Anomalous Financing Choices with the Change of Industrial Policy: The Case of Taiwan

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Abstract

This paper examines whether firms' financing choices are anomalously affected by the change of institutional environment. From the data of Taiwanese listed firms, the estimated results indicate that policy incentives for R&D investment and facility procurement affect firms' financing choices diversely in industries. Besides, firms decide appropriate leverage level depending on the incentives and benefits they can obtain from different policy periods. Specifically, change of the institutional environment causes firms to make active financing decisions that may distort firm value. To reduce risk of market and systemic failure, we suggest that government should consider curtailing disproportionate subsidies or incentives as a way to avert excessive intervention. On the other hand, firms should measure the pros and cons of obtaining benefits of policy incentives and avoid changing their decided financing strategy that may be more a loss than gain in the long run.

Keywords: Financing Choices; Institutional Environment; the Statute of Upgrading Industry; Policy Subsidy and Incentives

1. Introduction

Industrial policy is generally cited as an important reason why nations successfully innovate and gain competitive advantage in the knowledge economy (Porter, 1990). Well science and technology (S&T) policy incentives with foresight can even more encourage entrepreneurship and investment in R&D aimed at promoting the development of new technologies (George & Prabhu, 2003). Besides, policy-makers also expect that the public support generated by sound government policy can have a positive effect on economic growth and social welfare (Clarysse, Wright, & Mustar, 2009; Heijs, 2003). In this sense, the Taiwanese government's active role in promoting the nation's industrial restructuring in the past three decades, especially in the high-tech sectors, is particularly noteworthy (Lien, Wang, Wang, & Tsai, 2007; Zee, Stotsky, & Ley, 2002).

Although industrial policy indeed contributes to the technology development and industrial transition, we are aware that there may be unexpected effects from the implementation of these policies. In particular, behavior of funding acquisition and financing seems to be inconsistent with common understanding on the finance theory. For example, well-known and large-sized Taiwanese listed firms, such as the Taiwan Semiconductor Manufacturing Company (TSMC) or Formosa Plastics Group (FPG),[1] either reveal relative lower debt ratio than others in the industries or show decline trends in financing needs with the development. But other firms are newly listed or belong to emerging industries seem to have higher debts and more increasing financing needs than other mature firms.

[1]The TSMC and FPG are, respectively, the biggest semiconductor and petrochemistry manufacturer in Taiwan.

On the other hand, we found that the average debt ratios of Taiwan listed firms have obvious turning points in the past two decades. When the debt ratios are contracted to the announcement year of specific industrial policy entitled the Statute of Upgrading Industry (SUI),[2] the turning points seem to coincide with the years that the SUI was promulgated and amended. Apparently, the representation would naturally inspire us to examine whether the policy possess certain influences on firms' financing strategies.

Although previous studies have examined the relationship between the policy support and firm performance (George & Prabhu, 2003; Hemphill, 2009), they provide less discussion on the change of financing behavior affected by the policy. Some authors suggest that R&D investment significantly affect firms' financing choices (Wang & Thornhill, 2010), while such influence neglect industry difference and possible encouragement from the policy incentives. Besides, financing decision is an important strategic activity that may affect a firm's value. Under the goal of firm value maximization, anomalous or intervened short-term financing decisions may distort its market valuation and cause market or systemic failure in the long-run. Therefore, this paper focuses on analyzing whether the policy affects a firm's debt ratio across different institutional environment and industries, and further provide suggestions for policy makers and decision managers.

The paper is organized as follows. Section 2 reviews Taiwan's institutional environment and related literature for identifying our key variables. Section 3 introduces our data and regression model specification. Section 4 provides descriptive statistics of variables and analyzes our estimated results with various interaction terms and cross-industry comparisons. Section 5 concludes findings and provides our suggestions for related parties.

2. Institutional Environment and Literature Review

The rapid development in Asia Pacific region in recent years is obvious to all. To achieve the goal of economic growth, governments in these countries usually adopt strategic policies designed to assist firms through public support for firms to invest in R&D and specific procurements. With the development and improvement of Taiwan's industrial policies, we find that the support from government policies become numerous and interlocking. In order to clarify the purposes of those regulations, Figure 1illustrates the framework and related contents.

[2]The SUI was promulgated in 1991 to replace the Statute for the Encouragement of Investment. It had major amendments in 2001 and expired on December 31, 2009.

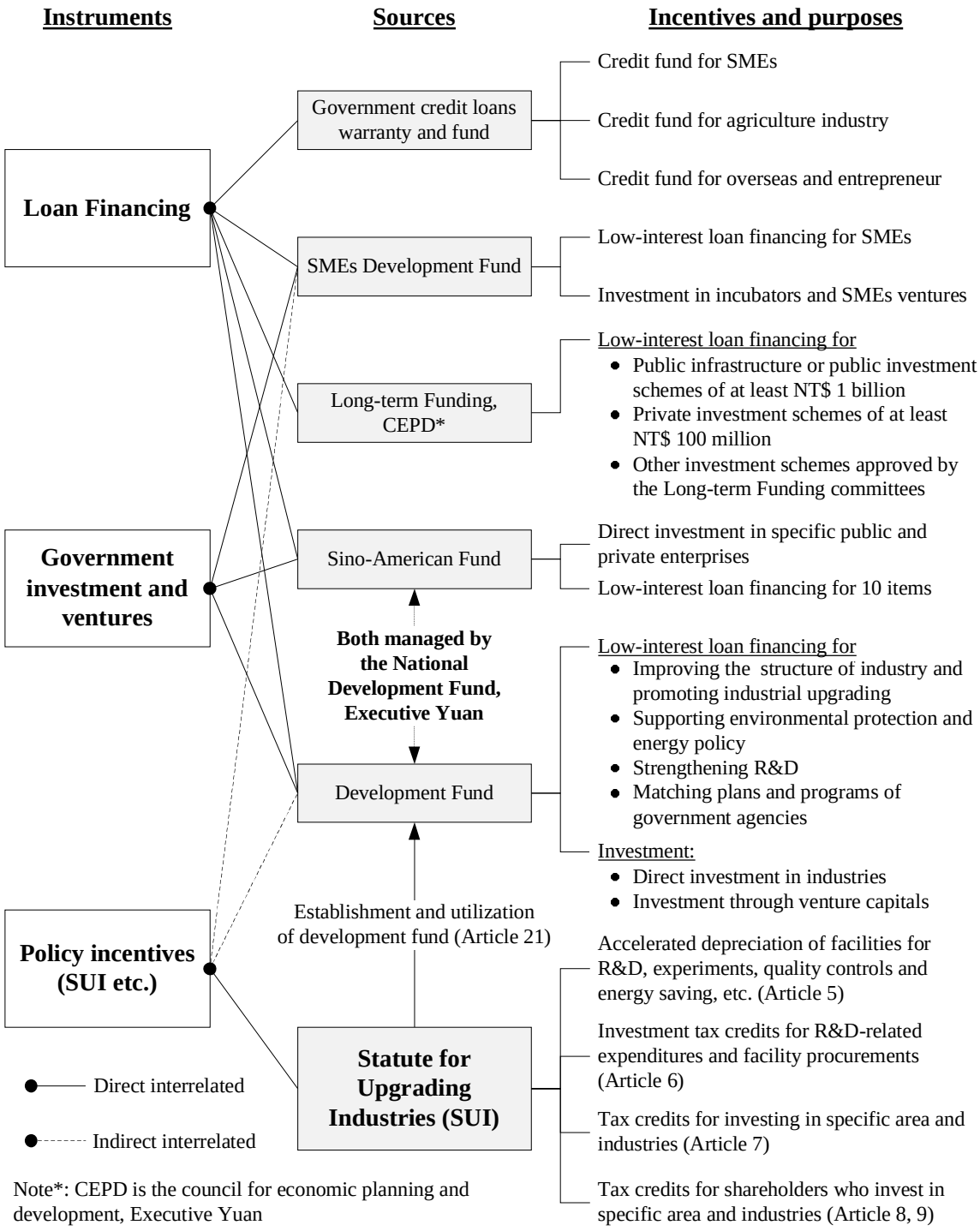

Figure 1: Framework of Taiwan's Major Industrial Policy Tools

The framework of industrial policy shows that Taiwan government provides plentiful funding sources and tax incentives for qualified firms. The purposes of policies indicate that qualified firms including emerging, high technology and those are innovative or possess with future growth potential can obtain strategic advantages from the policies. However, government subsidies are not only granted for small and young firms but also large-sized or elder firms that meet the criteria of policies.

We are aware that most industry-related incentives in Taiwan are provided by the Statute for Upgrading Industries (SUI) in the past two decades in terms of the above framework. The major purpose of the SUI is to accelerate industry transformation, especially in electronics and other technology-intensive industries.

The tax incentives focus on activities relevant to the operations of these industries. They include accelerated depreciation of R&D-related facilities (Article 5), investment tax credits for R&D-related expenditures and facility procurements (Article 6). Other tax credits are set aside for firms and their shareholders to invest in scanty area or slow development region and industries (Articles 7, 8 and 9). Related studies indicate that most firms obtain benefits from Articles 5 and 6 (Chen & Gupta, 2009; Lien et al., 2007), suggesting that they prefer tax incentives generated from facility procurement and R&D investments.

Previous studies have recognized that public support authorized by the industrial policy have a positive effect on economic growth, technological development and social welfare (Clarysse et al., 2009; George & Prabhu, 2003; Hemphill, 2009). The major reason is the policy incentives and subsidies can help encouraging firms to invest more in R&D related activities (Zee et al., 2002), and thus increase firms' competitive capacity and economic output. However, other research argues that incentives for R&D investment may bring some effects on firms' financing choices (O'Brien, 2003; Wang & Thornhill, 2010). Those direct or indirect policy-related influences on capital structure decisions may distort firms' resource utilization, and finally lead to market or systemic failure (Hyytinen & Toivanen, 2005; Pereira, 1994; Salmenkaita & Salo, 2002; Santamaría, Barge-Gil, & Modrego, 2010).

From the perspective of government funding, Grupp(1997) and Hejis(2003) find that large firms can more easily obtain public support so that SMEs probably do not acquire enough government funding as the main financing source. As for the perspective from capital structure decisions, Hall and Jorgenson(1967) indicates that tax incentives authorized by the policy can affect financing choices because the incentives decrease the user cost of capital.

Madsen et al.(2008) and Wang and Thornhill(2010) further provide evidence that R&D investment encouraged by policy subsidies would have a positive effect on the use of common stock because of their increasing market value. These findings provide further information that firms' financing choices would be affected by public support.

On the other hand, scholars have proposed several theories about the determinants of financing behavior. Among these finance studies, there are authors argue that the financial distress risk caused by bankruptcy costs has a negative relationship with the target debt ratio (Kim, 1978; Myers, 1977). Such risk varies with a firm's development and thus the target debt ratio will also be changed over time (Fischer, Heinkel, & Zechner, 1989). Some research believes that a firm has specific hierarchy on financing sources depending on which cost of capital is lower (Myers & Majluf, 1984). Other authors further propose that the market value and cost of equity would also affect a firm's decision on choosing its financing timing (Baker & Wurgler, 2002; Huang & Ritter, 2009). However, we observed that the Taiwanese listed firms' financing choices seem to be peculiar against the finance theories. New and emerging firms which are regarded as risky have higher debt ratio than old and existing firms and firms seem to decrease their debt ratio with the development over time. Such representations are probably related to different firm attributes, but we intuitively believe that the change of institutional environment plays an important role to cause anomaly in firms' financing choices. To further analyze the influences of policy incentives on firms' financing choices across different institutional environment and industries, we then proceed with cross-sectional comparisons and econometric techniques to disentangle the interrelated factors in our following analysis.

3. Data and Methodology

3.1 Data Source

We collect data from a sample of Taiwan listed firms and drawn on a year-to-year basis from the financial database of the Taiwan Economic Journal (TEJ) company from 1987 to 2009. Besides, as a result of the SUI focuses on providing incentives for emerging industries, especially in the electronics sector. To distinguish whether the policy generates cross-industry influence on financing choices, we intuitively divide the sample into two categories. The first is the electronics firms, which according to the Taiwan Stock Exchange (TSE) classifications that are categorized as the electronics industry. The other firms in the sample, which exclude finance and insurance companies, are identified as non-electronics firms.

To fulfill the research criteria, firms are excluded from the sample that fail to meet any one of the following conditions.

First, at least three years of financial data must be available after the firm is publicly listed. Second, the firm must have no missing data for any variable for each year over 1987 to 2009. Third, the firm must not have been de-listed or classified as undergoing reorganisation. The final sample consists of 561 Taiwanese listed firms over a period of 23 years, or 7,050 firm/year observations.

3.2 Model Specification

In Section 2, we discussed the institutional environment of Taiwan and possible influences on financing choices from the industrial policy. Unfortunately, these conjectures do not specify the relationship describing how the policy involves with the firms' attributes and their financing behavior. If we want to obtain precise evidence of the policy effect, models that the debt ratio is specified as functions of the attributes and the policy-related factors are need to be estimated.

To capture the variances of capital structure choices properly, we alter the measure proposed by Flannery and Rangan(2006) and Fama and French (2002) to obtain the following debt ratio (***DR***):

$$DR = \frac{L}{TA} \tag{1}$$

where*L* and *TA* are, respectively, interest-bearing debt (the sum of current and long-term liabilities) and total assets of each firm at the end of fiscal year.

To establish a model of target debt ratio, many authors have suggested determinants of capital structure and provided evidence that some attributes do affect the leverage choice. Among those firm-specific factors, firm size (total assets) and profitability (return on assets) are regularly adopted and show significant coefficients of the effects on the target debt ratio.

On the other hand, two major competing finance theories, which are the static trade-off and the pecking order theory, usually have opposite opinions to the determinants of capital structure. However, most financial empirical studies show that the two competing theories have similar expectations on the effects of firm size and profitability on financing choices (Fama & French, 2002; Frank & Goyal, 2009; Titman & Wessels, 1988).[3] Accordingly, we select the nature logarithm of total assets (***LNSIZE***) and the EBIT over total assets (***ROA***) as variables for controlling potential differences in raising funds.

As we mentioned previously, the SUI which affords tax incentives for R&D investments and specific facilities procurements is the major industrial policy of Taiwan. Besides, the SUI also focuses on providing subsidies and funding for encouraging entrepreneurship of emerging industries, especially in the electronics sectors. To identify whether the policy generates unexpected effect on the financing choices, we further propose the following explanatory variables in terms of the incentives authorized by the SUI to examine the relationships between debt ratio and policy influences.

R&D density (***RD***): R&D expenses over net sales. The SUI encourages firms to increase R&D expenditures through tax incentives, firms would tend to raise less loans because the benefits of non-debt tax shields increase (DeAngelo & Masulis, 1980).

Fixed assets growth rate (***FAGR***): The procurements of specific fixed assets that conform with the purposes of the SUI could also obtain additional benefits of non-debt tax shields from the accelerated depreciation. However, firms increase largely in the capital expenditures may need to raise enough funds from loans or equity.

Industry dummy (***IND***): A dummy variable that equals to one for the electronics firms. We speculate that the SUI focuses on providing subsidies and incentives for the electronics firms and thus the debt ratio has obvious industry difference.

Period dummies (***PR*1** and ***PR*2**): ***PR*1** equals one for the period 1987-1991, ***PR*2** equals one for the period 2003-2009, and zero otherwise. The two period dummies are proposed to examine whether the firms have differences in financing choices before the SUI was promulgated and after it was amended with one year lag.

[3]Both theories expect that firm's debt ratio is positively affected by firm size (total assets) and negatively influenced by profitability (ROA).

Based on the above discussion, our preliminary regression model is specified as follow:

$$DR_{it} = \beta_0 + \beta_1 LNSIZE_{it} + \beta_2 ROA_{it} + \beta_3 RD_{it} + \beta_4 FAGR_{it} + \beta_5 ID + \beta_6 PR1 + \beta_7 PR2 + \varepsilon_{it} \quad (2)$$

Because the SUI may have various effects on financing choices in different periods, we therefore add interaction terms between the period dummies (***PRN*** for ***PR1***and ***PR2***) and the explanatory variables (**Z** for ***RD***, ***FAGR*** and ***ID***) as alternative models.

$$DR_{it} = \beta_0 + \beta_1 LNSIZE_{it} + \beta_2 ROA_{it} + \beta_3 RD_{it} + \beta_j \sum PRN \cdot \mathbf{Z}_{it} + \varepsilon_{it} \quad (3)$$

As stated earlier, we want to examine whether the industrial policy causes industry difference in the determinants of the target debt ratio. Thus, Equation (3) excluding the industry dummy (***ID***) in the explanatory variables is further estimated over two sub-samples: the electronics firms and the non-electronics firms.

4. Results and Analysis

4.1 Descriptive Statistics

To compare whether firms' decisions are affected diversely by the industrial policy, we first report the statistics for major variables in Table 1 and illustrate further comparisons for the two industry groups in various periods.

Table 1: Descriptive Statistics and Cross-Industry Comparisons (*T*-Test)

	DR	***LNSIZE***	***ROA***	***RD***	***FAGR***
Panel A: Descriptive statistics of variables					
Mean	0.340	15.743	0.055	0.018	0.066
Std. Dev.	0.168	1.190	0.098	0.035	0.528
Maximum	2.437	20.543	0.653	0.803	20.208
Minimum	0.003	12.257	-2.441	0.000	-0.994
Mean of the electronics	0.343	15.843	0.060	0.039	0.086
Mean of the non-electronics	0.338	15.691	0.053	0.008	0.055
Panel B: Cross-industry comparisons (t-test) for different periods					
Period 1: 1987-1991					
Electronics	0.360	15.261	0.074	0.024	0.147
Non-electronics	0.343	15.313	0.096	0.003	0.149
t-statistics	0.611	0.385	-1.851	3.828	-0.034
(*p*-value)	(0.544)	(0.770)	(0.070)	(0.000)	(0.973)
Period 2: 1992-2002					
Electronics	0.348	16.002	0.062	0.033	0.198
Non-electronics	0.331	15.720	0.046	0.007	0.094
t-statistics	2.613	5.213	3.927	14.190	3.916
(*p*-value)	(0.009)	(0.000)	(0.000)	(0.000)	(0.000)
Period 3: 2003-2009					
Electronics	0.341	15.799	0.059	0.042	0.045
Non-electronics	0.345	15.738	0.051	0.009	-0.003
t-statistics	-0.662	1.463	2.097	24.847	2.737
(*p*-value)	(0.508)	(0.144)	(0.036)	(0.000)	(0.006)

Note 1. There are 7,050 observations in the entire sample. 2,394 observations belong to electronics firms and 4,656 observations belong to non-electronics firms.
Note 2. The results of *t*-statistic are computed by two-tailed *t*-test with 95% confidence interval.

Panel A of Table 1 gives us basic descriptive statistics of variables and a simple comparison between the two industry groups for the period from 1987 to 2009. We notice that the electronics firms exhibit higher means of variables than those of the non-electronics firms. These values only indicate that there exists differences between the industries, but influences from the change of institutional environment are needed to be further considered.

Besides, estimated values of firm size and performance can preliminarily provide us information that why the electronics firms have higher debt, but the result seems to vary from previous expectation for the electronics firms that high R&D investment decreases debts. To further examine above issues, we provide cross-period and cross-industry analysis as follows.

Panel Bof Table 1shows that, there are no significant differences in debt ratio (***DR***), firm size (***LNSIZE***), and fixed assets growth rate (***FAGR***) between the electronics and non-electronics firms before the SUI was promulgated (1987-1991). But we find that the non-electronics firms have higher profitability (***ROA***) than the electronics firms (0.096 vs. 0.074, $p< 0.10$), while the electronics firms have higher R&D investment than the non-electronics firms have (0.024 vs. 0.003, $p< 0.01$) in the pre-SUI period (1987-1991). These values are expected, given the pre-SUI status of the industries sampled. The results imply that the non-electronics firms have better performance in operating, but the electronics firms seem to privately raise more funds for investing in R&D to improve their competitive capability in the period.

Nevertheless, when the first stage of the SUI was launched (1992-2002, see Period 2 in Panel B of Table 1), differences between the two industry groups become significant on each variable. The electronics firms are obviously promoted because the firm size, profitability, R&D density, and fixed assets growth rate are significantly higher than the non-electronics firms during this period. Besides, the electronics firms also raise more funds from loan financing than the non-electronics firms do (0.348 vs. 0.331). This is probably due to the low-interest loans authorized by the SUI are sufficiently provided for qualified firms, especially for the electronics sectors.

Because the SUI was criticized for one-sidedly emphasizes on the incentives for the electronics firms, the government announced the SUI amendments in 2002 to decrease differences of cross-industry subsidies. We therefore find that difference of debt ratios between electronics and non-electronics firms become insignificant (see Period 3 in Panel Bof Table 1). With further comparing to the values of firms size and profitability, the statistic results also reveals diminution of variances for the control variables between the two industry groups. It interprets that firms belong to different industries have less development variances because the amended SUI relaxes criteria of subsidies for non-electronics firms. However, the industrial policy does not reduce incentives for R&D investment and particular facilities procurements, especially for firms in the high technology sectors. Thus, the differences of R&D density and fixed assets growth rate still maintain significant differences between the two industry groups.

Although the above comparisons have presented information about the changes of debt ratio and related variables before the SUI promulgated and after the policy amended. But some unexpected effects of the industrial policy can be found if we further observe the long-term trend from the statistical values. The debt ratios of the electronics firms reveal decline trend from 1987 to 2009, while those of the non-electronics firms present U-shaped trend. The representations of debt ratio appear to have anomaly in financing choices in contrast to the finance theories as we mentioned previously. Besides, variables correlated directly with the policy incentives, such as the R&D density and the fixed assets growth rate, may also affect firms' financing choices. To go deep into explaining the relationships between debt ratio and policy related variables, the parameters of our regression models are then estimated.

4.2 Regression Analysis

To avoid the bias of multicolinearity, we first compute the variance inflation factor (VIF) and the correlations for our variables. The results indicate that average VIF is 1.133 and there are no single VIF of variable exceeds 5. Besides, correlation coefficients of explanatory variables do not show obvious high values. These results can preliminarily interpret that multicolinearity of the variables are low.

However, the error term of the original models are found to have first-order serial correlation and heteroskedasticity. As a result of the policy impact is assumed to be a finite duration before it is abrogated. Thus, we made modifications on the linear models with the first-order moving average scheme, or MA(1)(MacDonald & MacKinnon, 1985). Besides, the White (1980) correction is also adopted to reduce the autocorrected estimation bias. The estimated results of our regression models with MA(1) and heteroskedasiticity corrections are reported in Table 2.

Table 2: Preliminary and Alternative Models of Debt Ratio

	(I) Model 1	(II) Model 2	(III) Model 3	(IV) Electronics	(V) Non-electronics
Firm size (***LNSIZE***)	**2.698*** (23.034)**	**2.687*** (23.147)**	**2.697*** (23.389)**	**2.224*** (10.175)**	**2.962*** (26.187)**
Profitability (***ROA***)	**-0.440*** (-11.066)**	**-0.440*** (-11.068)**	**-0.436*** (-11.169)**	**-0.356*** (-6.768)**	**-0.535*** (-17.720)**
R&D density (***RD***)	**-0.632*** (-6.648)**	**-0.629*** (-6.639)**	**-0.239*** (-5.657)**	**-0.220*** (-3.311)**	**-0.645*** (-7.730)**
Fixed assets growth rate (***FAGR***)	0.004 (0.817)	0.004 (0.816)	0.005 (1.478)	-0.012 (-1.141)	**0.009*** (5.424)**
Industry dummy (***ID***)	**2.001*** (5.884)**	**3.037*** (6.534)**			
Period dummy 1 (1987-1991) (***PR1***)	0.242 (0.217)	0.285 (0.268)	-0.560 (-0.498)	-0.205 (-0.120)	-0.035 (-0.025)
Perioddummy 2 (2003-2009) (***PR2***)	0.469 (1.142)	**0.907** (2.201)**	**1.427*** (2.850)**	0.657 (0.735)	**1.292*** (2.832)**
ID*PR1		1.181 (1.133)			
ID*PR2		**-1.509*** (-2.666)**			
RD*PR1			**0.570** (1.993)**	**0.373* (1.896)**	0.770 (1.353)
RD*PR2			**-0.388*** (-3.267)**	**-0.439*** (-2.829)**	**-0.286*** (-2.848)**
FAGR*PR1			**0.038*** (3.249)**	**0.079*** (2.798)**	**0.034*** (2.814)**
FAGR*PR2			-0.004 (-0.472)	0.012 (0.913)	<-0.001 (-0.046)
Intercept	**-6.614*** (-3.518)**	**-6.656*** (-3.574)**	**-6.690*** (-3.716)**	2.233 (0.666)	**-10.618*** (-5.648)**
Observations	6,489	6,489	6,489	2,133	4,356
Adj. R-squared	0.794	0.794	0.796	0.704	0.829

Note 1. All models include MA(1) (unreported) and heterskedasiticity corrections.
Note 2.***, ** and * represent significant atthe 1%, 5% and 10% levelrespectively.

4.2.1 Conventional Regression

Column (I) in Table 2presents estimates of Equation (2) which is our preliminary model to interpret the policy effect on the target debt ratio. The control variables (***LNSIZE*** and ***ROA***) explaining the target debt ratio have significant coefficients with appropriate sign as previous studies expected (Fama & French, 2002; Frank & Goyal, 2009; Titman & Wessels, 1988). However, estimates of explanatory variables show that only ***RD*** and ***ID*** have significant coefficients, whereas ***FAGR***, ***PR1*** and ***PR2*** do not have significant effects on the target debt ratio.
The evidence indicates that ***RD*** has a negative effect on the needs of financing, and the electronics firms indeed have higher debt ratio than the non-electronics firms. The results could be due to the tax incentives of R&D investments authorized by the SUI for accelerating industry transition and development.

Besides, the government also focused on subsidizing emerging industries, especially the electronics firms in the early stage of industry development. Those low-interest loans and investments from government agencies provide plentiful funding sources for the electronics firms and thus the industry dummy (***ID***) has significant positive effect on the target debt ratio.

As for the insignificant coefficients of ***FAGR***, ***PR*1** and ***PR*2**, the results address that firm's financing level is not affected by the procurement of fixed assets in the long run, and there are no significant effects on debt ratio before the SUI was promulgated and after it was amended. On the other hand, the significant negative intercept in column (1) shows that the debt ratio is shifted downward during our sample periods. Although the estimated intercept corresponds with the findings of previous studies that Taiwan has a lower debt ratio than other developed countries(Allayannis, Brown, & Klapper, 2003; Driffield, Mahambare, & Pal, 2005; Fan, Titman, & Twite, 2008), the result only reflects firms' long-term preference of leverage level and probably neglect influences of institutional and industry-related differences. To dismantle possible influences of the dummies, we include interaction terms with periods in the following estimations to examine whether there has interactive effects on the target debt ratio across different policy implementation periods.

4.2.2 Regression with Interaction Terms

Column (II) and (III) of Table 2show estimates for Equation (3) which incorporates interaction terms into regressions explaining the influences from various factors in the different periods. We first take a look on column (II) which considers only the industry difference interacting with different periods. The estimates in column (II) show that the significance of period dummies are different from the results in column (I) and the interaction terms only have significant effect on debt ratio in the period during 2003 to 2009 (***ID*PR*2**) (-1.509, $p< 0.01$). The single industry dummy (***ID***) indicates that the electronics firms have significantly higher loan financing needs during the first stage (1992-2002) of the SUI was promulgated (3.037, $p< 0.01$). After the SUI was amended, the electronics firms dropped their leverage level, while the non-electronics firms raised the debt ratio in this period (***PR2***) significantly (0.907, $p< 0.01$). The information explains that the government probably has less or no particular funding subsidy for specific firms before 1992. After the SUI was amended in 2002, the government loan financing warranty and subsidy for the electronics firms were retrenched, but those for non-electronics firms were relaxed. Thus, the result reveals an opposite effect on debt ratio when considering the industry difference.
Column (III) of Table 4 addresses that possible effect from the policy incentives on debt ratio without considering the industry difference. The estimated coefficients of ***LNSIZE***, ***ROA*** and ***FAGR*** remain close to those of the previous models. But the impact of ***RD*** coefficient decreases obviously comparing to column (II) (from -0.629 to -0.239). Besides, the interaction terms show that the estimated coefficients have quite different effects on the target debt ratio in the different periods. We are aware that the results in column (III) reflect different period-varying influences from the policy incentives on financing choices.

First, before the government provided specific tax incentives for R&D investment, firms probably needed to raise more loans for R&D spending and thus ***RD*PR*1** has significant positive effect on debt ratio (0.570, $p< 0.05$). When the government began to provide tax deductions of R&D investments for firms, the negative effect on debt ratio is significantly lasted since the SUI was promulgated after 1991. Such influence of ***RD*** is similar to the findings of previous studies that high level of R&D investment may be athigh risk of financial deficit and results in lower debt (Frank & Goyal, 2009). However, it could be resulted from firms that are attracted to obtain the benefits of non-debt tax shields for decreasing their debt needs (Titman & Wessels, 1988; Wald, 1999).

Second, the predecessor of the SUI provided investment incentives only for specific facility procurements. The early policy encouraged firms to increase loan financing to get the rewards and cause ***FAGR*PR*1** become positively affect debt ratio (0.038, $p < 0.01$). However, incentives in the abrogated policy were constricted and probably favored specific industry. To avoid criticisms of benefiting for specific firms, the Taiwanese government revised the incentives and expanded the range of preferential items in the successive statute. Thus, the influence of ***FAGR*** coefficient became insignificant after promulgation of the SUI because firms cannot obtain direct government subsidy through short-term financing for capital expenditure. As for the coefficient of ***FAGR*PR*2**, it reveals marginally significant with negative effect. We conjecture that the criteria of tax deductions for procurements were relaxed after the SUI amended; therefore, firms can obtain more non-debt tax shields from long-term capital expenditure for decreasing loan financing as previous studies predicted (Fama & French, 2002; Frank & Goyal, 2009). However, this situation does not cause obvious impact to the financing choices in our sample.

To further examine whether firms' financing choices are affected by different determinants depending on which industry they belong to, we estimate the revised models from Equation (3), which excludes the industry dummy for separated industry groups as below.

4.2.3 Cross-Industry Comparisons

The last two columns of Table 2, respectively, report the estimated coefficients for the electronics and non-electronics firms. Comparing to the coefficients between column (IV) and (V), the effects of variables on the target debt ratio are quite different for the two industry groups. For the two control variables, ***LNSIZE*** and ***ROA***, they both show expected effect on the target debt ratio for the two industry groups. But the non-electronics firms' target debt ratio is more sensitive to the influences than the electronics firms behave.

For the explanatory variables, ***RD*** and ***FAGR***, and the interaction terms with ***PR*1** and ***PR*2**, the determinants also show various influences on the target debt ratios for the two industry groups. ***RD**PR*1** brings significant positive coefficient only for the electronics firms' target debt ratio because they privately raise more debts for increasing competitive capability. After the promulgation of the SUI, the effect of ***RD*** on debt ratios for the two industry groups became negative. It is probably because the tax deductions for R&D investments are utilized by qualified firms. However, the significant influence of ***RD*** is almost two times greater for the electronics firms after the SUI was amended($-0.439/-0.220 \approx 2$), but the impact is decreasing for the non-electronics firms ($-0.286/-0.645 \approx 0.44$) in the same period.

On the other hand, ***FAGR*** shows significant effect on debt ratio for the electronics firms (0.079, $p < 0.01$) before the SUI was promulgated, but the effect become marginally significant in the follow-up periods. However, the influence for the non-electronics firms is continually significant before and after the SUI was promulgated (0.034, $p < 0.01$ and 0.009, $p < 0.01$), and it turns into insignificant in the period of the amended SUI.

Evidence presented above indicates that R&D investments indeed affect the electronics firms' financing strategies significantly across the three periods, and they keep obtaining tax benefits for decreasing debts needs after the SUI promulgated. While the debt ratio of non-electronics firms seem to be more sensitive to the change of ***RD*** during the first stage of the implementation period of the SUI (1992-2002), then the influence shrinks sharply after the SUI amended in the second stage of implementation period (2003-2009). As for the impact of ***FAGR***, procurements of facilities plays an important role of affecting the target debt ratio positively for the electronics and non-electronics firms before the SUI promulgated, while the significant influence on the non-electronics firms' financing choices sustained until the SUI was amended.

According to the influences of the explanatory variables and their interaction terms, we believe the results provide us information that firms will diversely decide appropriate leverage level depending on the incentives and benefits they can obtain from the policy. Besides, change of the institutional environment also causes firms to make active decision strategy on their financing needs.

We then return to the issue of why the electronics firms exhibit higher debt ratio than the non-electronics firms in average. The descriptive statistics show that the electronics firms have higher average debt ratio than the non-electronics firms and exhibit a decreasing trend in their loan financing. Although the industry dummy brings significant positive influence, it only shows the marginal effect on debt ratio. Thus, we further compare the period dummies and intercept between the two industry groups to obtain relevant and explainable evidence.

The estimates for period dummies and intercepts reported in Table 4 show obvious differences between the two industry groups. The ***PR*1** and ***PR*2** dummy variables for the electronics firms are both insignificant, but ***PR*2** become significantly affect the target debt ratio (1.292, $p< 0.01$) of the non-electronics firms. As for the representations of the intercepts, the estimated value for the electronics firms is positive but insignificant, while the value for the non-electronics firms turns into significantly negative (-10.618, $p< 0.01$).

The results provide attractive information and imply that the electronics firms do not exhibit obvious difference in their initial debts across the periods. On the contrary, non-electronics firms are significantly conservative in their initial financing needs and they are also sensitive to the environmental changes when the institutions become beneficial to them. Such impacts cause firms' financing choices vary from general expectation of finance theory and become the unexpected effects of the industrial policy.

5. Conclusion

5.1 Major Findings

Evidence from our preliminary model indicates that R&D investment have significant negative effect on firms' target debt ratio which is probably because of the tax incentives authorized by the policy. Next, estimated coefficients of interaction terms in our alternative models then show evidence that firms' target debt ratio would be affected differently by the change of policy incentives. Firm's debt ratio is positively affected by R&D density and fixed assets growth rate before the Statute of Upgrading Industry (SUI) was promulgated. After the substantial tax incentives were announced and implemented, R&D density became negatively affect the target debt ratio to decrease firms' financing needs. Such influence implies that the incentives of tax deduction for encouraging firms to invest more in R&D are effective and successful. Besides, the opposite effects of industry dummy across the periods indicate that the government loan financing warranty and subsidy for the electronics firms were retrenched after the SUI was amended, but those for non-electronics firms were relaxed.

In the cross-industry comparisons, the estimates provide persuasive results to explain the industry difference. The incentives of R&D investment significantly decrease the needs of debts for both industry groups, but they provide more and increasing tax shields impact to the electronics firms' debt ratio. Although the non-electronics firms also obtain such tax shields from R&D investment, they are more effectively encouraged to raise debts for facility procurements before the SUI was amended. Besides, the non-electronics firms are more conservative in their initial leverage level, but their debt ratio is more sensitive to the change of determinants than the electronics firms are. The results show that firms will decide appropriate leverage level depending on the incentives and benefits they can obtain from the policy. The Change of institutional environment also causes firms to make active decision strategy on their financing needs. But such short-term financing choices may distort firms' long-term valuation.

5.2 Practices for Industrial Policy Effectiveness

Evidence provided from our statistical estimations shows that Taiwanese listed firms' financing choices are anomalously affected by the policy subsidy and incentives. To avoid possible market and systemic failure proposed by Pereira(1994) and Salmenkaita and Salo(2002), we provide suggestions to related parties for reducing the risk. Taiwan's present industrial policy almost focuses on providing incentives for manufacturing process innovation and related R&D. However, incentives for high value-added technology services and knowledge-intensive innovation seem to be deficient in the future scheme of industry development. Although the tax incentives encourage firms to invest in R&D activities, such public support with finite duration may distributed disproportionately and cause impairment on firms' market value by anomalous financing choices. Thus, for the policy makers of government, they should consider curtailing disproportionate subsidies or incentives as a way to avert excessive intervention. In the meantime, government should also establish stable and open economy environment for improving the market mechanism of selecting long-term industry development. As for the firms and management, they should measure the pros and cons of the short-term financing strategy. If those policy-related advantages could possibly distort firm's valuation, they should avoid changing their decided financing strategy for obtaining such benefits that may be more a loss than gain in the long run.

5.3 Constraints and Further Research

Limitations of our study are the sample size of ignoring the unlisted and over-the-counter (OTC) listed firms. Besides, we simply separate our data into two industry groups and do not identify which firm meets the criteria of obtaining the tax incentives authorized by the policy. We suggest that future studies increase the sample size and the number of categories, and also indicators for firms which have obtained the policy-related subsidy or incentive items so that they can explore and test more precisely for measuring the effects on financing choices.

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