Mandated Benefits, Labor Costs, and Company Fixed Capital Investments*

Ping-Lung Hsin**, Tobias Haepp***, and Meng-Yu Tsai****

Abstract

In recent years, mandated benefits in Taiwan have increased significantly due to several policy reforms pertaining to social insurance and labor welfare. This has caused an increase in total labor costs, which may in turn cause a decrease in capital investments - a topic that has become an important policy issue. This research therefore uses data from Taiwanese stock market companies over the period from 2002 to 2012 in order to analyze the effect of mandated benefits on capital investments. To control for a bias possibly caused by unmeasurable heterogeneity, we employ a panel data fixed effect model. Moreover, we control for the endogeneity between mandated benefits and wages as well as for the traditional determinants

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of capital investments based on accelerator model, cash flow model, neoclassical model and Tobin's Q. According to our empirical research results, an increase in the mandated benefit ratio causes a reduction in company capital investments. We check the robustness of this result by employing the methodology proposed in Barslund et al. (2007) and find that the effect of mandated benefits on capital investments is negative and significant for all possible combinations of independent variables in all of our models.

Keywords: Mandated Benefits, Labor Costs, Fixed Capital Investment
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I. Introduction

To protect the economic security and well-being of the workers, Taiwanese policy makers have introduced several reforms pertaining to social insurance and labor welfare in recent years. As a result of these reforms, company mandated benefit expenditures have increased significantly. In particular, two policy shifts have had an immediate impact on the development of total company expenditures for mandated benefits. The first one is the Labor Pension Act introduced in 2004. According to the regulations, companies are required to make payments to a pension fund according to the defined contribution principle for new labor market entrants, while previous labor market entrants may choose between the new system and a defined benefit system which had been introduced in the Labor Standards Act. The new regulations require companies to contribute 6% of an insured person's monthly salary to the Labor Pension Fund and have induced a rise in non-wage labor costs during the two years after the introduction of the new law. Secondly, since 2008 premium rates for labor insurance have been raised. With previous rates at 7.5% of an insured person's salary, in July 2008 the authorities decided to successively increase the insurance premium by 0.5% annually until a 10% threshold rate was reached in 2013.[1] As a result, the current level of company mandated benefit expenditures, which also include severance pay, health insurance and employee welfare expenditures, therefore amounts to more than 15% of company wage expenditures.

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[1] The complete English versions of the related legal documents are provided by the Council of labor Affairs on its Law Source Retrieving System of labor Laws and Regulations (http://laws.cla.gov.tw) and the Bureau for Health Insurance (http://www.nhi.gov.tw).

While the reforms have improved the well-being of Taiwanese workers, at the same time they have also increased labor costs for Taiwanese companies. As a result of the reforms, total company expenditures for insurance premiums and pension contributions have risen by 28.9% between 2002 and 2012. According to previous findings in the literature, such an increase in labor costs due to mandated benefit and payroll tax system reforms exerts adverse effects on company labor input levels and wages (Baicker and Chandra, 2005; Kan and Lin, 2009). However, an analysis of the effect of mandated benefits on the other main factor of production - capital - via the fixed asset investment decision is missing to date. This effect may be of particular importance for the Taiwanese economy, since low levels of domestic capital investment in combination with a net outflow of international investments have become critical issues in recent years. Over most of the past decade, private investment rates in the manufacturing sector have been comparatively low and the capital stock of the manufacturing sector has grown at an annual average of 2.2% from 2002 until 2011 (at constant prices). The growth in domestic investment has been surpassed significantly by outward investment into other economies. Most notably, investment to mainland China has risen from US$ 4.5 billion to 12.2 billion, while investment to ASEAN economies has risen from US$ 1.05 to 2.13 billion over the same period. Moreover, despite providing a favorable overall investment climate[2], Taiwan has been unable to attract foreign capital at a significant scale and inward foreign investment currently amounts to about one fifth of outward direct investment.

Rising labor costs may be one reason behind capital outflows and low levels of capital investments in the Taiwanese economy. Wage costs are the major labor cost component, but wage growth has been notoriously stagnant during the past decade and is therefore an unlikely cause for these trends. On the other hand, mandated benefits have increased due to the recent social security reforms and are the major driving force behind the development of labor costs in Taiwan. Based on economic theory, we expect two effects that mandated benefits as dictated

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2 Taiwan is currently ranked 3rd globally in the BERI overall investment environment ranking (in 2012), 7th in the most recent IMD global competitiveness scoreboard (2013) and 13th in the WEF global competitiveness report (2013).

by policy makers exert on capital investment. The first one is a scale effect since an increase in mandated benefits puts a cost burden upon a company, in turn reducing overall company competitiveness and levels of output. Due to this scale effect, mandatory worker benefit payments may correlate with lower levels of capital investment. A second effect may occur in a situation where the increase in mandated benefits is not shifted backwards through wages and employment levels are affected. In this case, capital may be indirectly affected due to changes in company employment levels or labor utilization rates. The direction of the second effect then depends crucially on whether labor and capital are substitutes or complements in the production process. For a given level of productivity, a marginal increase in labor costs lowers the marginal return to labor. If labor and capital act as substitutes in the production process, higher non-wage labor costs therefore imply that the price of labor rises relative to that of capital, which induces a substitution effect that works towards an increase in capital investments. However, in a situation where the two factors are complements in production, the increase in labor costs indirectly reduces the return to capital and therefore lowers fixed asset investment. The overall effect of an increase in mandated benefits on capital investments therefore depends on the size of the scale effect and the size and direction of the second effect. The direction of the latter in turn depends on complementarity or substitutability between the two factors of production. The size of the overall effect therefore cannot be predicted on theoretical grounds and we intend to provide an answer based on our empirical analysis.

The rest of this paper is structured as follows. Section 0 develops the methodology for our panel data analysis. Section 0 introduces our dataset. Section 0 provides our empirical results and conducts several robustness checks, while section 0 concludes the paper.

II. Methodology

For our empirical analysis we construct a panel dataset of Taiwanese company data covering the mandated benefit reform period. The panel data structure of our dataset brings about the advantages of controlling for unobserved heterogeneity, reducing omitted variable bias and of providing a dynamic picture of what happens as companies adjust their mandated benefit rates to the requirements of policy makers over time. Within this basic framework, we then regress capital investment on mandated benefits and a set of control variables.

A. Dependent and Explanatory Variable

For our dependent variable we follow previous literature and calculate company investment rates as the purchase value of fixed assets from the current period divided by the company capital stock of the previous period (Bond et al., 2003; Becker and Jagadeesh, 2010). The level of investment spending is obtained directly from company accounts of sources and uses of funds, which is more accurate than inferring it from balance sheet data using the perpetual inventory method.[3] Since capital investments in any period add to the capital stock which is recorded at the end of the year, the capital stock from the previous period is used as normalization.

Regarding our explanatory variable, we pay attention to the fact that mandated benefit requirements in Taiwan are dictated by policy makers as a ratio of benefits to wages, which brings about a mathematical relationship between the levels of the two variables. This mathematical relationship would cause a multicollinearity problem for our regression coefficients if the variables were included simultaneously. In order to alleviate the multicollinearity issue, we focus on exogenous contribution rates and derive several instruments to measure the effect of the development in mandated benefit expenditures on capital investments in the next subsection. As explained in the introduction, the influence of mandated benefits may be either positive or negative, depending on whether the sum of the scale effect and a potential complementarity effect (negative) or a possible substitution effect (positive) dominates.

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[3] See Eberhardt and Helmers (2010) for a brief discussion of the two methods.

B. Regression Specifications

The starting point for the construction of our explanatory variables measuring the development of the mandated benefit regulations during our study period is to obtain the mandated benefit contribution rates from the websites of the authorities. The annual contribution rates are displayed in table 1 below. The development of the contribution rates for labor insurance, health insurance and pension fund contribution reflects the exogenous policy shifts explained in the introduction. We then calculate the exogenous mandated benefit contribution rate (*EMCR*) as the sum of the three individual contribution rates. In order to assess the effect of the exogenous mandated benefit rate as determined by policy makers on company capital investments, we then estimate the following regression:

$$I_{it} = \alpha_{0i} + \alpha_1 EMCR_t + \alpha_2 V_{it} + \alpha_3 W_{it} + \alpha_4 Y_{it} + \alpha_5 C_{it} + \alpha_6 U_{it} + \alpha_7 Q_{it} + \alpha_8 I_{it} + \alpha_9 I_{it}^2 + \varepsilon_{it} \quad (1)$$

where the subscript i identifies companies and t are the years covered. The variable I is the investment rate and the variables on the second line are control variables containing other labor costs, determinants based on different theories for capital investment and lagged dependent variables as will be explained in subsection C below. The letter ε denotes a stochastic error term.

Results based on the model above can provide a first indication of the direction of the effect of mandated benefits on capital investments. However, the policy shifts which alter the exogenous mandated benefit rate employed above affect the company investment decision via the actual expenditures incurred by companies. While *EMCR* differs only over time but not between companies, the realized mandated benefit expenditures differ between companies due to factors such as the incidence of an upper limit on insurance salaries.[4] The actual mandated

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[4] Current lower and upper bounds for insurance salaries are NT$ 18,780 and NT$ 43,900 for labor insurance, NT$ 18,780 and NT$ 182,000 for health insurance and NT$ 1,500 and NT$ 150,000 for pension fund contributions. The upper bound on insurance salary for labor insurance is most relevant for our dataset.

benefit ratio *MR* calculated as mandated benefit expenditures per worker divided by the average wage per worker is therefore the second instrument we employ. The estimation equation takes the following form:

Table 1 Annual company level exogenous mandated benefit contribution rates (% of wages)

Year	Labor Insurance Premium	Health Insurance Premium	Pension Fund Contribution Rate	Total exogenous mandated benefit contribution rate (EMCR)
2003	4.550	2.730	2.000	9.280
2004	4.550	2.730	2.000	9.280
2005	4.550	2.730	6.000	13.280
2006	4.550	2.730	6.000	13.280
2007	4.550	2.730	6.000	13.280
2008	4.550	2.730	6.000	13.280
2009	5.250	2.730	6.000	13.980
2010	5.250	3.102	6.000	14.352
2011	5.600	3.102	6.000	14.702
2012	5.950	3.102	6.000	15.052

Note: Labor insurance and pension fund contribution rates have been obtained from the Bureau of Labor Insurance Website (www.bli.gov.tw). Health Insurance rates have been obtained from the National Health Insurance administration website (www.nhi.gov.tw). The mandated range for pension fund contribution rates was between 2% and 15% prior to the reform in 2004. Since 2% was the strict lower limit, we consider this the exogenous part. Company insurance premium rates are calculated as the insurance premium rate multiplied by the share to be borne by employers, which is 70% for labor insurance premiums and 60% for health insurance premiums.

$$I_{it} = \beta_{0i} + \beta_1 MR_{it} + \beta_2 V_{it} + \beta_3 W_{it} + \beta_4 Y_{it} + \beta_5 C_{it} + \beta_6 U_{it} + \beta_7 Q_{it} + \beta_8 I_{it} + \beta_9 I_{it}^2 + \zeta_{it} \qquad (2)$$

While the above equation reflects the actual mandated benefit expenditure situation of the companies more accurately, this specification has introduced a multicollinearity problem due to the mathematical interrelation between mandated benefits and wages. In order to treat the multicollinearity issue in the above equation, we use the exogenous mandated benefit contribution rate to predict the actual mandated benefit ratio for each company in our next specification. In order to generate our final exogenous instrument, we thus regress the actual mandated benefit expenditure ratio *MR* on *EMCR* and a constant. The constant term accounts for company specific factors, such as the incidence of upper limits on insurance salaries mentioned above. The regression is as follows:

$$MR_{it} = \gamma_{0i} + \gamma_1 EMCR_t + \eta_{it} \tag{3a}$$

To complete our estimation we then include the predicted value of the mandated benefit ratio from the above regression ($\widehat{MR}$) as instrumental variable in our capital investment regression as follows:

$$I_{it} = \delta_{0i} + \delta_1 \widehat{MR}_t + \delta_2 V_{it} + \delta_3 W_{it} + \delta_4 Y_{it} + \delta_5 C_{it} + \delta_6 U_{it} + \delta_7 Q_{it} + \delta_8 I_{it} + \delta_9 I_{it}^2 + \theta_{it} \tag{3b}$$

The final issue to be resolved is that the above equations do not account for the endogenous interaction of the variables as predicted by the theory of compensating wage differentials. According to the theory of compensating wage differentials, an increase in mandated benefits causes a decrease in wages (Rosen, 1974, 1986). We therefore estimate first-stage regressions with changes in the wage level as dependent variable and changes in our mandated benefit indicator as explanatory variable. We use this specification to predict the wage residual $\widehat{W}$ as the part of wage expenditures that cannot be explained by changes in our mandated benefit indicator used in each of our regression specifications. We then use the wage residuals as instruments to replace the wage level from company accounts. Regressions (4), (5) and (6) are therefore analogous to equations (1), (2) and (3), respectively. In each of the former estimations, income statement wage expenditures are replaced by wage residuals accounting for the incidence of compensating wage differentials. The complete derivation of our estimation procedure and first stage estimation results for the wage residuals are shown in the appendix.[5] The final stage estimations for our investment regressions accounting for compensating wage differentials take the following form:

$$I_{it} = \alpha_{0i} + \alpha_1 EMCR_t + \alpha_2 V_{it} + \alpha_3 \widehat{W}_{it} + \alpha_4 Y_{it} + \alpha_5 C_{it} + \alpha_6 U_{it} + \alpha_7 Q_{it} + \alpha_8 I_{it} + \alpha_9 I_{it}^2 + \varepsilon_{it} \quad (4)$$

$$I_{it} = \beta_{0i} + \beta_1 MR_{it} + \beta_2 V_{it} + \beta_3 \widehat{W}_{it} + \beta_4 Y_{it} + \beta_5 C_{it} + \beta_6 U_{it} + \beta_7 Q_{it} + \beta_8 I_{it} + \beta_9 I_{it}^2 + \zeta_{it} \quad (5)$$

$$I_{it} = \delta_{0i} + \delta_1 \widehat{MR}_{it} + \delta_2 V_{it} + \delta_3 \widehat{W}_{it} + \delta_4 Y_{it} + \delta_5 C_{it} + \delta_6 U_{it} + \delta_7 Q_{it} + \delta_8 I_{it} + \delta_9 I_{it}^2 + \theta_{it} \quad (6)$$

C. Control Variables

a. Other labor cost components

We first introduce two other kinds of labor costs as our control variables. The first one are company expenditures for voluntary staff benefits. This variable includes payments for items related to employee welfare and allowances for food and transport. It also includes expenditures for employee training, which may be considered human capital investment from the point of view of the employer and a benefit from the perspective of the employee. While mandated and voluntary benefits are both non-wage labor costs from an accounting perspective, companies can exert significant leverage in adjusting the level of voluntary staff benefits without being restricted by government regulations such as in the case of mandated benefits. Since training expenditures reflect company investments in human capital, this variable may also correlate with company fixed capital investments based on evidence provided in the

[5] We also follow the same steps to test for compensating differentials of voluntary benefits in response to changes in mandated benefits. However, these were not found significant and we therefore retain the voluntary benefit variable calculated from income statement data in our regressions.

literature on capital-skill complementarity (Griliches, 1969; López-Bazo and Moreno, 2008). Due to the different nature of voluntary and mandated benefits, the inclusion of this voluntary benefit variable provides the most insightful unit of comparison to mandated benefits.

We then include the level of average wages in a company as our second labor related control variable. On the one hand, wages are a cost component in the production process and may therefore reduce funding available for other purposes, such as capital investments. On the other hand, the average wage level of a company also reflects the human capital endowment of the workforce and higher levels of human capital raise the return on investment in physical capital. Based on the theory of efficiency wages, companies may also pay higher wages in order to increase worker productivity (Shapiro and Stiglitz, 1984). Since the efficiency effect in combination with the human capital effect and the cost effect are potentially offsetting, the overall effect of changes in the wage level cannot be predicted on theoretical grounds.

b. Traditional determinants from theories of company investment

The remaining control variables are based on different models for the determinants of capital investments.[6] We first include the change in the logarithm of company output as put forward in the accelerator model (Clark, 1917; Chenery, 1952). According to the theory, changes in investment respond to fluctuations in output since inputs are used in a fixed proportion and their level increases with company output. The second control variable is based on cash flow models of investment (Tinbergen, 1938; Kalecki, 1949). Cash flow levels are a source of internal finance for company capital investments. Moreover, higher cash flow levels also improve collateral firm value and therefore the ability to raise external financing (Carpenter and Guariglia, 2008). In the calculation of this variable, we pay attention to the endogeneity problem between cash flows and capital investments by only including cash flows from financing and operations. Since capital investments are a cash outflow within company cash flows from investment activities, we exclude this part of company cash flows. Thirdly, according to the neoclassical model of company investments (Jorgenson, 1963; Hall and Jorgenson, 1967), investment levels are determined by the shadow price of capital, which is the sum of the price of money and the relative price of capital. We calculate the user cost of capital as the sum of company interest and depreciation expenditures.[7] Moreover, we include Tobin's Q (Tobin, 1969, 1982), which introduces the perspective of an investor into an analysis of the determinants of investments. According to the logic of the approach, managers rank investment projects according to their expected rate of return and execute those with higher returns first until the marginal rate of return of the remaining projects equals the market price of capital. Accordingly, the higher the expected rate of return of a company's assets - i.e. its market value - the more capital assets will be purchased by the company.[8] We follow the approach adopted in Bond et al. (2003) and include the lagged investment rate and its square as our final two control variables in order to capture the dynamics of the investment process over time. A positive coefficient is expected for the lagged value and a negative coefficient for its square. Our variable definitions and the predicted signs of the coefficients are summarized in table 2.

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[6] See Blanchard et al. (1993) and Samuel (1998) for reviews of these theories.

[7] According to the theoretical models, changes in the real price of capital goods also add to the shadow price of capital. However, since no company level data are available regarding this variable, we exclude it from the analysis.

[8] We use the approximation method proposed by Chung and Pruitt (1994) and calculate the value of Tobin's Q as the sum of common stock market value, preferred stock market value and debts outstanding, divided by the value of a company's total assets. According to their research, this method explains at least 96.6% of the variability of complex calculation methods for Tobin's Q.

Table 2 Variable definitions and expected signs of the coefficients

Variable (Notation)	Definition	Sign
Capital investment rate (I_t)	Fixed asset purchases$_t$ / capital stock$_{t-1}$	
Mandated benefits (M)	(Insurance + pension expenses) / worker	+ / -
Voluntary benefits (V)	Voluntary non-wage labor expenses / worker	+
Wages (W)	Wage costs per worker	+ / -
Change in Output (Y)	Change in operating revenues	+
Cash flow (C)	Cash flow from operations and financing	+
User cost of capital (U)	Interest payments + depreciation	-
Tobin's Q (Q)	(Total stock value + debt) / nominal assets	+
Capital investment rate$_{t-1}$ (I_{t-1})	Fixed asset purchases$_{t-1}$ / capital stock$_{t-2}$	+
Capital investment rate$_{t-1}^2$ (I_{t-1}^2)	(Fixed asset purchases$_{t-1}$ / capital stock$_{t-2}$)^2	-

Note: Variable definitions and signs of coefficiente as outlined in section II.

III. Dataset

Our dataset has been compiled by the Taiwan Economic Journal (TEJ) and consists of all manufacturing sector companies registered at the Taiwan stock exchange (TSE), the over-the-counter exchange (OTC) as well as the emerging stocks over-the counter exchange (ROTC).[9] Since the TEJ database contains all values disclosed in company balance sheets and income statements, it allows us to calculate the whole range of control variables based on theories of investment discussed in the preceding section. We then follow the standard procedure in the literature using company level data sets and delete the outlying 1% of data points of our dependent variable.[10] Stock market values for the calculation of Tobin's Q are obtained from a supplementary database also provided by TEJ, but are unavailable for a few

9 Other recent academic work using this database includes Yang et al. (2010) and Tsou et al. (2013).

10 These outliers are typically caused by data reporting errors or idiosyncratic events in a specific year, see for example International Study Group on Exports and Productivity (2008).

companies, especially from the OTC and ROTC markets in earlier years. To be able to make use of the information contained in the other variables for these company-year observations, we replace the values of Tobin's Q by making use of the information of Tobin's Q for the company in other years and the annual mean values for Tobin's Q in the whole market.[11] We will address how the random inclusion or exclusion of regressors affects our results in the robustness checks in section IV. Our final dataset consists of a total of 12,604 company-year observations. Summary statistics for our variables are shown in table 3.

Table 3 Summary statistics

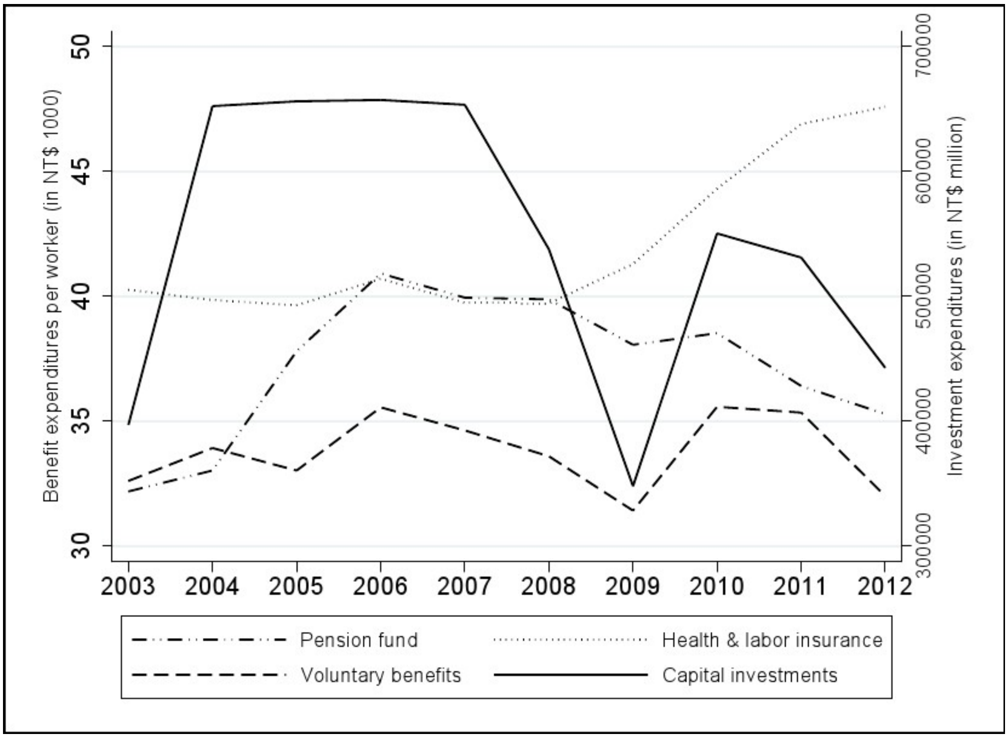
Variable	Mean	Std.Dev.	Min.	Max.	Obs.
Capital investment rate	0.224	0.364	0	3.520	12604
Mandated benefits/ labor	79.758	41.158	3.045	1676.389	12604
Voluntary benefits/labor	33.699	55.278	0	241.917	12604
Mandated benefits/wages	0.135	0.056	0.017	2.790	12604
Voluntary benefits/wages	0.060	0.095	0	4.107	12604
Wages/labor	620.859	271.531	80.291	6808.551	12604
Company output	8912.909	58433.672	0.017	2830812.500	12604
Cash flows	766.195	5630.622	-25341.611	233779.141	12604
User cost of capital	479.068	3479.843	0.027	108205.867	12604
Tobin's Q	14.232	15.768	0.048	553.834	12604

Note: Output, cash flows and the user cost of capital are measured in million NT$. Benefits and average wages are measured in thousand NT$.

[11] We first calculate annual mean values for Tobin's Q and the overall mean value for Tobin's Q for each industry. We then use the available values for Tobin's Q for the companies with missing company-year observations and multiply these by the ratio of the industry mean value in the year to be replaced divided by the average industry mean value of the years with available values.

Besides the summary statistics shown above, the way our data evolve over time is of particular importance for the estimation of the effects of the policies discussed on the development of investment rates. Figure 1 below shows the development of the two types of mandated benefits included in our study, as well as voluntary benefits and the development of capital investment levels over time. The development of our company data on the two categories of mandated benefits reflects the two policy shifts discussed in the introduction. In response to the pension system reform in 2004, annual pension expenditures per worker rose from NT$ 33,027 to NT$ 40,919 in the two subsequent years and have displayed a downward trend in the years thereafter. After the implementation of the new labor insurance premium rates in 2008, company insurance payments have subsequently been rising gradually from a level of NT$ 39,725 up to NT$ 47,593 annually per worker in 2012. For our regression analysis we construct our explanatory variable as the sum of mandated benefit expenditures through company labor and health insurance expenditures and pension plan expenditures as required by policy makers through the regulations outlined in the introduction. Due to the two policy shifts implemented between 2003 and 2012, company average annual mandated benefit expenditures per worker have risen from NT$ 72,455 to NT$ 82,878, which is an overall increase of 14.4%.

In addition to the mandated benefit expenditures, we also obtain data on voluntary benefit expenditures which are not mandated by policy makers. Voluntary benefits were at an annual level of NT$ 32,610 per worker in 2003 and remained around a similar level in the following years, but then responded sharply to the general contraction of economic activity during the recent recession. After dropping to NT$ 31,423 in 2009, voluntary benefit expenditures recovered back to a level of NT$ 35,346 in 2011, before dropping to NT$ 32,005 in 2012. The change in voluntary worker benefit expenditures during the recession shows that managers decided to reduce the part of the non-wage labor costs that they could influence during the slowdown of overall economic activity. However, since the introduction of higher labor insurance premium rates after 2008 partly coincided with the economic recession, insurance premium expenditures increased even during the recession years.



Note: All NT$-values have been deflated to the price level in 2002.

Figure 1 Expenditures for investment, mandated and voluntary benefits over time.

The dashed line in figure 1 displays data on company capital investment expenditures from the fixed asset investment expenses section in company cash flow statements. Overall, company capital investment levels have displayed a downward trend since 2004, with the only notably increase in the recovery year after the global recession. Starting from a level of NT$ 652 million in 2004, company level investment dropped to NT$ 348 million in 2009. During the recovery years in 2010 and 2011, investment rose to about NT$ 540 million, before dropping to NT$ 442 million in 2012. Notably, the development of investment rates follows a path similar to the voluntary labor benefit expenditures, in particular since the recession in 2009.

IV. Empirical Results and Robustness Checks

A. Empirical Model Results

The results of our regression models making use of the exogenous mandated benefit rate, the observed mandated benefit ratio, the predicted mandated benefit ratio as well as our final three models accounting for compensating wage differentials are shown in table 4 below. Across all six models, our mandated benefit indicators are found significant with a negative coefficient. Comparing model (1) and model (2), the second model has introduced a multicollinearity problem between the mandated benefit and the wage variable employed. Note that the average wage level is the denominator of the mandated benefit ratio and the two variables therefore correlate negatively. The correlation between wages and investment levels is positive. Since part of the wage effect is captured in our mandated benefit ratio coefficient, the multicollinearity hence results in a less negative and less significant regression coefficient for the mandated benefit ratio and an insignificant coefficient for average wages. This is resolved in model (3) which uses the mandated benefit ratio predicted by our exogenous instrument. In this model, wages are found significant and the mandated benefit variable is found significant at the highest level again. An increase in the absolute value of the mandated benefit coefficients can again be observed when we control the endogenous interaction between wages and mandated benefits by focusing on wage residuals rather than actual wage levels. Comparing each of the first three regressions to their counterparts amongst the final three regressions, the coefficient on our mandated benefit indicators turns more negative after removing the positive effect of wages on capital investments when controlling for compensating wage differentials.

Table 4 Results of panel data regressions

Dependent variable: capital investment rate	(1)	(2)	(3b)	(4)	(5)	(6)
Exogenous mandated benefit contribution rate	−1.602***			−1.615***		
	(0.000)			(0.000)		
Mandated benefits / wages		−0.139***			−0.148*	
		(0.056)			(0.035)	
Exogenous mandated benefit rate			−6.504***			−6.559***
			(0.000)			(0.000)
Voluntary benefits / wages	0.081*	0.086*	0.081*	0.081*	0.086*	0.081*
	(0.097)	(0.078)	(0.097)	(0.097)	(0.078)	(0.097)
Average wage	0.000**	0.000	0.000			
	(0.024)	(0.567)	(0.024)			
Wage residual (Model 4)				0.000**		
				(0.024)		
Wage residual (Model 5)					0.000	
					(0.567)	
Wage residual (Model 6)						0.000**
						(0.024)
Change in output	0.056***	0.064***	0.056***	0.056***	0.064***	0.056***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Cash flows	0.000***	0.000***	0.000***	0.000***	0.000***	0.000***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
User cost of capital	−0.000**	−0.000***	−0.000**	−0.000**	-0.000***	−0.000**
	(0.011)	(0.006)	(0.011)	(0.011)	(0.006)	(0.011)
Tobin's Q	0.094***	0.098***	0.094***	0.094***	0.098***	0.094***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Lagged capital investment rate	0.001	0.000	0.001	0.001	0.000	0.001
	(0.296)	(0.321)	(0.296)	(0.296)	(0.321)	(0.296)
Lagged capital investment rate squared	−0.000	−0.000	−0.000	−0.000	−0.000	−0.000
	(0.275)	(0.294)	(0.275)	(0.275)	(0.294)	(0.275)
Companies	1571	1571	1571	1571	1571	1571
Observations	10959	10959	10959	10959	10959	10959

Table 4 Results of panel data regressions (continue)

Dependent variable: capital investment rate						
	(1)	(2)	(3b)	(4)	(5)	(6)
Hausman test (χ^2)	46.47	42.92	40.42	56.66	63.68	49.63
Model selected	FE	FE	FE	FE	FE	FE
R^2 (overall)	0.083	0.087	0.083	0.083	0.087	0.083

Note: The symbols *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. P-values are shown in parentheses. All models also include a constant term.

Contrary to the effect of mandated benefits, our two other labor cost variables correlate positively with company investment rates. Our first labor cost control variable, the voluntary benefit ratio, is found significant in all model specifications. The Complementarity between investments in human and physical capital as previously found in the literature (López-Bazo and Moreno, 2008) or efficiency wages may account for the positive coefficient. Our second labor cost control variables are the company wage expenditures per worker. This variable is found significant in all model specifications except for the ones suffering from multicollinearity between the respective benefit variable and wages. Accordingly, the cost factor of wage expenditures is of minor importance and wages correlate positively with investment as they reflect the level of human capital endowment in the workforce. A higher level of human capital in turn raises the return to capital investments. An alternative interpretation is that wage levels reflect efficiency wages, which in turn raise labor productivity and the return to capital investments.

The signs and significance of our other control variables largely confirm previous findings in the literature on the determinants of capital investment. An increase in output, cash flow and Tobin's Q correlates with an increase in capital investment. An increase in the user cost of capital lowers capital investment. After accounting for various contemporary determinants of capital investments, the lagged investment rate and its square are not found significant.

B. Robustness checks

In this subsection, we adopt the procedure proposed in Barslund et al. (2007) and conduct a sensitivity analysis for our mandated benefit indicators used in each regression. For each of our six regression specifications, we retain the mandated benefit variable as our core variable and then randomly include all combinations of our control variables in order to test whether the random in or exclusion of controls affects the coefficient and significance of our mandated benefit indicator. For each of our six models, a total of 256 regressions are performed. The results of our sensitivity analysis are summarized in table 5.

For all regression models, the mandated benefit indicators are negative and significant at least at the 10%-level across all 1536 model specifications. For our regression specification in model (1) the mandated benefit ratio is found negative and significant at the 1%-level in all model specifications. Our second model has not fully resolved the multicollinearity problem between wages and mandated benefit expenditures which results in a reduction in the average significance of the mandated benefit variable. In this model the mandated benefit ratio is still significant at least at the 10%-level across all 256 specifications. Amongst these, it is significant at the 5%-level in 232 specifications and significant at the 1%-level in 184 specifications. The third model does not suffer from the multicollinearity and the predicted value of the mandated benefit ratio is again significant at the 1%-level across all model specifications. After taking compensating wage differentials into account in models (4), (5) and (6), the average significance level of model (5) is an improvement over model (2) and the significance level of the other two models remains at the highest level across all 256 combinations of control variables. In model (5), the mandated benefit ratio is now significant at the 5%-level in all specifications and at the 1%-level in 205 specifications. Our explanatory variable correlates negatively with capital investments across all regression specifications and the sign of the coefficients is always negative. The exogenous mandated benefit contribution rate and our instruments are found significant across all combinations for the inclusion and exclusion of control variables.

Table 5 Sensitivity analysis for coefficient of mandated benefit variables used

Model	Mean	Min.	Max.	% Sign.(10%)	% Sign.(5%)	%Sign.(1%)	%-	%+
(1)	–1.726	–2.233	–0.973	100	100	100	100	0
(2)	0.226	–0.409	–0.136	100	90.6	71.9	100	0
(3)	–7.008	–9.069	–3.952	100	100	100	100	0
(4)	–1.735	–2.258	–0.973	100	100	100	100	0
(5)	–0.233	–0.409	–0.142	100	100	80.1	100	0
(6)	–7.045	–9.170	–3.952	100	100	100	100	0

Note: Sensitivity analysis reports results from 256 regressions with random in-exclusion of control variables for each of the six models.

V. Conclusions and Discussion

Due to the recent policy reforms related to the social security system, mandated benefits have exhibited an upward trend in Taiwan. In our analysis we focus on changes in company expenditures for health and labor insurance as well as for pension contributions over a time span from 2003 until 2012. During our study period, company expenditures for the two categories of mandated benefits have risen by 28.9%. While the labor market effects of a government induced increase in mandated benefits have been covered extensively in the literature, in this paper we ask the question whether the policy shifts also affect company decisions about the other factor of production - capital - via the fixed asset investment decision. Based on economic theory, an increase in mandated benefits puts a cost burden upon a company that may trigger a negative overall scale effect, including a negative effect on investment. Moreover, depending on whether labor and capital are complements or substitutes in production, an increase in labor costs may also indirectly affect the marginal return to capital in either direction.

We use detailed information from the financial statements of Taiwanese stock market companies in order to disentangle the overall effect of an increase in mandated benefits on capital investments. Since mandated benefits are defined as a fraction of wages in the

Taiwanese labor market regulations, our first econometric specification includes uses the exogenous mandated benefit contribution rate which is calculated as the sum of labor insurance, health insurance and pension fund contribution payment contribution rates for companies. We then introduce the observed ratio of mandated benefit expenditures divided by company level wage expenditures obtained from income statement data in order to account for differences in actual ratios across companies in our second model. Since the second model has introduced a multicollinearity problem into our specification, we use the exogenous mandated benefit contribution rate in order to predict the realized values and include the predicted values as instrumental variable in our third regression. Our final three specifications are analogous to the first three, while the final ones also account for the role of compensating wage differentials by replacing income statement wage expenditures with wage residuals obtained after accounting for changes in each of our mandated benefit indicators.

Mandated benefits exert a negative and significant effect on fixed asset investment rates in all of our six model specifications. We further scrutinize these results via several robustness checks and conclude that our findings are robust across a range of different model specifications. The negative overall effect can be explained by a scale effect through the cost burden imposed on companies via mandated benefits that is a detrimental force for capital investment. An additional or alternative explanation is that capital and labor act as complements in the production process and an increase of labor costs at a given level of productivity bears an adverse impact on capital investments.

Interestingly, the two other labor cost variables which we introduce as controls - voluntary worker benefit expenditures and average wage levels - correlate positively with capital investments. The former result can be explained by a correlation between human capital and physical capital investments, either due to complementarity between the two types of investments or a simultaneous development over time as both variables follow the business cycle. Since wages are a measure of the level of skill endowment in the workforce, the latter results can be explained by the fact that an increase in the skill level of the work force increases the return to capital investments. Alternatively, higher wages can be interpreted as efficiency wages which raise labor productivity and the expected return to capital investments.

These results may also serve as a reference for policy makers in other economies, in particular from emerging economies undergoing reforms of the mandated benefit system similar to those currently implemented in Taiwan. Finally, our results may to some extent also reflect the effects of other labor regulations that increase the level of labor costs, such as minimum wage regulations, on the company capital investment decision. The direction of the effect found in our study is in line with the results in Rama (2001) who analyzes the effect of an increase in the minimum wage in Indonesia. Other research on this topic has concluded that the effect of an increase in the minimum wage is positive for OECD economies (Pischke, 2005), but insignificant for UK companies (Riley and Bondibene, 2013). The diversity of these findings in turn suggests that the effects differ across economies.

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Appendix

According to the theory of compensating wage differentials, wages (W) can be modelled as a function of an indicator for the level of mandated benefits (X). Since both of these variables follow a time trend, we derive the time-differenced version of this relationship as follows. We start from the initial equation:

$$W_{it} = \alpha_0 + \alpha_1 * X_{it} + \varepsilon_{it} \tag{A1}$$

And then obtain the lagged version of this equation as:

$$W_{it-1} = \alpha_0 + \alpha_1 * X_{it-1} + \varepsilon_{it-1} \tag{A2}$$

We then take differences to obtain:

$$\Delta W_{it} = \alpha_1 * X_{it} + \Delta \varepsilon_{it} \tag{A3}$$

Applying this procedure to each of our equations (4), (5) and (6) yields our first-stage estimation equations as follows:

$$\Delta W_{it} = \alpha_1 * \Delta EMCR_{it} + \Delta \varepsilon_{it} \tag{A4}$$

$$\Delta W_{it} = \alpha_1 * \Delta MR_{it} + \Delta \varepsilon_{it} \tag{A5}$$

For equation (6) we proceed analogous to estimation (3). We first estimate the effect of changes in *EMCR* on changes in mandated benefit expenditures (*M*).

$$\Delta M_{it} = \beta_1 * \Delta EMCR_{it} + \Delta \varepsilon_{it} \tag{A6}$$

We then use the time-differenced predicted values of the mandated benefit expenditures ($\widehat{M}$) to estimate the effect on changes in the wage level:

$$\Delta W_{it} = \alpha_1 * \Delta \widehat{M}_{it} + \Delta \varepsilon_{it} \tag{A7}$$

Our estimation results are shown in table 6 on the following page. After obtaining our estimates for the coefficient α_1, α_0 is calculated using mean values for our dependent and independent variables. We then return to equation (A1) above and calculate the wage residual ($\widehat{W}$) as:

$$\widehat{W}_{it} = W_{it} - \alpha_0 - \alpha_1 * X_{it} \tag{A8}$$

The three wage residuals are our instrumental variables to be included in equations (4), (5) and (6).

Table 6 Results of first-stage estimations for compensating wage differentials

	Mandated benefit estimation			Wage estimations		
	Dependent variable: ΔMR			Dependent variable: ΔW		
Model 4:				$\Delta EMCR$	−267.144***	(0.013)
Model 5:				ΔMR	−688.838***	(0.000)
Model 6:	ΔEMCR	0.246***	(0.000)	$\Delta \widehat{MR}$	−1084.778***	(0.013)

Note: The symbols *, ** and *** denote significance at the 10%, 5% and 1% level, respectively. *p*-values are shown in parentheses.

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法定員工福利支出、勞動成本與企業固定資本投資*

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摘 要

近幾年來，台灣法定員工福利支出明顯增加，而這是否會透過勞動成本上升造成企業投資意願下降，已成爲重要政策議題。爰此，本文特以 2002 至 2012 年國內上市櫃公司財報資料，探討國內法定員工福利支出對企業投資意願之影響。爲避免個別企業不可觀測差異 (unmeasurable heterogeneity) 對估計結果造成偏誤，本文採長期追蹤型資料 (panel data) 固定效果模型進行估計。此外，本文也利用工具變數法處理法定員工福利支出與薪資之內生關連性問題。本文實證結果發現提高法定員工福利支出會使企業實際投資減少。爲確保本文實證結果之穩定性，本文參考 Barslund et al. (2007) 所提方法進行穩定性檢測，發現不論其他解釋變數之間如何組合，法定員工福利支出對企業投資的估計係數皆爲顯著負值。

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