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THE CAPITAL STRUCTURE ADJUSTMENTS OF FIRMS IN FIVE ASIAN ECONOMIES

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ABSTRACT

This paper provides a first attempt to analyze the long-run adjustment towards the target for Asian firms. Annual data from 1980 to 2003 of five Asian economies including Hong Kong, Japan, Singapore, Taiwan and Thailand are extracted from the PACAP database. Our sample includes 386 firms from Hong Kong, 1,722 firms from Japan, 158 firms from Singapore, 191 firms from Taiwan and 261 firms from Thailand. The partial adjustment models for book leverage and market leverage are estimated. Results show that the leverage ratios of Asian firms adjust gradually towards their target levels. Significant deviations from target due to the pecking order and market timing effects are found. In contrast to Kayhan and Titman (2007), we show that the market timing behavior does not persist. It is also found that Asian firms tend to use more debt than equity when external funding is needed.

Keywords: Capital Structure; Pecking Order Theory; Market Timing Theory; Trade-Off Theory.

1. INTRODUCTION

How firms arrive at their optimal capital structure is a question of debate. Three major hypotheses, namely, the pecking order hypothesis, trade-off hypothesis and market timing hypothesis, have been put forward in the literature to explain the optimal capital structure of a firm.

The pecking order hypothesis (Donaldson, 1961; Myers, 1984) states that firms prefer internal financing by retained earnings to external financing and prefer debt to equity for external financing. Donaldson (1961) and Myers (1984) use the historical profit as a proxy of internal funds to test for the pecking order effect. If a firm prefers to use internal funds, the increase in the past earnings before interest and taxes (EBIT) tends to lower the debt ratio. Shyam-Sunder and Myers (1999), Frank and Goyal (2003) and Brounen et al. (2006) present evidence of firms' pecking order behavior.

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The trade-off hypothesis implies that firms make the capital structure decision based on the cost and benefit of different sources of financing. An optimal (target) leverage ratio is achieved when the marginal cost and marginal benefit of using extra debt and equity are equal.

Baker and Wurgler (2002) propose the market timing hypothesis that firms prefer to issue equity when the market overvalues the equity relative to the book value and to repurchase equity when the shares are undervalued.[1] The hypothesis implies that a high market-to-book ratio tends to lower the debt ratio as it indicates overvaluation of the shares.

Recently, the partial adjustment model has been widely applied to explain the change of debt ratio. Korajczyk and Levy (2003) use macroeconomic factors to analyze the 3-year change of leverage. Kayhan and Titman (2007) study the adjustment of the capital structure of US firms and show how the firms' histories of cash flows, investment expenditures and stock performance affect the change in capital structure in the long run.

In this paper, we examine the capital structure of Asian firms, with a focus on its long-term adjustment towards the target. While some previous works have examined the determination of capital structure of Asian firms (Deesomsak et al., 2004), studies on its adjustment process are scant. This paper estimates the long-run adjustment of the capital structure of firms in five Asian economies. The sample covers the industrial firms from Hong Kong, Japan, Singapore, Taiwan and Thailand. The contribution of this paper is two-fold: (1) It is the first study on the long-run adjustment towards the target for Asian firms; (2) It also analyzes the persistence and reversal effects. Our model contains tradeoff, pecking order and market timing variables to test for the corresponding hypothesis.

The rest of this paper is organized as follows: Section 2 describes the data. In Section 3, the target debt ratios of firms in the five Asian economies are estimated by tradeoff variables using the method of Deesomsak et al. (2004). In Section 4, the partial adjustment model of Kayhan and Titman (2007) is estimated to identify factors affecting the adjustment of leverage ratio. Section 5 examines the persistence and reversal of the effects. Section 6 is the conclusion.

2. DATA

Annual data from 1980 to 2003 of five Asian economies including Hong Kong, Japan, Singapore, Taiwan and Thailand are extracted from the PACAP database. Financial firms are excluded from our sample. Only the industrial firms with at least five-year history are included. Observations with leverage ratios greater than one and those with the market-to-book ratio greater than ten are dropped. Since the financial data are denominated in local currencies, the ratios of variables are constructed to facilitate the comparison across the economies. We first estimate the target leverage ratio by using the averages of firm characteristics over the sample

[1] Taggart (1977) is the earliest study investigating the tendency of firms to issue equity when their market valuations are high relative to book values or the past market values. Welch (2004) shows a strong inverse relationship between stock price movements and the leverage ratio. Alti (2006) studies the impact of market timing in IPO issuing under different market conditions.

period. Our sample includes 386 firms from Hong Kong, 1,722 firms from Japan, 158 firms from Singapore, 191 firms from Taiwan and 261 firms from Thailand. For the book leverage, there are 2,667 firms with 34,564 firm-years across the five economies for the three-year regression, 2,511 firms with 30,628 firm-years for the four-year regression and 2,284 firms with 26,576 firm-years for the five-year regression. For the market leverage, there are 2,686 firms with 33,629 firm-years for the three-year regression, 2,598 firms with 30,498 firm-years for the four-year regression and 2,325 firms with 26,384 firm-years for the five-year regression.

3. ESTIMATION OF THE TARGET LEVERAGE RATIO

Previous studies often use the fitted leverage ratio as a proxy of the target leverage ratio. Hovakimian et al. (2001) and Fama and French (2002) define leverage deficit as the difference of the observed leverage from fitted values to measure the deviation from the target ratio. Deesomsak et al. (2004) model the leverage ratios for sample of firms in Thailand, Malaysia, Singapore and Australia during 1993-2001. We estimate the following regression:

$$\begin{aligned} L_t = {} & \alpha_0 + \beta_1\, TANG + \beta_2\, EBIT + \beta_3\, SIZE + \beta_4\, LIQ + \beta_5\, RETURN \\ & + \beta_6\, M/B + \beta_7\, NDTS + \beta_8\, VOL + \beta_9\, Industrial\ dummies + e_t \end{aligned} \qquad (1)$$

where L_t is the leverage ratio,
TANG is the average fixed asset ratio,
EBIT is the average earning before interest and taxes scaled by total assets,
SIZE is the logarithm of average total assets,
LIQ is the average current ratio,
RETURN is the average one-year stock return,
M/B is the average market-to-book ratio,
NDTS is the average non-debt tax shield, and
VOL is the average volatility of earnings.

The explanatory variables are the averages of annual observations of financial variables over the sample period for each firm.[2] The method is similar to that of Fama and MacBeth (1973) that the averages of coefficients are taken in the model for cross-sections over the sample. Deesomsak et al. (2004) also adopt a similar method for filtering. Both the book and market leverage ratios are estimated by the model as in Equation (3). The book leverage ratio is defined as total liabilities divided by the book value of assets while the market leverage ratio is total liabilities divided by the market value of assets.[3] Our regressors include tangibility, profitability, firm size, growth opportunities, non-debt tax shield, liquidity, earning volatility and stock returns. The following impacts are expected for each variable:

[2] For example, there are 10-year observations of firm A. The leverage ratio at the final year, namely 2003, is taken as the dependent variable and the average of the fixed asset ratio and that of other variables for the 10 years are calculated as the independent variables.
[3] The book value of the total assets equals the sum of the book values of equity and liabilities where as the market value of the total assets is defined as the sum of the market value of equity and the book value of the total liabilities.

Profitability: The pecking order hypothesis predicts that firms tend to use internal funds to finance projects. Thus, it is expected that firms' profitability *(EBIT)* has an inverse relationship with the debt ratio.

Liquidity: Under the pecking order hypothesis, firms with a higher level of liquidity *(LIQ)* tend to borrow less. Thus, a negative coefficient of liquidity should be observed.

Firm Size: The risk of default for large firms is smaller and therefore they are likely to have a lower borrowing cost. According to the tradeoff hypothesis, large firms use more debt financing and should have a higher debt ratio. As a result, the coefficient of firm size variable *(SIZE)* should be positive.

Earning Volatility: The default risks and the borrowing cost of firms with higher earning volatility are higher. The coefficient of earning volatility *(VOL)* is expected to be negative.

Growth Opportunities and Stock Returns: Firms that have more growth opportunities are more willing to invest in risky projects with a high return. The high expected growth opportunities are reflected in the premium of the market value over the book value of a firm. Therefore, the high-growth firms tend to use equity financing since it bears a lower cost. Furthermore, if the stock return (r) is high, the equity is likely to be overvalued. The tradeoff hypothesis and market timing hypothesis predict an inverse relationship between the leverage and growth opportunities *(M/B)*.

Non-Debt Tax Shield: A higher non-debt tax shield *(NDTS)*, which is the ratio of depreciation to total assets, reduces the tax paid by firms and the relative benefit of debt financing is lower. It is has a negative impact on the leverage.

Both the book and market target leverage ratios for each country are estimated with the averaged firms' characteristics by using OLS for each of the economies with the sample period from 1980 to 2003. Industrial dummies are added to control for the industry specific effect. The results are reported in Table 1.

The coefficients of profitability *(EBIT)* range from -1.657 to -0.151 for book leverage regressions and from -2.127 to -0.189 for market leverage regressions. In our model, the coefficients of LIQ range from almost zero to -0.055 for book leverages and from almost zero to -0.046 for market leverages. Most of the coefficients are significant at the 5% level. Firm size *(SIZE)* has a positive impact on the target ratio for firms in Asia, suggesting that big firms enjoy low-cost debt financing due to better reputation and more collateral to secure loans. The estimates of stock price performance (r) for Hong Kong and Japan are significant, indicating the existence of market timing behavior. The signs of coefficients for both book and market leverage regressions agree with each other except for the market-to-book ratio. This is because the market debt ratio is more sensitive to the market value. The explanatory power of the model is higher in market leverage regressions as indicated by the R-square. The estimated leverage ratios serve as the proxies of target ratios in the next stage.

Table 1: Estimation of the target book leverage ratio

Book Leverage regression						Market Leverage regression					
L_t	Hong Kong	Japan	Singapore	Taiwan	Thailand	L_t	Hong Kong	Japan	Singapore	Taiwan	Thailand
constant	0.13341	0.29805**	0.37708**	0.38410	-0.36655**	constant	0.16254	0.51886**	0.41395	0.46804**	-0.06472
	(1.27)	(7.94)	(2.45)	(1.92)	(-2.12)		(1.32)	(12.5)	(1.86)	(2.12)	(-0.37)
TANG	-0.04724	0.05987	0.01706	0.01239	0.11257	TANG	0.03146	0.12453**	0.12283	0.143918	0.049394
	(-0.79)	(1.69)	(0.18)	(0.13)	(1.37)		(0.45)	(2.81)	(1.01)	(1.40)	(0.59)
EBIT	-0.15074**	-1.56237**	-0.66079**	-1.65673**	-1.20204**	EBIT	-0.18865	-2.12705**	-0.26508	-1.37068**	-1.69864**
	(-2.68)	(-16.73)	(-2.78)	(-5.30)	(-4.94)		(-1.32)	(-14.37)	(-0.66)	(-5.38)	(-5.75)
SIZE	0.02031**	0.02770**	0.00579	0.01198	0.06244**	SIZE	0.03071**	0.01508**	0.01670	0.01953	0.05446**
	(2.76)	(8.65)	(0.50)	(0.92)	(5.39)	(3.53)		(4.34)	(1.03)	(1.34)	(4.64)
LIQ	-0.01108**	-0.00033**	-0.00312**	-0.05477**	-0.03147**	LIQ	-0.00823**	-0.00043**	-0.00331**	-0.04613**	-0.03122**
	(-4.38)	(-3.38)	(-2.12)	(-5.83)	(-6.47)		(-2.78)	(-4.67)	(-2.06)	(-4.43)	(-6.36)
RETURN	-0.1141**	-0.02471**	0.01293	-0.02468	-0.03574	RETURN	-0.17745**	-0.0237	-0.10238**	-0.11623**	-0.08745
	(-3.05)	(-1.98)	(0.34)	(-0.70)	(-0.63)		(-3.92)	(-1.92)	(-2.00)	(-2.99)	(-1.41)
M/B	0.02512**	-0.02671**	0.03913	0.05268	0.00824	M/B	-0.12083**	-0.12971**	-0.09506**	-0.16035**	-0.09917**
	(2.32)	(-4.23)	(1.65)	(1.88)	(0.33)		(-9.38)	(-20.64)	(-2.52)	(-6.08)	(-4.14)
NDTS	0.00338	-0.00485	0.11851	0.04260	-0.0775	NDTS	-0.00004	-0.79847**	0.32091**	-0.0842	-0.06613
	(1.01)	(-0.02)	(1.11)	(0.42)	(-0.85)		(-0.01)	(-2.83)	(2.33)	(-0.74)	(-0.66)
VOL	-0.00069	0.00145**	0.00024	-0.00111	0.00183		-0.00006	0.00043	0.00034	-0.00133	0.00143
	(-1.40)	(2.45)	(1.45)	(-1.48)	(0.99)	VOL	(-0.10)	(0.76)	(1.46)	(-1.60)	(0.76)
N	386	2152	222	191	269	N	385	1719	158	191	260
R2	0.1094	0.2528	0.1288	0.3319	0.3245	R2	0.3081	0.3377	0.2426	0.4437	0.3521

Notes: **Significant at the 5% level
The variables are defined as follows. Tangibility is denoted by *TANG*, which is the ratio of total fixed assets and total assets. The variable of EBIT is used as a proxy of profitability and scaled by total assets to yield return on assets. The SIZE variable is the logarithm of total assets. The market-to-book ratio *(M/B)* captures the growth opportunities of firms and it is the ratio of the market value and the book value of total assets. Non-debt tax shield *(NDTS)* is the depreciation expense, which acts as a shield of taxes, scaled by total assets. Furthermore, the current ratio of the firm, which is the ratio of current assets and current liabilities, is used as a proxy of liquidity *(LIQ)*. Following Deesomsak et al. (2004), the volatility of earnings *(VOL)* is the absolute difference between the annual percentage change in earnings before interest and taxes

4. LONG-TERM ADJUSTMENT

Previous studies use the partial adjustment model to estimate the speed of adjustment of the observed leverage ratio towards the target. Fama and French (2002) explain the adjustment by the leverage deficit. Their model is as follows:

$$L_{t+1} - L_t = a_o + a_1\, Ldef_t + a_o\, Z + e_{t+1} \qquad (2)$$

where Lt is the observed leverage ratio at year t

$Ldef_t$ is the difference of the observed leverage ratio and the target ratio at year t,

Z is the vector of the current and past investments and earnings.

The slope coefficient a_1 is a measure of the adjustment speed. It is found that the US firms adjust their debt ratio at a rate of about 10% of the leverage deficit in a year. Flannery and Rangan (2006) use the panel regression model with firm-specific fixed effects to estimate the partial adjustment. These adjustment models focus on the short-run adjustment and do not have implications for the persistence of the effects. Kayhan and Titman (2007) analyze the change of leverage ratio over a five-year horizon. It is shown that the histories of cash flows, investment needs and stock price performance lead to deviations from the target ratio and that the capital structure adjusts towards the target ratio gradually in the long run. Besides, their results also indicate a partial reversal of the effects in financial deficit and that firms tend to move towards the target ratio. A strong negative effect of stock price performance similar to Welch (2004) is observed. It is also found that the market timing variables have little impact on the change of capital structure in the long run. We estimate the following regression for changes in book leverage and market leverage:

$$\begin{aligned} L_t - L_{t-i} = a_o &+ \beta_1\, FDd_{t-i,t} + \beta_2\, FD_{t-i,t} + \beta_3\, YT_{t-i,t} + \beta_4\, LT_{t-i,t} \\ &+ \beta_5\, r_{t-i,t} + \beta_6\, EBIT_{t-i,t} + \beta_7\, Ldef_{t-i} + \beta_8 \Delta\, Targ\ et_{t-i} \\ &+ \beta_9\, Industrial\ dummies + \beta_{10}\, 97\_\ dum + \varepsilon_t \end{aligned} \qquad (3)$$

where i is the measurement period,

$FDd_{t-i,t}$ is the dummy for positive $FD_{t-i,t}$,

$FD_{t-i,t}$ is the financial deficit over the past i years,

$YT_{t-i,t}$ is the yearly timing measure for i years,

$LT_{t-i,t}$ is the long-term timing measure for i years,

$r_{t-i,t}$ is the stock return from year *t-i* to year *t*,

$EBIT_{t-i,t}$ is the earnings before interest and taxes over the past *i* years,

$Ldef_{t-i,t}$ is the leverage deficit of year *t-i*, and

$\Delta \, Target_{t-i}$ is the change of the target leverage ratio over the past *i* years.

The estimation of long-term adjustments requires a longer history of a firm. Firms with a short history will be excluded from the sample. We also use the 3-year and 4-year changes of leverage ratio as our dependent variables. It is a robustness check for our results to see whether the accounting practices in 3-year and 4 year changes will arrive at same conclusion. The summary of the variables used in the partial adjustment model is shown in Tables 2a to 2c and the estimation results are reported in Table 3.

Table 2a: Descriptive Statistics of variables of partial adjustment model (3 year)

	Mean	Std. Err.	[95% Confidence Interval]	
Change in Book Leverage ($L_t - L_{t-3}$)	-0.01454	0.00052	-0.01556	-0.01353
Change in Market Leverage ($L_t - L_{t-3}$)	0.00945	0.00084	0.00780	0.01110
Financial Deficit ($FD_{t-3,\,t}$)	0.13535	0.00251	0.13042	0.14027
Yearly timing ($YT_{t-3,\,t}$)	0.00110	0.00020	0.00071	0.001479
Long-term timing ($LT_{t-3,\,t}$)	0.03036	0.00065	0.029085	0.03163
Cumulative stock return ($r_{t-3,\,t}$)	-0.07502	0.00380	-0.08248	-0.06756
Cumulative EBIT scaled by				
book value ($EBIT_{t-3,\,t}$)	0.17711	0.00113	0.17490	0.17932
Cumulative EBIT scaled by the sum of				
market equity and book debt ($EBIT_{t-3,\,t}$)	0.01875	0.00081	0.01716	0.02035
Book Leverage deficit ($Ldef_{t-3}$)	0.18186	0.00111	0.17969	0.18403
Market Leverage deficit ($Ldef_{t-3}$)	-0.00383	0.00055	-0.00490	-0.00275
Change in book target leverage ($\Delta Target_{t-3}$)	0.01207	0.00042	0.01126	0.01289
Change in market target leverage ($\Delta Target_{t-3}$)	0.01617	0.00060	0.014988	0.01736
Number of observations				33629

Table 2b: Descriptive Statistics of variables of partial adjustment model (4 year)

	Mean	Std. Err.	[95% Confidence	Interval]
Change in Book Leverage ($L_t - L_{t-4}$)	-0.02002	0.00059	-0.02118	-0.01886
Change in Market Leverage ($L_t - L_{t-4}$)	0.00977	0.00099	0.00782	0.011709
Financial Deficit ($FD_{t-4,t}$)	0.17721	0.00355	0.17026	0.184162
Yearly timing ($YT_{t-4,t}$)	0.00192	0.00021	0.00151	0.00233
Long-term timing ($LT_{t-4,t}$)	0.02938	0.00061	0.02818	0.03057
Cumulative stock return ($r_{t-4,t}$)	-0.08113	0.00456	-0.09007	-0.07220
Cumulative EBIT scaled by book value ($EBIT_{t-4,t}$)	0.22350	0.00164	0.22028	0.22671
Cumulative EBIT scaled by the sum of market equity and book debt ($EBIT_{t-4,t}$)	0.15590	0.00122	0.15351	0.15829
Book Leverage deficit ($Ldef_{t-4}$)	0.08825	0.00114	0.08601	0.09048
Market Leverage deficit ($Ldef_{t-4}$)	0.01119	0.00105	0.00914	0.01324
Change in book target leverage ($\Delta Target_{t-4}$)	0.01665	0.00046	0.01575	0.01756
Change in market target leverage ($\Delta Target_{t-4}$)	0.02134	0.00067	0.02003	0.02265
Number of observations				30498

Table 2c: Descriptive Statistics of variables of partial adjustment model (5 year)

	Mean	Std. Err.	[95% Confidence	Interval]
Change in Book Leverage ($L_t - L_{t-5}$)	-0.02465	0.00067	-0.02596	-0.02334
Change in Market Leverage ($L_t - L_{t-5}$)	0.01750	0.00115	0.01525	0.01974
Financial Deficit ($FD_{t-5,\,t}$)	0.22138	0.00505	0.21149	0.231271
Yearly timing ($YT_{t-5,\,t}$)	0.00259	0.00021	0.00218	0.00300
Long-term timing ($LT_{t-5,\,t}$)	0.02886	0.00058	0.02773	0.02999
Cumulative stock return ($r_{t-5,\,t}$)	-0.11407	0.00538	-0.124632	-0.10351
Cumulative EBIT scaled by book value ($EBIT_{t-5,\,t}$)	0.27091	0.00199	0.26702	0.27480
Cumulative EBIT scaled by the sum of market equity and book debt ($EBIT_{t-5,\,t}$)	0.18583	0.00138	0.183130	0.18852
Book Leverage deficit ($Ldef_{t-5}$)	0.08904	0.00121	0.08667	0.09141
Market Leverage deficit ($Ldef_{t-5}$)	0.00378	0.00109	0.00164	0.00592
Change in book target leverage ($\Delta Target_{t-5}$)	0.02146	0.00051	0.02046	0.02247
Change in market target leverage ($\Delta Target_{t-5}$)	0.02800	0.00074	0.02655	0.02946
Number of observations				26384

The expected effects of variables of pecking order, tradeoff and market timing hypotheses are as follows:

Table 3: Estimation of effects of factors affecting the long-run adjustment (All economies)

Book Leverage						
$L_t - L_{t-i}$	i=3years	t	i=4years	t	i=5years	t
constant	-0.0585**	-10.95	-0.04456**	-5.03	-0.05588**	-4.85
$FD_{t-i,t}$	0.01171	0.87	0.00115	0.14	0.01660**	2.71
$FDd_{t-i,t}$	0.03929**	12.41	0.04552**	15.22	0.04347**	14.81
$YT_{t-i,t}$	-0.03086	-0.56	-0.08571	-1.25	-0.09029	-1.21
$LT_{t-i,t}$	0.10135**	3.48	0.16362**	5.33	0.16258**	4.85
$r_{t-i,t}$	-0.01441**	-8.84	-0.01185**	-6.21	-0.01116**	-6.83
$EBIT_{t-i,t}$	-0.01186	-0.97	-0.06680**	-4.92	-0.07695**	-9.42
$Ldef_{t-i}$	-0.0694**	-7.19	-0.14181**	-24.33	-0.16006**	-22.10
$\Delta Target_{t-i}$	0.12260**	7.81	0.10423**	6.30	0.09858**	5.84
hk_dum	0.02332**	2.78	-0.00455	-0.42	0.00893	0.61
jp_dum	0.01967**	3.78	0.01330	1.75	0.02405**	2.27
sgp_dum	0.00907	1.29	0.00317	0.34	0.01300	0.98
tw_dum	0.01851	1.34	-0.05051**	-3.13	-0.00252	-0.13
97_dum	0.01586**	9.06	0.00528**	2.57	0.00794**	3.18
N	34564		30628		26576	
clusters	2667		2511		2284	
R^2		0.1475		0.2148		0.2344

Market Leverage						
$L_t - L_{t-i}$	i=3years	t	i=4years	t	i=5years	t
constant	-0.10224**	-16.29	-0.10595**	-14.11	-0.13233**	-12.23
$FD_{t-i,t}$	0.01739**	2.97	0.01422**	3.55	0.01223**	3.28
$FDd_{t-i,t}t$	0.03523**	14.35	0.04072**	14.73	0.04286**	14.36
$YT_{t-i,t}$	-0.03198	-0.70	-0.08937**	-2.22	-0.08975	-1.76
$LT_{t-i,t}$	0.17339**	6.82	0.23098**	8.09	0.30781**	9.45
$r_{t-i,t}$	-0.16823**	-65.71	-0.15303**	-52.32	-0.15098**	-51.59
$EBIT_{t-i,t}$	0.07111**	5.64	-0.00429	-0.53	-0.01356	-1.89
$Ldef_{t-i}$	-0.12333**	-9.06	-0.16326**	-24.19	-0.19341**	-25.43
$\Delta Target_{t-i}$	0.14743**	11.63	0.20483**	15.82	0.21203**	14.8
hk_dum	0.02939**	3.09	-0.01777**	-1.53	-0.01276	-0.77
jp_dum	0.06187**	9.96	0.06075**	8.3	0.08223**	7.84
sgp_dum	-0.02004	-1.79	0.02936**	3.24	0.04795**	3.70
tw_dum	0.03662**	3.68	-0.01821	-1.71	0.00815	0.57
97_dum	0.01922**	11.36	0.03001**	15.16	0.03546**	14.10
N	33629		30498		26384	
clusters	2686		2598		2325	
R^2	0.7457		0.7779		0.7943	

Notes: ** Significant at the 5% level.

4.1. Pecking order hypothesis

Financial deficit ($FD_{t-i,\,t}$) represents the need of external financing and is defined as the sum of net equity issues and net debt issues in the past *i* years, scaled by the total assets at the beginning of the first year. Therefore, financial deficit is the amount raised externally by a firm. Since a positive financial deficit ($FD_{t-i,\,t}$) may have a different impact on a firm's capital structure compared to a negative one, a dummy ($FDd_{t-i,\,t}$) is added to indicate if the financial deficit exists in the past *i* years to capture the difference. The pecking order hypothesis states that firms prefer internal funds to external funds. The positive coefficient of financial deficit shows that the increase in debt ratio, i.e., more debt or less equity in capital structure, is associated with an increase in the amount raised externally by a firm. It reveals the firm's preference to use debt rather than equity when external funding is needed. Under the pecking order hypothesis, firms with higher profits should have a lower debt ratio. In this paper, profitability is proxied by cumulative earnings before interest and taxes ($EBIT_{t-i,\,t}$) in the past *i* years, scaled by total assets at the beginning of year *t-i*. The effect of $EBIT_{t-i,\,t}$ on the change in leverage ratio should be negative.

4.2. Tradeoff hypothesis

Under the tradeoff hypothesis, firms should have a target leverage ratio, i.e., an optimal combination of debt and equity. The explanatory variables for the tradeoff hypothesis include leverage deficit and change in target ratio. The target ratio is estimated using model (1). The leverage deficit at year *t-i* ($Ldef_{t-i}$) is computed as the difference between the observed debt ratio and the target ratio at year *t-i*. The change in the target ratio ($\Delta Target_{t-i}$) is the difference in the target ratio between year *t* and year *t-i*. The long-term adjustment of leverage ratio towards the target is indicated by the negative coefficient of the variable coefficient. If the cost of adjustment is large (small), the magnitude of the coefficient will be small (large). Similarly, the sign for the change of the target ratio ($\Delta Target_{t-i}$) is expected to be positive.

4.3. Market timing hypothesis

The market timing hypothesis implies that firms tend to raise funds by issuing equity when the share price is high and issuing debt otherwise. Following Kayhan and Titman (2007), we decompose the expected finance weighted-average of Baker and Wurgler (2002) into yearly timing ($YT_{t-i,t}$) and long-term timing ($LT_{t-i,t}$). The market timing behavior is captured by the stock price performance, yearly timing and long-term timing variables. The yearly timing is calculated as the covariance between one-year financial deficits and market-to-book ratios in the past *i* years. When a firm raises external capital during at high stock price, it is more likely to lower its debt ratio. Therefore, an inverse relationship between the yearly timing and the change in debt ratio is expected. Our estimation shows that the coefficient of yearly-timing variable is slightly negative.

The long-term timing is tabulated as the product of the average financial deficit and the average market-to-book ratio for rolling windows from *year t-i to year t*. When a pecking order firm has high growth opportunities (market-to-book) and high external funding needs, it tends to borrow more. Therefore, the long-term timing tests the pecking order effect. The estimation results from Table 3 show that the effect of long-term timing is positive, which is different from Kayhan and Titman (2007). This suggests that the pecking order effect in Asian firms is stronger than that in the US firms. Welch (2004) shows a strong negative effect of stock return on the leverage. Thus, we also include the cumulative stock return ($r_{t-i,t}$) from year $t-i$ to year t in our model. A negative coefficient is anticipated when firms are more willing to issue equity in time of good stock performance. Similar to Welch (2004), the stock returns of Asian firms have shown a substantially negative impact on the leverage, especially in the market leverage regressions. Our t-statistics range from -65.71 to -51.59 in the market regression.

From Table 3, the long-term adjustments of the Asian firms' leverages are likely to make up for the leverage deficit gradually. For the book regression, the leverage changes to fill the leverage deficit with a speed of 6.94% for the three-year change, 14.18% for the four-year change and 16% for the five-year change. On the other hand, the firms show a much faster adjustment speed of 12.33% for the three-year change, 16.33% for the four-year change and 19.34% for the five-year change in the market regressions. The pattern of the increasing speed of adjustment is observed in the regressions of changes in debt ratio.

The constant terms of the two regressions are negative. A dummy (*97_dum*) is added to see if the Asian firms' capital structures are influenced by the Asian Financial Crisis. The effect is positive. In Table 3, the book leverage ratio is increased by 0.016, 0.005 and 0.008 for i = 3, 4, 5 respectively, while the corresponding market leverage ratio is increased by 0.019, 0.030 and 0.035 respectively. The stock market entered bearish state right after the Asian Financial Crisis and began to recover after 2003. Therefore, the equity value was depreciating during the period of 1997-2003, which causes an increase in the leverage ratio.

5. PERSISTENCE AND REVERSAL OF EFFECTS

5.1. Persistence of the Effects

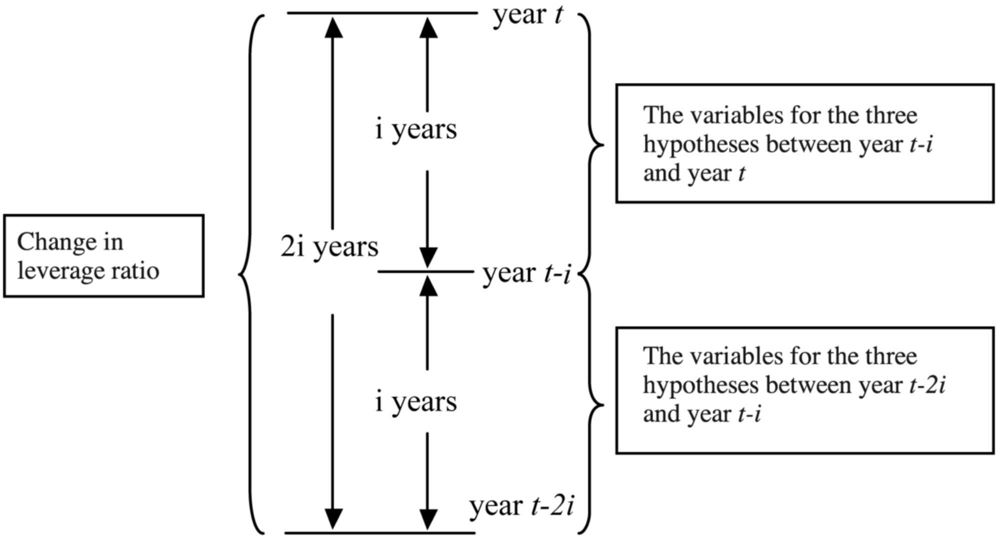
To see whether the effects of the determinants of long-term adjustment are persistent, we study how the change of observed leverage ratio over $2i$ years is affected by the variables in two i-year periods. The change in leverage over the $2i$-year period can be attributed to the effects of variables of both i-year periods. In order to show the persistent effect, the coefficient of a variable in the first i-year period should have the same sign as that in the following i-year period. The slope coefficients are estimated by OLS while the bootstrapping technique is used to estimate the standard errors. Figure 1 describes the estimation procedure.

The model is given as follows:

$$\begin{aligned} L_t - L_{t-2i} = \; & \alpha_0 + \beta_1 FDd_{t-2i,t-i} + \beta_2 FD_{t-2i,t-i} + \beta_3\, YT_{t-2i,t-i} + \beta_4\, LT_{t-2i,t-i} + \beta_5\, r_{t-2i,t-i} \\ & + \beta_6\, EBIT_{t-2i,t-i} + \beta_7\, FDd_{t-i,t} + \beta_8\, FDt\text{-}i,t + \beta_9 YT_{t-i,t} + \beta_{10}\, LT_{t-i,t} \\ & + \beta_{11}\, r_{t-i,t} + \beta_{12}\, EBIT_{t-i,t} + \beta_{13}\, Ldef_{t-2i} + \beta_{14}\, \Delta Target_{t-2i} \qquad (4) \\ & + \beta_{15}\, Industrial\ dummies + \beta_{16}\, 97\_dum + e_t \end{aligned}$$

where $i = 3, 4, 5$.

Figure 1: Estimation of the persistence of effects



The estimation results for the persistence of the effects are shown in Table 4. Firms generally adjust to make up for the leverage deficit and move towards the target ratio. It is represented by the negative coefficient of leverage deficit and the positive coefficient of the change in target ratio respectively. Besides, the negative effect of stock price performance persists across the $2i$-year horizon.

The effect of financial deficit in the first i-year period on the change of debt ratio in $2i$ years is stronger than that of the next i-year period, suggesting that the effect is diminishing across the $2i$ years. For example, the coefficient of the first five-year financial deficit is 0.0076 while that of the last five-year financial deficit is 0.0025 in the market leverage regression of 5-year change as shown in Table 4. The market timing behavior represented by yearly-timing is generally not persistent during the $2i$-year period. Except for $i = 4$, the coefficients of yearly-timing are significant in the market leverage regression as shown in Table 4. Note that the effect of long-term timing is short-lived. The negative sign of coefficients of variables for the first i-year period suggests a drop in leverage while the positive sign of the next i-year period represents an increase in leverage.

5.2. Reversal of the Effects

Equation (5) is modified by replacing the dependent variable with the change of leverage ratio in i years instead of $2i$ years to investigate the reversal effects. The model shows if the effects of firm histories of cash flow, investment expenditure, stock performance and profitability from year t-$2i$ to year t-i reverse in the next i years. The change of leverage in i years is regressed on variables in the two i-year periods. If a reversal exists, the sign of the same coefficient will

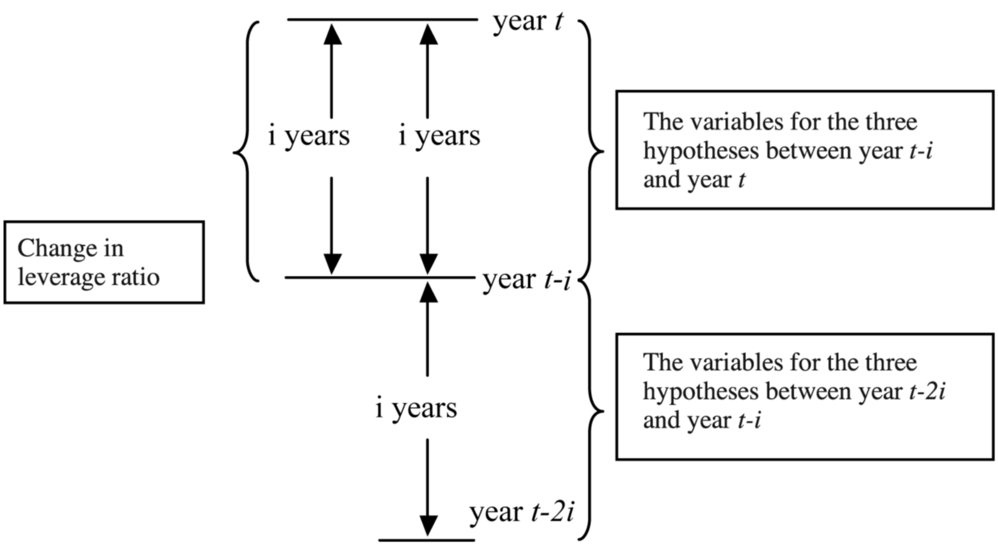
Table 4: Estimation of the persistence of effects (All economies)

Book Leverage							Market Leverage						
$L_t - L_{t-2i}$	i=3years	t	i=4years	t	i=5years	t	$L_t - L_{t-2i}$	i=3years	t	i=4years	t	i=5years	t
constant	-0.01764	-1.64	-0.01128	-0.77	-0.01501	-0.78	constant	-0.13427**	-12.43	-0.11668**	-8.7	-0.18680**	-10.48
$FD_{t-i,t}$	0.00074	0.15	0.00687	1.01	0.00706	1.50	$FD_{t-i,t}$	0.001861	0.18	0.00293	0.22	0.00246	0.35
$FDd_{t-i,t}$	0.04765**	16.48	0.04674**	12.32	0.04354**	11.99	$FDd_{t-i,t}$	0.04340**	12.57	0.03652**	14.25	0.04648**	8.12
$YT_{t-i,t}$	-0.05191	-0.83	-0.20735	-1.88	-0.20524	-1.62	$YT_{t-i,t}$	-0.13512	-1.74	-0.21301**	-3.41	-0.28500**	-2.80
$LT_{t-i,t}$	0.12786**	5.45	0.21147**	5.11	0.24872**	6.38	$LT_{t-i,t}$	0.19533**	7.00	0.31106**	6.97	0.35798**	4.88
$r_{t-i,t}$	-0.00743**	-4.04	-0.00852**	-3.76	-0.01332**	-5.56	$r_{t-i,t}$	-0.15374**	-49.16	-0.14958**	-43.42	-0.16848**	-53.16
$EBIT_{t-i,t}$	-0.03177	-1.5	-0.12612**	-10.68	-0.09227**	-5.56	$EBIT_{t-i,t}$	0.06856**	4.49	0.02266	1.92	-0.02469**	-2.84
$FD_{t-2i,t-i}$	0.00937**	4.82	0.00510	1.51	0.00443**	1.96	$FD_{t-2i,t-i}$	0.00481	1.33	0.00621	1.69	0.00761**	2.57
$FDd_{t-2i,t-i}$	0.034476**	19.05	0.03859**	16.24	0.04137**	14.33	$FDd_{t-2i,t-i}$	0.03799**	23.28	0.04350**	22.48	0.05351**	21.25
$YT_{t-2i,t-i}$	-0.02726**	-2.68	-0.05403**	-2.94	-0.04170**	-2.03	$YT_{t-2i,t-i}$	-0.03039**	-2.67	-0.04108**	-2.30	-0.01318	-0.70
$LT_{t-2i,t-i}$	-0.03674**	-5.87	-0.03383**	-2.47	-0.03347**	-2.96	$LT_{t-2i,t-i}$	-0.02297**	-1.96	-0.03279**	-2.33	-0.03602**	-2.60
$r_{t-2i,t-i}$	-0.02208**	-11.28	-0.02508**	-10.35	-0.03463**	-12.12	$r_{t-2i,t-i}$	-0.15371**	-46.06	-0.14323**	-38.23	-0.15872**	-43.15
$EBIT_{t-2i,t-i}$	-0.11561**	-6.53	-0.04516**	-5.21	-0.05543**	-5.35	$EBIT_{t-2i,t-i}$	0.00811	0.42	-0.08152**	-6.95	-0.0044	-0.69
$Ldef_{t-2i}$	-0.17983**	-25.00	-0.21657**	-24.25	-0.26239**	-22.34	$Ldef_{t-2i}$	-0.20057**	-27.10	-0.23516**	-24.29	-0.16964**	-17.68
$\Delta Target_{t-2i}$	0.16817**	6.48	0.06249**	2.84	0.08187**	3.24	$\Delta Target_{t-2i}$	0.24810**	16.14	0.29332**	16.64	0.24528**	11.48
hk_dum	-0.05476**	-3.67	-0.09499	-1.73	-0.25992**	-2.05	hk_dum	-0.03101**	-2.02	-0.08376	-1.33	0.0852	1.57
jp_dum	-0.02686**	-2.75	-0.02723**	-2.07	-0.01516	-0.87	jp_dum	0.06977**	6.48	0.05702**	4.41	0.11113**	6.60
sgp_dum	-0.03672**	-3.03	-0.03489**	-2.15	-0.03076	-1.31	sgp_dum	0.01926	1.72	0.02502	1.53	0.09214**	4.19
tw_dum	-0.03075	-1.67	0.03018	0.75	-0.02813**	-5.91	tw_dum	0.00877	0.55	0.03956	1.55		
97_dum	-0.00093	-0.35	-0.00746**	-2.14			97_dum	0.02384**	9.02	0.02759**	7.98	0.05375**	10.56
N	31877		27144		23316		N	31225		26518		22864	
clusters	2409		1910		1743		clusters	2428		1908		1732	
R^2	0.26		0.2887		0.2961		R^2	0.7861		0.8272		0.8401	

Notes: ** Significant at the 5% level.

differ in each *i*-year period. For instance, if the financial deficit has a positive effect on leverage in the current *i* years due to the pecking order, it will have a negative effect in the next *i* years. Figure2 explains the estimation:

Figure 2: Estimation of reversal of effects



The model for the estimation of reversal of effects is shown below:

$$
\begin{aligned}
L_t - L_{t-i} = {} & \alpha_0 + \beta 1FDd_{t-2i,t-i} + \beta_2 FD_{t-2i,t-i} + \beta_3\, YT_{t-2i,t-i} + \beta_4\, LT_{t-2i,t-i} + \beta_5\, r_{t-2i,t-i} \\
& + \beta_6\, EBIT_{t-2i,t-i} + \beta_7\, FDd_{t-i\,,t} + \beta_8\, FD_{t-i\,,t} + \beta_9 YT_{t-i\,,t} + \beta_{10}\, LT_{t-i\,,t} \\
& + \beta_{11}\, r_{t-i\,,t} + \beta_{12}\, EBIT_{t-i\,,t} + \beta_{13}\, Ldef_{t-2i} + \beta_{14}\, \Delta Target_{t-2i} \qquad (5) \\
& + \beta_{15}\, Industrial\ dummies + \beta_{16}\, 97\_dum + e_t
\end{aligned}
$$

where $i = 3, 4, 5$.

The results are reported in Table 5. The change in the sign of coefficient of the same variable indicates a reversal effect. Note that the coefficients of financial deficit are insignificant. However, the dummies of financial deficits demonstrate a reversal pattern. The effect of financial deficit from year *t-2i* to *t-i* is negative while that of financial deficit from year *t-i* to *t* is positive. The magnitude of the coefficient in the first *i*-year period is greater than that of the coefficient in the next *i*-year period. For example, in Table 3, the coefficients of dummies of financial deficit from year *t-i* to *t* are greater than that of the next *i* years for both book and market leverage regressions. A reversal is also observed in the *EBIT* variable.

Table 5: Estimation of reversal of effects (All economies)

Book Leverage							Market Leverage						
$L_t - L_{t-i}$	i=3years	t	i=4years	t	i=5years	t	$L_t - L_{t-i}$	i=3years	t	i=4years	t	i=5years	t
constant	-0.03758**	-5.58	-0.04615**	-4.33	-0.06809**	-4.15	constant	-0.06520**	-8.82	-0.06680**	-7.18	-0.09105**	-5.66
$FD_{t-i,t}$	0.00068	0.08	0.01095	1.11	0.01014	1.26	$FD_{t-i,t}$	0.00609	0.57	0.01166	1.03	0.01021	1.37
$FDd_{t-i,t}$	0.04221**	16.13	0.03749**	15.49	0.04296**	11.01	$FDd_{t-i,t}$	0.04261**	11.00	0.03498**	16.99	0.03715**	15.17
$YT_{t-i,t}$	-0.02594	-0.34	-0.32647**	-4.00	-0.31353**	-2.69	$YT_{t-i,t}$	-0.13918	-1.64	-0.20645**	-3.03	-0.21115**	-2.87
$LT_{t-i,t}$	0.13809**	5.00	0.28622**	8.29	0.27881**	4.59	$LT_{t-i,t}$	0.16576**	3.98	0.33841**	8.44	0.42675**	9.89
$r_{t-i,t}$	-0.01375**	-9.53	-0.01806**	-11.77	-0.02081**	-11.11	$r_{t-i,t}$	-0.17348**	-73.32	-0.17328**	-64.89	-0.16892**	-55.48
$EBIT_{t-i,t}$	-0.0419	-1.84	-0.12940**	-10.29	-0.10387**	-9.70	$EBIT_{t-i,t}$	0.06877**	3.06	0.01961	1.74	0.00866	0.85
$FD_{t-2i,t-i}$	0.00184	1.01	-0.00734**	-2.67	-0.00686**	-3.59	$FD_{t-2i,t-i}$	0.00203	0.77	-0.00687**	-3.33	-0.00716**	-3.54
$FDd_{t-2i,t-i}$	-0.01770**	-12.20	-0.01861**	-10.54	-0.01464**	-6.81	$FDd_{t-2i,t-i}$	-0.01775**	-13.17	-0.02012**	-14.79	-0.02092**	-12.37
$YT_{t-2i,t-i}$	-0.00689	-0.45	-0.01133	-0.91	-0.00183	-0.10	$YT_{t-2i,t-i}$	-0.01143	-0.72	-0.00882	-0.64	0.00782	0.42
$LT_{t-2i,t-i}$	-0.01246**	-2.05	0.02154**	2.03	0.0239**	2.53	$LT_{t-2i,t-i}$	-0.01652	-1.74	0.02367**	2.90	0.02946**	2.86
$r_{t-2i,t-i}$	-0.01325**	-8.78	-0.02027**	-11.89	-0.02547**	-11.31	$r_{t-2i,t-i}$	0.01469**	7.18	0.01935**	9.97	0.02657**	11.03
$EBIT_{t-2i,t-i}$	-0.02001	-1.19	0.04368**	4.75	0.02960**	4.38	$EBIT_{t-2i,t-i}$	-0.03190**	-1.80	-0.04645**	-5.57	-0.03837**	-5.71
$Ldef_{t-2i}$	-0.06355**	-14.73	-0.07685**	-14.47	-0.09322**	-14.22	$Ldef_{t-2i}$	-0.08116**	-18.32	-0.09278**	-17.49	-0.10081**	-16.29
$\Delta Target_{t-2i}$	0.13411**	5.76	0.01827	1.01	0.02270	1.35	$\Delta Target_{t-2i}$	0.11595**	11.53	0.15104**	13.01	0.18553**	13.87
hk_dum	0.01883	1.84	0.05841	1.07	-0.0457	-1.17	hk_dum	0.01283	1.09	-0.06322	-0.70	0.06294**	4.00
jp_dum	0.01779**	2.86	0.03417**	3.47	0.05399**	3.62	jp_dum	0.04120**	5.69	0.04541**	5.33	0.06350**	3.38
sgp_dum	0.01695**	2.14	0.03367**	2.79	0.05741**	3.26	sgp_dum	0.02045**	2.82	0.03775**	3.60	-0.03882	-1.29
tw_dum	0.03480**	2.86	0.08608**	3.32			tw_dum	0.04740**	3.68	0.05169**	2.67		
97_dum	-0.0003	-0.17	-0.00481**	-2.10	-0.0125**	-3.81	97_dum	0.00723**	4.71	0.01424**	6.55	0.02303**	7.74
N	31737		27049		23242		N	31096		26431		22794	
clusters	2392		1905		1742		clusters	2411		1903		1730	
R^2	0.1824		0.2386		0.2331		R^2	0.7719		0.8166		0.8272	

Notes: ** Significant at the 5% level.

Note that the coefficients of yearly timing variables in the previous *i*-year period are generally insignificant. The t-statistics of the coefficients are smaller than 1 as shown in Table 5. It provides further evidence that the market timing behavior based on the market-to-book ratio is not very persistent.

As mentioned in the previous section, the long-term timing effects tend to cancel each other. The positive signs for both coefficients in the case of large *i* can also be explained by the fact that the market timing behavior is dominated by the pecking order effect in the long run.

The stock returns and leverage deficit show a persistently negative relationship with the leverage ratio while the change in the target ratio has demonstrated a long-run positive relationship. These provide evidence for the tradeoff hypothesis. A higher stock return encourages a firm to use more equity financing. Both the positive effect of the change in the target ratio and the negative effect of the leverage deficit show that the observed leverage ratio tends to move towards the target ratio.

6. CONCLUSION

This paper provides a first attempt to analyze the long-run adjustment towards the target for Asian firms. The partial adjustment models for book leverage and market leverage are estimated for a sample of industrial firms in Hong Kong, Japan, Singapore, Taiwan and Thailand. The results obtained in this study indicate that Asian firms adjust gradually towards their target leverage ratio. This can be attributed to the low cost of deviating from the target ratio. Our results show that the market timing behavior does not persist, which is in sharp contrast to Kayhan and Titman (2007). The difference can be attributed to the fact that the United States has a more mature debt market, and thus the cost of capital is lower compared to Asian countries (Chong et al., 2010). The pecking order behavior can be observed through the financial deficit and long-term timing variables but it is persistent only for the latter. Although deviations from the target persist, the leverage reverts gradually to the target ratio to fill up the leverage deficit. It is also found that the adjustment speed of debt ratios tends to fall after a financial crisis. It is also found that Asian firms tend to use more debt than equity in when external funding is needed. The preference of Asian firms to use more debt in their financing increases the systemic risk of the banking sector. Therefore, compared to other regions, a fall in credit quality of Asian firms is more likely to trigger a domino effect of defaults leading to regional banking crises.

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