Determinants of the target capital structure and adjustment speed – evidence from Asian capital markets

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This draft: February 2010

Abstract

Even though Asia is a major region of the world economy, robust tests of the tradeoff theory on corporate capital structure do not exist for Asian capital markets. The aim of this study is to close this gap in the literature by providing an econometrically robust and geographically comprehensive analysis of the determinants of capital structure and the speed of adjustment towards the target capital structures in Asian capital markets. We use a homogeneous panel of 1301 companies with market capitalizations of at least 1 bn. USD, listed on fourteen Asian stock exchanges. Our main findings are based on a GMM-estimation for the determinants of capital structure, respectively System-GMM-estimation for the speed of adjustment. Robustness is provided by a modification of the regression model as well as by reporting OLS-, and TSLS-estimations. We contribute to the existing literature by finding strong evidence that Asian companies pursue target capital structures during the period 1995 – 2009. The convergence towards target capital structures in Asian firms is estimated at a speed ranging from 27% to 39%, consistent with international evidence on the speed of adjustment to target capital structures. Additionally, our results provide evidence that industry-fixed effects do influence capital structure choices in Asia.

JEL-classifiation: G10, G32

Keywords: Capital structure, dynamic adjustment, panel models

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1. Introduction

Capital markets in Asia are much researched on an aggregate level with regard to their extraordinary growth and the accompanying volatility in the advancement of this growth. For example, asset price bubbles and moral hazard in capital markets pose one important strand of empirical finance research on Asia (i.e. Sarno and Taylor (1999)). However, even though factors such as over-investment and excessive leverage have been identified as crucial for Asian growth from an aggregate level (i.e. Stiglitz (1999)), only few empirical studies take this observation as a motivation to broadly research corporate capital structures in Asia from a corporate finance perspective. A comprehensive and context-free Asian market analysis can only be extracted from the global study of Clark, Francis and Iftekhar (2009). Earlier studies mainly contribute to the explanation of the Asian crisis of 1997 (Driffield (2008), Driffield, Mahambare and Pal (2005), Booth, Aivazian, Demirgunc-Kunt and Maksimovic (2001)).

The aim of this study is to close this gap in the literature and to provide an econometrically robust and geographically comprehensive analysis of the determinants of capital structures in Asian companies. Therefore, our econometric approach is based on different estimation methods and two models to control for the robustness of results. The methods applied are similar to related studies on the U.S. capital markets (Flannery and Rangan (2006)) and the European capital markets (Drobetz and Wanzenried (2006)). Besides, we enhance the homogeneity of the panel by imposing a size restriction to control for different financing cost structures between small and large stock companies (Frank and Goyal (2009)). In addition, this makes sure that the financial environment is comparable to the one faced by U.S. and European companies. By contrasting our findings for Asia with results reported in the literature for Europe and the U.S.A., we aim to establish comparability between these major regions of the world economy, with regard to the determinants of corporate capital structures and the speed of adjustment to target capital structures.

We contribute to the existing literature on empirical capital structure research, by discussing our findings for different industries of the Asian economies on the basis of a representative dataset of companies traded on fourteen Asian stock exchanges. So far, international capital structure research shows evidence for the tradeoff theory, documenting that the leverage decision is based on a set of firm-specific factors whose statistical significance varies across countries. Furthermore, an important characteristic of the tradeoff theory, namely whether the observed adjustment behavior is a mechanical reversal or truly reflects a movement towards the equilibrium, is up for debate for European and U.S. capital markets data. Research for the Asian market is necessary, as the existing empirical evidence reveals mainly pecking order behavior in Asian companies (Fan and So (2004), Booth, Aivazian, Demirguc-Kunt and Maksimovic (2001), Pandey (2001)). This stands in sharp contrast to the findings on the U.S. and European markets, where evidence for the tradeoff theory can be found. Discussing these remaining issues for the Asian market adds a further piece to the capital structure puzzle and contributes empirical evidence to support a unified capital structure theory, which is currently developed in the literature.

Our econometric design to test capital structure theories in Asia is based on the idea, that companies follow a target capital structure over time, which is determined by the variation of endogenous as well as exogenous factors. In a second step, we research the speed of adjustment that Asian companies display in adapting their balance sheets to these target capital structures. The paper is structured as follows: section 2 gives an overview of the literature and results on empirical capital structure research. In section 3 we introduce the econometric methodology and data. Section 4 discusses the empirical results, and section 5 concludes.

2. Literature review

The basis for empirical capital structure research is the seminal study by Modigliani and Miller (1958) who prove, that under the restrictive assumptions of perfect capital markets with no arbitrage, no taxes or transaction costs and equal interest on debt and equity, the value of a company is independent of the management´s financial decisions. If these assumptions are relaxed through the inclusion of corporate taxes, transaction costs, differing interest rates for debt and equity and information asymmetry, the question of what determines capital structures becomes complex. Myers (1984) underscores this central question in corporate finance by formulating the three major schools of thought on capital structure. Fischer, Heinkel and Zechner (1989) are the first authors to develop a theory of *dynamic* capital structure choice in the presence of corporate recapitalization costs. The theory provides the firm´s optimal dynamic recapitalization policy as a function of firm specific characteristics. Most recently the dynamic capital structure theory is extended to include aspects of corporate governance. Berk, Stanton and Zechner (2009) derive a firm's optimal capital structure and managerial compensation contract when employees are averse to bearing their own human capital risk. The theory delivers empirically consistent optimal debt levels and implies persistent idiosyncratic differences in leverage across firms as well as a positive relationship between leverage and executive compensation.

Empirical research has focused predominantly on validity tests of the three theories on capital structure: the static and dynamic versions of the tradeoff theory, the pecking order theory and the market timing theory. Rajan and Zingales (1995) analyze the determinants of capital structure choices for firms in the G-7 countries and find firm leverage to be similar across countries. Factors identified as correlated in the cross-section with firm leverage in the United States, are similarly correlated in other countries as well. Further research was done from an international perspective, where Fan, Titman and Twite (2008) examine the capital structure and debt maturity choices in a cross-section of firms in 39 developed and developing countries. They find a stronger relationship between profitability and leverage in countries with weaker shareholder protection. In countries with better legal protection for financial claimants, firms tend to hold less total debt, and more long-term debt as a proportion of total debt. In addition, firms that choose to cross-list, tend to use more equity and longer-term debt. The cross-sectional determinants of leverage differ across countries.

As empirical capital structure research has grown fast over the years, our literature review does not claim to be exhaustive. We reflect a selection of studies, which relate to the approach chosen in our empirical analysis. Therefore, the emphasis is put on the three major capital structure theories and dynamic capital structure research, as described by the target adjustment hypothesis.

2.1. Industry fixed vs. firm fixed effects

Bradley, Jarrell and Kim (1984) are among the first authors to report significant differences and variation in corporate leverage between industry sectors. Mac Kay and Phillips (2005) find in a U.S.-sample that industry fixed effects explain about 13% of the variation in leverage, while firm fixed effects account for 54% in the variation of leverage. Even though these unobservable firm fixed effects elucidate the majority of leverage variation over time, Roberts (2002) highlights that the average degrees of leverage ratios analyzed for fifty industry sectors in the U.S.A. span from a minimum of 9% to a maximum of 54%. Furthermore, Almazan and Molina (2005) argue that intra-industry capital structure dispersion is larger in industries that are more concentrated, use leasing more intensively, and exhibit looser corporate governance practices. With regard to country-specific evidence, Glen and Singh (2004) report that companies in emerging markets display lower debt levels than their peers in industrialized countries. An exception to this observation is reported by Kim (2009), who detects higher book levels of debt for Korean companies compared to their U.S.-peers in the same industries.

In general, the explanatory power of regression-based capital structure tests varies considerably across different data sets and regressors. The coefficient of determination R^2 is between 18% to 29% for traditional methods (Lemmon, Roberts and Zender 2008). When regressions are supplemented by regressors accounting for time-constant firm fixed effects, the explanatory power rises considerably. Flannery and Rangan (2006) report coefficients of determination of 45%. In the studies of Lemmon, Roberts and Zender (2008) and Antoniou, Guney and Paudyal (2008), R^2 amounts to 60% and 66% respectively. From an economic perspective, firm fixed effects are the permanent, time invariant component of debt. The drastic increase of explanatory power through the inclusion of firm fixed effects is an indication for a certain degree of persistence in capital structures.

From an econometric perspective Arellano and Bover (1995) and Blundell and Bond (1998) present an estimation technique, which is applicable for estimating a dynamic model from panel data by the generalized method of moments (GMM). In particular, their technique improves the efficiency of the results when the number of time-series observations is small. The GMM estimator optimally exploits all linear moment restrictions that follow from the assumption of no serial correlation in the errors. In addition, we use White´s (1980) parameter covariance matrix estimator for the disturbances of the heteroscedastic linear regression models and report the White's period standard errors. These standard errors are robust to serial correlation and heteroscedasticity.

2.2. Static and dynamic trade-off theory

The pioneers of the tradeoff theory are Modigliani and Miller (1963), who analyze capital structure decisions in a model with taxes, where interest payment on debt shields profits from being taxed. Bradley, Jarrell and Kim (1984) reports evidence on the static tradeoff theory, which stipulates that companies increase debt levels until the utility of an additional unit of debt equals the cost of debt, including the costs of a higher probability of financial distress with rising debt levels. Hence, companies strive to reach this static optimal point, also called target capital structure. Bris, Welch and Zhu (2006) report that the utility of tax shields rises with profitability, higher tax rates and lower depreciations, estimating the costs of financial distress to 2 – 20 percent of assets. Andrade and Kaplan (1998) report costs of financial distress between 10 – 20 percent of assets. Moreover, the costs and benefits of different capital structures are determined by the principal-agent conflict of debt and equity holders. Jensen and Meckling (1976) and Jensen (1986) argue that corporate debt has a disciplining effect on management, since its service reduces the free cash flow and therefore minimizes management´s discretionary scope of action. Capital structure related agency costs – the costs resulting from the deviation of the optimum – become manifest in under-investment and investments in too risky projects (Morellec (2004)).

The dynamic tradeoff theory implies that the optimal target capital structure of companies adjusts over time and is a function of changing exogenous and endogenous factors. Fischer, Heinkel and Zechner (1989) formulate a theory of dynamic capital structure choice in the presence of transaction costs and find empirical evidence for firm specific effects relating to firm´s debt ratio ranges. Leland and Toft (1996) develop a dynamic model with endogenous levels of bankruptcy, thereby explaining the optimal amount and maturity of debt. Ju, Parrino, Poteshman and Weisbach (2002) use a dynamic capital structure model based on the contingent claims method, and find that firm´s actual leverage levels are in line with the tradeoff theory. Hennessy and Whited (2005) analyze a dynamic tradeoff model with endogenous choice of leverage and real investment in the presence of taxes and transaction costs and find that leverage is path dependent as well as decreasing in liquidity. Strebulaev (2007) underscores that leverage is mean-reverting and inversely related to profitability. Furthermore, research on the departures from target capital structures due to shocks in the market value of equity yields the insight, that companies weigh the rebalancing decision against the transaction costs of rebalancing (Leary and Roberts (2005), Byuon (2008)). Under certain circumstances, it can be a firm value maximizing strategy not to return to target capital structures immediately. Hovakimian, Opler and Titman (2001) argue, that in a world with transaction costs, evidence for a short-term pecking order behavior can be detected in the data. This implies that small projects are short-term financed with internal funds, and only large projects are financed externally, if the issuance of debt is cheaper than the issuance of equity (Welch (2007)).

In a broad study for U.S. capital markets, Frank and Goyal (2009) report empirical support for the tradeoff theory. Furthermore, there exists a positive correlation between leverage and company size, the tangibility of assets, expected inflation and the industry median. Positive shocks to profitability lead to an increase in equity and a decrease in debt. Since firms do not adjust capital structures immediately after shocks due to transaction costs, a negative correlation can be detected between profitability and leverage.

For Asian capital markets Ang, Fatemi and Tourani-Rad (1997) investigate the capital structure and dividend policies of a sample of large publicly traded Indonesian firms and find weak support for the trade-off theory, hence firms operate as if there exists an optimal debt level. Colombage (2005) empirically investigates the capital structure of Sri Lankan companies and finds that the financing trends of Sri Lankan firms confirm the pecking order hypothesis to a greater extent than predictions of information asymmetry and static tradeoff considerations. More specifically, the overall analysis strongly supports the correlations of a negative relationship between leverage and profitability, leverage and growth and leverage and retained earnings.

Clark, Francis and Iftekhar (2009) find evidence in support of the dynamic tradeoff theory for a large sample of 26,395 firms from 40 countries. Firms in every country of the sample partially adjust toward target capital structures. Legal, institutional, and other country-level factors explain about 16 percent of the variation in adjustment speed for the full sample and about one-third for developing countries. These factors, however, have significantly different effects for developing and developed countries. Strong creditor and shareholder rights are both associated with faster adjustment speed in developing nations, while they have no explanatory power in developed nations. Financial market development and higher tax rates are also positively associated with adjustment speed in developing countries, but have the opposite effect in developed countries.

2.3. Pecking order theory

The roots of the pecking order theory can be traced to Donaldson (1961). Myers (1984) and Myers and Majluf (1984) stipulate the pecking order theory as an alternative model to the tradeoff theory. The traditional version of the pecking order theory stipulates that the firm prefers internal to external financing, and debt to equity, when issuing securities and therefore does not possess a target debt-to-value ratio. Myers (1984) introduces an extended version of the pecking order theory, where asymmetric information between managers and investors causes costs of adverse selection and ties the firm to the pecking order in financing new projects. The adverse selection costs stem from mark downs on share prices, when new equity is issued, because investors assume an overvaluation of the company. On the other hand, the issuance of debt increases the probability of financial distress, which in turn increases the firm´s cost of capital. Therefore, firms always recur to internal financing for new projects first. If internal resources are not available, the safest securities are issued first, implying the issuance of debt before equity. Halov and Heider (2005) emphasize that large firms face smaller costs of adverse selection than small firms, when the possibility of risky or mispriced debt is considered. Equity is only issued, if other resources of financing, such as internal funds and debt, are not available to the company.

A few studies have looked at pecking order behavior using samples of firms in Europe. Bessler, Drobetz and Pensa (2008) present European evidence for Welch's (2004) notion that a large part of firms' variation in leverage is determined through stock price movements. In an unbalanced panel of 425 European firms over the period from 1990 to 2005, they find results that are largely consistent with the US findings.[1]

For Asia the case is different. Wiwattanakantang (1999) analyzes the Thai capital market and presents evidence on tax effects, signaling effects, and agency costs in firm´s financing decisions, indicating the validity of the pecking order theory. Fattouh, Scaramozzino and Harris (2005) find significant nonlinearities in the determinants of capital structure of South Korean firms in the years 1992–2001. This speaks for the extended version of the pecking order theory, including asymmetric information. Yau, Lau and Liwan (2008) test the pecking order theory of capital structure for Malaysian firms from 1999-2005 and find a negative correlation between long term debt and external financing needs. Furthermore, conventional leverage determinants such as profitability, firm size and asset tangibility are positively related to firms´ debt levels.

Seifert and Gonenc (2008) find no support for the pecking order hypothesis in 23 emerging markets. Firms issue equity more often than would be expected under the pecking order hypothesis. Moreover, low investor protection countries issue debt more often than firms residing in high investor protection countries. The influence of strong debt protection laws on debt levels, however, is not clear cut.

2.4. Market timing theory

The market timing theory suggests that managers decide on equity or debt financing depending on the current capital market conditions. If conditions on markets are unfavorable, there exists the possibility to delay investments. Therefore capital structure only depends on equity market returns and conditions on the bond markets and a target capital structure does not exist. This implies capital markets, which are not strong-form efficient in the sense of Fama (1970). Thus managers are attributed the ability to profit from inefficiencies by timing corporate equity and bond issuances (Baker and Wurgler (2002)).

Timing signals for equity offerings include high risk premia of the firm's stock (Huang and Ritter (2009)) and significant price advances of the firm's stock (Hovakimian, Opler and Titman (2001)). Baker and Wurgler (2002) report high market-to-book ratios as important timing signal and argue that capital

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[1] See also Drobetz and Fix (2003) for Switzerland, Ozkan (2001) for the UK, Bontempi (2002) for Italy, and DeMiguel and Pindado (2001) for Spain.

structure is the cumulative result of manager's attempts to time the equity market. However, even though firms tend to issue equity in times of high book ratios, Hovakimian (2006) does not find any long-term significant effects on firms´ capital structures. The short-term influence of market timing decisions on capital structure is reported by Alti (2006) for initial public offerings. The effect of market timing on IPO´s disappears already after two years.

A written survey of 392 CFO´s in the U.S.A. reveals that 67 percent of the interviewed persons report the amount of under- or overvaluation of the firm´s stock as an important factor, upon which the decisions on equity issuances are based. Only one factor – the dilution of earnings per share – is deemed more important (Graham and Harvey (2001)). The criterion of over- or undervaluation is also the second most important factor for decisions on equity issuances reported by European and Asian executives (Brounen, de Jong and Koedijk (2006), Fan and So (2004), Drobetz, Pensa and Wöhle (2006)).

2.5. Target adjustment hypothesis

The adoption of transaction costs in dynamic tradeoff models produces three strongly debated research questions: (1) the adjustment speed to target capital structures (2) the magnitude of transaction costs (3) firm´s behavior in response to capital structure shocks. These questions reach beyond the classical tradeoff theory and are therefore discussed in the framework of the target adjustment hypothesis (Frank and Goyal (2007)). Flannery and Hankins (2007) point out that the adjustment speed towards the target capital structure depends on the adjustment costs as well as the costs of deviating from the target. Adjustment costs are in turn dependent on transaction costs and the market value of the firm´s stock. Costs from deviating from the target capital structure are a function of the probability of financial distress and the present value of the tax shield (Flannery and Hankins (2007)). Faulkender, Flannery, Hankins and Smith (2008) find that adjustment speeds of firms with positive and negative cash flows differ significantly from adjustment speeds of firms with free cash flows close to zero. Firms that have to take up or distribute capital, have to bear deeper transaction costs and thus adjust their leverage ratios quicker. A study of the Swiss capital market confirms firm specific as well as macroeconomic factors to be relevant for adjustment speeds. The corporate growth rate and short-term interest rates have a significantly positive correlation with adjustment speeds, while the term spread has a negative influence on adjustment speeds (Drobetz and Wanzenried (2006)). Driffield, Mahambare and Pal (2005) reports a close correspondence between excess leverage and excess capital stock and reveals signs of corporate inertia during the crisis of 1997 for firms in Indonesia, South Korea, Malaysia and Thailand.

In terms of the measurement of yearly adjustment speed rates, the literature is still discordant. Estimations on the basis of substituting the target capital structure into the regression equation for adjustment speeds yields the following values: 34% (Flannery and Rangan (2006)), 13% in LS-regressions and 25% in GMM-regressions (Lemmon, Roberts and Zender (2008)), 17% (Huang and Ritter (2009)), 15% (Frank and Goyal (2007)), 18% in LS-regressions and 15% in Blundell-Bond GMM-regressions (Flannery and Hankins (2007)). Furthermore, on the basis of different models for the calculation of adjustment speeds: 7% - 18% (Fama and French (2002)), 21% - 39% (Tsyplakov (2007)) and 16% (Roberts (2002)). The adjustment speed measure is very sensitive to the econometric design. Econometric challenges are unobservable variables, heterogeneous panel data, short panel biases, autocorrelation und unbalanced panels (Zhao and Susmel (2008)). These measures are usually expressed in terms of the time needed to return to the target capital structure after a shock. The average half-life of the stated adjustment speeds is a minimum of 1.77 years (39%) and a maximum of 9.9 years for the slowest adjustment speed of 7%.

3. Methodology

The applied multiple regression methodology, as well as the measurement of the speed of adjustment are methods, to test the tradeoff theory. Therefore, several determinants of the target capital structure are regressed against leverage (LEV). Leverage is constructed as the book value of debt divided by the sum of total capital and structured debt. We intentionally use book values, because leverage should be explained retrospectively from a designated point in time, without the bias of future expectation, which arises from a market value approach. Our methodology includes four determinants for which the tradeoff theory and the pecking order theory predict contrary signs: Profitability, size, market expectations and tangibility of assets.

3.1. Determinants of capital structure

The selection of the tested determinants is based on the significant results for the U.S. market as reported by Frank and Goyal (2009). Each determinant is modeled with one or two proxies constructed with figures from the Worldscope database. Subsequently, table 1 gives an overview of the proxies and their signs predicted by the tradeoff theory and the pecking order theory.

Table 1

Determinants of the target capital structure and their by theory predicted sign

	Determinant	Tradeoff theory	Pecking order theory	Proxy
PR	Profitability	$+/-$	$-$	$\frac{EBIT}{Total\ assets}$
SI	Size	$+$	$-$	$\ln(Total\ assets)$
ME	Market expectation	$-$	$+$	$Price\ to\ Book\ Ratio$
TA	Tangibility of assets	$+$	$-$	$\frac{Fixed\ assets}{Total\ assets}$
NT	Non-debt tax shield	$-$		$\frac{Expenses\ for\ Depreciation}{Total\ assets}$
RE	Retained earnings			$Earnings\ Retention\ Rate$
IM	Industry median	$+$		$Calculation\ based\ on\ LEV$

The effect of profitability (PR) on leverage depends on the point of view. According to the pecking order theory, profitable companies finance themselves if possible internally, hence should be less leveraged.

Besides, a negative relationship between profitability and leverage can result because of transaction costs. Due to these costs, it may be rational to not adjust the target capital structure after an equity shock. But as profitable companies have a lower bankruptcy probability and value the tax shield higher, leverage should increase according to the tradeoff theory. A positive relationship can furthermore be derived from the free cash flow hypothesis. The disciplinary effect of debt is more valuable, if free cash flow is high. For size (SI), we also find arguments for a positive as well as a negative relationship. As diversification reduces the volatility of cash flows, the probability of a bankruptcy is reduced, too. Besides, low volatility increases the probability that companies can profit from the full benefit of the tax shield. Consequently, the tradeoff theory predicts a positive relationship. However, as large companies are monitored more closely by analysts, and the information asymmetry is lowered by extensive disclosure duties, the pecking order theory predicts a negative relationship. Growth, which is proxied by ME, often needs funding in excess of profits. That is why leverage should increase according to the tradeoff theory. As growth implies a reduction of the free cash flow, the tradeoff theory states a negative relationship. As tangible assets can normally be sold more easily than intangible assets, valuable tangible assets increase the credibility of the guarantee to repay debt. Furthermore, as an external investor can value tangible assets more accurately, the degree of asymmetric information is reduced. This enables a company, according to the tradeoff theory, to become more indebted. As lower costs of adverse selection at the same time lower the cost of equity, the tradeoff theory predicts a negative relationship. The determinant non-debt tax shield (NT) measures the earnings reduction caused by depreciation expenses. Depreciation expenses reduce profits and therefore lower the value of the debt tax shield. A reduction of the utility of debt leads according to the tradeoff theory, to a lower leverage. The determinant retained earnings, investigates whether a relation between percentage of retained earnings (RE) and leverage exists. Plow back of profit for example, is a positive equity shock, which lowers leverage. U.S. companies do not adjust deviations resulting from profits and losses (Welch (2004)). A high significance of the factor retained earnings would therefore be evidence that this statement holds for the Asian market, too. This means that either transaction costs impede an adjustment, or that the capital structure may not be actively arranged by managers, but rather is a product of the lack of adjustment. The decision concerning the distribution of earnings is not only a question of financing policy, but must be considered under dividend policy aspects as well. According to the pecking order theory, the financing policy should postulate a low distribution rate. If managers tend to choose a capital structure similar to the one of their competitors, the factor industry median leverage should be highly significant. Graham and Harvey (2001) find moderate survey based evidence for this conjecture. Flannery and Rangan (2006) find significance of this factor for the U.S. market.

3.2. Regression equation and regression method

We use one period lagged determinants for the regression on leverage. This has two advantages: First of all, the determinants were well-known by the CFOs at the time of decision and second, the problem of endogeneity is less severe. The regression equation is:

$$LEV_{i,t+1}^{*} = \alpha_t + \beta_1 PR_{i,t} + \beta_2 SI_{i,t} + \beta_3 ME_{i,t} + \beta_4 TA_{i,t}$$

$$+\beta_5 NT_{i,t} + \beta_6 RE_{i,t} + \beta_7 IM_t + \varepsilon_{i,t} \quad (1)$$

where LEV* is the target capital structure of company i at time *t+1*, PR is profitability, SI is size, ME stands for market expectations, TA is tangible assets, NT is non-debt tax shield, RE is retained earnings, IM is the industry median of Leverage, u_i is the firm fixed effect, α and β are parameters and ε is the error term. For all nine industries we perform an OLS-, TSLS- and a GMM-estimation. For the OLS-estimation, a parameter u_i denoting firm fixed effects must be added to the regression equation. The variation of the method allows a better understanding of the robustness of the capital structure determinants. As choosing a target capital structure is a complex process, we cannot a priori assume that the explanatory variables reflect the entire number of important factors. That is why we use firm fixed effects for the OLS-estimation. The TSLS- and GMM-estimations are conducted without the factor firm fixed effects u_i.

We use TSLS and GMM methods, because unbiased and consistent estimators are based on assumptions, which econometric time series rarely fulfill. Particularly, because autocorrelation often exists in time series and endogeneity often exists in econometric models, we expect biased OLS estimates. Instrumental variables regressions (IV-Regression), as for example TSLS and GMM, are a frequently used approach to mitigate the problem of endogeneity. The decision whether a variable is endogenous or exogenous is in the first step based on an analysis of the causality. Determinants like profitability, market expectations and industry median of leverage lie beyond the control of managers and are therefore exogenous. The remaining variables are checked for endogeneity with the Hausman test. Therefore we have to designate an instrument for every endogenous variable, which satisfies the requirement of “instrument relevance” and “instrument exogeneity”. The first requirement means that a high correlation of the instrument and the endogenous variable must be present. The second requirement means that no correlation between the instrument and the error term is allowed to be present. As the residuals of the population are unknown, the second requirement cannot be controlled, and hence is always an assumption. If more than one instrument per endogenous variable is present, we can test the exogeneity of the surplus instruments.[2]

The accuracy of the estimation depends on the quality of the instruments. The estimation is only reliable, if the instruments fulfill the above stated requirements. In time series, the one period lagged variable can be used as an instrument. All determinants that qualify as endogenous by the Hausman test,

[2] See: Hill, Griffiths and Lim (2008)

are instrumentalized by the one period lagged variable. Tangibility of assets (TA) is in addition instrumentalized by the factor research and development.[3]

TSLS-regression is a method based on a two-step OLS-regression procedure. The first regression constructs appropriate instruments, which replace the endogenous variables in the second regression based on model (1). TSLS is a viable method to deal with the problem of model overidentification, as TSLS builds the optimal instrument, based on the linear combination with the highest correlation to the endogenous variable. We conduct TSLS on the basis of a weighted least square estimation. Moreover, we use period weights to correct for heteroscedasticity.

GMM is a semiparametric regression method. This kind of estimation replaces the distributional assumption of the population with the estimate of several moments of a distribution. Estimates based on the generalized method of moments (GMM) are generally consistent and convert to the true value in big data samples (Hill, Griffiths and Lim (2008)). The results of both IV-estimations are based on the White Period method to estimate the covariance matrix and report White's period standard errors. Hence, they are robust to serial correlation and heteroscedasticity.

3.3. Model tests

In order to have unbiased and consistent OLS-regression estimates as well as test results, the simple linear regression must fulfill seven assumptions.[4] The consequences of a violation as well as the possibilities to correct the estimation depend on the assumption. Subsequently, we discuss an outline of the seven assumptions, followed by the technique used to detect violations as well as the specification of possible corrective actions.

Table 2

Assumptions of the linear regression model

	Assumption	**Description**
A1	Linearity	Linear relationship between regressor and regressand
A2	Zero Conditional Mean	Expectation of residuals is zero
A3	Exogeneity	No correlation between explanatory variable and residuals
A4	Homoskedasticity	Constant variance of residuals
A5	No serial correlation	No correlation of residuals
A6	No multicollinearity	No dependancy between the explanatory variables
A7	Normal Distribution	Normally distributed residuals

[3] Research and Development / Sales

[4] See, Greene (2008)

Linearity between regressor and regressand will be assumed based on economical arguments for all the determinants except for the factor size. To get a linear relationship, we use the log function of size. Assumption two is not of relevance. As the estimation includes an intercept, a possible systematic error will only bias the intercept, which has no explanatory content.

A variable correlated with the error term is endogenous and violates assumption A3. Reasons for the correlation include, simultaneity, which means the fixation of the independent variable in consideration of the dependant variable, measurement errors and omitted variables. An endogenous variable biases all coefficients, even the ones of the exogenous variables in the model. Based on the following economic facts, we assume that endogeneity is present. Simultaneity exists because CFOs consider leverage when choosing the plow back rate or the size of the company. Besides, the coefficient of determination shows that we face a problem of omitted variables, such as competency of the management, the company's reputation, the tax rate or expected inflation. Endogeneity is primarily controlled for with an analysis of the causality, and in case of doubt checked with the Hausman test. The Hausman test is carried out by regressing in the first step all potentially endogenous factors on the surely exogenous factors and instruments. As we work with time series data, the one period lagged variables are used as instruments. In the second step, the residuals of the first step are included as regressors in the regression model (1) and checked for significance. Endogeneity can only be rejected, if the OLS regression rejects the significance of the residuals. The problem of endogeneity is mitigated by lagging the determinants for one period. Endogeneity is corrected by using the IV-regression. For the OLS-regression, we cannot apply a correction.

Homoskedasticity of the residuals is visually analyzed with a scatterplot. In the presence of heteroscedasticity, the estimation of the OLS-regression is inefficient and the standard error of the estimation is biased. TSLS- and GMM-regressions are robust to heteroscedasticity.

Serial correlation describes a situation where the deviation from the regression line is not at random any more, but depends in the direction of the deviation on previous values. This is a common phenomenon for time series, but misspecifications of the model can lead to serial correlation, too. We use the Durbin-Watson test to check for first order serial correlation. Autocorrelation biases all coefficients unless the explanatory variables are strictly exogenous. The TSLS- and GMM-regressions are robust to serial correlation due to the chosen specifications.

Empirical data always has a certain degree of multicollinearity, which does not have to be perturbing. To detect multicollinearity we inspect the correlation matrix of the regressors in the first step and compute the variance inflation factor (VIF) in case of doubts. We use the following definition of the VIF[5]:

$$VIF_{DET} = \frac{1}{1-R_{DET}^2} \tag{2}$$

[5] DET stands for determinant

where R_{DET}^2 is the coefficient of determination for the examined determinant. R_{DET}^2 is generated with an auxiliary regression of one of the determinants on the remaining determinants. Strong multicollinearity is indicated by VIF-values larger than two. This leads to unreliable OLS-estimators, but multicollinearity does not affect the IV-estimations of the chosen specifications.

The violation of A7 has no further implications, if the data set is large enough (as in our case), because most of the results are asymptotically valid (Greene (2008)).

3.4. Estimation of the speed of adjustment

The estimation of the speed of adjustment is a two step process. In the first step, the target capital structure is constructed. This calculation is based on model (1). The model is estimated with the GMM-method. In the second step we calculate the annual change of the gap between the target capital structure and the actual capital structure. We use the following model for the estimation:

$$LEV_{i,t+1} = \lambda LEV_{i,t}^{*} + (1-\lambda)LEV_{i,t} + \varepsilon_{i,t} \qquad (3)$$

where LEV is leverage, LEV* stands for target capital structure, λ is the speed of adjustment and $\varepsilon_{i,t}$ is the error term. The target adjustment model is a dynamic regression model. It is inherent to dynamic regression models that the regressand acts in the same equation in a lagged variation as a regressor. Some new econometric challenges come along with this form of regression. As $LEV_{i,t+1}$ is a function of the error term, $LEV_{i,t}$ is a function of the error term, too (Baltagi (1995)). This means that endogeneity is present. According to Lemmon, Roberts and Zender (2008) the results of leverage models without firm fixed effects are suspect, because of the high explanatory power of firm fixed effects. On the one hand results are economically suspect, because the speed of adjustment is reported to be too low, due to the ignorance of firm fixed effects[6]. On the other hand an incorrect assumption is made, with regard to no correlation between the observable variable and the unobservable determinants. Additional challenges are the short panel bias and serial correlation of the residuals (Zhao and Susmel (2008)). There is no consensus on the optimal estimation method to meet these challenges. Ultimately, the discussion whether target capital structures exist, has to balance the tradeoff between consistency and efficiency of the methods to estimate the speed of adjustment. Publications do therefore mostly report more than one regression method, whereas the following methods are generally accepted: System-GMM (GMM-Sys) by Clark, Francis Ifthekar (2009), Lemmon, Roberts and Zender (2008) and Antoniou, Guney and Paudyal (2008), difference-GMM by Flannery and Rangan (2006), long difference estimator by Huang and Ritter (2009), corrected least squares dummy variables estimation by Flannery and Hankins (2007), Kalman filter estimation by Zhao and Susmel (2008), restricted maximum likelihood method by Byoun (2008). So far we can state, that GMM-estimations are robust to the exact specification and more consistent than estimations based on OLS.

[6] OLS-regression without firm fixed effects was for example used by Fama and French (2002) and Kayan and Titman (2007)

Therefore, we use GMM-Sys to estimate the speed of adjustment. The approach was developed by Arellano and Bover (1995) and Blundell and Bond (1998) to make dynamic regressions with firm fixed effects possible.[7] GMM-Sys has the advantage of robustness to endogeneity and the short panel bias (Greene (2008)). As instruments for the endogenous variable $LEV_{i,t}$ we use lagged values of this variable. Thereby we do not define a concrete lag as instrument, but rather define a range, which is dynamically enhanced from one up to a maximum of five period lags. This implies that the leverage of the first four periods cannot be instrumentalized over five periods. GMM does not only use the lagged values to build the instrument, but also uses the differences of the absolute values of two lagged variables (Clark, Francis and Iftekhar (2009)). For instrument validity, there must be a correlation between the endogenous variable and the instrument. Furthermore, serial correlation of higher order than the periods for which the instrument is lagged, must be absent. Finally we indicate that the GMM-Sys estimation can be biased in the case of a highly persistent dependant variable (Hahn (2007)). If this is the case, long difference estimation would provide more reliable estimates.[8]

4. Data

The dataset contains all companies with a market capitalization of at least one billion US-Dollar listed on one of the following stock exchange markets: Bangkok, Bombay, Hong Kong, Jakarta, Karachi, Kuala Lumpur, Osaka, the Philippines, Seoul, Shanghai, Singapore, Shenzhen, Taipei and Tokyo. This leads us to an unbalanced panel of 1301 companies, which are analyzed from 1995 to 2009. The coverage of the analysis gives way to a maximal scope of 19'515 firm years. The availability of the data varies according to industry and determinants. This leaves us effectively with leverage information for 15'011 firm-year observations, which consists of 1301 firms with an average of 11.54 years.

All company figures are extracted from the database Worldscope. This database is designed to enable the user to draw comparisons between countries and industries. Worldscope uses properly defined, self standardized definitions for every company figure and offsets possible differences. This is necessary, because the legal and fiscal environment and accounting regulations are highly country-specific. Over 90% of the analyzed companies use local accounting regulations and only the remaining 10% of the companies keep their books according to International Financial Reporting Standards (IFRS) or US-Generally Accepted Accounting Principles (US-GAAP).

We use the Industry Classification Benchmark (ICB) to split the dataset into ten industries. The concrete classification is extracted from Worldscope. In the framework of this paper, we analyze nine out of the ten industries, excluding financial companies, because their capital structure is chosen in accordance

[7] The authors as well as further literature refer to this method as extended GMM

[8] See, Hahn (2007), Huang and Ritter (2009)

with country-specific regulations for financial institutions and therefore reflects special factors. The subsequent table gives an overview of the analyzed industries and the number of companies per industry.

Table 3

Number of companies per industry

Oil and Gas	38
Basic Materials	217
Industrials	374
Consumer Goods	228
Health Care	61
Consumer Services	174
Telecommunications	29
Utilities	62
Technology	118
Total Asia	**1301**

In the database we find outliers, which cannot be explained by economic theory. Therefore the dataset has been winsorized at the 0.5% level in both tails of the distribution. Winsorization is an approach to mechanically remove the furthest outliers.[9] In this process, the outliers behind a designated barrier will be replaced by the most extreme value within the barrier. This procedure sets the barrier at the 0.5% level of the distribution.

By using this technique we implicitly assume that the reported value is incorrect, a value with similar tendency however exists. Hence, it makes sense to replace the value behind the barrier with a more plausible value. Besides winsorization, capital structure research frequently carries out outlier removal by rule of thumb truncation or by using robust regressions.[10] The first technique is not an optimal choice, because it is highly subjective and makes comparisons impossible. Although the second technique is used more often, we choose winsorization, because it is a systematic approach, which enables comparisons between different publications and results in no data loss.

5. Results

5.1. Descriptive Statistics

The boxplots show that leverage is significantly different between industries, highly volatile within industries and that the magnitude of within industry dispersion varies from industry to industry. With 44%

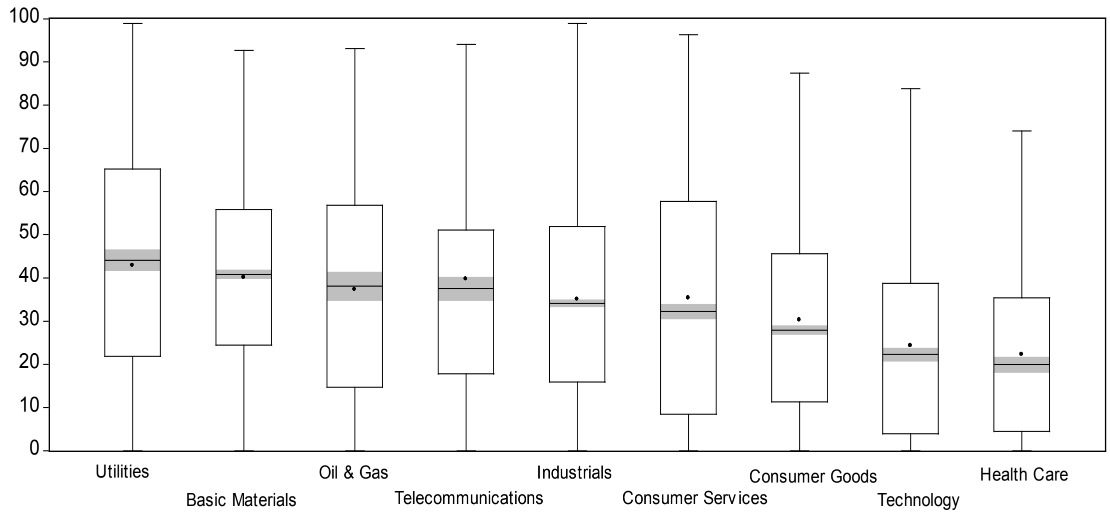
[9] As the factor BM is a median, the effect of outliers is negligible and hence, winsorization is not applied.
[10] Frank and Goyal (2007)

leverage, the industry Utilities is the most leveraged industry in the dataset. With 20% leverage, the Health Care industry uses the most conservative financing approach. Consumer Services is the industry with the highest leverage dispersion.

Figure 1

Leverage per industry

Figure 1 shows the leverage per industry in the years 1995 to 2009. The length of the box corresponds to the inter-quartile range, which includes 50% of the values. The line in the middle represents the median. The average is marked with a point. We do not show outliers. The smallest and the biggest values, which are not yet outliers, are marked by the staples.



5.2. Regression results

This section reports the results of the following estimation:

$$LEV^*_{i,t+1} = \alpha_t + \beta_1 PR_{i,t} + \beta_2 SI_{i,t} + \beta_3 ME_{i,t} + \beta_4 TA_{i,t} + \beta_5 NT_{i,t} + \beta_6 RE_{i,t} + \beta_7 IM_t + \varepsilon_{i,t} \quad (4)$$

where LEV* is the target capital structure, α and β are parameters, PR stands for profitability, SI for size, ME for market expectations, TA for tangibility of assets, NT for non-debt tax shield, RE for retained earnings, IM for industry median of leverage and ε is the error term. We estimate this model with OLS, TSLS and GMM. For the OLS estimation, a parameter u_i denoting firm fixed effects must be added to the regression equation. The results are presented in table A.1 in the appendix.

The coefficient of determination and the significance of the capital structure determinants are high among all three regression methods. On the basis of all nine industries and three regression methods, we find on average 3.8 significant determinants.[11] Due to serial correlation and possible heteroscedasticity in the model, the subsequent analysis of the capital structure determinants and their signs will solely be based on TSLS- and GMM-regressions. The differences concerning significance of the determinants and sign are

[11] If not stated otherwise, significance will always be reported on a 0.05 level.

marginal between the two methods. As the model does not explain the data for the industry Telecommunications well, we do not include this industry in the further analysis.

The judgment on whether the model fits the data of a particular industry well is based on the R^2 of the OLS-Regression. Although this kind of regression may be biased upwards due to endogeneity, we nevertheless can approximately conclude about the explanatory content of the model. This stands in sharp contrast to the instrumental variable regression, where the coefficient of determination has no natural explanation, hence does not reflect the explanatory content in percentage points.

To provide a solid analysis, whether the data fits the model well, the coefficient of determination is estimated by two OLS regressions. One includes, the other one excludes, firm fixed effects. The estimation with firm fixed effects (OLS I) leads to values between 0.72 and 0.88[12]. Hence, the explanatory power of the model is high and volatility low, aside from the industry Utilities, where a coefficient of determination of 0.46 is measured. For the estimation without firm fixed effects (OLS II) the values lie in between 0.21 and 0.55. These values are close to the values for the U.S. market measured by Flannery and Rangan (2006) and for the U.S. market plus Japan and parts of Europe measured by Antoniou, Guney and Paudyal (2008). They are somehow slightly higher than the values reported by Frank and Goyal (2007). The model explains the industries Consumer Services, Oil and Gas and Basic Materials very well.

Table 4

Coefficient of determination by method of regression and industry

	OLS I	**OLS II**	**TSLS**	**GMM**
Oil & Gas	0.84	0.38	0.49	0.37
Basic Materials	0.82	0.33	0.42	0.42
Industrials	0.80	0.23	-0.05	-0.98
Consumer Goods	0.76	0.22	0.11	-0.04
Health Care	0.79	0.41	0.45	0.42
Consumer Services	0.88	0.55	0.71	0.61
Utilities	0.46	0.32	0.71	0.79
Technology	0.72	0.31	0.34	0.34

Capital structure decisions of Asian firms are industry independently driven by the factors profitability (PR) and tangibility of assets (TA). Besides, industry individual factors complete the picture. The industry median is significant in the following six out of eight industries: Oil and Gas, Basic Materials, Industrials, Consumer Goods, Utilities and Technology. Size (SI) is significant in the following five out of eight industries: Basic Materials, Industrials, Consumer Goods, Health Care and Technology. Non-debt tax

[12] The value for the industry Utilities is higher.

shield (NT) is significant in the following four industries: Oil and Gas, Basic Materials, Industrials and Utilities. The determinant retained earnings (RE) is only significant for Industrials and Utilities. Welch's (2007) thesis, that companies do not counteract capital structure changes resulting from profits and losses can thus not be confirmed for the Asian market, based on a test with the factor retained earnings (RE). The factor market expectation (ME) does only influence the industry Basic Materials and Consumer Services.

Accordingly, we can show that the capital structure decision is a tradeoff influenced by multiple factors. Moreover, we can divide capital structure choices in a common and an industry-based component. It seems that the non debt-tax shield (NT) is an industry-based component for companies in the secondary sector.

A consistent sign in all eight industries is found for profitability (PR) and tangibility of assets (TA). Profitability (PR) is negatively correlated with leverage. Although this can be explained by the tradeoff theory, it is basically considered as evidence for the pecking order theory. Tangibility of assets (TA) behaves as predicted by the tradeoff theory and is therefore positively related to leverage. The factors size (SI) and non-debt tax shield (NT) show, aside from the industry Health Care, the signs predicted by the tradeoff theory. Market expectation behaves, aside from the industry Health Care, in accordance with the pecking order theory. To sum up, the signs are quite stable over the industries and can by majority be predicted by the tradeoff theory. But this does not enable us, to reject the pecking order theory. In particular the negative relationship between profitability and leverage can somehow be explained by the tradeoff theory, but more fundamentally reflects pecking order behavior.

5.3. Regression results with the determinant research and development

This section reports the results of the following estimation:

$$LEV^{*}_{i,t+1} = \alpha_t + \beta_1 PR_{i,t} + \beta_2 SI_{i,t} + \beta_3 ME_{i,t} + \beta_4 RD_{i,t} + \beta_5 NT_{i,t} + \beta_6 RE_{i,t} + \beta_7 IM_t + \varepsilon_{i,t} \quad (5)$$

where LEV* is the target capital structure, α and β are parameters, PR stands for profitability, SI for size, ME for market expectations, RD for research and development expenses, NT for non-debt tax shield, RE for retained earnings, IM for industry median of leverage and ε is the error term. We estimate this model with OLS, TSLS and GMM. For the OLS estimation, a parameter u_i denoting firm fixed effects must be added to the regression equation. The results are presented in Table A.2 of the appendix.

The only difference to regression model (1) is that we replace the factor tangibility of assets (TA) by the factor research and development (RD), which is constructed by dividing research and development expenses by sales. The regression specifications used are identical to the ones used to estimate model (1). Although the explanatory content of the model with RD cannot cope with the results of model (1), even this research design confirms that the capital structure decision of Asian companies is based on multiple determinants. Due to serial correlation and possible heteroscedasticity in the model, the subsequent analysis of the capitals structure determinants and their signs is based on TSLS- and GMM-regressions.

The ratio fixed assets to total assets (determinant TA) is not the only possibility to proxy for the tangibility of assets. Research and development expenses can be used as a proxy, too. From our point of view, this proxy does divide the data set into companies selling unique products and companies selling standardized products. Whereas research and development is crucial for the first group of companies, there exist a great number of companies, which do not report research and development expenses. In addition, this proxy quantifies the value of the research and development tax shield. High research and development expenses reduce the utility of debt as a tax shield.

Correlation analysis of TA and RD shows that the relationship between tangibility measured by research and development expenses and tangibility measured by fixed assets to total assets is weak. The values are dispersed between 0.02 and 0.33 for seven industries and 0.6 for the industry Utilities.

The model fits the capital structure decision of the following industries well: Basic Materials, Industrials and Technology. For these industries the factors profitability (PR), size (SI), research and development (RD) and industry median (IM) are significant. The model does not fit the industry Oil and Gas, because no explanatory variable is significant. In five out of eight industries the capital structure decision is driven by profitability (PR) and size (SI). In four industries the capital structure decision is driven by research and development (RD).

Interestingly, in four industries, the significance of the factor tangibility of assets (TA) is robust when we switch from proxy TA to RD. The factors non-debt tax shield (NT) and retained earnings (RE) are not significant for any of the industries in both regressions. In this model, only the minus sign of the coefficient for profitability (PR) is consistent in all industries.

In conclusion, the average number of significant determinants decreases in comparison to model (1) from 3.8 to 2.9. Nevertheless capital structure decisions can still be divided in a common and an industry-based component. The common component is, as in model (1), based on profitability (PR) and completed by size (SI). This reflects a completion and not a replacement, because the factor of the common component in model (1), namely tangibility of assets (TA), was replaced by research and development (RD). The explanatory content of RD is less than that of TA.

5.4. Regression test results[13]

After analyzing the causality structure of the model, the factors size (SI), tangibility of assets (TA), non-debt tax shield (NT) and retained earnings (RE) are considered as potentially endogenous. We conducted a Hausman test, based on an instrumental variables regression model, to control for potentially endogenous factors. The concrete approach is subsequently demonstrated for the potentially endogenous factor SI.

[13] All tests are based on regression model (1)

In the first step, we conduct a regression of SI on the exogenous variables and the instrument:

$$SI_{i,t} = \propto_t + \beta_1 PR_{i,t-1} + \beta_3 SI_{i,t-2} + \beta_3 ME_{i,t-1} + \beta_4 TA_{i,t-2} +$$

$$\beta_5 NT_{i,t-2} + \beta_6 RE_{i,t-1} + \beta_7 IM_{t-1} + \varepsilon_{i,t-1} \quad (6)$$

In the second step, we include the residuals of regression (6) in the original regression model (1) and check their significance based on an OLS regression. This leads to the finding, that the industries Oil and Gas, Basic Materials, Technology and Consumer Goods contain only exogenous factors. TA is endogenous for Health Care companies and GR is endogenous for the Utility industry. Endogeneity is most present in the industry Industrials, where the factors TA, SI and RE are endogenous as well as in the industry Consumer Services, where TA and SI are endogenous. Hence, if endogeneity is present, it is mainly caused by TA und SI.

Multicollinearity is detected with the variance inflation factor (VIF). Table A.3 of the appendix contains all values of the VIF. These values lie below two, for six out of eight industries. High multicollinearity, more precisely a VIF over two was only found for the factors TA and NT for Technology, respectively TA, NT and RD for Utilities. The values for TA are systematically higher than the values for the other determinants. In particular, the values of RD are below the ones of TA.[14]

To guarantee consistent IV-estimates, all instruments must be tested for relevance. Relevance can be taken for granted, if there exists, even under inclusion of all exogenous variables, a relationship between the instrument and the endogenous variable. The statistical implementation of this test is based on the following reduced regression model:

$$x_{G+1} = \propto_1 + \beta_1 x_1 + \cdots + \beta_G x_G + \theta_1 z_1 + \cdots \theta_L z_L + \varepsilon \quad (7)$$

where x_{G+1} is the endogenous variable, x_1 to x_G are additional exogenous or endogenous variables, z_1 to z_L are instruments, α, β are θ_1 parameters and ε is the error term. Relevance is given if the null-hypothesis, that the parameters of all instruments equal zero, is strongly rejected. An often used rule of thumb says that instruments with a t-statistic below 3.3 should be qualified as weak instruments (Hill, Griffiths and Lim (2008)). The overall test is based on a repetition of the test above for every single potentially endogenous variable. The overall picture of all individual t-statistics does however not stand for a test of the comprehensive model, hence the absence of weak instruments cannot be completely guaranteed. In addition, weak instruments can be presumed, if the standard errors of the IV-estimation are higher than the ones for the OLS-estimation. The t-statistics of the three endogenous variables SI, TA and NT, respectively the one period lagged instruments of these variables, show strong instrument relevance in all industries. Solely the instrument of RE must be qualified as weak for the industries Consumer Goods and Basic Materials. In addition we test the instrument relevance of RD and TA. Whereas RD is a relevant instrument

[14] For Utilities the values of RD above the values of TA.

for TA in four out of eight industries, this does not hold for the industries Oil and Gas, Technology and Utilities.

Instrument exogeneity cannot be tested, hence must be assumed. As serial correlation is a frequent problem in time series, lagged instruments are probably correlated with the error term. We mitigate this problem by using instruments which are, compared to the dependant variable, lagged for two periods. Besides that we detect and report first order serial correlation with the Durbin-Watson statistic. Durbin-Watson values are reported in table A.4 of the appendix. An average Durbin-Watson statistic of 0.86 stands for positive serial correlation in all industries. Serial correlation is only absent, for the GMM-estimation in the Consumer Service industry.

5.5. Speed of adjustment

This section reports the results of model (1) and model FE estimated with two slightly different GMM-Sys regressions. Detailed results are reported in table 5. The first GMM-Sys regression (GMM-Sys dyn(-2,-5)) uses LEV as a dynamic instrument starting at a lag of two periods, ending at a lag of five periods. The second GMM-Sys regression (GMM-Sys dyn(-1,-5)) uses LEV as a dynamic instrument starting at a lag of one period, ending at a lag of five periods. We report Hansen's J-statistic, a GMM compatible version of the Sargans test, to provide information about the validity of the instruments. As the high values may be interpreted as evidence for suboptimal instrument choice, the emphasis of the subsequent analysis lies on the GMM-Sys dyn(-2,-5) regression, which has permanent lower statistics.

Table 5

Speed of adjustment and Hansen's J-statistic

	Model (1)				**Model FE**			
	GMM-Sys dyn(-2,-5)[15]	**J-statistic**	**GMM-Sys dyn(-1,-5)**[16]	**J-statistic**	**GMM-Sys dyn(-2,-5)**	**J-statistic**	**GMM-Sys dyn(-1,-5)**	**J-statistic**
Oil & Gas	35%	28	37%	29	28%	27	32%	48
Basic Materials	31%	75	33%	82	15%	73	13%	81
Industrials	27%	103	26%	109	25%	93	23%	103
Consumer Goods	32%	76	32%	84	25%	77	24%	88
Health Care	28%	26	25%	30	13%	36	17%	46
Consumer Services	25%	43	16%	60	20%	46	18%	59
Telecommunications	52%	26	33%	23	52%	26	32%	30
Utilities	73%	47	73%	48	59%	46	55%	49
Technology	45%	48	32%	53	29%	48	25%	52
Average	**39%**		**34%**		**30%**		**27%**	

By providing four estimations, we report comprehensive evidence on target capital structure behavior of large companies listed on the Asian stock exchange. With an average overall industry speed of adjustment

[15] dyn(-2,-5) denotes, that the instrument is dynamically enlarged from the second lag to maximal five lags
[16] dyn(-1,-5) denotes, that the instrument is dynamically enlarged from the first lag to maximal five lags

ranging from 27% to 39%, we show robust convergences toward a target capital structure. Based on this range, the companies' average half-life lies between 1.77 and 2.56 years. Since not only the averages are high, but also all the industry individual speed of adjustments, the pursuance of a target capital structure is not influenced by industry-fixed effects.

Nevertheless, we can show that industry-effects do influence the speed of adjustment. Our model (1) estimation with GMM-Sys dyn(-2,-5) leads to a maximum half-life of 2.77 years, measured for the Consumer Services industry and a minimum half-life of 0.94 years, measured for the Utility industry.

These results are remarkably similar between model (1) and model FE. GMM-Sys dyn(-2,-5) ranks the five fastest adjusting industries similarly for both models. The highest speed of adjustment was found for Utilities followed by Telecommunications, Technology, Oil and Gas, Consumer Goods. Although the effectively measured speed of the two models does differ, we find consistently lower speeds of adjustment for the model FE.

With regard to absolute values and dispersion, the speed of adjustment is – aside from the industry Utilities – consistent with the global findings of Clark, Francis and Iftekhar (2009) and Antoniou, Guney and Paudyal (2008). The former analyzes companies from over 40 countries and find speeds of adjustment per country between 12% and 47%. The average speed of adjustment is however higher as the reported 25% by Lemmon, Roberts and Zender (2008), respectively 17% by Flannery and Hankins (2007). A higher speed was expected due to the restrictions of the data set to large firms with a market capitalization of at least 1 billion US Dollar. This can be interpreted as an empirical indication that large firms which are well established on stock markets, face lower transaction costs. Finally, we conjecture that large Asian companies do not face significant higher transaction costs than U.S. companies, due to the fact of a higher speed of adjustment in the Asian market.

6. Conclusion

As far as we know, this is the first empirical study reporting a geographically as well an econometrically comprehensive discussion on the target adjustment behavior for the Asian market. Our results complete the capital structure puzzle by contradicting earlier findings of pecking order behavior in Asia.

We find strong evidence that large Asian non-financial and non-telecommunication companies identify and pursue target capital structures during the 1995 – 2009 period. First and foremost, this can be shown by the high significance of capital structure determinants for two different models. The capital structure choices in the Asian capital markets can, according to our results, be divided into a common and an industry-based component. Profitability and tangibility of assets are the common determinants. Industry median, size and non-debt tax shield are the most popular industry-based components, which determine capital structure. Hence, the leverage decision is influenced by industry-fixed effects. In total, in over eight analyzed industries and three different regressions techniques, 4.16 determinants out of 7 are significant.

The relationship between leverage and the determinants tangibility of assets, size and non-debt tax shield behaves as predicted by the tradeoff theory. Nevertheless, the pecking order theory cannot be rejected due to its correct prediction of the signs of profitability and market expectations.

We underscore our finding of target capital behavior by reporting convergences towards target capital structures at a speed ranging from 27% to 39%. These values are akin to the values measured for the U.S. market by Flannery and Rangan (2006). Even though convergence toward a target capital structure is observed for all industries, the effective adjustment speed seems to be influenced by industry-fixed effects.

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Appendix

Table A.1
Regression results

This table contains the estimated regression coefficients of the OLS, TSLS and GMM estimates for the following model:

$$LEV_{i,t+1}^{*} = \alpha_t + \beta_1 PR_{i,t} + \beta_2 SI_{i,t} + \beta_3 ME_{i,t} + \beta_4 TA_{i,t} + \beta_5 NT_{i,t} + \beta_6 RE_{i,t} + \beta_7 IM_t + \varepsilon_{i,t}$$

For the OLS estimation, a parameter u_i denoting firm fixed effects must be added to the regression equation. T-statistics are shown in parentheses. T-statistics of the TSLS and GMM estimation are robust to serial correlation and heteroskedasticity. * denotes statistical significance at the 0.05 level. ** denotes statistical significance at the 0.1 level. The results are classified by industry and regression technique. LEV* stands for the target capital structure, PR stands for Profitability, SI for Size, ME for Market expectations, TA for Tangibility of assets, NT for Non-debt tax shield, RE for retained earnings and IM for the Industry median of leverage.

	Oil & Gas				Basic Materials				Industrials		
	OLS	TSLS	GMM		OLS	TSLS	GMM		OLS	TSLS	GMM
PR	-87.25	-87.81	-108.06	PR	-92.09	-144.53	-141.72	PR	-60.43	-120.13	-112.99
	*(-6.25)	*(-2.68)	*(-2.68)		*(-16.19)	*(-7.10)	*(-7.31)		*(-12.22)	*(-5.94)	*(-4.99)
SI	2.71	2.38	2.33	SI	3.028	6.097	6.768	SI	6.33	6.30	7.45
	**(1.81)	(0.94)	(0.79)		*(3.99)	*(4.37)	*(4.76)		*(11.78)	*(5.29)	*(5.77)
ME	-0.20	0.11	0.90	ME	0.44	2.33	2.49	ME	-0.23	1.04	0.60
	(-0.56)	(0.03)	(0.25)		**(1.87)	*(4.05)	*(4.26)		(-1.43)	*(2.00)	(0.91)
TA	27.44	66.31	62.82	TA	21.680	65.984	69.799	TA	13.17	65.36	61.44
	*(3.40)	**(1.97)	*(2.06)		*(4.70)	*(4.81)	*(4.77)		*(4.67)	*(6.57)	*(4.91)
NT	-259.82	-957.23	-894.82	NT	-51.33	-400.51	-426.29	NT	-18.17	-253.48	-257.79
	*(-4.41)	*(-3.33)	*(-2.94)		**(-1.8)	*(-4.31)	*(-4.30)		(-0.72)	*(-3.27)	*(-2.96)
RE	-0.01	0.10	0.16	RE	0.001	0.036	-0.004	RE	0.00	0.31	0.53
	(-1.43)	(0.64)	(0.80)		(0.33)	(0.42)	(-0.05)		(0.31)	*(2.33)	*(2.49)
IM	0.37	0.66	0.78	IM	0.76	1.19	1.09	IM	1.12	1.20	1.17
	*(4.30)	*(2.47)	*(2.31)		*(14.08)	*(10.21)	*(9.44)		*(21.54)	*(5.23)	*(4.12)

	Consumer Goods				Health Care				Consumer Services		
	OLS	TSLS	GMM		OLS	TSLS	GMM		OLS	TSLS	GMM
PR	-67.21	-98.97	-89.83	PR	-84.53	-111.73	-89.03	PR	-51.36	-112.92	-148.34
	*(-12.06)	*(-5.35)	**(-1.84)		*(-6.71)	*(-3.96)	*(-3.33)		*(-7.99)	*(-1.67)	*(-4.14)
SI	2.49	2.78	5.05	SI	4.64	-4.77	-5.06	SI	5.41	1.36	0.86
	*(3.26)	*(2.31)	*(3.09)		*(3.36)	*(-3.65)	*(-3.76)		*(8.27)	(0.69)	(0.49)
ME	0.24	1.95	1.31	ME	-0.55	-0.53	-0.57	ME	0.57	3.16	2.48
	(1.59)	*(3.47)	(1.44)		**(-1.71)	-0.95	(-0.97)		*(3.89)	*(3.14)	*(3.82)
TA	13.39	31.73	38.08	TA	-10.68	53.47	46.20	TA	15.49	97.55	89.99
	*(2.90)	*(3.25)	*(2.72)		(-1.21)	*(2.37)	*(2.21)		*(5.09)	*(9.90)	*(10.05)
NT	28.79	16.35	21.22	NT	35.56	-15.34	-16.80	NT	-59.82	-229.77	-111.99
	(1.06)	(0.22)	(0.14)		(0.66)	(-0.11)	(-0.14)		*(-2.20)	**(-1.83)	(-0.92)
RE	-0.01	-0.11	-0.18	RE	0.01	0.08	0.04	RE	-0.002	-0.05	0.10
	*(-2.38)	(-0.63)	(-0.37)		(0.99)	(0.76)	(0.32)		(-0.82)	(-0.24)	**(1.72)
IM	0.92	0.82	1.35	IM	0.63	0.21	0.16	IM	0.60	0.25	0.19
	*(12.49)	*(3.00)	*(4.14)		*(6.25)	(1.26)	(1.04)		*(4.64)	(0.41)	(0.54)

	Telecommunications				Utilities				Technology		
	OLS	TSLS	GMM		OLS	TSLS	GMM		OLS	TSLS	GMM
PR	-231.42	-14.19	-13.65	PR	-9.44	-208.37	-214.02	PR	-43.71	-72.02	-71.56
	*(-12.83)	(-0.27)	(-0.06)		(-0.29)	*(-4.77)	*(-7.44)		*(-7.48)	*(-9.10)	*(-5.74)
SI	2.32	0.36	-0.44	SI	6.37	1.83	1.94	SI	4.09	3.70	3.93
	(0.67)	(0.24)	(-0.16)		*(2.81)	(1.29)	(1.43)		*(5.16)	*(6.86)	*(3.33)
ME	0.83	0.44	-0.51	ME	-0.20	-1.03	-2.91	ME	0.05	0.24	0.18
	*(2.21)	(0.27)	(-0.2)		(-0.20)	(-0.68)	*(-2.27)		(0.66)	(1.23)	(1.09)
TA	-21.53	8.20	-1.32	TA	47.57	44.96	43.74	TA	38.23	23.82	23.34
	(-1.1)	(0.43)	(-0.04)		*(5.18)	*(3.68)	*(3.12)		*(6.28)	(3.99)	*(2.07)
NT	207.55	15.08	57.10	NT	-58.06	-216.67	-301.73	NT	-54.71	-13.85	-9.21
	*(2.76)	(0.18)	(0.6)		(-0.46)	*(-2.39)	*(-4.25)		(-2.65)	(-0.43)	(-0.18)
RE	0.01	0.55	0.47	RE	0.04	-0.18	-0.22	RE	0.00	-0.02	0.01
	(0.77)	*(2.98)	(1.01)		(1.44)	**(-1.90)	*(-2.88)		(-0.52)	(-0.15)	(0.04)
IM	1.38	0.07	0.67	IM	-1.22	-0.60	-0.09	IM	0.85	0.75	0.82
	*(3.06)	(0.10)	(1.15)		*(-7.25)	*(-4.73)	(-0.68)		*(7.77)	*(4.15)	*(2.99)

Table A.2
Regression results with RD

This table contains the estimated regression coefficients of the OLS, TSLS and GMM estimates for the following model:

$$LEV^{*}_{i,t+1} = \alpha_t + \beta_1 PR_{i,t} + \beta_2 SI_{i,t} + \beta_3 ME_{i,t} + \beta_4 RD_{i,t} + \beta_5 NT_{i,t} + \beta_6 RE_{i,t} + \beta_7 IM_t + \varepsilon_{i,t}$$

For the OLS estimation, a parameter u_i denoting firm fixed effects must be added to the regression equation. T-statistics are shown in parentheses. T-statistics of the TSLS and GMM estimation are robust to serial correlation and heteroskedasticity. * denotes statistical significance at the 0.05 level. ** denotes statistical significance at the 0.1 level. The results are classified by industry and regression technique. LEV* stands for the target capital structure, PR stands for Profitability, SI for Size, ME for Market expectations, RD for Research and development expenses, NT for Non-debt tax shield, RE for retained earnings and IM for the Industry median of leverage.

	Oil & Gas			Basic Materials			Industrials	
	TSLS	GMM		TSLS	GMM		TSLS	GMM
PR	-132.95	-111.72	PR	-151.99	-175.25	PR	-127.8	-133.81
	(-1.5)	(-1.15)		*(-07.48)	*(-7.94)		*(-6.45)	*(-6.65)
SI	4.84	5.52	SI	6.07	5.48	SI	5.62	6.06
	-0.95	-0.95		*(4.26)	*(3.65)		*(4.14)	*(4.49)
ME	2.92	-1.41	ME	2.26	2.6	ME	0.41	-0.39
	-0.37	(-0.21)		*(4.42)	*(4.15)		-0.72	(-0.68)
RD	247.7	583.83	RD	-266.22	-258.61	RD	-276.55	-265.98
	-0.41	-0.76		*(-2.69)	*(-2.42)		*(-3.26)	*(-3.12)
NT	-675.79	-728.26	NT	-65.75	-51.92	NT	104.72	99.63
	(-1.77)	(-1.5)		(-0.5)	(-0.38)		-1.36	-1.27
RE	0.36	0.29	RE	0.08	0.1	RE	0.19	0.28
	-0.78	-0.54		-1.16	-1.16		-1.59	*(2.17)
IM	0.75	0.83	IM	1.3	1.07	IM	1.2	1.29
	-1.53	-1.4		*(8.77)	*(7.64)		*(5.95)	*(6.15)
	Consumer Goods			Health Care			Consumer Services	
	TSLS	GMM		TSLS	GMM		TSLS	GMM
PR	-115.64	-41.94	PR	-88.24	-93.02	PR	-1053.3	-438.82
	(-1.24)	(-0.39)		*(-2.27)	*(-3.02)		*(-1.84)	*(-2.21)
SI	6.71	6.42	SI	-5.16	-5.66	SI	-29.14	0.39
	*(3.26)	*(1.99)		*(-3.37)	*(-3.56)		(-1.16)	-0.06
ME	1.4	0.62	ME	-1.16	-0.63	ME	1.46	2.7
	-0.76	-0.4		**(-1.95)	(-1.04)		-0.22	*(2.14)
RD	-810.69	-197.25	RD	-72.09	-53.37	RD	3240.81	-41.53
	*(-2.56)	(-1.70)		**(-1.89)	(-1.47)		-1.1	(-0.09)
NT	236.66	272.97	NT	276.36	203.68	NT	1789.59	594.11
	-0.89	-1.03		*(1.91)	-1.45		-1.31	-1.59
RE	0.21	-0.62	RE	-0.1	-0.03	RE	6.05	0.9
	-0.17	(-0.51)		(-0.65)	(-0.19)		-1.69	**(1.87)
IM	1.39	1.15	IM	0.25	0.11	IM	-10.5	-0.33
	*(2.16)	-1.61		-1.3	-0.59		(-1.25)	(-0.21)
	Telecommunication			Utilities			Technology	
	TSLS	GMM		TSLS	GMM		TSLS	GMM
PR	-41.99	-4.00	PR	-234.63	-288.95	PR	-68.94	-78.49
	(-1.15)	(-0.02)		*(-5,20)	*(-6.01)		*(-7.96)	*(-6.39)
IS	0.27	-0.68	IS	4.72	3.82	IS	3.09	3.57
	(0.15)	(-0.25)		*(3.21)	*(2.27)		*(5.27)	*(3.23)
ME	0.35	-0.52	ME	-0.68	-3.58	ME	-0.04	-0.01
	(0.23)	(-0.21)		(-0.41)	*(-3.02)		(-0.16)	(-0.06)
RD	-177.37	4.14	RD	318.84	707.72	RD	-111.38	-111.23
	(-0.94)	(0.02)		-0.56	-0.68		*(-5.89)	*(-3.28)
NT	52.99	23.32	NT	-161.14	-298.73	NT	53.83	40.5
	(0.60)	(0.24)		(-1.55)	*(-1.96)		**(1.89)	-0.84
RE	0.49	0.53	RE	-0.19	-0.24	RE	0.2	0.2
	*(3.96)	(1.55)		**(-1.90)	*(-2.0)		-1.4	-1.01
IM	0.24	0.71	IM	-0.74	-0.24	IM	0.55	0.66
	(0.50)	(1.45)		*(-4.59)	(-1.51)		*(2.89)	*(2.27)

Table A.3
Variance inflation factor per determinant and industry

	PR	SI	ME	TA	NT	RE	IM	RD
Oil & Gas	1.78	1.27	1.21	1.70	1.86	1.07	1.08	1.40
Basic Materials	1.20	1.08	1.20	1.21	1.25	1.00	1.03	1.09
Industrials	1.23	1.11	1.21	1.37	1.32	1.00	1.05	1.06
Consumer Goods	1.65	1.23	1.59	1.18	1.20	1.00	1.04	1.11
Health Care	1.39	1.44	1.47	1.49	1.20	1.03	1.13	1.39
Consumer Services	1.38	1.46	1.19	1.51	1.38	1.01	1.03	1.13
Utilities	1.13	2.01	1.16	2.10	2.15	1.07	1.06	3.22
Technology	1.33	1.22	1.26	2.30	2.41	1.04	1.09	1.08

Table A.4
Durbin-Watson statistic per determinant and industry

	OLS	TSLS	GMM
Oil & Gas	1.42	0.70	0.95
Basic Materials	0.98	0.40	0.37
Industrials	0.89	0.96	1.47
Consumer Goods	0.81	0.54	0.92
Health Care	1.07	0.47	0.38
Consumer Services	0.92	0.52	2.00
Utilities	1.14	1.09	0.82
Technology	0.96	0.39	0.39