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Dynamic Adjustment of Corporate Leverage: Is there a lesson to learn from the Recent Asian Crisis?[1]

Nigel Driffield, Aston Business School, Birmingham, UK

Vidya Mahambare, Cardiff Business School, Cardiff UK

Sarmistha Pal[♣], Cardiff Business School, Cardiff UK

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Abstract: Much of the macro literature on the recent Asian crisis argues that a major cause was over borrowing and over investment encouraged by poor supervision and the resulting moral hazard problem. Surprisingly however there is little firm-level evidence to corroborate this. The present paper examines the extent to which firms in these countries had deviated from their optimal levels of leverage and also the determinants of their ability to adjust their capital structure. Results obtained using the Worldscope firm-level panel data for the four of the worst affected countries suggest that higher quality firms had lower optimal leverage while firms with excess capital stock had higher optimal leverage required to finance this capital expenditire. Further, there are signs of corporate inertia in the worst affected countries exhibiting very slow adjustment processes in their capital structure. This result holds even for those firms potentially better placed to control their levels of leverage. These results seem to strengthen the moral hazard argument of bad loans in poorly regulated and supervised East Asian economies.

Key words: Moral hazard, Optimum leverage, Dynamic model, Speed of adjustment

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[♣] Corresponding author. Address for correspondence: Cardiff Business School, Colum Drive, Cardif CF10 3EU, UK. E-mail: pal@cardiff.ac.uk; Fax: +44-29-2087 4419.

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1. INTRODUCTION

Much of the existing literature on the recent Asian crisis focuses on the macroeconomic problems of the economies. These highlight the problem of bad loans and moral hazard at the aggregate level as the common source of excessive borrowing and over-investment (e.g., Krugman, 1998c; Corsetti, Pesenti and Roubini, 1999a). There is however very little firm-level analysis of this, and thus far there is an absence in the literature of any analysis of the behaviour of leverage at the firm level, and the extent to which firms attempted to change their behaviour in the face of the crisis. This is precisely what the present paper aims to do, with particular focus on the process of adjustment towards an optimum leverage in a dynamic framework.

In doing so, the paper draws together primarily two strands of the literature. First, a key macroeconomic argument of the recent Asian Crisis has been that the moral hazard in the loan market was created by future bail-out policy of the government and the lack of supervision in poorly regulated economies. The result was financing of unprofitable projects and cash shortfalls with external borrowing causing overinvestment and lower returns, paving the way for the crisis.

Secondly, there is a relatively large literature on the choice of optimum capital structure in corporate finance.[2] In a world of fully informed investors, no taxes and risk-free debt, Modigliani and Miller (1958) argued that firm value and in particular equity value is determined without regard to the firms' capital structure. Thus leverage will be independent of firm value.

In the trade-off models, firms obtain optimal leverage by comparing the costs and benefits of an additional unit of debt. Costs of debt include costs of potential bankruptcy and also the costs due to agency conflicts (if there are informational problems) between the agents involved (e.g., managers/shareholders/lenders). At the leverage optimum marginal costs will be equated to marginal benefits of an additional unit of debt. Considerations of bankruptcy

[2] Though there is a sizeable literature on the theory and evidence on optimal capital structure, most analyses are done in static framework and that too primarily for the US corporations (e.g., see Titman and Wessels, 1988) and other industrialised countries (Rajan and Zingales, 1995) with the single exception of Welch (2004) who examined the debt ratio dynamics for US corporations. .

and agency costs will however modify the central hypothesis of Modigliani and Miller (1958). For example, in the presence of asymmetric information, retained earnings and debt could be regarded as better financing tools than new equity, especially when the equity is under priced. Secondly, in the presence of bankruptcy costs, there is a limit to how much risky debt can be issued before new equity is preferred. Thus leverage will be dependent on the net present value (NPV) so that firms with higher NPV are more likely to issue higher debt. This is the focus of a number of theoretical papers on optimal choice of leverage under asymmetric information. As in Ross (1977), Leland and Pyle (1977) model too predicts a positive correlation between firm quality and leverage. Similar arguments are found in Brennan and Kraus (1987), Kale and Noe (1991).

The dynamic extension of the static theory of optimal capital structure[3] involves hypothesising (right word) an adjustment process, where the observed capital structure, adjusts towards a long-run optimum (determined by observed internal and external factors). There is a relatively limited literature on dynamic modelling of capital structure, and the focus of such work is generally the transaction costs associated with the adjustment process. For example, Fischer, Heinkel and Zechner (1989) argue that even small recapitalization costs could lead to wide swings in a firm's debt ratio over time. Conversely, Leland (1998) emphasizes the role of agency costs of debt in determining optimal leverage. A common theme in the existing theoretical and empirical literature is that transaction costs and capital market imperfections lead to firms having sub-optimal levels of capital, while in the SE Asian case there is evidence that the reverse is true. The moral hazard problems of corporate borrowing in the East Asian economies indulged in excessive borrowing thus resulting in actual capital stock exceeding the optimal. In this context, it is important to consider the extent to which firms had deviated from their optimal levels of capital and what, if any, determines their inclination to adjust their capital structure. This is an issue which is often overlooked in the dynamic adjustment literature and we aim to bridge this gap of the literature.

[3] The alternative theory of firm financing relates to Pecking Order of funds (Myers, 1984). Pecking Order arises if the costs of issuing new equity outweigh other costs and benefits of dividends and debt. Financing costs that produce Pecking order include transaction costs of new issues and the costs that arise from managers' access to superior information about firms' prospects and value of its risky securities. Hence, firms may finance new investment first with riskless debt, then with risky debt and finally under duress with equity. Myers and Majluf (1984) further argued that Pecking Order of funds will be retained even with this adverse selection problem. Unlike the trade-off theory, however the Pecking Order theory does not explain a target level of optimal leverage.

Our analysis is based on the recent Worldscope firm-level data from four worst affected countries, namely, Indonesia, Korea, Malaysia and Thailand. We then compare the capital structure adjustment behaviour of firms in these countries with those in Hong Kong, Singapore and Taiwan, countries those were relatively unaffected by the Crisis. Results suggest that optimal leverage was lower for firms with higher market valuation and for given market valuation was higher for firms with excess capital stock. Dynamic estimates of speed of adjustment however suggests a kind of corporate inertia, especially among larger firms in Indonesia, Korea and Thailand, more profitable firms in Malaysia, firms with negative equity valuation in Indonesia and Thailand and even firms with higher stock returns in Thailand. In contrast, these problems were almost nonexistent in the relatively unaffected countries. These results seem to strengthen the moral hazard argument of bad loans in poorly regulated and supervised East Asian economies of Indonesia, Korea, Malaysia and Thailand.

The paper is developed as follows. Section 2 reviews the relevant literature and specifies the analytical model. Section 3 analyses the data while section 4 explains the empirical model and analyses the estimates. Section 5 concludes.

2. DATA ANALYSIS

The analysis is based on the Worldscope firm-level data. Here we extend the Worldscope firm-level data used in Driffield and Pal (2001, 2004) in two ways: (a) in addition to countries badly affected by the crisis, namely, Indonesia, Korea, Malaysia and Thailand, we include Hong Kong, Singapore and Taiwan, which were relatively unaffected by the crisis and label them as 'comparator countries'. (b) Our previous analysis was based on firm performance during 1989-97 periods. We now update the data to cover the post-crisis period 1998-2002. The latter enables us to trace the patterns of recovery, if any, in these countries. The number of firms in each country with and without outliers is summarised in Table 1 for each year. However, there is a problem of missing observations for many firms, especially during the early years, e.g., 1989-93. This was particularly problematic for our dynamic analysis which requires firms with relevant information for at least four consecutive years. Accordingly, we had to create a sub-sample for firms with at least four consecutive years of information, which resulted in smaller number of firms for each country (see Appendix Table A1).

The initial analysis commences by considering the distribution of internal and external funds before (1989-97) and after (1998-2002) the crisis as summarised in Table 2. In general there was a greater dependence on external finance in all countries in the pre-crisis period. External finance accounted for 60% of total finance in Korea followed by Thailand (35%) and Indonesia (33%). After the crisis, the average ratio of external finance in total finance declined, decreased by some 22% in Indonesia, 20% in Thailand, 17% in Korea and 9% in Malaysia. In contrast, the average share of external finance in total finance in the least affected countries was modest and did not change perceptibly after the crisis.

Secondly, we consider the composition of debt and equity in external finance. Among the worst affected countries, Korean, Indonesian and Thai firms had on average much higher reliance (60%-90%) on debt finance. In comparison, the average share of debt finance was only 38% in Malaysia. Following the crisis, however, the share of debt decreased in Korea and Malaysia, though not in Indonesia and Thailand. Compared with the worst affected countries, Singapore and Hong Kong had a more even distribution of external finance between new debt and new equity, though Taiwanese firms had on an average a higher reliance on debt finance as well. In all these comparator countries there was a slight decline in average share of new debt in total external finance after the crisis.

In order to understand the gradual development of the crisis during 1989-97, we next subdivide the pre-crisis period into two sub-periods: (a) 1989-94: we consider this as 'normal' period before the symptoms of crisis started appearing and (b) 1995-97: we label it as 'build-up to the crisis' period. Finally we compare the period-specific averages of leverage and some useful indicators of firm performance during these pre-crisis sub-periods with those in the post-crisis period. Two alternative definitions of leverage are considered here: (i) book value of total debt divided by book value of total debt & market value of equity and (ii) total liability divided by total assets. Alongside the leverage, we consider the average share of tangible assets in total assets as an indicator of productive investment. Finally, we also consider the ability of an average firm to cover its liabilities. In this respect, we examine three possible indicators, namely, cash flow to current liabilities (generally used as an indicator of potential bankruptcy), interest coverage and debt coverage ratios (common indicators of default probability) over these sub-periods. This information is summarised in Table 3. Compared with 1989-94 period, average debt-equity ratio increased in all the sample countries in the run up to the crisis period 1995-97.[4] While the reasons for high leverage may vary from country to country, it is well documented that many East Asian corporations were heavily reliant on debt during this period. Explanations for this may include: the large shareholders' desire to keep control of the management by preventing dilution of their ownership; low real interest rates on bank loans; and poor financial and corporate governance which resulted in over lending by banks. There is evidence that firms in all countries except Korea took some steps to reduce their levels of short term debt immediately before the crisis. Compared with the earlier period, the ratio of current to total liabilities dropped in the remaining countries. As against this significant increase in average leverage in all countries, there was only a marginal increase in tangible assets in Korea, Indonesia, Singapore and Thailand while in other countries the share of tangible assets fell. There were further signs of problems among the firms in sample countries. For example, average value of cash flow to current liabilities declined in all countries, but more significantly in Indonesia and Thailand, the worst affected countries. This indicates the levels of financial distress that the firms were operating under during the 1995-97 period, especially those in the worst affected countries. There were further problems as both interest coverage (interest payments as a share of EBIT) and debt coverage (interest payments plus principal as a share of EBIT) significantly increased in all sample countries apart from Hong Kong.

It is possible to detect some signs of recovery in all of the worst affected countries in the post-crisis period. For example, the average debt-equity ratio decreased while share of tangible assets slowly increased in all these countries. It was accompanied by a declining trend in interest and debt coverage ratios. Also, the problem of falling cash flow in relation to current liability was to some extent corrected in Korea and Thailand in the post-crisis period.

Similar patterns can be detected if one examines the year-to-year fluctuations of leverage rates in these countries. Table 4 summarises the mean, minimum, maximum and the range (the difference between maximum and minimum) for each country over the sample period. The fluctuations in leverage levels were far greater in firms in the worst affected countries, and were greater in the period leading up to the crisis. In addition, many firms in

[4]One could argue that excessive dollar borrowings could make the corporate sector vulnerable to sudden currency fluctuations. Though we do not have data on foreign loans, the increase in average DE during 1995-97 was in part due to a sudden rise in value of debt in 1997 attributable to the collapse of exchange rates. A rapid rise in the value of debt was due to the revaluation of dollar-dominated debt which was unhedged. In part this increase in DE during this period was also in part due to a decline in equity value (see further discussion later in the section).

the worst affected countries demonstrated a negative equity values[5] in the build-up to the crisis period, generally after 1994. One exception is Korea where firms seem to have the problem of negative equity from as early as 1989 (though the problem worsened in 1997). With a rapid depreciation of currencies exchange rate, some firms became technically insolvent which could partly be reflected in negative equity valuations, which in turn increased the range. There is not much evidence that the range narrowed significantly in any of these worst affected countries even in the post-crisis period.

Finally, Figure 1 shows the trend in average annual debt-equity ratios while Figure 2 shows the trend in share of tangible assets to total assets over the 14-years period 1989-2002. These figures clearly demonstrate that compared with other sample countries, Korean firms on an average maintained a much higher debt-equity ratio over much of the pre-crisis period. Also, while average debt-equity ratios increased dramatically from 1993 onwards, especially in Korea, Indonesia, Malaysia and Thailand, they were accompanied by only modest increases in share of tangible assets. In contrast, average share of tangible assets were much higher in Hong Kong and Taiwan over this period, with much smaller fluctuations in both average debt equity ratios and share of tangible assets. After the crisis, the average debt-equity ratio plunged most visibly in Korea and Indonesia, but also in most other countries, before it was stabilised some time around 2000.

3. A Dynamic Analysis of Corporate leverage

Existing empirical research on the dynamics of firm's capital structure is often limited by the absence of long panel data as well as unavailability of certain key variables. Most existing analysis is based on the hypothesis of a target leverage level for the firm, tested cross sectionally within a country, usually the US (e.g., Welch, 2004)[6] or UK. Thus these cross sectional analyses omit a good deal of necessary information. More recently, in order to increase the degrees of freedom in such studies, data have been pooled, but then these models ignore the possibility of serial correlation, or structural breaks between years. More

[5] Number of observations in each sample with negative equity are as follows: 5.3% in Korea and Thailand, 7.5% in Indonesia and 4.7% in Malaysia. In comparison, number of observations in the countries least affected by the Crisis was much smaller: only 0.2% in Taiwan, 0.6% in Singapore and 1.2% in Hong Kong.

[6] In examining the debt ratio dynamics for the US corporations, Welch focuses on the role of stock returns and argues that firms do not immediately readjust. Firms whose debt ratio increase (decrease) because of poor (good) stock returns performances seem to use their issuing activities not to readjust, but to amplify the stock return changes.

importantly, because of the latent variable problem, many studies tend to use observed debt level as a proxy for optimal debt level (e.g., Titman and Wessels, 1988; Rajan and Zingales, 1995, Hovakimian et al, 2001) and then explain how firms periodically adjust their capital structures toward a target ratio (that reflects the costs and benefits of debt financing found in the static trade-off models).

However, firms may not find it easy to adjust their debt ratios frequently or fully, even if they are aware of the implied inefficiency. Thus it is also important to establish the speed of the adjustment process as well as the determinants of the speed. Among the existing studies Heshmati (2001) attempts to differentiate between the observed and the estimated optimal debt ratio levels, and determines the speed of adjustment for the micro and small Swedish firms during the period 1994-97. We are, however, not aware of any study analysing the case of East Asian firms as is presented here.

3.1. A Model of Dynamic Adjustment

Our central focus is on the moral hazard problem as the common source of excessive external borrowing in a poorly supervised and regulated economy. If private agents act under the presumption that there exists public guarantees on corporate and financial investment, return on domestic assets is perceived as implicitly insured against adverse circumstances. In circumstances where lenders are willing to lend against future bail out revenue, unprofitable projects and cash shortfalls would be refinanced through external borrowing. This generates excessive corporate leverage, without significant growth of tangible assets. In this context, we examine the process of adjustment of actual leverage towards the optimum.

Let the optimal leverage of a firm i at time t be DE_{it}^{*}, which varies across firms as well as over time.[7] In the absence of any market imperfection, and with instantaneous adjustment, the observed leverage of firm i at time t DE_{it} would be equal to its optimal, i.e. $DE_{it} = DE_{it}^{*}$. If, however, adjustments are costly, for example due to agency or transaction costs) $DE_{it} < DE_{it}^{*}$ or if loans are not well-regulated (e.g., due to moral hazards problems), $DE_{it} > DE_{it}^{*}$. In either case, firms may fail to adjust completely to the optimal level.

[7] It, however, follows from the analysis of our data (see section 3) that there is limited fluctuations in the firm leverage level from year to year, especially during 1989-93/94 and accordingly we argue that there is a concept of firm-specific optimal leverage in the normal years that does not fluctuate from year to year.

In these circumstances, the movement of leverage rates over time becomes a partial adjustment process, of the form:

$$\Delta DE_{it} = a + b\,(DE_{it}^{*} - DE_{it-1}) + e_{it} \qquad (1)$$

where the speed of adjustment of a firm i in period t is given by β. If β = 1, i-th firm will take one period to adjust its leverage to its optimum within period t. If, however, β <1, then the adjustment from year t-1 to t falls short of the adjustment required to attain the target. In contrast, β could also exceed unity suggesting that the firm over-adjusts beyond the optimum and is still not at the optimum. Thus *b* measures the degree of adjustment per period and can therefore be alternatively known as the speed of adjustment. It is possible that the speed of adjustment β would vary with the factors affecting the externality of adjustment in poorly supervised and regulated economies, for example. The extensions to this model are developed in two stages as discussed in the following subsections 3.1.1. and 3.1.2.

3.1.1. Determination of optimum leverage

Determination of optimum leverage is central to an understanding of the process of adjustment of the actual leverage to the optimum. Most existing studies tend to use observed leverage to generate predictions or estimates of the optimum leverage, based on the following type of model:

Suppose a standard random effects model of leverage for a firm i, i=1,2,…,I , in period t, t=1,2,….,T is described as:

$$\begin{aligned} DE_{it} &= b' X_{it} + f_i + m_t + e_{it} \\ &= b' X_{it} + u_{it} \end{aligned} \qquad (2)$$

where $u_{it} = f_i + m_t + e_{it}$ Estimating (2) in order to obtain a measure of optimal leverage is however far from ideal. Firms may not find it cost effective to adjust their debt ratios from year to year even if they are aware of the suboptimaility of the existing levels. Indeed, our analysis (see Table 4 and discussion in section 2) suggests that in the 'normal period' up to 1994, leverage rates at the firm level showed very little fluctuation from year to year. It is clear from Table 4 that the worst affected countries experienced sudden increase in the range of leverage from around 1993/94 when problems appeared in their equity valuations. This suggests that the optimum leverage for a firm does not vary from year to year, so any prediction of optimal leverage based on annual variation is likely to overestimate the volatility of optimal leverage rates. In order to redress this, we use group means estimates of leverage during the normal years to generate predictions about the optimum leverage for firms in our sample countries. Summing both sides of (2) over T periods and then taking the average yields the following group means:

$$\overline{DE}_i = b'\overline{X}_i + \overline{u}_i \qquad (3)$$

Thus in the light of our sample, the long run leverage level obtained from (3) is argued to be a more reliable estimate of the optimal leverage of a firm than one based on cross sectional or intertemporal variation.

Following the trade-off theory, market valuations and profitability of firms are important determinants of optimum leverage in a world characterised by market imperfections and informational problems. This is accounted for by including profit margin in the determination of optimal leverage. In addition, we include a measure of the deviation of actual capital (K) from the corresponding optimal (K*); the latter (K-K*)[8] is taken to be a measure of over-investment, if any.[9] Finally, we control for firm size and use natural logarithm of total sales as the relevant size variable. In order to reduce the extent of simultaneity bias, we use one period lagged values of market valuation and profitability in determining optimal leverage.

This allows us to derive the group means of observed leverage in the normal years for each of the sample countries (see Table 3). Subsequently these group means estimates are used to generate predicted values of optimum leverage to be used in the dynamic adjustment process.[10]

3.1.2. The dynamics of capital adjustment

The baseline dynamic adjustment model (1) can be estimated,[11] and values of β derived for each country in order to determine the average speed of adjustment. The results from this estimation are presented in table A2 in the Appendix. These illustrate that the speed of

[8] The econometric approach to modelling the optimal capital stock of the firm is discussed at length in the Appendix. Also note that we include both the nominal and the absolute deviation of actual capital stock from its optimal. The latter allows us to account for the possibility of non-linearity in this respect.
[9] We have also experimented with other possible variables like some measure of bankruptcy and interest coverage (as a measure of loan default of firms), but none of these variables turned out to be significant in our samples.
[10] This is different from the normal convention in the literature where the optimal leverage is considered to vary over the years for each firm.
[11] Note that the baseline model does not include any of other explanatory variables.

adjustment coefficients are significant, but that the average speed of adjustment is significantly less than 1. .

While these results are instructive up to a point, it is likely that the inclination and ability of individual firms to adjust to equilibrium will vary across time, depending on the circumstances of the firm and the time period. As such therefore, it is possible to re-write (1) as:

$$\Delta DE_{it} = a + b_{it}(DE_i^* - DE_{it-1}) + e_{it} \qquad (4)$$

Where DE_i^* is the optimal leverage obtained from first stage group means estimates[12] (see section 3.1.1) and

$$\beta_{it} = \beta_{0it} + \beta_{1it} * (K\text{-}K^*) + \beta_{2it} * |K\text{-}K^*| + \beta_{3it} * (DE\text{-}DE^*) + \beta_{4it} * |DE\text{-}DE^*| + \beta_{5it} * (SALES) + \beta_{6it} * CRISIS + \beta_{7it} * (DE<0) + \beta_{8it} * (DE=0) \qquad (5)$$

In other words, the speed of adjustment in specification (5) is assumed to vary among firms, and is determined by a vector of variables, both real and financial. The estimation of (5) then allows one to generate firm-specific estimates of speeds of adjustment.

Among the possible determinants of the speed of adjustment towards the optimal leverage, we include firm size (SALES), the nominal (K-K*) and absolute |K - K*| deviations of actual capital stock from the corresponding optimum, profitability (PROFIT), stock returns (SR), and also a crisis dummy (CRISIS) to account for any structural break around the time of the crisis.[13]

In addition, we experimented with a number of variables that would capture the distress under which a firm is operating. It is important to identify the firms under distress since compared with other relatively better-off firms, the behaviour of these distressed firms could affect the speed of adjustment. In particular, we tried to include the conventional measure of distress, e.g., cash flow as a share of current liability, interest coverage (interest payments as a share of cash flow) and debt coverage (total debt + interest payments as a share of cash flow) ratios. However, this generated problems of multicollinearity. As an alternative, we include two dummy variables, namely, if DE=0 and DE<0. All firms in our sample had

[12] Note that this could give rise to the problem of heteroscedasticity. This is addressed in our estimation method (see section 3.1.3).
[13] We experiment with a number of possible definitions of the CRISIS dummy. In the final results summarised in Table 6, the CRISIS variable is defined as follows: CRISIS =1 if year =97-99 and 0 otherwise.

some equity finance and thus DE=0 for those firms who were unsuccessful to raise any external debt in a given year presumably because they could not qualify for it (e.g., because of low profitability or market valuation). More importantly DE<0 if firms experience negative equity valuation in some years. It is important to identify these two groups of firms, as for most firms with a negative equity valuation, total debt fell in subsequent years, the trend being similar across all countries in the sample. This suggests that these firms had obtained significant debt leading up to the period of negative equity, but did not take on (or could not obtain) further debt subsequently. Further, the ratio of long term debt to total debt is very low for these firms, between 19% and 36% for these all countries except in Korea, where it is 53%. These firms have therefore been mainly surviving by taking on short term debt. Not surprisingly, these firms report significant losses, for almost all of these firms, cash flow and EBIT is negative. Q is also negative by definition.

3.1.3 Estimation Method

Due to the inclusion of a lagged change in D/E ratios on the left hand side of equation (1), and given that the model is estimated within a panel framework, ordinary least squares cannot be applied. Rather, one has to use the generalised method of moments estimator following Arellano and Bond (1988, 1991) employing instrumental variables. This is because, within a panel framework, the "lagged levels" variables are treated as being pre-determined. The estimation procedure that is employed here is outlined in some detail by Sevestre and Trognon (1996). This approach is common for example in labour demand modelling, where a non-linear adjustment process is assumed. For further discussion of this, see Hamermesh (1995).

It is possible that heteroskedasticity is introduced into the dynamic model, as by construction the error term from (4) is related to the *changes* in the X term from (2). The estimation procedure generates heteroscedasticity consistent estimates by employing White's correction.

In general our data covers a period of 1989-2002 for each firm, which in turn provides a panel of thirteen annual differences. Allowing for the use of lags and instruments, this provides a panel of ten years in differences on which the partial adjustment equation can be estimated.

The multiple correlation coefficient squared R^2 and its adjusted value are routinely used in most models as a measure of goodness of fit. There are however, problems of using R^2 in a regression model estimated by instrumental variable (IV) methods, as outlined by

Pesaran and Smith (1994). As an alternative, we use two possible indicators of goodness of fit: (a) Pesaran and Smith (1994) generalised R^2 commonly abbreviated as GR^2. (b) We also calculate a second measure, which is the correlation between predicted values of the change in leverage from GMM estimation and the actual values of the change.

Diagnostic tests:

Exogeneity of instruments (Sargan's test): In a regression model estimated by IV method, it is important to test for the exogeneity of instruments to ensure the consistency of estimates. Sargan (1976) proposed a general procedure in this respect that involves the examination of the covariance between IV residuals and the set of instruments used. Sargan derived a chi-square test criterion by obtaining the asymptotic null distribution of the scaled covariance vector. This chi-square test is used here to test for exogeneity of instruments used.

Serial Correlation: When estimating panel data models by GMM, the consistency of the estimator relies on the assumption of no serial correlation. We therefore test for 1st and 2nd order serial correlation, and with differenced data, to quote Doornik et al (2002) "there should be evidence of significant negative first order serial correlation in the differences residuals, and no evidence of second order correlation". The appropriate AR1 and AR2 tests are then based on average residual autovariances, which are asymptotically distributed N(0,1).

3.2. Results

In this subsection, we present and analyse the estimates of optimal leverage as well as the firm-specific speed of adjustment towards the optimum leverage, contingent on the estimates of the optimal leverage.

3.2.1. Estimates of optimal leverage

We determine the group means estimates of optimal leverage for the normal years.[14] These estimates are summarised in Table 5A. Our main findings are as follows: (a) Firms with higher valuation had lower leverage, as has been predicted by trade-off models with asymmetric information. (b) For given values of other variables, firms with a larger deviation

[14] Depending on the experience of the sample countries, definition of normal years varies:

of K from K* generally had higher leverage, presumably indicating the aspect of debt-funded over-investment in these firms. (c) Firm size or firm efficiency was not however significant in determining long-run leverage in terms of group means estimates.

While there are many similarities across the countries, this pattern is not uniform. Firms with higher market valuation in all countries have a lower dependence on external debt. Deviation of actual capital stock from its optimum is important and in most sample countries (except Indonesia, Malaysia and Hong Kong) firms with greater deviation from optimum capital stock had significantly greater optimal debt-equity ratio. However, firm size and profitability is not significant in most countries, except Thailand. In Thailand, coefficients of both firm size and profitability are significant and hence, ceteris paribus, larger firms and firms with higher profitability had significantly higher leverage.

Using these group means estimates we generate the estimates of long-run optimum leverage, and then calculate the deviation of actual leverage from the optimum. Distributions of these deviations are summarised in Table 5B for the sample countries for the three sub-periods, 1989-94, 1995-97 and 1998-2002. This demonstrates that the average deviation (both mean and median) increased markedly in the build up to the crisis period 1995-97 for all countries. The magnitude of these increases however is smaller for Hong Kong, Singapore and Taiwan. More importantly, only Korea among the worst affected countries shows any evidence of an apparent adjustment process.

3.2.2. Dynamic estimates and speeds of adjustment

Table 6 displays the estimates of dynamic adjustment process in the sample countries. These estimates are heteroscedasticity consistent in that the covariance matrix is adjusted for White's correction. Two measures of goodness of fit are presented for each case. The first is the generalised r-squared (GR^2) for instrumental variable estimation (Pesaran and Smith,1994), while the second is the more common square of the correlation between the actual and fitted dependent variable. In general, there is evidence of good fit for differences data in each case. Secondly, P-values from the Sargan test are shown in the Table, which suggest that one cannot reject the null hypothesis of exogeneity for all cases. The tests for serial correlation (negative first order, positive second order) are also presented for each case, which confirm the absence of any serial correlation problem here.[15]

[15] Table A3 in the Appendix also presents the estimates of an alternative specifications, using only real variables (excluding the stock returns variable) and suggest that our primary findings remain almost the same. In fact the

The results vary among the sample countries, though patterns emerge when comparing the worst affected countries with the others. Most notably, firm size is significant in all the worst affected countries, but not in the comparator countries. In all the worst affected countries, larger firms seem to have a slower pace of adjustment in leverage. With the exception of Malaysia, the coefficient on (K-K*) is significant and negative. This indicates that the greater the nominal deviation of K from K*, the slower is the pace of adjustment. One interpretation of this is that firms that built up an excessively large capital stock (relative to its optimal) find it impossible to reduce their leverage, even when facing a crisis of the magnitude suggested here. There is also significant evidence of asymmetry in the adjustment of leverage with respect to K-K*, as the absolute term is also significant, suggesting that firms with only a small deviation from K* are unable/unwilling to adjust their leverage.

Firm performance, as measured by profit margin, plays a significant role, especially in Indonesia, Korea and Malaysia, but not in Thailand. More profitable firms in Indonesia and Korea had higher speed of adjustment though the result was opposite in Malaysia. Similarly, coefficients of stock returns are not significant in the comparator countries, though these are significant in three of the four worst affected countries, namely, Korea, Malaysia and Thailand. While the coefficient is positive and significant in Korea and Malaysia, it is negative in Thailand. In other words, firms with higher stock returns generally experienced higher speed of adjustment in Korea and Malaysia and those in Thailand, in contrast, had lower speed of adjustment. Distress variables are significant too, especially in the worst affected countries. In particular, firms with negative equity valuation experienced slower speed of adjustment in Indonesia and Thailand though the same did not hold for Korea. Firms with zero debt (in some years) too had however higher pace of adjustment in Korea, Malaysia and Thailand. However, the crisis dummy turned out to be significant and positive for the countries except Taiwan. The latter tends to indicate that compared with other years the speed of adjustment was generally significantly higher during the crisis period. It is possible that firms responded to the crisis by adjusting faster. The latter could be facilitated by various restructuring programmes (e.g., debt-equity swaps, raising new equity or increasing the existing equity values) introduced to fight the crisis.

Finally, we calculate the distribution of the firm-specific speeds of adjustment (Table 7) and compare these estimates across the sample countries. (a) With the exception of

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goodness of fit measures decrease marginally for Indonesia,Korea, Thailand and even increases for the rest of the sample countries. We however focus on the estimates of the full model for the rest of the paper.

Indonesia, mean speed in all the worst affected countries is significantly different from the median speed; in the comparator countries the difference between mean and median is much less. (b) Compared to the rest of the countries, the maximum speed is significantly higher for Indonesia and Malaysia. (c) Mean and median speeds of adjustment are close to unity in Hong Kong while in all other countries they are less than unity (the lowest is observed in Indonesia being close to 0.10). If, however, we compare the distribution of speed of adjustment between firms with positive and negative leverage, mean as well as median speed of adjustment is significantly higher among firms with negative leverage (i.e., those with negative equity valuation). Thus these distressed firms (with negative equity valuation) seem to have a greater inclination to change their capital structure than the relatively better off firms (those with positive equity valuation). Leverage can be reduced either by debt-equity swaps, raising new equity or increasing the value of existing equity. Assuming that the relatively better-off firms were not under restructuring, the first option would not be available for the better off firms while the other two available options may not be working for the better off firms due to stock market collapse around the crisis period.

To summarise, there are significant deviations of actual leverage from the optimal among firms in the worst affected countries, especially in the build up to the crisis period. We identified a number of both real and financial variables[16] playing significant roles in the dynamic adjustment process. These results suggest signs of corporate inertia among firms in the worst affected countries, exhibiting evidence of lack of adjustment in their capital structure. This is true especially for the relatively better off firms; larger firms in Indonesia, Korea and Thailand; more profitable firms in Malaysia and Thailand and firms with higher stock returns in Indonesia and Thailand. Transaction and other indirect costs based theories seem to provide little support to explain this apparent lack of inclination/ability of these firms to adjust their capital structure, although they are rather active in other respects. These findings may on the other hand support the moral hazard argument of bad loans in poorly regulated economies where even relatively better off firms can afford not to respond to adjust their capital structure towards the optimum. One could also bring in other alternative explanations e.g., Pecking Order of funds or managerial entrenchment behaviour to explain this corporate behaviour. We however have not access to appropriate data to test the validity of these alternative explanations.

[16] Estimates presented in Table A3 in the Appendix suggest the relative importance of the real variables (e.g., sales, profit margin) in comparison to the financial variable like stock returns.

4. CONCLUDING COMMENTS

A series of macroeconomic studies have identified a standard moral hazard problem of excessive borrowing and overinvestment in the east Asian economies. While it is suggested that this was a key factor in the recent Asian crisis, there is hitherto little firm-level evidence to corroborate it. The present paper aims to contribute to filling the gap in the literature and examines leverage at the firm level, as well as the dynamics of leverage adjustment.

The results obtained from firm-level panel data suggest that higher quality firms had lower optimal leverage while firms with greater than the optimum capital stock had higher optimal leverage required to fund the excessive capital stock installation. Importantly, there are signs of corporate inertia among firms in the worst affected countries, as leverage adjusts only very slowly in such firms, and slower still in larger firms. This is true especially for the relatively better performing firms in Malaysia and Thailand, and firms with higher stock returns in Indonesia and Thailand. These results seem to strengthen the moral hazard argument of bad loans in poorly regulated and supervised east Asian economies.

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Table. 1. Number of Sample Firms, 1989-2002

	Korea	Malaysia	Singapore	Thailand	Indonesia	Taiwan	Hong Kong
1989	75 (75)	55 (55)	29 (29)	11 (11)	1 (1)	5 (5)	44 (41)
1990	73 (73)	63 (63)	33 (33)	22 (22)	31 (31)	5 (5)	49 (46)
1991	74 (73)	108 (108)	56 (56)	70 (70)	33 (33)	22 (22)	61 (59)
1992	83 (81)	136 (136)	64 (64)	119 (119)	64 (64)	25 (25)	75 (74)
1993	122 (118)	134 (134)	64 (64)	159 (157)	65 (65)	40 (40)	76 (76)
1994	146 (144)	146 (146)	80 (80)	165 (164)	70 (70)	93 (93)	94 (94)
1995	161 (158)	203 (203)	110 (110)	174 (173)	91 (91)	170 (170)	161 (160)
1996	179 (175)	249 (249)	129 (129)	188 (188)	104 (104)	181 (181)	226 (215)
1997	190 (177)	265 (260)	141 (141)	186 (168)	103 (86)	192 (192)	257 (245)
1998	182 (175)	266 (263)	148 (147)	182 (165)	102 (68)	194 (191)	259 (247)
1999	175 (173)	266 (257)	170 (164)	174 (154)	100 (81)	313 (304)	283 (271)
2000	169 (165)	263 (251)	267 (262)	170 (158)	100 (80)	372 (365)	409 (393)
2001	160 (158)	264 (257)	316 (308)	166 (152)	100 (85)	411 (404)	544 (528)
2002	160 (158)	262 (258)	332 (326)	161 (159)	98 (90)	405 (396)	572 (562)

Note: Number in the parentheses give the corresponding number excluding the outliers in each sample.

Table 2. Use and Composition of External Finance

	External Finance/total Finance (%)	Composition of External Financing (%)	
		new debt	**new equity**
Korea			
Pre-crisis	59.88	88.11	11.89
Post-crisis	43.35	78.50	21.50
Thailand			
Pre-crisis	34.61	60.06	39.94
Post-crisis	14.93	73.92	26.08
Malaysia			
Pre-crisis	29.91	38.24	61.76
Post-crisis	21.35	29.83	70.17
Indonesia			
Pre-crisis	32.79	77.77	22.23
Post-crisis	10.51	86.06	13.94
Singapore			
Pre-crisis	31.15	58.95	41.05
Post-crisis	29.84	57.88	42.12
Hong Kong			
Pre-crisis	33.37	65.95	34.05
Post-crisis	31.11	61.04	38.96
Taiwan			
Pre-crisis	27.48	79.83	20.17
Post-crisis	21.27	76.73	23.27

Table 3A: Selected Sample Characteristics

	Averages over the Period					
	DE Ratio	current liabilities/ total liabilities	tangible assets/ total assets	Cashflow/ current liabilities	Interest payments/EBIT [1]	(Interest +debt)/ EBIT
Korea						
1989-94	2.37	0.58	0.35	0.14	0.75	8.05
1995-97	2.73	0.62	0.36	0.12	0.91	10.79
1998-02	1.28	0.61	0.45	0.14	0.55	-8.02
Indonesia						
1989-94	0.70	0.77	0.38	0.55	0.26	1.76
1995-97	1.02	0.67	0.40	0.34	-0.09	-5.59
1998-02	0.32	0.68	0.43	0.22	0.05	-0.73
Malaysia						
1989-94	0.44	0.78	0.74	0.45	0.11	2.37
1995-97	0.80	0.75	0.70	0.40	0.22	4.00
1998-02	0.65	0.73	0.70	0.28	-0.43	-4.24
Singapore						
1989-94	0.39	0.78	0.34	0.38	0.23	4.35
1995-97	0.58	0.76	0.38	0.29	0.34	6.60
1998-02	0.61	0.78	0.40	0.27	0.10	3.04
Thailand						
1989-94	0.89	0.77	0.42	0.48	-0.19	-1.21
1995-97	1.06	0.70	0.45	0.27	0.53	3.35
1998-02	0.78	0.69	0.47	0.35	0.13	1.68
Taiwan						
1989-94	0.44	0.73	0.71	0.54	0.20	2.83
1995-97	0.49	0.70	0.58	0.50	1.96	31.03
1998-02	0.61	0.69	0.55	0.35	0.13	1.70
Hong Kong						
1989-94	0.47	0.75	0.66	0.52	0.630	7.07
1995-97	0.56	0.75	0.56	0.32	0.142	3.47
1998-02	0.38	0.80	0.58	0.14	0.105	2.29

Note: [1] Negative figures correspond to the cases where earnings before interest and taxes (EBIT) are negative.

Table 3B. Adjusted and Unadjusted Leverage

	Thailand		Indonesia		Malaysia		Korea		Taiwan		Singapore		Hong Kong	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B
1989	0.74	0.74	1.11	1.11	0.88	0.61	1.71	1.37	0.39	0.39	0.31	0.3	0.53	0.42
1990	0.87	0.87	0.77	0.67	0.50	0.41	2.22	1.78	0.34	0.34	0.38	0.37	0.49	0.43
1991	0.89	0.89	0.52	0.51	0.42	0.36	3.24	3.10	0.52	0.52	0.39	0.38	0.61	0.55
1992	0.96	0.93	0.63	0.6	0.41	0.36	3.02	2.70	0.51	0.51	0.44	0.41	0.55	0.49
1993	0.95	0.94	0.65	0.61	0.55	0.49	2.65	2.60	0.45	0.45	0.51	0.48	0.47	0.42
1994	0.99	0.99	0.72	0.68	0.52	0.43	2.68	2.65	0.44	0.44	0.45	0.42	0.50	0.48
1995	1.14	1.08	0.88	0.85	0.68	0.61	2.65	2.63	0.47	0.46	0.51	0.48	0.62	0.61
1996	1.29	1.2	0.99	0.96	0.87	0.8	2.89	2.85	0.51	0.49	0.62	0.6	0.61	0.58
1997	1.92	0.90	2.09	1.20	1.08	0.98	3.60	2.70	0.53	0.52	0.69	0.67	0.52	0.48
1998	1.73	1.10	3.98	1.55	1.19	0.9	2.65	2.07	0.65	0.63	0.84	0.82	0.54	0.45
1999	1.48	0.77	2.40	0.53	1.20	0.83	1.46	0.89	0.64	0.62	0.62	0.57	0.54	0.41
2000	1.43	0.76	2.87	-1.30	0.99	0.59	1.68	0.98	0.69	0.67	0.60	0.55	0.46	0.37
2001	1.24	0.72	2.34	0.79	0.88	0.45	1.48	1.11	0.69	0.65	0.63	0.57	0.46	0.35
2002	1.3	0.56	1.85	-0.81	0.97	0.50	1.66	1.35	0.67	0.64	0.63	0.56	0.47	0.33

Note: A - dropping 2% of outliers and leverage<=0
B - dropping 2% of outliers only

Table 4. Range of Observed Leverages, 1989-2002

	Mean	Max	Min	Range	Mean	Max	Min	Range
	Indonesia				**Hong Kong**			
1989	NA	NA	NA	NA	0.525	2.903	0.004	2.898
1990	0.773	2.174	0.001	2.173	0.489	2.826	0.000	2.825
1991	0.524	3.893	0.003	3.891	0.609	3.055	0.004	3.051
1992	0.629	1.823	0.004	1.818	0.551	3.062	0.001	3.061
1993	0.653	1.653	0.003	1.650	0.473	2.185	0.002	2.183
1994	0.715	2.293	0.001	2.292	0.502	2.402	0.001	2.401
1995	0.880	2.868	0.002	2.866	0.615	2.710	0.001	2.709
1996	0.989	3.086	0.000	3.086	0.593	3.062	-2.172	5.234
1997	1.224	11.936	-28.689	40.626	0.499	2.288	-2.926	5.214
1998	1.618	33.056	-24.994	58.050	0.467	2.807	-2.846	5.653
1999	0.572	28.056	-15.720	43.776	0.432	3.176	-2.942	6.118
2000	-1.414	18.468	-143.825	162.293	0.404	3.174	-1.705	4.880
2001	0.828	30.955	-14.562	45.516	0.394	3.129	-2.662	5.792
2002	-0.887	35.530	-149.002	184.532	0.393	3.200	-3.277	6.476
	Korea				**Singapore**			
1989	1.367	6.594	-7.307	13.900	0.306	1.0992	0.0000	1.0992
1990	1.777	12.149	-8.746	20.895	0.379	2.4455	0.0008	2.4447
1991	3.103	24.197	-2.166	26.363	0.394	2.4399	0.0002	2.4398
1992	2.736	20.473	-10.254	30.727	0.441	2.9355	0.0004	2.9351
1993	2.625	17.796	-0.602	18.398	0.507	2.9142	0.0037	2.9104
1994	2.653	23.322	-0.715	24.036	0.447	2.4102	0.0004	2.4098
1995	2.626	23.427	-0.715	24.142	0.512	2.7367	0.0016	2.7351
1996	2.867	26.100	-1.164	27.263	0.624	4.5465	0.0003	4.5462
1997	2.715	21.889	-14.925	36.814	0.686	5.1308	0.0001	5.1308
1998	2.127	21.967	-5.359	27.326	0.841	8.2175	0.0024	8.2151
1999	0.903	14.568	-7.503	22.070	0.620	4.1223	0.0007	4.1216
2000	1.000	26.526	-14.801	41.327	0.587	7.5160	-1.0812	8.5971
2001	1.134	10.098	-10.042	20.140	0.610	5.6898	-1.5013	7.1910
2002	1.377	30.181	-16.134	46.314	0.594	8.5256	-1.5703	10.0959
	Malaysia				**Taiwan**			
1989	0.793	12.279	-2.606	14.885	0.387	0.9829	0.1040	0.8788
1990	0.502	3.720	0.000	3.720	0.338	0.8871	0.0438	0.8433
1991	0.418	2.458	0.006	2.453	0.524	1.5066	0.0079	1.4988
1992	0.408	4.971	0.000	4.971	0.511	1.1422	0.0257	1.1166
1993	0.549	13.629	0.000	13.629	0.453	1.7182	0.0072	1.7109
1994	0.478	3.109	-2.571	5.680	0.435	1.4514	0.0006	1.4507
1995	0.670	5.107	-1.801	6.908	0.471	2.0575	0.0040	2.0535
1996	0.872	5.473	0.001	5.473	0.507	2.4194	0.0039	2.4154
1997	1.063	11.994	-1.245	13.239	0.532	2.6387	0.0001	2.6386
1998	0.966	9.112	-6.045	15.156	0.652	5.8630	0.0025	5.8606
1999	0.896	11.886	-6.226	18.112	0.638	5.0303	0.0003	5.0300
2000	0.638	13.033	-6.669	19.702	0.690	5.7555	0.0001	5.7554
2001	0.487	8.823	-5.169	13.992	0.688	5.2809	0.0001	5.2808
2002	0.548	14.931	-7.078	22.009	0.671	5.9339	0.0003	5.9337

	Thailand							
	Mean	**Max**	**Min**	**Range**				
1989	0.736	2.143	0.069	2.073				
1990	0.873	2.923	0.007	2.917				
1991	0.892	4.281	0.001	4.280				
1992	0.957	6.046	0.002	6.044				
1993	0.951	4.142	0.001	4.141				
1994	0.999	6.168	0.000	6.168				
1995	1.091	3.800	-7.159	10.959				
1996	1.204	6.079	-7.134	13.213				
1997	0.907	7.770	-14.511	22.281				
1998	1.104	9.166	-11.536	20.702				
1999	0.783	8.674	-12.849	21.523				
2000	0.803	7.680	-9.672	17.352				
2001	0.764	8.721	-12.740	21.461				
2002	0.600	9.205	-14.632	23.837				

Table 5A. Group means estimates of leverage

	Indonesia	Korea	Malaysia	Thailand	Hong Kong	Singapore	Taiwan
	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coeff (T-stat)
Market valuation	-2.39** (8.56)	-1.53** (11.33)	-2.5*8 (4.92)	-2.1** (2.59)	-2.04** (2.70)	-3.07** (7.57)	-3.31591 (11.48)
Size	0.09 (1.50)	-0.0867 (1.23)	-0.28 (2.16)	0.12* (1.77)	-0.09 (1.07)	-0.15 (1.59)	0.0014 (0.02)
Profit	0.04 (0.798)	0.19457 (1.5)	-0.15 (0.58)	0.17* (1.93)	-0.003 (0.02)	-0.11 (0.93)	0.0073 (0.08)
K-K*	-0.05 (0.22)	0.6549* (2.6)	-0.52 (1.60)	1.04** (5.04)	0.12 (0.30)	1.28** (2.71)	0.5381 (1.59)
Intercept	-2.7** (6.96)	-0.38** (0.89)	-2.76** (4.33)	-2.37** (7.83)	-2.1** (4.18)	-2.96** (5.37)	-2.99 (5.48)
F-stat	27.76**	42.00	7.53**	36.68**	10.61**	18.32**	41.35**
Normal period	1989-95	1989-92	1989-92	1989-93	1989-94	1989-96	1989-96

Note: * denotes significance at 10% or lower level and ‘**’ denotes the same at 1% or lower level.

Table 5B. Distribution of the deviation of actual leverage from the long-run optimum

	Excluding outliers				All Firms			
Thailand	Mean	Max.	Min.	Median	Mean	Max.	Min.	Median
1989-94	0.45	3.11	0.01	0.28	462.48	87254.88	0.01	0.28
1995-97	2.18	37.26	0.00	0.85	716.33	130941.49	0.00	0.88
1998-02	2.78	52.40	0.01	0.91	734.89	130940.46	0.01	0.96
Malaysia								
1989-94	0.29	6.08	0.00	0.09	0.29	6.08	0.00	0.09
1995-97	0.78	11.48	0.00	0.37	6.85	1635.25	0.00	0.37
1998-02	1.67	78.52	0.00	0.43	2.55	245.58	0.00	0.44
Korea								
1989-94	1.22	29.21	0.01	0.67	5.28	504.91	0.01	0.68
1995-97	3.20	66.41	0.01	1.17	13.67	1272.66	0.01	1.22
1998-02	2.88	111.67	0.01	0.78	7.40	583.56	0.01	0.78
Singapore								
1989-94	0.25	1.58	0.01	0.14	0.26	1.58	0.01	0.14
1995-97	0.40	3.08	0.00	0.23	0.40	3.08	0.00	0.24
1998-02	0.79	50.78	0.00	0.28	1.46	160.58	0.00	0.28
Hong Kong								
1989-94	0.50	5.22	0.01	0.20	0.50	5.22	0.01	0.20
1995-97	0.72	25.89	0.00	0.29	0.74	25.89	0.00	0.30
1998-02	0.73	26.69	0.00	0.22	6.75	1580.08	0.00	0.22
Indonesia								
1989-94	0.46	6.82	0.03	0.28	0.46	6.82	0.03	0.29
1995-97	1.24	21.76	0.01	0.52	1.23	21.76	0.01	0.51
1998-02	4.06	110.36	0.02	1.26	6.22	201.12	0.02	1.29
Taiwan								
1989-94					0.17	0.59	0.02	0.14
1995-97					0.22	1.43	0.00	0.16
1998-02					0.65	38.82	0.00	0.32

Table 6. Estimates of speed of adjustment towards the optimum leverage

	Indonesia	Korea	Malaysia	Thailand	Hong Kong	Singapore	Taiwan
Variables	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coef. (T-stat)	Coeff (T-stat)
α	0.327051* (1.89)	-0.0206 (0.54)	-0.02908 (0.45)	-0.16791 (.87)	-0.13942 (0.98)	-0.00653 (0.82)	0.060547 (0.07)
ΔD	0.243212 (1.42)	-0.16421** (3.58)	-0.73921 (1.11)	-0.1169** (2.08)	0.38059 1.12)	-1.23038 (1.028)	0.059317 (1.17)
(K-K*)*ΔD	-0.2955** (3.87)	-1.1842** (4.02)	0.009402 (1.45)	-0.43737** (2.58))	-0.99451** (3.08)	-0.86005** (4.69)	-0.9590** (5.09)
|K-K*|*ΔD	0.81971** (4.18)	-0.23107 (1.24)	0.358996** (5.25)	-0.52548** (2.41)	0.117681 (1.07)	0.748924 (1.57)	1.20219** (3.024)
Sales*ΔD	-0.0007** (2.13)	-2.4E-05* 1.81)	0.000176** 3.01)	-0.04884* (1.864)	-1.7E-05 (0.23)	0.000426 (0.95)	1.67E-05 (.88)
SR*ΔD	-0.51145 (0.98)	0.76991** (4.14)	0.002259** (3.04))	-0.00172** (2.68)	0.000224 (1.54)	-0.00108 (0.92)	0.00689 (1.37)
PROFIT*ΔD	.316692** (4.58)	0.83012** (3.68)	-0.33574** (2.04)	-0.10208 (1.09)	0.848255 (1.60)	-0.54174 (1.00)	-0.20017 (0.56)
(DE=0) *ΔD	0.226837 (1.24)	0.00732** (2.17)	0.019565** (2.357)	0.328061** (3.27)		0.013986* (1.73)	
(DE <0) *ΔD	-.548083* (1.92)	0.55204** (2.78)		-0.22566** (3.07)			
CRISIS*ΔD	0.23345** (3.21)	1.40641** (3.27)	0.621241** (3.68)	0.231988** (5.67)	0.523448** (5.51)	0.93751** (6.02)	0.233849 (1.24
Sargan's test	0.182122	0.282839	0.145139	0.346085	0.193728	0.452392	0.297495
GR^2	0.0410	0.22219	0.25675	0.51529	0.37587	0.2836	0.51529
Corr(y, $\hat{y}$)	0.0409	0.31414	0.23433	0.36118	0.32543	0.36659	0.36118
*AR1~ $\chi^2(1)$ (pvalue)	5.215 (0.22)	4.1578 (0.041)	3.2014 (0.074)	4.259 (0.039)	3.988 (0.045)	4.9845 (0.025)	4.259 (0.039)
AR2~ $\chi^2(1)$ (pvalue)	1.249 (0.317)	2.148 (0.142)	1.658 (0.198)	1.453 (0.229)	2.232 (0.135)	1.5436 (.214)	1.453(0.229)

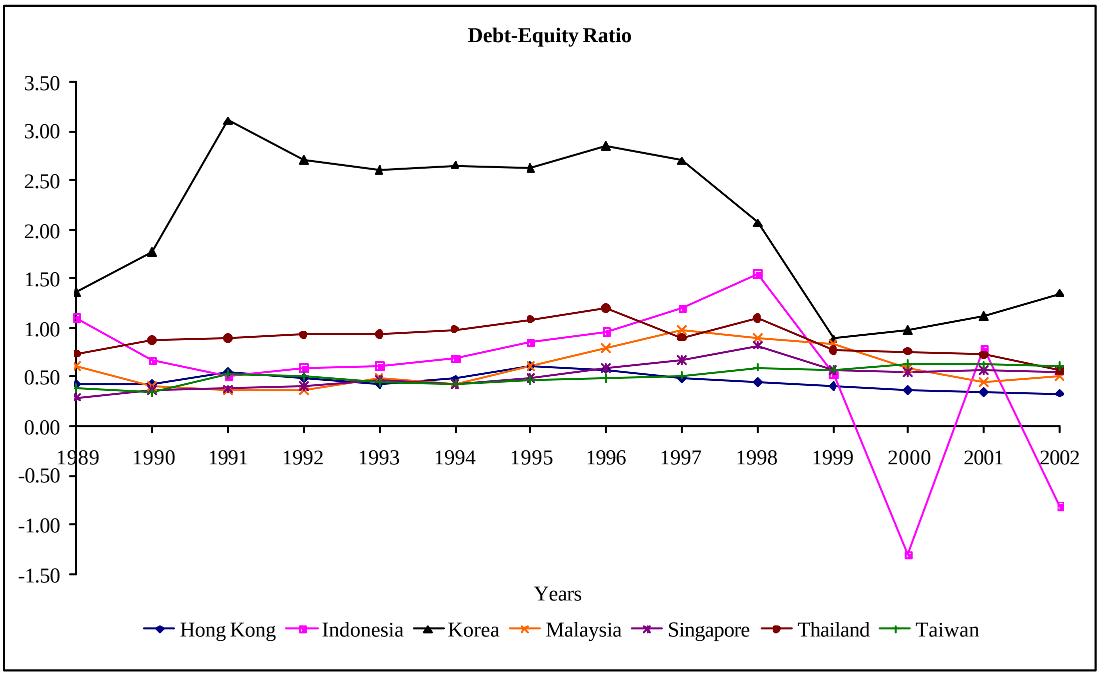
Note: [1] ΔD = (DE-DE*). * denotes significance at 10% or lower level and '**' denotes the same at 1% or lower level. All estimates use White's correction for heteroscedasticity.

* The AR1 tests presented here and in table A2 are for negative serial correlation, following Doornik *et al* (2002)

Table 7. Distribution of speeds of adjustment among all firms

	Worst affected countries	Comparator countries	Worst affected countries		Comparator countries	
	All firms	**All firms**	**DE >0**	**DE <0**	**DE >0**	**DE <0**
	Indonesia	**Hong Kong**	**Indonesia**		**Hong Kong**	
Mean	0.099832	0.980763	0.056679364	0.910544403	0.982248	0.821923
SD	2.382381	3.140999	2.399906583	2.069240085	3.186168	3.408418
MAX	20.55784	6.108971	20.16545426	0.986447268	6.169905	4.615028
MIN	7.87E-06	0.076985	7.96898E-06	5.11071E-05	0.075455	0.378969
SKEW	-0.32444	0.351798	-0.332067826	-0.18036737	0.363435	0.024536
Median	0.096761	1.013486	0.054918668	0.895180847	1.015643	0.82381
	Korea	**Singapore**	**Korea**		**Singapore**	
Mean	0.669293	0.277122	0.658799681	0.881164526	0.260929	0.647573
SD	10.10589	0.861272	10.42348082	6.215243608	0.875285	0.420917
MAX	2.652618	8.316869	2.201220747	2.636760331	8.335354	0.009458
MIN	7.77E-08	1.45E-08	0.030240538	7.93101E-08	1.45E-08	5.7E-05
SKEW	2.470208	1.303362	2.346731415	4.242598005	1.375201	-0.10833
Median	0.826095	0.311378	0.803426691	1.230885379	0.294497	0.641011
	Malaysia	**Taiwan**	**Malaysia**		**Taiwan**	
Mean	0.486046	0.261653	0.422084353	1.81287123	0.208732	1.322471
SD	4.328506	0.782967	4.38265348	4.505682405	0.68741	2.315163
MAX	16.49108	7.12772	3.6078812	16.245047	7.07018	6.132073
MIN	3.27E-08	5.13E-08	3.26181E-08	0.820172831	5.08E-08	0.050327
SKEW	-1.57884	1.878981	-1.803252695	2.620893192	1.885533	2.394355
Median	0.413265	0.308281	0.350882961	2.257347848	0.24555	
	Thailand		**Thailand**			
Mean	0.547292		0.520780383	0.820702712		
SD	0.671246		0.666878863	0.641582137		
MAX	2.443896		2.502566643	1.656763951		
MIN	1.45E-05		1.42864E-05	0.446126151		
SKEW	-1.1424		-1.208470029	-0.316982346		
Median	0.487994		0.461906437	0.796366466		

Figure 1. Trend in debt-equity ratio, 1989-2002



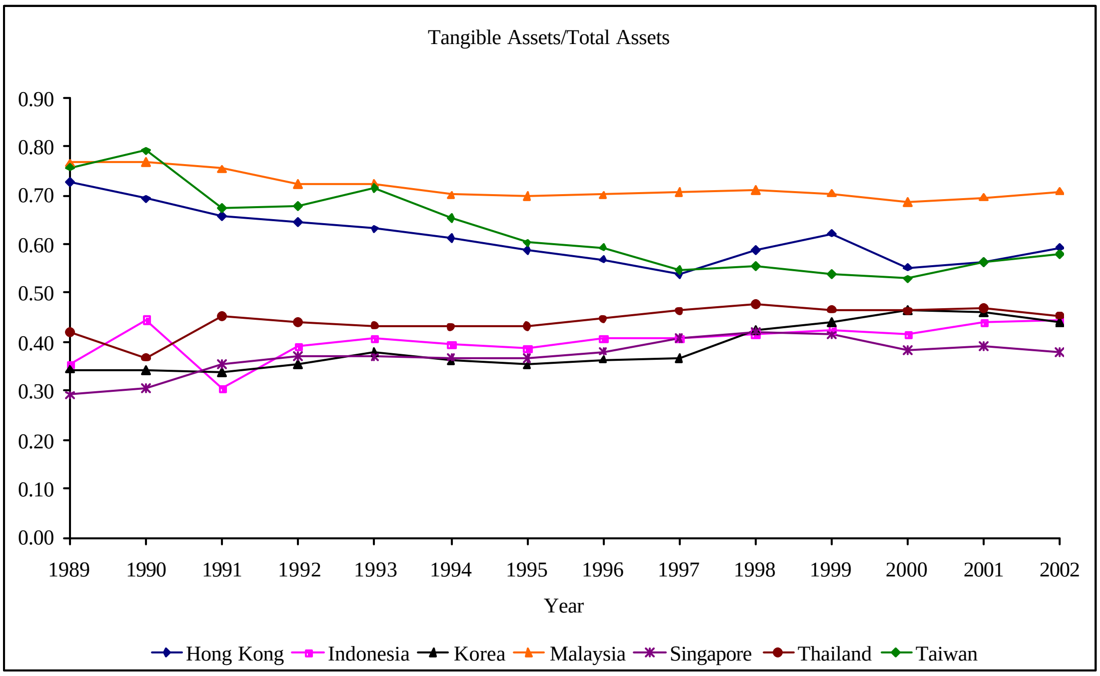


Figure 2. Trend in tangible assets, 1989-2002

APPENDIX

Determination of optimal capital stock

Before embarking on the determination of optimal leverage and the dynamic adjustment of actual leverage to the optimum, we first determine the optimal capital stock and its deviation from the actual since it plays an important role in our analysis.

We only observe actual capital stock K, but not the optimal capital stock K*. So as a first step, we need to determine K*. Standard models of the optimal level of capital services are based on the work of Nickell (1979), Pfann (1996), or Thomsen (2000) which makes use of a simple structural model of the capital market. Output (Q) allows for any exogenous change in local output, either due to change in demand in the product market, or the relocation decision of the firm for example. However, the development of a firm's capital stock is generally assumed to follow a partial adjustment process, as the firm moves to wards optimal capital levels. Partial adjustment arises because firms are presumed to operate in imperfect capital markets that prevents them from fully adjusting when financial structure deviates from its target and also prevent optimal funding of new investment spending. The primary hypothesis in this case is that the speed of adjustment coefficients is positive but less than unity, see for example Hall (1992), Nickell (1979ii). For empirical treatments of this type of model, see Barrell and Pain (1996) or Bajo-Rubio and Sosvilla-Rivero (1994) for example.

We estimate the optimal capital stock using a standard fixed effects estimator, though this was tested against group means estimator and the dynamic fixed effects model following Arrellano and Bond (1989). compared with the estimates from the various procedures were very similar, and the (within) fixed effects estimates were employed to generate the optimal capital stock K* in our sample. A further consideration here is the larger number of observations that it generates compared with the dynamic model, requiring lags and instruments.

Table A1. Number of firms, total observations in the dynamic estimates

	Total	Pre crisis	Crisis (97-99)	Post crisis	Period
Indonesia					
Firms	114	105	114	67	
No of obs	474	105	302	67	
Korea					1994-2001
Firms	40	40	38	35	
No of obs	298	115	113	78	
Malaysia					1996-2001
Firms	200	200	200	176	
No of obs	1067	200	532	335	
Thailand					1996-2001
Firms	147	147	128	102	
No of obs	602	147	353	102	
Hong Kong					1996-2001
Firms	186	165	186	175	
No of obs	1002	165	499	337	
Singapore					1996-2001
Firms	112	85	106	112	
No of obs	571	85	289	197	
Taiwan					1996-2002
Firms	277	80	165	277	
No of obs	1003	80	475	448	

Table A2: Estimation of equation (1), holding b_{it} constant across firms.

Singapore	Estimate	Standard error	T statistic	P-value
α	.0036946	.053441	.069135	[.945]
β_1	.285148	.042651	6.68557**	[.000]
AR1~ $\chi^2(1)$ (p-value)		5.623215 (.01772)		
AR2~ $\chi^2(1)$ (p-value)		2.398745 (.12143)		
Sargan		5.70988 [.335]		
GR^2		0.214		
Malaysia	Estimate	Standard error	T statistic	P-value
α	.013993	.221187	.063263	[.950]
β_1	.21000	.059903	3.50565**	[.000]
AR1~ $\chi^2(1)$ (p-value)		5.025841 (.02497)		
AR2~ $\chi^2(1)$ (p-value)		1.258741 (.26189)		
Sargan		2.74844 [.739]		
GR^2		0.275		
Korea	Estimate	Standard error	T statistic	P-value
α	.136301	.073413	1.85662*	[.063]
β_1	.419420	.058716	7.14320**	[.153]
AR1~ $\chi^2(1)$ (p-value)		2.658740 (.10298)		
AR2~ $\chi^2(1)$ (p-value)		1.897452 (.16836)		
Sargan		7.412740 [.192]		
GR^2		0.202		
Indonesia	Estimate	Standard error	T statistic	P-value
α	.175213	.457331	.383121	[.702]
β_1	.298406	.030999	9.62633**	[.000]
AR1~ $\chi^2(1)$ (p-value)		4.369874 (.03658)		
AR2~ $\chi^2(1)$ (p-value)		2.389565 (.12215)		
Sargan		6.139860 [.189]		
GR^2		0.269		
Hong Kong	Estimate	Standard error	T statistic	P-value
α	.048481	.117621	.412175	[.680]
β_1	.544955	.020625	26.4224**	[.000]
AR1~ $\chi^2(1)$ (p-value)		3.078456 (.07934)		
AR2~ $\chi^2(1)$ (p-value)		2.565874 (.10919)		
Sargan		6.20216 [.287]		
GR^2		0.382		
Taiwan	Estimate	Standard error	T statistic	P-value
α	.430163	.110785	3.88285**	[.000]
β_1	.392536	.072837	5.38922**	[.000]
AR1~ $\chi^2(1)$ (p-value)		3.178452 (.07462)		
AR2~ $\chi^2(1)$ (p-value)		1.369548 (.24189)		
Sargan		8.59995 [.126]		
GR^2		0.382		
Thailand	Estimate	Standard error	T statistic	P-value
α	.460896	.133168	3.46101**	[.001]
β_1	.219195	.085792	2.55497**	[.011]
AR1~ $\chi^2(1)$ (p-value)		3.257841 (.07108)		
AR2~ $\chi^2(1)$ (p-value)		1.658745 (.19777)		
Sargan		2.09816 [.552]		
GR^2		0.358		

Note: All estimates use White's correction for heteroscedasticity.

Table A3. Dynamic Estimates of Speed of Adjustment (excluding SR)

	Indonesia	Korea	Malaysia	Thailand	Hong kong	Singapore	Taiwan
Variables	Coef.	Coef.	Coef.	Coef.	Coef.	Coef.	Coeff
α	.288306	-.0502491	-.011119*	-.177882	-.081718	-.004979	.041675 *
ΔD	.211270	-.3912**	-.008127*	-.29567**	.400690	-1.02316*	.04006*
(K-K*)*ΔD	-.336854**	-.4259**	-.20637**	-.41272**	.87159**	-.64677**	-.0394**
|K-K*|*ΔD	.706438**	-0.253**	.13051**	-.52096**	.128772	.21101**	.6018**
Sales*ΔD	-.000519**	-.0323**	.00141**	-.02905**	-.00064**	.065241	.051257
PROFIT*ΔD	.392742**	-.8399**	-.29287**	-.0691037	.338611*	-.410033	-.094745
(DE=0) *ΔD	.2302744**	.01834**	0.028745	.54205**		0.024698	
(DE <0) *ΔD	-0.68527*	0.6841**		-.34975**		-.	
CRISIS*ΔD	0.25656**	1.5841**	0.543698	.28364**	.25372**	1.0247**	0.27895
Sargan's test	0.390	0.143	0.190	.490751	0.3681	Sargan test is missing	0.101
GR^2	0.387	0.2198.	0.25177	0.2406	.485	0.511	0.4995
Corr($y, \hat{y}$)	0.399	0.3087	0.3137	0.45874	0.3357	0.368	0.3568

Note: [1] ΔD = (DE-DE*). * denotes significance at 10% or lower level and '**' denotes the same at 1% or lower level. All estimates use White's correction for heteroscedasticity.