on intensive-margin misallocation. Besides, the current study also extends misallocation measurement by Hsieh and Klenow (2009) in the labor market. The emphasis on the labor market facilitates the understanding to bridge the efficiency gains or losses by enforcing policies on expensing stock bonus implemented starting in 2008.

Referring to the second type of literature, survival of the fittest may point to the major workhorse of the selection force. Dynamics of aggregate productivity in the investigated industries can be linked with surviving firms' productivity levels after the market selection. Specifically, entry and exit will determine the reshuffling of remaining incumbents in the market and reveal the industry productivities in the end. However, the selection is determined by profitability, not productivity. Foster, Haltiwanger, and Syverson (2008) argue that within-industry output price differences are embodied in productivity and output measures, and firms exhibiting high productivities may not be especially physically efficient. Existing literature with revenue-based measures may undervalue the contribution of young businesses and entrants to aggregate productivity growth since they charge lower prices.

[4] Policies that distort the relative prices faced by different firms will affect the resource allocation in the industry and can potentially have substantial effects.

DOI:10.6814/NCCU202100891

In our model, we attempt to investigate the role of labor distortion in industry-level productivity. Under favorable accounting regulations before 2008, firms with higher stock prices were able to pay their employees at a lower cost, that is to say, a within-industry input price difference can exist and is irrelevant to firm-level physical productivity. Inadaptable subsidies in the labor market can bring about resource misallocation; moreover, an overpaid sector can also affect the occupational choice of agents and might generate some type of misallocation. Hsieh et al. (2019) study the impact caused by removal of entry barriers on high-skilled professions in the labor market between 1960 and 2010. In their baseline calculations, reducing barriers explains roughly 40% of growth of GDP per capita in America. Another study by Cavalcanti and Santos (2021) also points out a major type of labor market distortion long existing in the market.[5] The public sector might attract more capable workers because the public sector usually has positions featuring stability and higher pay. Therefore, crowding out effects would influence the labor flow between the private and public sectors. The crowding out effects would in turn cause negative effects on employment and entrepreneurship in the private sector.

To echo Cavalcanti and Santos (2021), the current research also has similar results for occupational choice, but driven by different kinds of incentives. In the current research, firms take advantage of favorable accounting rules before the implemtation of expensing stock bonuses. Firms with higher market share prices can pay higher real wages to workers at relatively low costs under the non-expensed stock bonus system, in which the firms can utilize the gap between par value and market value. Besides wages, other forms of compensation such as bonus schemes or promotion

[5] Cavalcanti and Santos (2021) provide a life-cycle model with endogenous occupational choice to study the implications of an overpaid public sector in Brazil.

DOI:10.6814/NCCU202100891

opportunities[6] are also critical factors for workers' career paths (Ke, Li, and Powell, 2018). The occupational choice may be affected by prospective employees' pursuit of earning stock premiums. We have studied and measured labor market distortions driven by non-expensed stock bonuses. In this vein we can compare the distortionary outcome before and after expensing stock bonuses was enforced in Taiwan.

ESB had been widely used in Taiwan'selectronic industry since 1980. An extensive body of research has inquired into the effects of bonus systems on firm performance (Han and Shen, 2007; Guo, Shiah-Hou and Yang, 2006; Han, 2003; Ang, Chen and Lin, 2005; Liu, Chen and Wang, 2014). While a stock bonus provides incentives to put more effort into work, it also comes with share dilution. A branch of literature focuses on the relationship between equity value and stock bonuses (Chen, 2003; Chan, Tai, Li, and Jelic, 2014; Chiang and Kuo, 2006; Lin, Ko, Chien, Lee, 2010). There is also some discussion about the effects of stock bonus on R&D expenditure and employee turnover (Chen and Huang, 2006; Chang and Chen, 2002; Cheng, Han, Li, Lee, and Yang, 2020). Different from existing studies, the current study pays attention to the labor wedge caused by the ESB which may damage industry-level productivity.

2.2 Taiwan employee stock bonuses

In the information explosion era, human capital is an invaluable asset for many companies. How to recruit and retain productive employees is a critical capability, especially in technology-intensive industries such as the electronics industry. Cash profit-sharing plans were the main approach for profit-sharing in Taiwan's early days. Since the 1980s, broad-based employee stock ownership started to prevail over cash bonuses in Taiwan and became the primary equity incentive plans. The stock bonus

[6] Firms can motivate and retain their workers through promotion opportunities, since workers' wages increase on promotion.

DOI:10.6814/NCCU202100891

systems in Taiwan's high-tech sector are similar to cash profit-sharing plans, since they usually have short lock-up periods. The lock-up periods generally lie between three months to two years, varying from firm to firm (Liu et al., 2014). These unique equity incentive plans were first adopted in 1983 by United Microelectronics Corporation[7] (Han and Shen, 2007). Enterprises can motivate employees at a lower cost with the stock bonus system, and this may be the reason why it was prevalent in the following decades. The Asia Wall Street Journal even reported that Taiwan was home to companies with some of the world's most generous employee stock giveaways in 2002.[8] The stock bonus system became a powerful tool to attract talented employees, and many believe that it was the secret to accelerate the development of the Taiwanese electronics industry. The prevalence of adopting ESB stemmed from favorable accounting regulations, but the accounting practice could be misleading and lacked transparency for outside shareholders.

Before the reform in 2008, the accounting standards of ESB in Taiwan had two main differences compared to international accounting conventions (Cheng et al., 2020). First of all, ESB was considered to be profit distribution instead of labor costs. Secondly, the bonuses given to employees were valued at the par value.[9] This implies that a company could execute ESB without clearly listing the costs in its financial report. On top of that, companies which had a higher share price could give their employees extremely high actual compensation at a lower cost. In order to comply with the international accounting standards, the Business Entity Accounting Act in Taiwan was amended in May 2006 and the new regulation became effective on January 1st, 2008. Since then,

[7] UMC is a leading global semiconductor foundry company founded in 1980, and its headquarters are located in Hsinchu, Taiwan. < https://www.umc.com/en/StaticPage/about_overview >
[8] Jason Dean, "Taiwan Bonuses Spur Accounting Concerns", The Wall Street Journal, 18 July 2002, < https://www.wsj.com/articles/SB1026937468348785720>
[9] Before 2014, the Financial Supervisory Commission, R.O.C. stipulated that the par value of each share was 10 TWD.

DOI:10.6814/NCCU202100891

ESB should be recorded as expenses and valued at market prices rather than their par value. This heavily raised the cost of issuing ESB and lead to a rapid extinction of ESB.

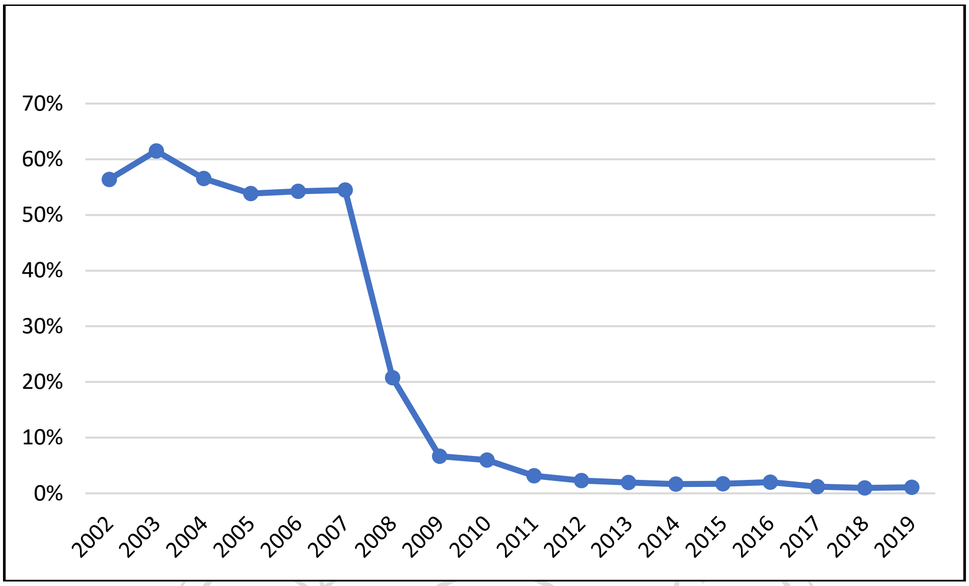

Figure 1. Proportion of Companies Using ESB in Electronics Industry

Source: Organized by this article

The reform of the accounting standards has led to a decrease in companies' profit, since they must list their stock bonuses as costs on their balance sheet. On the other hand, the policy modification has heavily changed the employees' annual compensation. Besides the reduction in the number of ESB shares, the individual income tax base of ESB should be valued at market prices rather than the par value after 2008. To illustrate, assume a company's stock price is 20 NTD per share and the company decides to reward an employee with 100 NTD by ESB. Before 2008, this employee could get 10 shares, and the actual value of the stock bonus was 200 NTD. Furthermore, the income tax base of these earnings from ESB was 100 NTD. For the company, the ESB would be counted as a distribution of 100 NTD net earnings to their employees. If the ESB were executed after 2008, the company should still record a payment of 100 NTD in its financial statements, but the ESB would be considered to be an expense. In addition, from the employee's perspective, he would only receive 5 shares, and the actual value of the stock bonuses would be 100 NTD. The income tax base of these earnings from ESB

DOI:10.6814/NCCU202100891

would still be 100 NTD. Thus, employees who received ESB before 2008 could obtain huge returns deriving from a large price gap between par value and the market price of the stock. This implies that companies with a higher market price could enjoy a higher subsidy in labor input by the capital market. In conclusion, Table 1 shows the differences before and after the reform in 2008.

Table 1. Differences Before and After 2008

Source: Organized by this article

Before 2008	1. ESB is recorded as a distribution of net profit. 2. The value of ESB is calculated using the par value per share (10 NTD). 3. Individual income tax imposed on ESB is calculated using the par value per share (10 NTD).
After 2008	1. ESB is recorded as labor costs. 2. The value of ESB is calculated using the closing price. 3. Individual income tax imposed on ESB is calculated using the closing price.

DOI:10.6814/NCCU202100891

Chapter 3. Model

In order to capture the features of misallocation in the electronics industry, we adapt the misallocation measurement in Hsieh and Klenow (2009) and apply the revised misallocation measurement in the labor market. The setup of decreasing return to scale in each firm's production technology allows us to derive the static equilibrium with input distortions. Our model can estimate the firm-level distortions in the labor market and the capital market. Moreover, we can also measure the loss of aggregate output due to resource misallocations in our model.

In this model, each firm i produces homogeneous products Y_i in an industry with M_s firms, and the aggregate output Y_s is a linear combination of all firms' output represented by

$$Y_s = \sum_{i=1}^{M_s} Y_i. \tag{1}$$

We assume that there are two factors of production adopted by each firm in the industry. A firm is operating under a Cobb-Douglas production function given by

$$Y_i = A_i (L_i^{\alpha} K_i^{1-\alpha})^{\gamma}. \tag{2}$$

where Y_i is the output of firm i, L_i is the amount of labor input, K_i is the amount of capital input, A_i is firm-specific productivity and $(L_i^{\alpha} K_i^{1-\alpha})^{\gamma}$ is a decreasing returns production technology with $\gamma \in (0,1)$. This operative returns to scale parameter is often referred to as "span-of-control" parameter, and was brought up in Lucas (1978). Labor share is denoted by α and capital share is denoted by $1-\alpha$. Let the products of firm i be sold at price P_i, then the gross revenue generated by this firm is $P_i Y_i$. However, input distortions should also be considered when a firm is making production decisions, thus we adopt the concept in Hsieh and Klenow (2009). For firm i, labor input distortion is denoted by τ_{L_i} and capital input distortion is denoted by τ_{K_i}. Firm

DOI:10.6814/NCCU202100891

i's profits are given by

$$\pi_i = P_i Y_i - (1+\tau_{L_i}) w L_i - (1+\tau_{K_i}) R K_i. \quad (3)$$

We can separately identify the distortion of each factor that changes the marginal product of the factor. For example, τ_{K_i} would be higher if firm i has to deal with a higher loan cost, and τ_{L_i} would be higher when firm i has a higher labor compensation cost. These distortions decrease the labor and capital input demand, which increases the marginal products of labor and capital. That is to say, the actual interest confronted by firm i is $(1+\tau_{K_i})R$ and the actual compensation for the workforce costs $(1+\tau_{L_i})w$ per unit.

Under the assumptions of homogeneous output and competitive input market, the price of each product produced by firm i equals P for every firm in the industry:

$$P_i = P. \quad (4)$$

Labor demand and capital demand can be derived by the profit maximization problem in perfectly competitive factor markets:

$$L_i = L_i(A_i, \tau_{L_i}, \tau_{K_i}) \propto \left[A_i (1+\tau_{L_i})^{\gamma(1-\alpha)-1} (1+\tau_{K_i})^{\gamma(\alpha-1)}\right]^{\frac{1}{1-\gamma}}, \quad (5)$$

$$K_i = K_i(A_i, \tau_{L_i}, \tau_{K_i}) \propto \left[A_i (1+\tau_{L_i})^{\alpha\gamma} (1+\tau_{K_i})^{\alpha\gamma-1}\right]^{\frac{1}{1-\gamma}}. \quad (6)$$

The allocation of labor and capital across firms depends not only on the firm's productivity level but also on the input distortions they underwent. That is to say, the differences in each firm's marginal revenue products of labor and capital are driven by the input distortions they face. The marginal revenue products of labor and capital are proportional to revenue, which we denote as follows:

$$MRPL_i(w, \tau_{L_i}) \triangleq \alpha\gamma \frac{P_i Y_i}{L_i} = (1+\tau_{L_i}) w, \quad (7)$$

$$MRPK_i(R, \tau_{K_i}) \triangleq (1-\alpha)\gamma \frac{P_i Y_i}{K_i} = (1+\tau_{K_i}) R. \quad (8)$$

Firm i's output $(P_i Y_i)$ is defined by value added, which is the earnings before interest,

DOI:10.6814/NCCU202100891

taxes, depreciation and amortization $(EBITDA_i)$ coupled with the actual labor compensation cost $(1+\tau_{L_i})w$.

Under the assumption of decreasing returns to scale, firms which face greater distortions will exhibit higher marginal revenue products. In other words, firms with greater distortions will present a smaller equilibrium scale of production than the optimal scale. From equation (7) and equation (8), the labor distortion factor and capital distortion factor for firm i can be solved as follows:

$$\tau_{L_i} = \frac{\alpha\gamma}{1-\alpha\gamma}\frac{EBITDA_i}{wL_i} - 1\,, \tag{9}$$

$$\tau_{K_i} = \frac{(1-\alpha)\gamma}{1-\alpha\gamma}\frac{EBITDA_i}{RK_i} - 1. \tag{10}$$

In order to investigate the effect of resource misallocation on industrial productivity, we derive an expression for aggregate TFP as a function of the labor distortion factor and the capital distortion factor. From equation (2), equation (5), and equation (6), we can represent the aggregate demand of labor, capital, and output as the summation of each firm's input demand and output:

$$L = \sum_{j=1}^{M} L_j = L_i \times \sum_{j=1}^{M} \left(\frac{A_j}{A_i}\right)^{\frac{1}{1-\gamma}} \left(\frac{1+\tau_{L_j}}{1+\tau_{L_i}}\right)^{\frac{\gamma-\alpha\gamma-1}{1-\gamma}} \left(\frac{1+\tau_{K_j}}{1+\tau_{K_i}}\right)^{\frac{\gamma(\alpha-1)}{1-\gamma}}, \tag{11}$$

$$K = \sum_{j=1}^{M} K_j = K_i \times \sum_{j=1}^{M} \left(\frac{A_j}{A_i}\right)^{\frac{1}{1-\gamma}} \left(\frac{1+\tau_{L_j}}{1+\tau_{L_i}}\right)^{\frac{-\alpha\gamma}{1-\gamma}} \left(\frac{1+\tau_{K_j}}{1+\tau_{K_i}}\right)^{\frac{\alpha\gamma-1}{1-\gamma}}, \tag{12}$$

$$Y = \sum_{i=1}^{M} Y_i = \sum_{i=1}^{M} A_i (L_i^{\alpha} K_i^{1-\alpha})^{\gamma}. \tag{13}$$

Here, L_i, K_i, and Y_i represent firm i's labor input, capital input, and output. We are now ready to express aggregate output as a function of L, K, and industrial TFP:

$$Y = TFP \times L^{\alpha} \times K^{1-\alpha}. \tag{14}$$

Following the concept in Hsieh and Klenow (2009), productivity is divided into "physical productivity" and "revenue productivity". The former is denoted as TFPQ and the latter is TFPR. The definitions are as follows:

$$TFPQ_i \triangleq \frac{Y_i}{(L_i^{\alpha} K_i^{1-\alpha})^{\gamma}}, \tag{15}$$

DOI:10.6814/NCCU202100891

$$TFPR_i \triangleq \frac{PY_i}{L_i^{\alpha} K_i^{1-\alpha}}. \tag{16}$$

In this model, $TFPQ_i$ is each firm's physical productivity as A_i represented in equation (2), which can be different for each firm. On the other hand, we can infer from equation (7) and equation (8) that $TFPR_i$ does not vary across firms in the industry when labor and capital distortions do not exist. This implies that more labor and capital should be allocated to the firms with higher $TFPQ_i$ in the absence of distortions. Specifically, we can express a firm's $TFPR_i$ as

$$TFPR_i = \left[\left(\frac{MRPL_i}{w}\right)^{\alpha} \left(\frac{MRPK_i}{R}\right)^{(1-\alpha)}\right]^{\gamma} = \left[\left(1+\tau_{L_i}\right)^{\alpha}\left(1+\tau_{K_i}\right)^{(1-\alpha)}\right]^{\gamma}. \tag{17}$$

A higher $TFPR_i$ indicates that firm i confronts higher barriers; thus, it ends up with smaller size than its optimal scale by the law of diminishing returns to production inputs. That is because each kind of distortion will raise firm i's real cost to the input adoption and increase marginal products of labor and capital in the equilibrium. Aggregate output of the industry can be derived by simply aggregating each firm's output as shown in equation (13). Then industry-level TFP in equation (14) can be written as

$$TFP = \frac{Y}{L^{\alpha}K^{1-\alpha}} = \frac{\left\{\sum_{i=1}^{M}\left(TFPQ_i \frac{\overline{TFPR}}{TFPR_i}\right)^{\frac{1}{1-\gamma}}\right\}^{1-\gamma}}{(L^{\alpha}K^{1-\alpha})^{1-\gamma}}, \tag{18}$$

where $\overline{TFPR}$[10] is a harmonic average of the average marginal revenue product of labor and capital across firms in the industry.

[10] $\overline{TFPR} \equiv \left\{\sum_{j=1}^{M}\left[\frac{Y_j}{Y}\left(1+\tau_{L_i}\right)^{\frac{\gamma-1}{1-\gamma}}\right]\right\}^{-\alpha\gamma} \left\{\sum_{j=1}^{M}\left[\frac{Y_j}{Y}\left(1+\tau_{K_i}\right)^{\frac{\gamma-1}{1-\gamma}}\right]\right\}^{-(1-\alpha)\gamma}$

DOI:10.6814/NCCU202100891

Chapter 4. Data and Methodology

4.1 Sources

The data used in this study are drawn from the Taiwan Economic Journal (TEJ) database, which includes the TEJ Company database, TEJ IFRS Finance database, and TEJ Share Price database. Our unbalanced panel data[11] cover all listed companies in the electronics industry from 2002 to 2019, comprising 967 firms with 10,331 observations.

This study aims to investigate the resource misallocation in labor inputs that stemmed from non-expensed employees' stock bonuses before 2008. In 2008, in order to comply with the international accounting standards, the authority revised the accounting standards favorable to firms whose stock prices were high; as a result, their costs of executing ESB were heavily raised since then. The revision has led to asymmetric shocks to different industries. Industries suffered different degrees of impact from this policy change depending on firms' reliance on employee stock bonuses before the policy change. This study focuses on the Taiwanese electronics industry, where executing ESB was prevalent since the early eighties. We follow the industry classification defined by TWSE, which involves semi-conductors manufacturing, computers and peripheral equipment manufacturing, optoelectronic materials and components manufacturing, communication equipment manufacturing and telecommunications, electronic parts and components manufacturing, electronic components distributors, information services, and other electronic parts and components manufacturing. Table 2 summarizes the industry classification and

[11] A panel is said to be unbalanced if each entity has a different number of observations. Our data include all listed companies in the electronics industry from 2002 to 2019; however, the data before listing and after delisting are unobservable in our database.

DOI:10.6814/NCCU202100891

representative firms in each subsector.

Table 2. Industry Classification

Source: Organized by this article

Major Sector	**Subsector**	**Description and Representative Firms**
Electronics industry	Semi-conductors Manufacturing	Manufacture of semi-conductors, related products, and materials, e.g., TSMC, MediaTek, UMC.
	Computers and Peripheral Equipment Manufacturing	Manufacture of computers and peripheral equipment, e.g., Quanta, Acer, ASUS.
	Optoelectronic Materials and Components Manufacturing	Manufacture of optoelectronic materials and components, e.g., Largan, Innolux, AUO.
	Communication Equipment Manufacturing and Telecommunications	Manufacture of telephones, cellular phones, other communication equipment, and services, e.g., CHT, TWM, FET.
	Electronic Parts and Components Manufacturing	Manufacture of electronic components except semi-conductors, e.g., Delta, YAGEO, Unimicron.
	Electronic Components Distributors	Supplier of electronic components and electromechanical products, e.g., Synnex, WPG, WT.
	Information Services	Provide software design, information software, electronic information, and other information service, e.g., SYSTEX, CyberLink, X-Legend.
	Other Electronic Parts and Components Manufacturing	Manufacture of other electronic components excluded from above, e.g., Foxconn, Catcher, Kinpo.

DOI:10.6814/NCCU202100891

4.2 Definitions of Variables

Table 3 shows all the constructed variables that will be used in this study. In our model, firms' output is equal to earnings before interest, taxes, depreciation and amortization (EBITDA) plus labor inputs; labor input is the summation of cash bonus, stock bonus multiplied by share price, and wages; capital input is assessed by total assets in companies' financial statement. Hsieh and Klenow (2009) provide a useful method to recover wedges from firm-level data and evaluate the potential impact of misallocation, which is driven by the heterogeneity in size and productivity across firms (Hopenhayn, 2014). In section 4.6, we will first probe the forces behind this misallocation by controlling firm-level characteristics. Section 4.6 delineates our regression setup. In the regression analyses, the business scale is governed by Total_assets and Market_cap; the financial ratios are governed by Current_ratio, Turnover_ratio, and ROA; the stock value is governed by EPS, PB_ratio, PS_ratio, and Dividend_yield; the ownership is governed by Foreign_own, Gov_own, and Localinst_own.

DOI:10.6814/NCCU202100891

Table 3. Definition of Variables

Source: Organized by this article

Variable	**Definition**
Bonus_cash	Employee cash bonus, thousand TWD.
Bonus_stock	Employee stock bonus, shares.
EBITDA	Earnings before interest, taxes, depreciation and amortization, thousand TWD.
Wages	The actual amount paid for all employee wages and benefits, thousand TWD.
Foreign_own	The percentage of foreign ownership.
Gov_own	The percentage of government ownership.
Localinst_own	The percentage of local institutional ownership.
Total_assets	The sum of current assets and non-current assets, thousand TWD.
Current_ratio	Current ratio = current assets / current liabilities.
Turnover_ratio	Total asset turnover ratio = operating revenue / total assets.
ROA	Return on assets = operating income / operating assets.
Share_price	The last transacted ex-dividend price of a security in each year, TWD.
Market_cap	The share price multiplied by the number of shares outstanding, million TWD.
EPS	Earnings per share = profit / outstanding shares of common stock.
PB_ratio	Price-book ratio = closing price / net worth per share.
PS_ratio	Price-to-sales ratio = market capitalization / revenue.
Dividend_yield	Dividend yield = dividend / closing price.

DOI:10.6814/NCCU202100891

4.3 Descriptive Statistics

There are several points to be explained in detail about data collection. First, our analyses focus on the listed firms because private firms are not obligated to reveal their financial performance in the designated accounting standards. Therefore, we only utilize the TEJ dataset to retrieve firms' performance for TWSE and TPEx listed firms in the Taiwanese electronics industry. Hopenhayn (2014) points out the industry-level TFP is determined both by the allocation of resources across firms and the underlying distribution of establishments' productivities. However, our analyses mean to bridge the labor market distortions with industry-level productivities. Like Hsieh and Klenow (2009), we focus more on the allocation of resources in a static market without entry and exit. Secondly, we drop observations with negative output in the dataset. Furthermore, we need the share price to recover employees' stock bonus income; nevertheless, the issuance pattern of ESB and ex-dividend date vary from firm to firm, and thus we standardize the share price by using the adjusted share price on the last transaction day in each year. Table 4 is the statistical description of the variables.

DOI:10.6814/NCCU202100891

Table 4. Descriptive Statistics of Variables

Source: Organized by this article

Variables	Mean	Median	S.D.	Min.	Max.	Obs.
Bonus_cash	82678.85356	7004.5	658461.76799	0	23570040	10332
Bonus_stock	1267318.15331	0	10783410.72367	0	457279801	10332
EBITDA	3027660.54684	384793	20077203.93191	70	693107788	10332
Wages	2075115.03823	447187	10709966.88111	2834	339238605	10332
Total_assets	22128425.05468	3783364	110832998.26276	32072	3407216613	10332
Share_price	37.34070	19.435	102.00425	0.73	4901.25	10332
EPS	2.72637	1.76	5.89196	-11.3	210.7	10332
Foreign_own	10.42400	4.08	15.25169	0	100	10332
Gov_own	0.55527	0	2.81799	0	95.33	10332
Localinst_own	1.61006	0.01	3.62006	0	60.13	10332
Current_ratio	265.45273	202.32	206.61511	9.89	3783.42	10332
Turnover_ratio	1.04949	0.89	0.67499	0.01	8.04	10332
ROA	8.18400	6.83	9.83772	-71.58	106.56	10332
Market_cap	21507.69144	3130	162858.52059	72	8582955	10332
PB_ratio	1.86016	1.43	1.58068	0	22.03	10332
PS_ratio	1.75941	1.11	3.33714	0	140.78	10332
Dividend_yield	4.56214	3.87	4.85060	0	161.44	10332

Note: The unit of Bonus_cash, EBITDA, Wages, Total_assets is thousands of TWD; the unit of Market_cap is millions of TWD; the unit of Share_price is dollars of TWD.

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4.4. Efficiency Measures

We need to determine the values of some parameters in our model before we estimate the production efficiency of Taiwan's electronics industry. First, we set the interest rate at 0.0615, which is the internal rate of return (IRR) of the Electronics Index (created by TWSE) for the past fifteen years. This study focuses on the Taiwanese electronics industry, hence we adopt the IRR of the Electronics Index as the interest rate, which can be seen as the opportunity cost of capital invested in the electronics industry. After that, we use the interest rate mentioned above to calculate the labor share, which is equal to 0.6218. Note that this value is reasonably close to 0.6, which is the labor share set in Prescott (1986). Furthermore, the results won't be significantly affected by the labor share setting of around 0.6218 and will be verified in the following robustness check. Our model provides a theoretical framework in which production is conducted by heterogeneous firms characterized by decreasing returns-to-scale technology, with the extent of the returns to scale governed by a Lucas span-of-control parameter. We set the Lucas span-of-control parameter at 0.8, following the setting in Basu and Fernald (1995), Basu (1996), Basu and Kimball (2000), and Atkeson and Kehoe (2005). Table 5 shows the values of calibrated parameters in our model.

Table 5. Calibrated Parameters

Source: Organized by this article

Parameters	Value
Lucas Span-of-Control (γ)	0.8
Interest Rate (R)	0.0615
Labor Share (α)	0.6218

In equation (18), the industrial TFP can be computed by TFPR, which embodies the

DOI:10.6814/NCCU202100891

barriers that each firm confronts. In other words, the industrial productivity we compute in equation (18) is distorted by the presence of labor distortion and capital distortion. We can measure the industrial efficiency gap by introducing the "efficient output" in our model, which is the output when there are no distortions in the industry. No distortions means that there are no idiosyncratic barriers among firms within the industry. Therefore, the marginal products of the production factors will be equalized across firms in the electronics industry. Thus, we have

$$TFPR_i = \overline{TFPR}.$$

Equation (18) shows that the industry TFP will be a CES function of $TFPQ_i$ if each firms' $TFPR_i$ is equal in the industry. When $TFPR_i$ is equal to $\overline{TFPR}$ for all firms, the industry productivity $TFP_{efficient}$ can be represented by

$$TFP_{efficient} = \frac{\left\{\sum_{i=1}^{M}(TFPQ_i)^{\frac{1}{1-\gamma}}\right\}^{1-\gamma}}{(L^{\alpha}K^{1-\alpha})^{1-\gamma}}. \qquad (19)$$

From equation (18) and equation (19), we can investigate the role of misallocation in the industrial productivity. The production efficiency can be expressed as a ratio of the actual output (Y) and the output without distortions $(Y_{efficient})$:

$$Y_R = \frac{Y}{Y_{efficient}} = \left\{\sum_{i=1}^{M}\left(\frac{TFPQ_i}{\overline{TFPQ}}\frac{\overline{TFPR}}{TFPR_i}\right)^{\frac{1}{1-\gamma}}\right\}^{1-\gamma}. \qquad (20)$$

The production efficiency (Y_R) is between 0 and 1. There are no distortions across all firms in the industry when Y_R is equal to 1. By contrast, a smaller Y_R indicates that misallocations play a more important role in the industry.

4.5 Marginal effect of distortions

In this section, we provide a quantitative framework to measure the marginal effect of resource misallocation on industrial manufacturing productivity in the electronics industry. This framework measures the marginal effects of labor distortion and capital

DOI:10.6814/NCCU202100891

distortion respectively, and the following results show how the distortions lower industrial TFP. In our model, each firm's optimal scale can be solved by profit maximization:

$$\left(\frac{Y_i}{A_i}\right)^{\frac{1}{\gamma}} = \left(\frac{PA_i\alpha\gamma}{w^{\alpha}R^{1-\alpha}}\right)^{\frac{1}{1-\gamma}} \left(\frac{1-\alpha}{\alpha}\right)^{\frac{1-\alpha}{1-\gamma}} \left[\frac{\left(1+\tau_{K_i}\right)^{\alpha-1}}{\left(1+\tau_{L_i}\right)^{\alpha}}\right]^{\frac{1}{1-\gamma}}.$$

Each firm's labor demand and capital demand can be represented by functions of labor distortion and capital distortion. For instance, given an optimal scale, firm i's labor demand will decrease with a higher real wage rate, and firm i's capital demand will decrease with a higher real interest rate; that is,

$$L_i^* = \left(\frac{Y_i}{A_i}\right)^{\frac{1}{\gamma}} \left[\frac{\left(1+\tau_{L_i}\right)w}{\left(1+\tau_{K_i}\right)R}\right]^{\alpha-1} \left(\frac{1-\alpha}{\alpha}\right)^{\alpha-1} \text{ and}$$

$$K_i^* = \left(\frac{Y_i}{A_i}\right)^{\frac{1}{\gamma}} \left[\frac{\left(1+\tau_{L_i}\right)w}{\left(1+\tau_{K_i}\right)R}\right]^{\alpha} \left(\frac{1-\alpha}{\alpha}\right)^{\alpha}.$$

To estimate the marginal effect of factor distortions, we lay out a decrease in labor distortion and capital distortion respectively, then reallocate the resources in the industry to compute the variety in aggregate output. The following takes capital distortion as an illustration, and the marginal effect of labor distortion can be measured by similar steps. First, we assume the capital distortion confronted by each firm decreases by 1%. For instance, firm i originally dealt with the capital distortion measured by 1.2, and now the capital distortion decreases to 1.188. Next, firm i's labor demand and capital demand will vary with the capital distortion. Along with the decrease in the actual capital cost, the proportion of labor input will decrease and the proportion of capital input will increase. Finally, the resources are reallocated to each firm by the distribution according to the decrease in capital distortion across all firms, then we can evaluate the variation of aggregate output in the electronics industry.

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4.6 Factors of Production Inefficiency

Based on the analysis in section 4.4 and section 4.5, we can now disclose the efficiency in the electronics industry and assess the marginal effect of both labor distortion and capital distortion. The next question is: what is the relationship between the firms' productivity and the labor market barriers? Before the reform of accounting standards in 2008, the companies with higher-priced shares could elevate employees' real compensation at lower costs relative to competitors. The stock bonus could in turn be deemed a subsidy to those companies that have a higher share price. In this section, we provide a regression to verify whether the level of labor distortions softened after the accounting regulatory reform.

$$
\begin{aligned}
1+\tau_{L_i} = {} & \alpha + \beta_1 Share_{price_{it}} * before + \beta_2 Share_{price_{it}} * after \\
& + \beta_3 TFPQ_{it} * before + \beta_4 TFPQ_{it} * after + X_{it} + Firm_i \\
& + Year_t + \varepsilon_{it}
\end{aligned}
\quad (21)
$$

Equation (21) shows the relationship between firms' labor distortion, share price, and TFPQ before and after 2008. $(1+\tau_{L_i})W$ is the actual labor cost, so higher τ_{L_i} means that firm i encounters a higher cost to pay the employees; $before$ and $after$ are dummy variables, $before$ equals 1 and $after$ equals 0 before 2008; $before$ is equal to 0 and $after$ is equal to 1 after 2008. $Share\_price_{it}$ is the last transacted price of a security in each year. $TFPQ_{it}$ is each firm's physical productivity, which is defined in equation (15). X_{it} includes all the control variables about business scale, financial ratios, stock value, and ownership. $Firm_i$ is the dummy variable of each firm, and $Year_t$ is the dummy variable of each year in our dataset. ε_{it} is the error term. In Equation (21), we expect to observe that β_2 should be greater than β_1, and β_3 should be greater than β_4. This implies that the subsidy to firms with higher share prices has decreased and the labor resource has been assigned to higher productivity firms after

DOI:10.6814/NCCU202100891

the reform of accounting standards in 2008.

Chapter 5. Results

In this chapter, we divide our results into four parts. Section 5.1 shows the production allocation efficiency measurement from 2002 to 2019. Section 5.2 provides a measurement of the marginal contribution of resource misallocation to industrial manufacturing productivity. We verify the decrease in labor distortion after the reform of accounting standards in section 5.3. Finally, section 5.4. conducts robustness tests of our results.

5.1 Efficiency Measurement

Figure shows the production efficiency (Y_R) estimated in equation (20) from 2002 to 2019. Y_R is the ratio of the actual output (Y) divided by the output without distortions ($Y_{efficient}$), which is between 0 and 1. The lower the distortions in the industry, the closer this ratio is to 1. Note that Y_R is distributed between 0.5519 and 0.6538 from 2002 to 2010, then drops after 2011 and varies between 0.3919 and 0.5348. The resource misallocation reflects various distortion factors in the industry; the industrial structure might have a transformation after 2010 that leads to inefficiencies, such as technical progress, industrial concentration, industrial scale, and the percentage of foreign ownership. However, in this study, we focus on the effect of the accounting regulatory reform on the labor market. The distortions in the labor market and the capital market will be examined separately in the following section, and then we will zoom in on the labor distortion in section 5.3.

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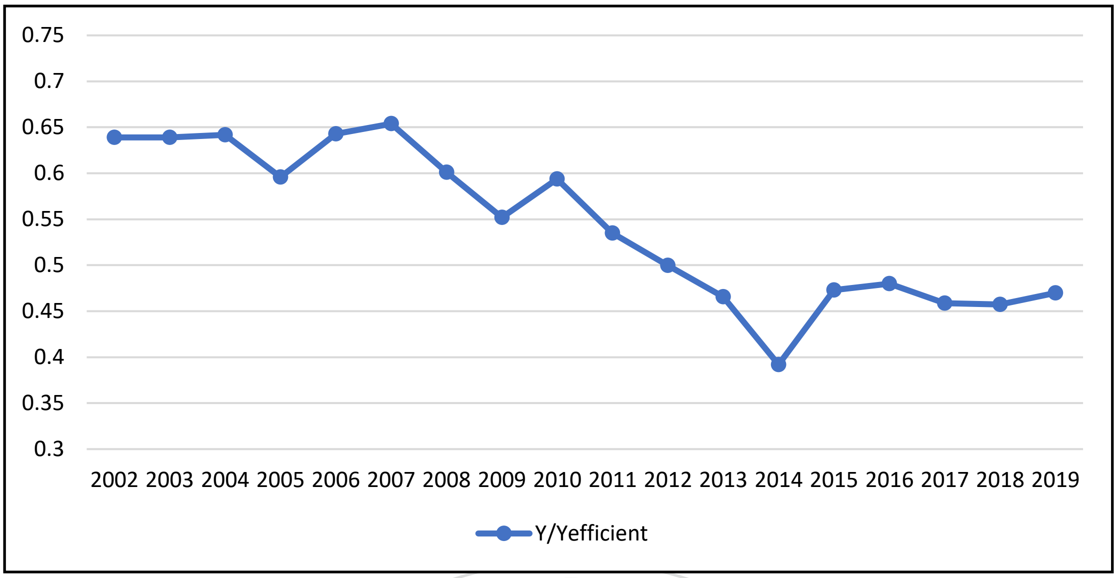

Figure 2. The Production Allocation Efficiency Measurement

Source: Organized by this article

5.2 Marginal effect of distortions

To estimate the marginal effect of labor distortion and capital distortion, we separately decrease the labor distortion and the capital distortion by 1% and reallocate the resources in the industry accordingly to compute the variation in aggregate output. In Figure, the marginal output of labor distortion is distributed between 0.0045 and 0.0143 and the marginal output of capital distortion is distributed between 0.0036 and 0.0078. Figure shows that the marginal output of labor distortion steadily lies above the marginal output of capital distortion from 2002 to 2019. Higher marginal output implies that a reduction in labor distortion could enhance the aggregate output at a higher ratio compared to the reduction in capital distortion. We now jump into our core issue to figure out the labor distortion in section 5.3.

DOI:10.6814/NCCU202100891

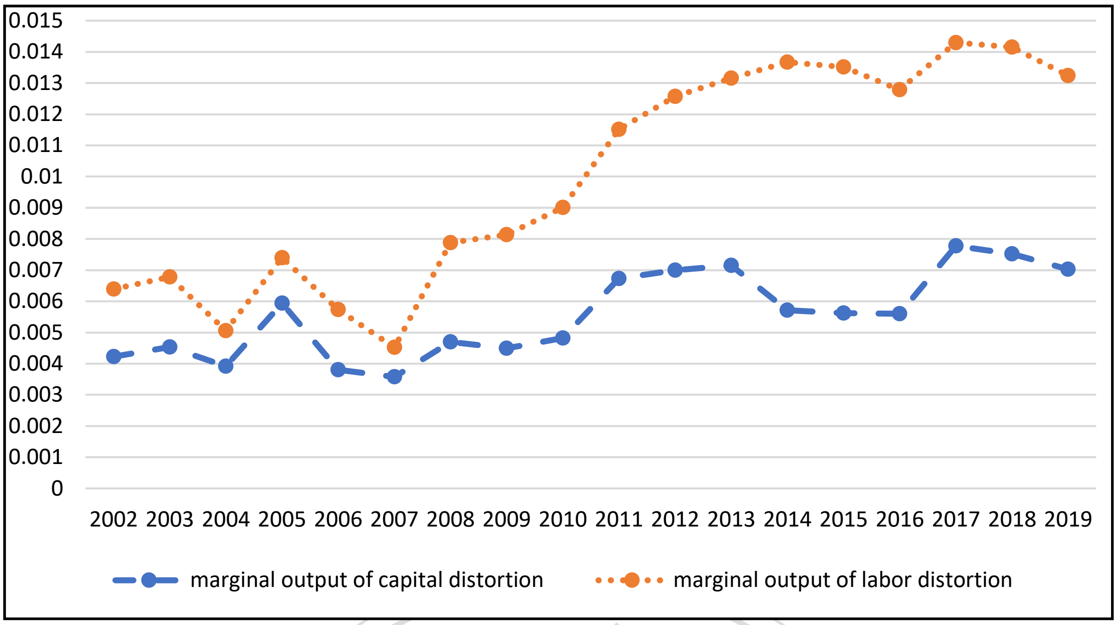

Figure 3. Marginal effects of labor distortion and capital distortion

Source: Organized by this article

5.3 Factors of Production Inefficiency

The reform of accounting standards about employee stock bonuses in 2008 has had a gigantic effect on companies that have relied on employee stock bonuses. The previously favorable accounting standards subsidized those companies which had a high share price, even if their productivity was low. However, this subsidization no longer exists after the reform in 2008. We can gauge the relationship between the labor distortion and other factors after controlling for the firms' characteristics through equation (21), among which the differences between β_1, β_2, β_3, and β_4 are our main concerns.

Column (1) in Table 6 shows a negative relationship between share price and labor costs after 2008, which means that the companies with a higher share price confront lower labor costs. Column (2) in Table 6 shows a positive relationship between TFPQ and labor cost. Companies with a higher TFPQ confront a lower labor cost after 2008 compared to the one before 2008. However, as we show in Table 7, there is a positive

DOI:10.6814/NCCU202100891

relationship between TFPQ and share price, and those which have a higher TFPQ tend to have a higher share price, both before and after 2008. Column (3) in Table 6 regresses labor costs on both share price and TFPQ, which shows that companies with a higher share price confront a higher labor cost after 2008, and there is no more subsidy to the firms which have a higher share price. Furthermore, companies with a higher TFPQ confront a lower labor cost after 2008 compared to that before 2008, which implies that the labor resources are reallocated to companies with higher productivity.

Firms' characteristics and year fixed effect are separately controlled for in column (4) and column (5), while column (6) shows the result which jointly controls for the firm fixed effect and the year effect. Column (6) in Table 6 shows that companies with a higher share price confronted a lower labor cost before 2008 compared to the labor cost after 2008, which implies that the subsidy was suspended after 2008; furthermore, the difference before and after 2008 is significant at the 0.01 level. It also shows that there is a positive relationship between TFPQ and labor cost before and after 2008; however, the labor cost is slightly lower after 2008, which means that the companies with higher productivity face a lower labor cost after 2008. These results are in line with our hypothesis about these favorable accounting standards. That is, the accounting practice not only can be misleading and lack transparency for outside shareholders, but also leads to the prevalence of adopting employee stock bonuses, which in turn causes resource misallocation in the labor market. The results with setting other parameter values are quite similar to those in Table 6, which will be shown in the following section.

DOI:10.6814/NCCU202100891

Table 6. Regression Results: Factors of Production Inefficiency

Source: Organized by this article

	(1)	(2)	(3)	(4)	(5)	(6)
Share_price*before2008	0.000407		-0.000448*	-0.00157***	-0.000895***	-0.00183***
	0.000446		0.000262	0.000553	0.00023	0.00055
Share_price*after2008	-0.00289***		0.000541***	0.00112***	0.000514***	0.00111***
	0.000381		0.000185	0.00034	0.000181	0.000346
TFPQ*before2008		0.0750***	0.0762***	0.0993***	0.0727***	0.0978***
		0.00224	0.00233	0.0059	0.00229	0.00566
TFPQ*after2008		0.0734***	0.0736***	0.0932***	0.0756***	0.0953***
		0.00299	0.00305	0.00697	0.00331	0.00726
Business Scale	✓	✓	✓	✓	✓	✓
Financial Ratios	✓	✓	✓	✓	✓	✓
Stock Value	✓	✓	✓	✓	✓	✓
Ownership	✓	✓	✓	✓	✓	✓
Firm_fixed effect				✓		✓
Year_fixed effect					✓	✓
Observations	10332	10332	10332	10332	10332	10332
R-squared	0.21	0.693	0.694	0.824	0.699	0.829

Robust standard errors in parentheses

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

DOI:10.6814/NCCU202100891

Table 7. Regression Results: TFPQ vs. Share Price

Source: Organized by this article

	(1) Before 2008	(2) After 2008	(3) All
Constant	20.60***	-10.53*	-1.354
	2.397	5.857	4.205
TFPQ_EX	0.642***	3.388***	2.559***
	0.14	0.482	0.34
Observations	2813	8750	11563
R-squared	0.012	0.07	0.052

Robust standard errors in parentheses

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

5.4 Robustness checks

In this section, we perform several robustness checks. A placebo test is performed to check other mechanisms, which labor distortion would be affected. We also present the results in which the distortions are estimated by share price without adjustment. In addition, the following sensitivity exercises are shown to verify the results when we adjust the labor share parameter (α) and Lucas span-of-control parameter (γ) in our calculations.

The placebo test in Table 8 addresses the concern about other potential factors that also lead to the decrease in labor distortion after 2008. Following the approach in Eggers, Tuñón and Dafoe (2021), we reproduce our core analysis (labor distortion) with an alternative outcome variable (capital distortion), which allows us to test whether there exist other mechanisms that could also affect capital distortion. Table 8 doesn't show the same pattern as in Table 6, as we can't observe a decrease in capital distortion after 2008. This implies that we can rule out the possibility that the decrease in labor distortion after 2008 was due to other factors which also affect the capital market.

DOI:10.6814/NCCU202100891

In our main results, we use adjusted share price to calculate the distortions in our model for consistency. Besides the difference in the lock-up period of ESB and ex-dividend date, the issuance pattern of ESB also varies from firm to firm. The difficulty in identifying actual labor compensation value leads us to adopt the last transacted ex-dividend price of a security in each year as our second-best choice. However, we also have the last transacted price without adjustment in our data which can be used to calculate the distortions as a robustness check. The usage of the non-adjusted share price is also reasonable, since the utility of ESB for each employee may be calculated by the market price before the adjustment even if they haven't got the bonuses yet. Table 9 shows the results in which the distortions are calculated by the last transacted price without adjustment, which have similar patterns compared to the results in Table 6.

Finally, to consolidate the robustness of our estimations, we also consider alternative parameter values of $\gamma = 0.7$, $\gamma = 0.75$, $\gamma = 0.85$, $\gamma = 0.9$, $\alpha = 0.5$, $\alpha = 0.55$, $\alpha = 0.65$, and $\alpha = 0.7$ respectively from column (1) to column (8) in Table 10. The different settings of gamma and alpha will affect the numerical values of the coefficients in our regressions, but the patterns of decrease in labor distortion are roughly the same as our main result presented in Table 6.

DOI:10.6814/NCCU202100891

Table 8. Placebo Test: Regressions of Capital Distortion

Source: Organized by this article

	(1)	(2)	(3)	(4)	(5)	(6)
Share_price*before2008	-0.000942***		-0.000373***	-0.000386	-0.000540***	-0.000564
	0.000193		0.00014	0.000329	0.000146	0.000343
Share_price*after2008	-0.00178***		-0.000954***	-0.00102***	-0.000876***	-0.000904***
	0.000216		0.000179	0.000264	0.000175	0.000256
TFPQ*before2008		0.0198***	0.0184***	0.0309***	0.0174***	0.0297***
		0.000904	0.000858	0.00169	0.000834	0.00156
TFPQ*after2008		0.0254***	0.0247***	0.0353***	0.0251***	0.0357***
		0.00124	0.00119	0.00195	0.00132	0.00208
Business Scale	✓	✓	✓	✓	✓	✓
Financial Ratios	✓	✓	✓	✓	✓	✓
Stock Value	✓	✓	✓	✓	✓	✓
Ownership	✓	✓	✓	✓	✓	✓
Firm_fixed effect				✓		✓
Year_fixed effect					✓	✓
Observations	10,332	10,332	10,332	10,332	10,332	10,332
R-squared	0.669	0.762	0.766	0.894	0.769	0.897

Robust standard errors in parentheses

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

DOI:10.6814/NCCU202100891

Table 9. Results: Adopting Share Price Without Adjustment to Calculate Distortions

Source: Organized by this article

	(1)	(2)	(3)	(4)	(5)	(6)
Share_price*before2008	0.00129**		0.000141	-0.00123**	-0.000198	-0.00143***
	0.000544		0.000232	0.000535	0.000195	0.000535
Share_price*after2008	-0.00205***		0.000751***	0.00115***	0.000746***	0.00113***
	0.000324		0.000171	0.00031	0.000168	0.000317
TFPQ*before2008		0.0739***	0.0750***	0.0983***	0.0717***	0.0971***
		0.00224	0.00231	0.00594	0.00228	0.00572
TFPQ*after2008		0.0740***	0.0744***	0.0933***	0.0763***	0.0952***
		0.00294	0.00298	0.00676	0.00325	0.00708
Business Scale	✓	✓	✓	✓	✓	✓
Financial Ratios	✓	✓	✓	✓	✓	✓
Stock Value	✓	✓	✓	✓	✓	✓
Ownership	✓	✓	✓	✓	✓	✓
Firm_fixed effect				✓		✓
Year_fixed effect					✓	✓
Observations	10332	10332	10332	10332	10332	10332
R-squared	0.176	0.682	0.683	0.818	0.687	0.822

Robust standard errors in parentheses

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

DOI:10.6814/NCCU202100891

Table 10. Robustness Tests: Setting Different Parameters

Source: Organized by this article

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	$\gamma = 0.7$	$\gamma = 0.75$	$\gamma = 0.85$	$\gamma = 0.9$	$\alpha = 0.5$	$\alpha = 0.55$	$\alpha = 0.65$	$\alpha = 0.7$
Share_price*before2008	-0.00234***	-0.00217***	-0.00130**	-0.000609	-0.00156***	-0.00167***	-0.00189***	-0.00201***
	0.000574	0.000573	0.000518	0.000512	0.000371	0.000433	0.000606	0.000726
Share_price*after2008	0.000179	0.000625**	0.00156***	0.00191***	0.000673***	0.000840***	0.00122***	0.00143***
	0.000291	0.000313	0.000392	0.000448	0.0002	0.000251	0.000391	0.000484
TFPQ*before2008	0.0135***	0.0370***	0.248***	0.601***	0.0848***	0.0904***	0.100***	0.105***
	0.000886	0.0023	0.0132	0.0295	0.00447	0.00493	0.00596	0.00649
TFPQ*after2008	0.0127***	0.0356***	0.243***	0.592***	0.0791***	0.0859***	0.0989***	0.105***
	0.00104	0.00283	0.0177	0.0412	0.0052	0.00598	0.00781	0.00884
Business Scale	✓	✓	✓	✓	✓	✓	✓	✓
Financial Ratios	✓	✓	✓	✓	✓	✓	✓	✓
Stock Value	✓	✓	✓	✓	✓	✓	✓	✓
Ownership	✓	✓	✓	✓	✓	✓	✓	✓
Firm_fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Year_fixed effect	✓	✓	✓	✓	✓	✓	✓	✓
Observations	10,332	10,332	10,332	10,332	10,332	10,332	10,332	10,332
R-squared	0.761	0.795	0.86	0.885	0.797	0.81	0.836	0.849

Robust standard errors in parentheses

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

DOI:10.6814/NCCU202100891

Chapter 6. Conclusion

Broad-based employee stock ownership is a well-known profit-sharing plan long adopted by start-up companies and high-tech industries because firms of these two types face difficulty in monitoring employees. In the Taiwanese electronics industry, however, favorable accounting standards from the early eighties to 2008 provided another reason to execute employee stock bonuses (ESB). The lower cost of rewarding employees could be the reason why those high-tech firms heavily relied on using ESB for labor compensation. However, the accounting standards can be misleading and lack transparency for outside shareholders. On top of that, companies with a higher share price enjoy huge subsidies from stock markets on firms' labor hiring costs. Yet, a higher share price does not guarantee higher productivity. To comply with the International Accounting Standards, ESB have been recorded as expenses and valued at market prices rather than their par value since January 1st, 2008. This policy change allows us to examine empirically the effect of the favorable accounting standards of ESB on labor market distortion and on the production efficiency of the industry.

The accounting regulations favorable to ESB were practiced in Taiwan for nearly 30 years and caused a unique compensation structure in the Taiwanese electronics industry. Though plenty of studies have focused on the effectiveness of broad-based stock incentives, R&D expenditures, human resource management, and employee turnover, these studies have not provided a full policy reference on Taiwan's situation. This study complements previous research and focuses on the premium subsidy for higher share price companies and the effects on industry-level productivity. To capture the features of misallocation in the electronics industry, we propose a theoretical framework following Hsieh and Klenow (2009).

DOI:10.6814/NCCU202100891

There are three main points to highlight in our results. First, the production efficiency (Y_R) significantly decreases after 2010. Furthermore, a decrease in labor distortion provides higher marginal output than a decrease in capital distortion throughout our data period (2002-2019). Finally, we find that companies with a higher share price confronted a lower labor cost before 2008, and the companies with higher productivity have faced lower labor costs after 2008. This implies that the subsidy to companies having a higher share price was suspended after 2008, and the labor distortion has also decreased after the regulatory reform in 2008.

To sum up, our study applied a theoretical framework to investigate the industrial productivity affected by the reform of accounting standards in 2008, while previous studies mainly focus on the issue of individual firms. However, there are a few limitations in our study that could be overcome in further research. The dataset in this study only includes listed companies, and a dataset comprising the administrative Taiwan tax return data with all firms in the electronics industry might better represent the entire industry's structure. Moreover, our model only concerns the allocation of resources in a static market. Firms' entry and exit could be embedded in a dynamic general equilibrium model in future studies. In addition to these limitations, we also observed that the marginal output improvement from labor distortion has increased and the industrial efficiency has decreased after 2010; these features may be related to transformation in the electronics industry's structure that could be investigated in further studies.

DOI:10.6814/NCCU202100891

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