Sustainable Adjustment of Capital Structure in the Course of Economic Development: Evidence from the Electronics Industry of Taiwan

Hsien-Hung Yeh
National Pingtung University of Science and Technology, Taiwan and Griffith University, Australia

Abstract: This paper utilizes the partial adjustment model to investigate the behavior of capital structure adjustment across the years of economic peak and trough over Business Cycles 8 and 10 in the course of economic development for the listed firms of the electronics industry in Taiwan. The findings show that economic development affect capital structure adjustment but its effect varies upon the gap between the target capital structure and the previous capital structure. The results illustrate the variation in the rate of debt ratio adjustment across Business Cycles 8 and 10 in the case of negative gap between the target debt ratio and the previous debt ratio. The variation in the adjustment rate of debt ratios reflects the variation in the demand for the spare debt capacity in the course of economic development in Taiwan.

Keywords: Capital structure, Sustainable adjustment, Spare debt capacity, Economic development, Taiwan

1 Introduction

Most of prior studies addressed the determination of capital structure at the firm and industry levels (Harris and Raviv, 1991). Rarely did the prior studies include the effect of economic development under consideration. Boyd and Smith (1996) argue that firms would finance with more equity due to higher efficiency in the financial intermediation of capital markets as an economy develops further. This implies that debt leverage ratio would be negatively related to economic development. Chen (2004) addressed the effect of economic development on capital structure but she found mixed results among countries. Chen found a negative relationship between the growth rate of real gross domestic product (GDP) per capita and the aggregate debt-to-equity ratios in Taiwan but a positive relationship in USA.

Several studies have documented the existence of the target capital structure and the behavior of adjustment towards their target capital structure over time (Taggart, 1977; Marsh, 1982; Jalilvand and Harris, 1984; Hovakimian et al., 2001; Flannery and Rangan, 2006). Moreover, Myers and Majluf (1984) and Narayanan (1988) claimed that shareholders can be better off when the firm reserves spare debt capacity for future investment and growth opportunities. In addition, several surveys (Pinegar and Wilbricht, 1989; Allen, 1991; Graham and Harvey, 2001) have documented qualitative evidence on the importance of spare debt capacity in capital structure choices. Based on these prior studies, this implies that firms would trade off the benefit against the cost of the deviation from the target capital structure in the short run instead of sticking to the target capital structure.

From an operational viewpoint, maintaining financial flexibility means to reserve adequate spare debt capacity (Brigham and Daves, 2004). The more the demand for maintaining financial flexibility, the more the need for the spare debt capacity reserved for future investment and growth opportunities and, in turn, the smaller the capital structure adjustment. The adjustment behavior of capital structure decisions matches well with the partial adjustment model. Besides, Flannery and Rangan (2006) found that the rate of adjustment towards the target capital structure remain constant over time in their study. Thus, this paper, following Flannery and Rangan (2006), utilizes the partial adjustment model and extends the work to test the effect of economic development on capital structure adjustment and to explore the adjustment behavior of capital structure over the business cycles in the course of economic development in Taiwan. In doing so, this paper could provide evidence on the following questions: (1) Does economic development affect

capital structure adjustment? (2) Does the effect of economic development on capital structure adjustment vary over the business cycles? and (3) Does the adjustment rate of capital structure remain constant over the business cycles in the course of economic development?

Besides, I conduct the study within the context of the electronics industry in Taiwan. Taiwan has a successful experience of economic transition from an emerging country to a developed one within several decades and, in addition, Taiwan's electronics industry plays an important role in the economy of Taiwan and in the world market of electronic products. This paper could provide a new perspective and evidence on the effect of economic development and the adjustment behaviour of capital structure. The rest of this paper is structured as follows. Section 2 reviews literature. The partial adjustment model of capital structure is discussed in Section 3. Section 4 describes the methodology. The empirical results and analyses are presented in Section 5. Finally, Section 6 concludes the paper.

2 Literature Review

After the work of Modigliani and Miller (1958), prior studies on capital structure rarely include economic development under consideration except few studies (Boyd and Smith, 1996; Chen, 2004). However, these few studies have no consistent conclusion on the effect of economic development on capital structure choices. Further, several studies have documented both the existence of the target capital structure and the behavior of adjustment towards the target capital structure (Taggart, 1977; Marsh, 1982; Jalilvand and Harris, 1984; Hovakimian et al., 2001; Flannery and Rangan, 2006). In addition, several studies contend that spare debt capacity or financial flexibility is an important factor of capital structure decisions (Myers and Majluf, 1984; Narayanan, 1988; Pinegar and Wilbricht, 1989; Allen, 1991; Graham and Harvey, 2001). This paper incorporates the concept of spare debt capacity into the partial adjustment model to investigate the effect of economic development on capital structure adjustment and the behavior of sustainable adjustment towards the target capital structure over the business cycles in the course of economic development. Further literature review is discussed as follows.

2.1 Economic Development and Capital Structure Adjustment

Boyd and Smith (1996) argue that the efficiency of capital markets could be improved as the economy becomes further developed and the intermediation cost of capital markets would decline. Thus, they contend that equity capital financing would be increasing as the economy develops further in the course of economic development. This implies that capital structure would be negatively related to economic development. Chen (2004) conducted a study on the effect of economic development on capital structure in USA, Canada, Australia and Taiwan and found mixed results among the countries. Chen found a negative effect of economic development on aggregate debt-to-equity ratios during the period of 1965 to 2001 in Taiwan but a positive effect during the period of 1946 to 2002 in USA.

Moreover, Stulz (1990) contends that, to reduce the cost of overinvestment and underinvestment, firms finance with more debt when cash flow increases but with less debt when cash flow decreases. Cash flow likely increases at economic peak but decreases at economic trough. This implies that capital structure would be positively related to macroeconomic conditions. Thus, this paper examines the effect of economic development on capital structure adjustment with macroeconomic conditions taken into account.

2.2 Spare Debt Capacity and Capital Structure Adjustment

Several studies argue that firms adjust towards their target capital structure in the long run but deviate away from the target capital structure in the short run (Taggart, 1977; Marsh, 1982; Jalilvand and Harris, 1984; Hovakimian et al., 2001; Flannery and Rangan, 2006). In addition, Myers and Majluf (1984) and Narayanan (1988) contend that shareholders' wealth can be better if firms reserve the spare debt capacity for future investment opportunities. Several surveys (Pinegar and Wilbricht, 1989; Allen, 1991; Graham and Harvey, 2001) also provide qualitative evidence on the importance of spare debt capacity

in the determination of capital structure. This implies that firms may reserve the spare debt capacity to maintain financial flexibility for future investment and growth opportunities and thus deviate from the target capital structure. The more the need for the spare debt capacity, the smaller the capital structure adjustment. Thus, capital structure adjustment is negatively related to spare debt capacity reserved for future investment and growth opportunities.

3 The Partial Adjustment Model of Capital Structure

Based on the modern theory of capital structure, firms adjust towards the optimal or target capital structure over time in order to maximize their firm value. Therefore, capital structure adjustment from the previous capital structure to the target capital structure would be completed without gap. However, firms may deviate away from the target capital structure in the short run with adjustment cost under consideration (Taggart, 1977; Marsh, 1982; Jalilvand and Harris, 1984). Further, the importance of the spare debt capacity reserved for future investment opportunities in the determination of capital structure has been recognized by Myers and Majluf (1984), Narayanan (1988) and several surveys in USA and Australia (Pinegar and Wilbricht, 1989; Allen, 1991; Graham and Harvey, 2001). This implies that firms adjust the capital structure by trading off the benefit and cost of the deviation from the target capital structure. The spare debt capacity reserved for future investment and growth opportunities would lead to the deviation from the target capital structure in the short run.

As suggested by the related work regarding target capital structure and spare debt capacity, capital structure adjustment at a given time is a fraction of the gap between the target capital structure and the previous capital structure. The fraction of the gap, i.e. the rate of the adjustment towards the target capital structure, is determined by the spare debt capacity reserved for future investment and growth opportunities. The more the need for the spare debt capacity, the smaller the capital structure adjustment. According to the standard partial adjustment model, the equation for the adjustment towards the target capital structure with spare debt capacity under consideration is expressed as follows.

$$CSA_t = \gamma (DR_t^* - DR_{t-1}) + \varepsilon_t \tag{1}$$

where, CSA_t = capital structure adjustment at time t, DR_t^* = the target capital structure at time t, DR_{t-1} = the previous capital struc ture at time t, γ = the rate of the adjustment towards the target capital structure that is determined by the spare debt capacity reserved for future investment and growth opportunities and ε_t = the error term. Note that I assume that the adjustment rate (γ) is greater than zero.

According to Equation 1, capital structure adjustment is positively related to the rate of adjustment in the case of positive gap between the target capital structure and the previous actual capital structure (i.e. $DR_t^* > DR_{t-1}$). The greater the adjustment rate in the case of positive gap is, the more the capital structure adjustment and the less the spare debt capacity. This indicates that capital structure adjustment is positively related to adjustment rate but negatively related to spare debt capacity in the case of positive gap. On the other hand, capital structure adjustment is negatively related to the rate of adjustment in the case of the negative gap between the target capital structure and the previous capital structure (i.e. $DR_t^* < DR_{t-1}$). The smaller the adjustment rate in the case of negative gap is, the greater the capital structure adjustment but the smaller the absolute value of the capital structure adjustment and, consequently, the less the spare debt capacity. This indicates that capital structure adjustment is negatively related to both adjustment rate and spare debt capacity in the case of the negative gap. The theoretical relation between capital structure adjustment (dDR) and adjustment rate (γ) in the cases of the positive and negative gap between the target capital structure and the previous actual capital structure can be summarized in Table 1.

However, the target capital structure is unobservable. As shown in Table 1, capital structure adjustment (CSA) is positively related to adjustment rate (γ) in the case of positive gap, i.e. the case of positive capital structure adjustment, and, on the other hand, capital structure adjustment is negatively related to adjustment

Table 1 The capital structure adjustment, the rate of adjustment and the gap between the target capital structure and previous actual capital structure

Adjustment Rate	(A) Positive Gap ($DR_t^* > DR_{t-1}$)		(B) Negative Gap ($DR_t^* < DR_{t-1}$)	
	Relationship among DR_{t-1}, DR_t^* and DR_t	CSA_t	Relationship among DR_{t-1}, DR_t^* and DR_t	CSA_t
$\gamma>1$	$DR_{t-1} < DR_t^* < DR_t$	+	$DR_{t-1} > DR_t^* > DR_t$	-
$\gamma=1$	$DR_{t-1} < DR_t = DR_t^*$	+	$DR_{t-1} > DR_t = DR_t^*$	-
$0<\gamma<1$	$DR_{t-1} < DR_t < DR_t^*$	+	$DR_{t-1} > DR_t > DR_t^*$	-

Notes: 1. DR_t^* = the target capital structure at time t.
2. DR_t = actual capital structure at time t.
3. DR_{t-1} = previous actual capital structure at time t.
4. CSA_t = capital structure adjustment at time t (DR_t - DR_{t-1}).
5. γ= the rate of adjustment towards the target capital structure.

rate in the case of negative gap, i.e. the case of negative capital structure adjustment. Thus, the adjustment behavior of capital structure is investigated in this study by splitting the sample into two subsamples based on the positive and negative capital structure adjustment.

As suggested by prior studies, this paper assumes that the target capital structure is a linear function of the factors at the firm, industry and macroeconomic levels over the business cycles in the course of economic development (Harris and Raviv, 1991; Korajczyk and Levy, 2003; Chen, 2004; Flannery and Rangan, 2006; Hackbarth et al., 2006; Levy and Hennessy, 2007). Thus, the determination for the target capital structure can be expressed as follows.

$$DR_t^* = \sum_{j=1}^{c} \beta_{jt} X_{jt}^{FC} + \beta_t^{IND} IND_t + \beta_t^{EC} EC_t + \beta_t^{ED} ED_t \tag{2}$$

where, DR_t^* = the target capital structure at time t, β = the regression coefficient, X_{jt}^{FC}: the variables at the firm level and j = 1 to c at time t, IND: industry types, EC: macroeconomic conditions and ED: economic development. Substituting DR_t^* in Equation 2 into Equation 1, then we can derive the equation for capital structure adjustment expressed as follows.

$$CSA_t = \gamma \sum_{j=1}^{c} \beta_{jt} X_{jt}^{FC} + \gamma\beta_t^{IND} IND_t + \gamma\beta_t^{EC} EC_t + \gamma\beta_t^{ED} ED_t - \gamma DR_{t-1} + \varepsilon_t \tag{3}$$

where, CSA_t = the capital structure adjustment at time t, γ = the adjustment rate that is determined by the spare debt capacity reserved for future investment and growth opportunities, β = the regression coefficient, X_{jt}^{FC}: the variables at the firm level and j = 1 to c at time t, IND: the industry types, EC: macroeconomic conditions, ED: economic development, DR_{t-1}: the previous actual capital structure at time t, and ε: the error term.

4 Methodology

4.1 Research Period and Sample

Controlling for the impact of the speedy development of financial liberalization in the late 1980s (Harris et al., 1994; Chu, 2003) and the implementation of tax integration policy in 1998 (Huang et al., 2001; Hung et al., 2006) in Taiwan, I conduct this study at the years of economic peak and trough over Business Cycles 8 and 10 in the course of economic development in Taiwan. The years at economic peak and trough in the sample are se-

lected according to the reference dates listed in the Business Indicators published by the Council for Economic Planning and Development of Executive Yuan of Taiwan. The years of 1994 and 1999 closest to the reference dates of economic peak and the years of 1995 and 2001 closest to the reference dates of economic trough over Business Cycles 8 and 10 are selected to represent the years of economic peak and trough, respectively.

Besides, the electronics industry of Taiwan plays an important role in the economy of Taiwan as well as in the world market. The total value of Taiwan's electronic products reached 40.6 billion US dollars in 1995 with a 58% increase since 1992 and Taiwan became the third largest producer of laptop computers with 27 percent of the world market share in the same year (Lee and Pecht, 1997). Besides, the contribution of the technology-intensive industries to total GDP of the manufacturing sector in Taiwan increased from 58.2 percent in 1986 to 74.2 percent in 1997 and, in addition, the proportion of the total output by the manufacturing sector in Taiwan accounted for by the electronics industry increased from 10.5% to 24.1% during the same period (Chiang, 2004). Thus, I conduct this study in the electronics industry of Taiwan. The sample includes the firms in the electronics industry that are listed on the Taiwan Stock Exchange and, in addition, have complete financial data used in the study. Annual financial data used in this study are collected from the data bank of Taiwan Economic Journal.

4.2 Empirical Model

This study is conducted in the electronics industry over the business cycles in the course of economic development in Taiwan to investigate the sustainable adjustment of capital structure. The proxy variables at the firm level that are suggested by prior studies (Harris and Raviv, 1991) and the proxy for economic development are incorporated into Equation 3 and then we get Equation 4 for the determination of capital structure adjustment expressed as follows.

$$\begin{aligned} dDR_t = {} & \gamma\beta_1 \ln S_t + \gamma\beta_2 gTA_t + \gamma\beta_3 OITA_t + \gamma\beta_4 DEPTA_t + \gamma\beta_5 INVFATA_t \\ & + \gamma\beta_t^{EC} EC_t + \gamma\beta_t^{ED} gGDP_t - \gamma DR_{t-1} + \varepsilon_t \end{aligned} \tag{4}$$

where, dDR_t = debt ratio adjustment at year t, β : regression coefficient, γ : the adjustment rate, *ln*S: natural logarithm of net sales, gTA: the annual growth rate of total assets, OITA: the ratio of net operating income to total assets, DEPTA: the ratio of total depreciation to total assets, INVFATA: the ratio of inventory plus net fixed assets to total assets, EC: 0 for economic trough and 1 for economic peak, gGDP: the future annual growth rate of real gross domestic product (($gGDP_{t+1}$-$gGDP_t$)/$gGDP_t$), DR_{t-1}: the previous total debt ratio at year t and ε : the error term. The dependent variable and the explanatory variables except the dummy variable, EC, are calculated at book value of annual financial data.

Due to the relation among capital structure adjustment, adjustment rate and the gap between the target capital structure and the previous capital structure as discussed earlier in Section 3, this paper examines the behavior of capital structure adjustment by splitting the sample into two subsamples based on the positive and negative debt ratio adjustment. The empirical model used to investigate the behavior of debt ratio adjustment in the case of positive and negative gap is expressed as follows.

$$\begin{aligned} dDR_t^{DUMdDR} = {} & \gamma\beta_1 \ln S_t + \gamma\beta_2 gTA_t + \gamma\beta_3 OITA_t + \gamma\beta_4 DEPTA_t + \gamma\beta_5 INVFATA_t \\ & + \gamma\beta_t^{EC} EC_t + \gamma\beta_t^{ED} gGDP_t - \gamma DR_{t-1} + \varepsilon_t \end{aligned} \tag{5}$$

where DUMdDR: the binary dummy for the capital structure adjustment with a value of zero for the case of negative debt ratio adjustment (i.e. negative gap between the target debt ratio and the previous debt ratio) and one for the case of positive debt ratio adjustment (i.e. positive gap) over Business Cycles 8 and 10, respectively.

As discussed earlier in Section 3 and shown in Table 1, capital structure adjustment is positively related to adjustment rate but negatively related to spare debt capacity in the case of positive gap. Firms needs more spare debt capacity at the time of economic trough for future investment and growth opportunities and consequently firms adjust less towards the target capital structure. Thus, it is expected that the dummy EC will be positively related to capital structure adjustment in the case of positive gap. On the other hand, capital structure adjustment is negatively related to adjustment rate and spare debt capacity in the case of negative gap. Firms would maintain lower debt ratio level at economic trough for reserving spare debt capacity than at economic peak and consequently the greater decrease in debt ratio will be made at economic trough than at economic peak in the case of negative gap. Thus, it is expected that the dummy EC will be negatively related to capital structure adjustment in the case of negative gap.

Similarly, firms reserve spare debt capacity for future economic growth and development, thus gGDP will be negatively related to capital structure adjustment in the case of positive gap but positively related to capital structure adjustment in the case of negative gap.

5 Empirical Results and Analysis

5.1 Data Analysis

The sample used in the study includes 359 and 458 observations across the years of economic peak and trough over Business Cycles 8 and 10, respectively. The debt ratios and the previous debt ratios of the firms in the sample are less than 0.88, which indicates that no firms of the sample are in financial distress. The descriptive statistics for the sample are shown in Table 2. In addition, no observations of 'zero' debt ratio adjustment are found in the study. Further, to avoid multicollinearity problem, the centering technique suggested by Cronbach (1987) is used in this study.

5.2 Regression Results

The regression results for the debt ratio adjustment of the listed firms in the electronics industry across the years of economic peak and trough over Business Cycles 8 and 10 in the course of economic development in Taiwan are shown in Table 3. As shown in the table, no serious problems of the residual autocorrelation and heteroscedasticity as well as multicollinearity are found according to the values of Durbin-Watson D, Chi-square and variance inflation factor. In addition, I find no outlier effect in this study based on the result of no observations with values of DFFITS (Belsey et al., 1980) exceeding one while using the INFLUENCE option in the SAS regression procedure. Further analysis on the regression results is described as follows.

5.2.1 Adjustment Rate of Capital Structure

As shown in Table 3, controlling for the effect of factors at the firm and industry levels, the previous total debt ratio (DR_{t-1}) is statistically significant and negatively related to debt ratio adjustment in the cases of both positive and negative gap over Business Cycles 8 and 10. This indicates that the adjustment rate (γ) as the proxy for the spare debt capacity is positive based on Equation 5. In addition, as discussed in Section 3, the result reflects negative relationship between debt ratio adjustment and spare debt capacity. The finding is consistent with the conclusion of prior studies (Myers and Majluf, 1984; Narayanan, 1988; Pinegar and Wilbricht, 1989; Allen, 1991; Graham and Harvey, 2001).

Further, as shown in Table 3, the adjustment rate of debt ratios is about 10% in the cases of the positive gap between the target debt ratio and the previous debt ratio across years of economic peak and trough over Business Cycles 8 and 10. The finding in the case of positive gap is consistent with Flannery and Rangan (2006). However, the adjustment rate of debt ratios is about 7% and 16% in the cases of negative gap between the target debt ratio and the previous debt ratio across years of economic peak and trough over Business Cycles 8 and 10, respectively. The result illustrates the variation in the adjustment rate of debt ratios

Table 2 Summary of descriptive statistics

Panel A Subsample for years of economic peak and trough in Business Cycle 8

Variable	Mean	Standard Error	Minimum	Maximum
dDR_t	-0.02129	0.09624	-0.35675	0.22926
DR_{t-1}	0.50508	0.18095	0.00813	0.87370
EC	0.46797	0.49967	0	1
gGDP	0.06253	0.00161	0.06102	0.06424
lnS	20.93782	1.36478	16.54270	25.69420
gTA	0.40412	0.46980	-0.29166	4.28790
OITA	0.08683	0.08201	-0.25360	0.47290
DEPTA	0.02480	0.02025	0	0.12669
INVFATA	0.44573	0.16850	0.05421	0.84201
DUMdDR	0.43454	0.49639	0	1

Panel A Subsample for years of economic peak and trough in Business Cycle 10

Variable	Mean	Standard Error	Minimum	Maximum
dDR_t	-0.00079	0.09306	-0.31484	0.28445
DR_{t-1}	0.37395	0.15207	0.01891	0.81194
EC	0.49782	0.50054	0	1
gGDP	0.04859	0.00919	0.03944	0.05781
lnS	21.99001	1.34292	17.96910	25.92830
gTA	0.31278	0.55785	-0.49003	7.50706
OITA	0.06931	0.07950	-0.19496	0.49391
DEPTA	0.02518	0.02436	0.00162	0.14558
INVFATA	0.37195	0.18406	0.04854	0.89405
DUMdDR	0.50000	0.50055	0	1

Notes: 1. Sample size=359 in Panel A and Sample size=458 in Panel B.
2. dDRt = total debt ratio adjustment; DRt-1 = total debt ratio of previous year;
EC = 0 for economic trough and 1 for economic peak;
gGDP= future annual growth rate of real gross domestic product ((gGDPt+1-gGDPt)/gGDPt);
lnS = natural logarithm of net sales; gTA = annual growth rate of total assets;
OITA = net operating income/total assets; DEPTA = depreciation/total assets;
INVFATA = inventory plus net fixed assets/total assets;
DUMdDR = 0 for negative debt ratio adjustment and 1 for positive debt ratio adjustment.

in the cases of negative gap between the target debt ratio and the previous debt ratio over Business Cycles 8 and 10. This does support the constant adjustment found by Flannery and Rangan (2006). As a whole, the findings in this paper do not completely support the finding of constant adjustment concluded by Flannery and Rangan (2006). In addition, the findings in the variation in the adjustment rate of debt ratio reflects the variation in the spare debt capacity reserved for future investment and growth opportunities for the listed firms in the electronics industry over Business Cycles 8 and 10 in the course of economic development in Taiwan.

5.2.2 Economic Development and Capital Structure Adjustment

As shown in Table 3, the future annual growth rate of gross domestic product (gGDP) as the proxy for economic development is, as expected, negatively related to debt ratio adjustment (dDR) in the case of

Table 3 Regression results of sustainable adjustment (dDR) based on Equation 5

Panel A Results for the years of economic peak and trough in Business Cycle 8

Variable	(1) Positive Gap			(2) Negative Gap		
	Regression Coefficient	t Value	Variance Inflation	Regression Coefficient	t Value	Variance Inflation
DR_{t-1}	-0.1007	-4.36[a]	1.2563	-0.0746	-2.66[a]	1.3545
EC	1.5186	18.01[a]	2.6222	-1.7032	-12.84[a]	2.2699
gGDP	-460.2797	-12.66[a]	2.5632	500.6511	9.27[a]	2.1553
lnS	0.0002	0.01	1.1297	0.1226	2.66[a]	1.0398
gTA	1.0110	8.07[a]	1.3087	-0.7090	-6.36[a]	1.0848
OITA	-3.5386	-6.33[a]	1.5152	0.4451	0.56	1.2569
DEPTA	-0.9801	-0.46	1.4467	-5.3852	-1.51	1.4392
INVFATA	0.2968	1.22	1.2719	-0.1551	-0.36	1.4699

Panel B Results for the years of economic peak and trough in Business Cycle 10

Variable	(3) Positive Gap			(4) Negative Gap		
	Regression Coefficient	t Value	Variance Inflation	Regression Coefficient	t Value	Variance Inflation
DR_{t-1}	-0.1049	-3.92[a]	3.0734	-0.1580	-6.16[a]	1.7437
EC	0.4938	8.07[a]	2.0618	-0.4006	-10.30[a]	1.3429
gGDP	-31.0040	-8.33[a]	3.2630	19.1747	9.42[a]	2.7036
lnS	0.0423	1.60	1.8465	0.0452	2.55[b]	2.0160
gTA	0.3609	6.69[a]	1.2998	0.0718	1.07	1.6526
OITA	-2.7327	-5.30[a]	1.9032	-0.5750	-1.81	1.2215
DEPTA	-9.6040	-4.92[a]	2.3051	-1.2144	-0.96	1.8844
INVFATA	0.9566	3.83[a]	2.3082	0.0306	0.18	2.3804

Note: 1. DRt-1 = total debt ratios of previous year; EC = 0 for economic trough and 1 for economic peak; gGDP = future annual growth rate of real gross domestic product ((gGDPt+1-gGDPt)/gGDPt); lnS = natural logarithm of net sales; gTA = annual growth rate of total assets; OITA = net operating income/total assets; DEPTA = depreciation/total assets; INVFATA = inventory plus net fixed assets/total assets.

2. a and b indicate the significance level of 1% and 5%, respectively.
3. The value of the coefficient is the product of the rate of adjustment (γ) and the regression coefficient (β) of seach independent variables as shown in Equation 4.
4.

	N	Adj. R-squared	F value	Durbin-Watson D value	Chi-square value
(1)	156	0.7842	71.85a	2.198	49.24
(2)	203	0.5535	32.46a	1.996	38.74
(3)	229	0.7868	106.62a	1.925	46.34
(4)	229	0.5360	34.07a	2.141	40.55

positive gap between the target debt ratio and the previous debt ratio over Business Cycles 8 and 10. On the other hand, also as shown in Table 3, the proxy for economic development (gGDP) is, as expected, positively related to debt ratio adjustment across years of economic peak and trough in the case of negative gap between the target debt ratio and the previous debt ratio over Business Cycles 8 and 10. As a whole, the finding in the effect of economic development on debt ratio adjustment is consistent with Stulz (1990).

Further, in the case of positive gap between the target debt ratio and the previous debt ratio, the dummy EC as the proxy for macroeconomic conditions is, as expected, positively related to debt ratio adjustment across years of economic peak and trough over Business Cycles 8 and 10 in the course of economic development in Taiwan. The finding is consistent with the conclusion of Stulz (1990) but does not support the conclusion of Korajczyk and Levy (2003), Hackbarth et al. (2006) and Levy and Hennessy (2007). On the other hand, the dummy EC as the proxy for macroeconomic conditions is, as expected, negatively related to debt ratio adjustment across years of economic peak and trough in the case of negative gap between the target debt ratio and the previous debt ratio over Business Cycles 8 and 10. This finding is consistent with Stulz (1990).

6 Conclusions and Suggestions

This paper utilizes the partial adjustment model to explore the adjustment behavior of capital structure across years of economic peak and trough over Business Cycles 8 and 10 in the course of economic development for the listed firms in the electronics industry of Taiwan. The findings in the paper show that debt ratio adjustment is affected by economic development. In addition, the effect of economic development on debt ratio adjustment depends upon the case of positive or negative gap between the target debt ratio and the previous debt ratio. The findings in the effect of economic development on capital structure adjustment are consistent with Stulz (1990).

In addition, debt ratio adjustment is influenced by macroeconomic conditions over Business Cycles 8 and 10. The effect of macroeconomic conditions on debt ratio adjustment depends upon the case of positive or negative gap between the target debt ratio and the previous debt ratio over Business Cycles 8 and 10 in the course of economic development. The findings in the effect of macroeconomic conditions support the conclusion of Stulz (1990).

Further, this paper finds a negative relationship between spare debt capacity and debt ratio adjustment. This paper also finds that the adjustment rate of debt ratios in the case of negative gap between the target debt ratio and the previous debt ratio varies across Business Cycles 8 and 10. The finding is not consistent with the constant adjustment concluded by Flannery and Rangan (2006). The finding in the variation of adjustment rate of capital structure reflects the variation in the spare debt capacity reserved for future investment and growth opportunities across business cycles.

Based on the findings in this paper, the economic policy makers may try to minimize the fluctuations of macroeconomic conditions over the business cycles in the course of economic development that could help to decrease the volatility of capital structure adjustment of firms. On the other hand, firms may forecast adequately future investment and growth opportunities based on macroeconomic conditions over the business cycles in the course of economic development. In doing so, firms could reserve adequate spare debt capacity for future investment and growth opportunities and, consequently, make a proper adjustment towards the target capital structure to maximize the firm value over the business cycles in the course of economic development.

References

Allen, D.E. (1991). 'The Determinants of the capital structure of listed Australian companies: the financial manager's perspective', *Australian Journal of Management* Vol. 16, pp. 103-127.

Belsey, D.A., Kuh, E. & Welsch, R.E. (1980). 'Regression diagnostics: identifying influential data and sources of collinearity', New York: John Wiley and Sons.

Boyd, J. & Smith, B. (1996). 'The coevolution of the real and financial sectors in the growth process', *World Bank Economic Review* Vol. 10, pp. 371-396.

Brigham, E.F. & Daves, P.R. (2004). 'Intermediate financial management', Mason: South-Western.

Chen, L. (2004). 'The effects of economic development on corporate financial structure', Doctoral Thesis, University of Hawaii.

Chiang, P.K. (2004). 'Deliberation and outlook for the economic development of Taiwan', Taipei: Linking.

Chu, W.W. (2003). 'The economy of Taiwan under globalization', Taipei: Tonsan Publication.

Cronbach, L. (1987). 'Statistical tests for moderator variables: flaws in analysis recently proposed', *Psychological Bulletin* Vol. 102, pp. 414-417.

Flannery, M.J. & Rangan, K.P. (2006). 'Partial adjustment toward target capital structures', *Journal of Financial Economics* Vol. 79, pp. 469-506.

Graham, J.R. & Harvey, C.R. (2001). 'The theory and practice of corporate finance: evidence from the field', *Journal of Financial Economics* Vol. 60, pp. 187-243.

Hackbarth, D., Miao, J. & Morellec, E. (2006). 'Capital structure, credit risk, and macroeconomic conditions', *Journal of Financial Economics* Vol. 82, pp. 519-550.

Harris, J.R., Schiantarelli, F. & Siregar, M.G. (1994). 'The effect of financial liberalization on the capital structure and investment decisions of Indonesian manufacturing establishments', *World Bank Economic Review* Vol. 8, pp. 17-47.

Harris, M. & Raviv, A. (1991). 'The theory of capital structure', *Journal of Finance* Vol. 46, pp. 297-355.

Hovakimian, A., Opler, T. & Titman, S. (2001). 'The debt-equity choice', *Journal of Financial and Quantitative Analysis* Vol. 36, pp. 1-24.

Huang, J.C., Shyu, D.S. & Liao, S. (2001). 'Effect of the integration of individual and corporate taxes on the firm value, dividend policy and capital structure: a dynamic capital structure model based analysis and empirical study of Taiwan industries', *Management Review* Vol. 20, pp. 43-74.

Hung, J.H., Kuo, Y.P. & Hsiao, W.H. (2006). 'Tax imputation effect on capital structure: a comparison between high-tech and traditional industries', *Fu-Jen Management Review* Vol. 13, pp. 29-56.

Jalilvand, A. & Harris, R.S. (1984). 'Corporate behavior in adjusting to capital structure and dividend targets: an econometric study', *Journal of Finance* Vol. 39, pp. 127-145.

Korajczyk, R.A. & Levy, A. (2003). 'Capital structure choice: macroeconomic conditions and financial constraints', *Journal of Financial Economics* Vol. 68, pp. 75-109.

Lee, C.S. & Pecht, M. (1997). 'Recent developments in Taiwan's electronics industry', *Circuit World* Vol. 23, pp. 16-19.

Levy, A. & Hennessy, C. (2007). 'Why does capital structure choice vary with macroeconomic conditions?', *Journal of Monetary Economics* Vol. 54, pp. 1545-1564.

Marsh, P. (1982). 'The choice between equity and debt: an empirical study', *Journal of Finance* Vol. 37, pp. 121-144.

Modigliani, F. & Miller, M.H. (1958). 'The cost of capital, corporation finance and the theory of investment', *American Economic Review* Vol. 48, pp. 261-297.

Myers, S.C. & Majluf, N.S. (1984). 'Corporate financing and investment decisions when firms have information that investors do not have', *Journal of Financial Economics* Vol. 13, pp. 187-221.

Narayanan, M.P. (1988). 'Debt versus equity under asymmetric information', *Journal of Financial and Quantitative Analysis* Vol. 23, pp. 39-51.

Pinegar, J.M. & Wilbricht, L. (1989). 'What managers think of capital structure theory: a survey', *Financial Management* Vol. 18, pp. 82-91.

Stulz, R.M. (1990). 'Managerial discretion and optimal financing policies', *Journal of Financial Economics* Vol. 26, pp. 3-27.

Taggart, R.A., Jr. (1977). 'A model of corporate financing decisions', *Journal of Finance* Vol. 32, pp. 1467-1484.