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DYNAMIC CAPITAL STRUCTURE: EVIDENCE FROM THE SMALL DEVELOPING COUNTRY OF JORDAN

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ABSTRACT

This paper examines the determinants of the target capital structure of Jordanian manufacturing firms and the adjustment process towards this target. The study extends the empirical work on capital structure in two ways. First, it uses a dynamic model which sheds light on the dynamic nature of the capital structure adjustment process by firms. Second, the study employs a panel data analysis and GMM estimation techniques that control for unobserved firm-specific effects and the endogeneity problem. The findings of the paper suggest that Jordanian firms have target leverage ratios and they adjust to them relatively fast. Consistent with the predictions of capital structure theories, and the findings of the empirical literature, the results of this paper suggest that size, tangibility, profitability, growth opportunity, and earnings volatility exert significant effects on the capital structure choice of Jordanian firms.

JEL classification: G3, G32, C33

Key words: Dynamic capital structure, Jordanian companies, Asset tangibility, GMM estimation

1. INTRODUCTION

Modigliani and Miller (1958) claim that in perfect financial market, the value of a company is independent of its financing choice. Following this seminal paper, firm financing patterns have attracted a large number of theoretical and empirical research papers. One strand of this literature examines the financial structure of companies across and within countries and looks for underlying explanatory factors. It is well-known that mix of funds affects the cost and availability of capital, and thus firms' real decisions on investment, production, and employment (Pagano, 1993; Zwiebel, 1996; Boyd and Smith, 1998; Biaes and Casamatta, 1999; Shin and Stulz, 2000; Yanagawa, 2000; Parrino, Poteshman and Weisbach, 2002; and Morellec and Smith, 2003).[1]

Modigliani and Miller (MM) state that under certain assumptions, capital structure is irrelevant. Obviously, this conclusion is at variance with what one observes in the real world. The capital structure of companies does, indeed, matter and banks are extremely reluctant to finance a company which has a high proportion of debt. The MM classical paper spurred financial economists to come up with conditions under which an optimal financial structure would matter, and this effort still continues today. Broadly speaking, four theoretical approaches can be distinguished, namely, models based on tax considerations, bankruptcy and financial distress costs, agency costs, and symmetric information issues.[2] These theories identify many firm-specific factors that may affect a firm's optimal capital structure.

While there have been many empirical studies devoted to testing the determinants of capital structure in developed countries (for example, Taub, 1975; Bradley, Jarrell and Kim, 1984; Titman and Wessels, 1988; Rajan and Zingales, 1995; Bevan and Danbolt 2000; Graham and Harvey, 2001; Titman and Tsyplacov, 2001; Nengjiu et al., 2003; Morellec, 2004; and others), there is a limited number of empirical studies which use data from developing countries (see for example, Samuel 1996; Colombo, 1999; and Gallego and Loayza, 2000). However, the common approach has been to study the determinants of optimal leverage by examining the relationship between the observed leverage ratio and a set of explanatory variables using non-dynamic models. This approach has two shortcomings. First, the observed leverage ratio may not necessarily be optimal. As Myers (1977) points out, changes in capital structure are costly to implement. Hence, the observed leverage ratio at any point in time may substantially differ from its optimal level. Furthermore, Myers and Majluf (1984) suggest that the observed leverage ratio may differ from the optimal level predicted by the trade-off between the costs and benefits of debt. Second, the empirical analysis, being non-dynamic, is unable to shed any light on the nature of the dynamic aspect of the capital structure of firms.

This paper attempts to add to this growing literature by analyzing the capital structure behavior of manufacturing companies which are listed on the Jordanian capital market (Amman Securities Market, ASM). In particular, this paper empirically examines the determinants of the target capital structure of Jordanian firms and the adjustment process towards this target. Thus, this study helps to determine whether the stylized facts we have learned from studies of developed countries apply to these markets, or whether they are not valid to developing countries which have different institutional structures from those in developed countries.

This study makes the following contributions to the capital structure literature. First, it represents one of the limited number of papers that examines empirically the capital structure choice using Jordanian firm-level data. The experience of an "emerging" market presents an excellent research opportunity to add to the capital structure literature. Secondly, this study employs a dynamic adjustment model. This model allows us to understand the nature of the capital structure dynamic adjustment process of firms, i.e., whether firms move towards target leverage ratios or away from them, and the speed with which they carry out their adjustment process.

Second, the empirical analysis is carried out using the Generalized Method of Moments (GMM) for panel data with instrumental variables. One advantage of this approach over conventional cross-sectional or time-series data sets lies in the fact that it usually gives a large number of observations, which increases the degrees of freedom and reduces the multicollinearity problem among the explanatory variables, hence improving the efficiency of the estimates. Furthermore, it is generally argued that the capital structure choice may actually differ across firms. It is empirically difficult for cross-sectional data to allow for such differences in the capital structure. Thus, the most important advantage in using the panel data approach is that it allows for the differences in the capital structure across firms in the form of unobserved firm-specific effects. Moreover, compared to cross-sectional data, the use of panel data allows more flexibility in the choice of variables used as instruments to control for endogeneity. The endogeneity problem arises because observable as well as unobservable shocks which affect corporate capital structure decisions are also likely to affect other firm-specific characteristics. It is also possible that any observed relationships between leverage and firm-specific characteristics reflect the effects of leverage on the latter rather than *vice versa*. The use of panel data mitigates this problem by allowing us to include firm-specific effects (which account for the cross-sectional components of these unobservable shocks) and time dummies (which control for macroeconomic shocks common to all firms).[3]

The rest of the paper is organized as follows. Section 2 provides some basic information about the financial sector in Jordan. Section 3 outlines the empirical model and the variables which are used in the paper. Section 4 provides a detailed description of the econometric methods which are used in the estimation of our model. Section 5 presents the empirical results, and Section 6 concludes the paper.

2. SOME GENERAL FEATURES OF THE FINANCIAL SECTOR IN JORDAN

Jordan is a small open economy with an over-representation of small-scale firms. The financial sector in Jordan is dominated by commercial banks of which the share of three main banks in total bank assets is almost 90 percent. This is much higher than in the developed countries. For example, in Germany, the top three banks' assets are less than 20 percent of the total. The Jordanian banking sector is relatively large where the ratio of their total assets to nominal GDP is equal to about 198 percent. This ratio is much higher than the 52 percent in the USA and the 157 percent in Japan (Genay, 1999). The average ratio of cash to total assets of 20 percent is much higher than that of Japan which is 1.57 percent and the USA of 6.6 percent. This reflects the conservative nature of managing Jordanian banks.

The bond market in Jordan is relatively small and in the early stages of development. It has always been weak and dependent mainly on government development bond issues. New issues of corporate bonds registered a small value, almost zero during most of the years in the period 1991-2002. There are several factors underlying the under development of corporate bonds in Jordan, among them the lack of an institutional and legal infrastructure.

Jordan established its equity market in 1978 upon realizing its importance. The market has a total of 99 listed companies. The increase in the ratio of market capitalization to GDP from 37 percent (1978) to about 79 percent (2002) indicates the growth and importance of the market in the national economy. However, trading activity on the secondary market leaves much to be desired. For example, the market experienced sharp fluctuations in its turnover ratio during the period 1978-2002. Moreover, for any year, only 10 companies account for a large proportion of the total trading volume. In other words, most listed shares are thinly traded on the secondary market. The fact that in 2002, ten companies accounted for about 61.3 percent of the total market trading volume and the market value of these companies' shares was approximately 70 percent of the capitalization of all listed companies. Thus, Jordanian stock exchange is a highly concentrated market in terms of both market value of companies as well as trading volume.

There are considerable financial reforms and progress made to improve the development of the equity market in Jordan. However, it is still suffering from several restrictions and imperfections which impede corporations from relying on this market to finance their investment activities. These imperfections include the absence of an accurate legal and regulatory framework that enables the governance of the market to protect the international investors, have higher standards of transparency, and internal control rules.

3. THE EMPIRICAL MODEL AND MEASUREMENT OF VARIABLES

The theory of capital structure postulates that in a world of imperfect and incomplete financial markets, firms could increase their value by changing their respective leverage ratios. However, the fact that there are costs and benefits (a trade-off) involved in changing leverage ratios implies the existence of an interior debt level for a firm (Zwiebel, 1996). The value corresponding to this optimal debt level is the maximum value of the firm given the level of its operating cash flow.

Based on the discussion above, we assume that the optimal debt-equity ratio, Y_{it}^{*}, is a function of firm specific characteristics. For the firm i^{th} at time t, we can formalize this by the following equation:

(1) $$Y_{it}^{*} = \phi_0 + \sum_k \beta_k X_{kit} + \alpha_i + \alpha_t + \varepsilon_{it}$$

such that $i = 1,...,N$, and X_{kit} captures firm-specific characteristics which varies with time and across firms. α_i is the unobserved firm-specific effect and represents time-specific effect (e.g., economic shock) which is common to all firms and can change through time. ε_{it} is the error term, which represents measurement errors in the independent variables, and any other explanatory variables that have been omitted. It is assumed to be independently and identical normally distributed with a zero mean and a constant variance, $\varepsilon_{it} \sim$ *i.i.d.* $N\left(0,\sigma_{\varepsilon}^{2}\right)$.

As can be seen from the above specification, the optimal leverage is allowed to vary across firms and over time. Since the factors that determine a firm's optimal leverage change over time, it is likely that the optimal capital structure moves over time even for the same firm. Consistent with this argument, Hopenhayn (1992) and Cooley and Quadrini (1999) provide general equilibrium models showing that the optimal capital structure of firms changes over time as a result of their financial decisions, technological changes and in response to idiosyncratic shocks. Thus, we capture the dynamic nature of the capital structure problem using a 'unique' set of data on an emerging market.[4]

In a perfectly frictionless world with no adjustment costs, the firm would immediately respond to variations in the independent variables by varying its existing leverage ratio to equal its optimal leverage (complete adjustment). Thus, at any point in time, the observed leverage ratio Y_{it} of firm i should not be different from its optimal one , *i.e.*, $Y_{it} = Y_{it}^{*}$. This implies that the change in leverage from the previous to the current period should be exactly equal to the change required for the firm to be at its optimal leverage at time *t*, i.e., $Y_{it} - Y_{it-1} = Y_{it}^{*} - Y_{it-1}$. In practice, however, the existence of significant adjustment costs means that the firm will not completely adjust its actual leverage to Y^{*}. Thus, with less than complete adjustment, the firm's observed leverage ratio at any point in time would not equal its optimal leverage ratio. We can represent this by a partial adjustment model as[5]

(2) $$Y_{it} - Y_{it-1} = \lambda_{it}\left(Y_{it}^{*} - Y_{it-1}\right)$$

where λ_{it} is known as the coefficient of adjustment or the speed of adjustment.

The above partial adjustment model can alternatively be written as

(3) $$Y_{it} = (1-\lambda_{it})\, Y_{it-1} + \lambda_{it} Y^*_{it}$$

If we substitute equation (1) into equation (3) to remove the unobservable optimal leverage, Y^*_{it}, we get the following empirical model:

(4) $$Y_{it} = (1-\lambda_{it})Y_{it-1} + \lambda_{it}\left(\phi + \sum_k \beta_k X_{kit} + \alpha_i + \alpha_t + \varepsilon_{it}\right)$$

which can be written as:

(5) $$Y_{it} = \varphi_0 + \gamma_0 Y_{it-1} + \sum_k \gamma_k X_{kit} + \eta_i + \eta_t + u_{it}$$

where $\varphi_0 = \lambda_{it}\phi_0$, $\gamma_0 = 1-\lambda_{it}$, $\eta_i = \lambda_{it}\alpha_i$, $\eta_t = \lambda_{it}\alpha_t$, and $u_{it} = \lambda_{it}\varepsilon_{it}$ (where u_{it} has the same properties as ε_{it}). Since equation (1) represents the optimal leverage ratio, equation (5) represents the short-run leverage ratio since the actual or existing leverage ratio may not be equal to its optimal one. When an equation in the form of (5) is estimated, the coefficient of the observed lagged leverage variable, Y_{it-1}, gives the estimate of one minus the partial adjustment. If the coefficient value of the lagged leverage ratio is greater than zero, we can conclude that the adjustment from period *t*-1 to *t* falls short of the adjustment required to attain the target. On the other hand, if the coefficient is less than zero, the firm over-adjusts in the sense that it makes more adjustment than is necessary and still does not reach the optimal level.

The related empirical literature suggests a number of factors that may influence the financial structure of companies. However, as argued by Titman and Wessels (1988) and Harris and Raviv (1991), the choice of underlying explanatory variables is fraught with difficulty. First, there may be some attributes which cannot be well represented by the available proxies, or there may be several proxies that can be used for certain attributes. Second, the attributes themselves can be related, so the chosen proxies may actually measure the effects of several different attributes. Third, measurement errors in the proxy variables may be correlated with measurement errors in the dependent variables thus creating spurious correlations.[6]

In this study, we focus on the following five variables that are most commonly used in the empirical studies: asset tangibility, growth, size, profitability and volatility.

i. Asset Tangibility

In an uncertain world, with asymmetric information, the asset structure of a firm has a direct impact on its capital structure since tangible assets are the most widely accepted source for bank borrowing and raising secured debt. Since a bank has imperfect information regarding the behavior of firms, those with little tangible assets find it difficult to raise funds via debt financing. In addition, it is posited by some researchers that firms with higher bankruptcy risk or higher liquidation costs will issue less debt. Firms with more intangible assets will have higher liquidation costs (Johnson, 1997). Therefore, firms with higher tangible assets will have lower liquidation costs and will issue more debt (Scott, 1976; Myers, 1977; and Choate, 1997). Finally, higher liquidation values reduce the expected losses accruing to debt holders in the event of financial distress, thus making debt less expensive (Williamson, 1988).[7] Consequently, most existing studies suggest that collateral value is the major determinant of the level of debt finance (see for example, Bradley, Jarrell and Kim, 1984; and Rajan and Zingales, 1995). Since collateral is more relevant in traditional bank lending than in borrowing from capital markets, we expect this variable to be important in determining the leverage ratio in Jordan. We use the ratio of fixed assets to total assets as a measure of tangibility.

ii. Firm Size

Many researchers found that firm size is positively related to leverage ratio. Firm size is an important factor in the ability of firms to raise capital. Large firms, which are more diverse, have more stable cash flows and better established operating and credit histories to sustain more debt compared to small firms (Titman and Wessels, 1988). These factors provide large firms with greater access to alternative sources of finance in times of financial distress. Furthermore, it is argued that larger firms may have lower agency costs associated with asset substitutions and under-investment problems, which may encourage them to take on relatively high debt burdens. Another possible reason for larger firms to have higher leverage ratios is that they are more likely to have better access to capital markets and be able to borrow at lower cost due to lower information asymmetry (Rajan and Zingales, 1995; Pagano, Panetta and Zingales, 1998; Paranque, 2000; and Shin and Stulz, 2000), and can borrow at more favorable interest rates. Based on these arguments, a positive relationship between firm size and leverage ratio is expected. In agreement with other studies in this field (e.g., Titman and Wessels, 1988; Rajan and Zingales, 1995; and Bevan and Danbolt, 2000), we use the natural logarithm of total sales as a proxy for the size of firms.

iii. Firm Growth

The agency theory predicts a negative relationship between growth and leverage. Myers' (1997) under-investment problem suggests a negative relationship between profitable investment opportunities and debt. The argument is that a firm's growth opportunities lie in its intangible assets instead of tangible assets; the cost of financial distress which is associated with high leverage may affect a firm's ability to finance its future growth. So managers of firms with valuable growth opportunities would choose low leverage (Lang, Ofek and Stulz, 1996). Zweibel (1996) points out that, "The better a manager's investment opportunities, the less debt a firm will have . . . Firms in new rapidly expanding industries, for which many good new investments are likely to be available, should have less debt than other firms" (p. 1210).

On the other hand, faster growing firms are likely to be in need of external funds to finance their positive investment opportunities. As suggested by the pecking order theory (Myers and Majluf, 1984), if firms require external finance they prefer debt relative to external equity. This causes the debt to go up and thereby the leverage ratio. Furthermore, Ross (1977) signaling theory assumes that managers know the true distribution of a firm's returns, but investors do not. It argues that investors interpret larger levels of leverage as a signal of higher quality. The intuition behind this argument is that debt and equity differ in an important way that is crucial for signaling insider information. Debt is a contractual obligation to repay the principal plus interest. Failure to make these payments can lead to bankruptcy and managers may lose their jobs. In contrast, equity is more forgiving. Although shareholders expect dividends to be maintained, at least, managers have more discretion and can cut them in times of financial distress. Therefore, adding debt to the capital structure can be interpreted as a credible signal of high future investment opportunities and managers' confidence about their own firm. Lower quality firms will not imitate higher quality firms by issuing more debt because they have higher bankruptcy costs at any level of debt. Accordingly, Ross (1977) concludes that investors take larger levels of debt as a signal of higher quality and that growth opportunities and leverage are thus positively related.

Due to the high degree of information asymmetry in Jordan and hence banks demand higher risk premiums (higher rates of interest) on their investment (loans), we expect a strong negative relationship between growth opportunities and leverage. A higher rate is likely to deter firms from borrowing. Consistent with empirical studies (e.g., Titman and Wessels, 1988; Chung, 1993; and Barclay, Smith and Watts, 1995), we use the percentage change of total assets as an indicator of growth opportunities.

iv. Profitability

Capital structure theories have different views on the relationship between leverage and profitability. The pecking order theory suggests that more profitable firms have less leverage, and thus rely more on internal finance. It is suggested that the observed capital structure of firms reflects the cumulative requirement for external financing. A profitable and slow-growing firm should generate the most cash, and a less profitable fast-growing firm will need significant external financing. Based on this argument, one can expect an inverse relation between leverage and profitability.

Rajan and Zingales (1995), among others, provide empirical evidence for an inverse relation between the leverage ratio and profitability.

On other hand, asymmetric information theories argue that the choice of a firm's capital structure signals to outside investors the information of insiders, in which case investors take a larger debt level as a signal of good performance by the firm and of the management's confidence. According to this argument, a firm's value (or profitability) and leverage must be positively related. However, the findings of Titman and Wessels (1988) contradict this suggestion. Following Titman and Wessels (1988), Rajan and Zingales (1995), and Bevan and Danbolt (2000), we use the ratio of operating income before taxes to total assets as our indicator of profitability. Since Jordanian firms retain about 74 percent of earnings on average, we expect a negative relationship between leverage ratio and profitability. Thus, we expect that more profitable firms have less leverage, and an alternative rely more on internal finance (return earnings) whihc support the prediction of the pecking order theory.

v. Earning Volatility

In general, firms with high earnings volatility have a greater chance of being unable to meet their debt commitments, thereby incurring a higher cost of financial distress. Accordingly, earnings volatility should be negatively related to leverage. However, the agency theory suggests otherwise. A positive relationship between earnings volatility and leverage is because higher earnings encourage greater reliance on debt since large gains accrue primarily to stockholders while large losses are shared by both stockholders and debt holders. In the case of Jordan, firms have an arms-length relationship with banks. Therefore, the cost of failing to service debt is high. For this reason, Jordanian firms are expected to be highly concerned with earning volatility. In this paper, we measure earnings volatility by the standard deviation of earnings before taxes and interest for the 5-year period centered on the year of observation scaled by the mean of earnings before taxes and interest for the same 5-year period.

This study measures financial leverage as total debt divided by total assets. There are two reasons for the choice of this measure.

First, various capital structure theories have not specified which leverage measurement should be used. Second, for the purpose of being consistent, since the measure for leverage is used by most of the previous studies.

4. THE ESTIMATION METHODS

This section describes the econometric techniques that we use to estimate our dynamic panel data regressions. It is well-known in dynamic panel regressions which consist of many firms and a limited number of time periods, using the OLS technique will not provide consistent estimates. There are many reasons for this which include the possible correlation between unobserved firm-specific effects and other explanatory variables, the potential correlation between the lagged endogenous variable and residuals, and the possibility that the explanatory variables are not exogenous. In panel data estimation, consistent estimates of the coefficients depend on the stochastic properties of the model. If the error term is orthogonal to the right-hand side variables, an OLS estimator will be consistent. On the other hand, if all explanatory variables are strictly exogenous, then a fixed effect estimator will be consistent. The equation model we estimate here contains unobservable firm-specific effects, which are correlated with the explanatory variables as well as the endogenous variables. Hence, the orthogonality conditions between the error terms and the variables are not likely to be met in the OLS or within-group estimation to produce consistent estimators (Blundell and Bond, 1998a, b; and Nerlove, 2000).

One can have the orthogonality conditions satisfied through appropriate differencing of the equation. However, in our model we have a lagged dependent variable as well as possible endogenous variables as regressors. Therefore, the error terms in the differenced equation are correlated with the lagged dependent variable through contemporaneous terms in period $t + j$ even if there is no unobserved firm- or time-effects that correlate with the regressors. Neither the within-group estimation nor the OLS will produce consistent estimates. An instrumental variable estimator that can account for corrected fixed-effects as well as for the possibility of endogeneity of the regressors is, therefore, needed. Chamberlain (1984) has proposed a generalised method of moment's (GMM) estimation that allows the regressors to be transformed to achieve orthogonality between them and the error terms.[8]

While the GMM estimation can account for firm heterogeneity, it does not resolve the problem of endogeneity of regressors. The dynamic growth effects may introduce autoregression in the error structure. Arellano and Bond (1991) have proposed a dynamic panel estimation that optimally exploits the linear moment restrictions implied by the dynamic panel model we use here. This method uses all past values of the endogenous regressors as well as the lagged values of all strictly exogenous regressors as instruments.[9] We use this method to estimate equation (5).

Notice that the error term in equation (5) has three components: unobserved firm-specific effects α_i, time-specific effects α_t, and the standard innovation error term ε_{it}. In order to get consistent estimators, Arellano and Bond (1991) propose to first-difference the regression equation to eliminate the unobserved firm fixed-effects. Thus, the regression equation (5) after taking the first difference can be written as:

$$\Delta Y_{it} = \varphi_0 + \gamma_0 \Delta Y_{it-1} + \sum_k \gamma_k \Delta X_{kit} + \eta_i + \eta_t + u_{it} \tag{6}$$

The GMM methods are used to estimate the parameters in equation (5). Given that the u_{it}'s are serially uncorrelated, the GMM is the most efficient one within the class of instrumental variable estimators (Honore and Hu, 2003). Assuming that the disturbances are not correlated, it is expected that u_{it} is orthogonal to the past history of the variables Y and X so that $(X_{it-2}, X_{it-3}, ..., Y_{it-2}, Y_{it-3}, ...)$ can be used as valid instruments for u_{it}. If the disturbances follow a MA(1) process, the first valid instruments start from the third lag and not from the second since the differenced disturbances follow a MA(2) process. As a result, it is essential to ensure that there is no higher-order serial correlation in order to have a valid set of instruments independent from the residuals. This can be investigated by the Sargan (1958) test of over-identifying restrictions. This two-step GMM methodology can control for the correlation of errors over time, heteroscedasticity across firms, simultaneity, and measurement errors due to the utilization of orthogonality conditions on the variance-covariance matrix.[10]

Blundell and Bond (1998b), however, show that when the lagged dependent and the explanatory variables are persistent over time, the lagged levels of these variables are weak instruments for the regression equation in differences. The instruments' weaknesses have repercussions on both the asymptotic variance and the small-sample performance of the difference estimator. As the variables' persistence increases, the asymptotic variance of the coefficients obtained with the difference estimator rises. Furthermore, according to Blundell, Bond and Windmeijer's (2000) simulation study, the difference estimator has a large finite-sample bias and poor precision, especially with samples which have a small time series dimension.

To confront these econometric problems, we use the GMM system estimator developed by Arellano and Bover (1995) and Blundell and Bond (1998b). This estimation combines the regression in differences with the regression in levels. The instruments for the regression in differences are the same as above i.e., the lagged levels of the corresponding variables. The instruments for the regression in levels are the lagged differences of the corresponding variables.

We use the GMM system estimation to generate consistent and efficient estimators of the parameters of interest. However, the consistency of the GMM estimator depends on the assumption that the lagged values of the dependent variable and the other explanatory variables are valid instruments and that the error terms do not exhibit serial correlation. To address these issues, Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998b) propose three tests. The first is to test the hypothesis that the error term is not serially correlated. Under the null hypothesis of no serial correlation, the test statistic is distributed as a standard normal. The second is the Sargan test of over-identifying restrictions.[11] This tests the overall validity of the instruments. Under the null-hypothesis, the test statistic is χ^2 distributed with the degrees of freedom calculated as the difference between the number of instruments and the number of regressors. Finally, the difference Sargan test which tests the additional set of restrictions of the system estimator. This test is the difference between the first-difference and the system Sargan test. The test statistic is

TABLE 1
Summary Statistics

	LEVERAGE	*SIZE*	*TANG*	*GROWTH*	*PROF*	*VOL*
Mean	0.408243	15.35246	0.438069	0.138105	0.078343	10.23227
Median	0.390457	15.33239	0.385603	0.056100	0.071019	7.613603
Maximum	0.913048	20.07210	0.970205	16.03833	1.979475	116.3426
Minimum	0.013872	10.57781	0.021226	0.901574	-0.339421	0.240964
Std. Dev.	0.204891	1.738351	0.269036	0.857426	0.131539	10.63656
Skewness	2.186929	0.213571	5.093594	15.61227	6.063463	5.163124
Kurtosis	18.89089	3.659536	67.00407	268.8358	89.52281	44.49409
Jarque-Bera	4729.3892	12.81185	87156.23	1486606	158390.1	37939.12
Probability	(0.000000)	(0.001652)	(0.000000)	(0.000000)	(0.000000)	(0.000000)

Notes: *LEVERAGE* is defined as the ratio of total debt to total assets. *SIZE* is the natural logarithm of total sales. *TANG* is the ratio of fixed assets to total assets. *GROWTH* is the percentage change in total assets. *PROF* is the ratio of total profits before taxes and interest to total assets, and *VOL* is the standard deviation of earnings before taxes and interest for the 5-year period centered on the year of observation scaled by the mean of earnings before taxes and interest for the same 5-year period.

asymptotically distributed as a χ^2 under the null hypothesis of validity of the additional instruments. The degrees of freedom of the difference Sargan statistic is equal to the number of additional restrictions in the system estimator, which is given by the difference between the number of degrees of freedom of the system estimator and that of the difference estimator. Failure to reject the null hypothesis of both tests gives support to model non-misspecification.

In the next section, we present the results under the OLS, within-group, GMM-level, GMM-difference, and GMM-system estimations, respectively. We also show that the GMM-difference is more appropriate to estimate our dynamic capital structure model.

5. THE EMPIRICAL RESULTS

The annual data for our company sample which consists of 36 manufacturing companies for the period 1984-2002 are obtained from *Guide of Publicly Held Corporations* published annually by the Amman Stock Exchange (ASE). This guide contains of summarized annual financial statements for all Jordanian firms listed on the ASE. Although the number of companies is not large, our sample accounts for more than 65 percent of the total number of listed manufacturing companies. Moreover, our sample includes the largest companies in the market and the only ones which have all the needed data. Therefore, the number of the chosen companies should not be considered as a shortcoming of this study since the analysis will be based on the most representative sample possible of the Jordanian capital market. Table 1 reports the summary statistics for all the variables used in this study for the period 1984-2002. As can be seen, for all the firm-level variables, the mean is higher than the median. Hence, the data are characterized by positive skewness. This is a normal phenomenon in panel data firm studies. The correlation matrix is reported in Table 2.

We estimate several specifications of the dynamic structure model. Columns (1), (2) and (3) of Table 3 give the OLS, within-group and GMM type (level) estimates of equation (5), while columns (4) and (5) present difference- and system-GMM estimates, respectively. In the difference- and system-GMM estimates, first differencing eliminates the fixed-effects and all the variables, except the lagged dependent

TABLE 2
Correlation Coefficients

	LEVERAGE	*SIZE*	*TANG*	*GROWTH*	*PROF*	*VOL*
LEVERAGE	1.000					
SIZE	0.370**	1.000				
TANG	0.406**	-0.157**	1.000			
GROWTH	-0.091	-0.013	-0.046	1.000		
PROF	0.036	0.107*	0.166**	0.041	1.000	
VOL	0.080	-0.183**	0.125**	-0.039	-0.246**	1000

Notes: 1. See notes of Table 1 for definitions of variables.
2. ** and * indicate significance at the 1% and 5% levels, respectively.

variable, are treated as exogenous. However, in columns (1) and (3) which give the OLS and GMM level estimates respectively, the lagged dependent variable is also treated as exogenous and the unobservable firm-specific fixed-effects remain. For all GMM type estimates (in level, difference and system) we present only two-step GMM estimates, since they are more efficient than one-step estimates, and since the Sargan test of overidentifying restrictions is heteroscedasticity-consistent only if based on the two-step estimates. In all estimation, the sample contains 36 firms and 864 observations although usable observations vary according to the estimation method. In order to evaluate which technique is more appropriate to estimate our dynamic model, we report six test statistics:[12] (i) first-order autocorrelation of residuals which is *i.i.d.* $N\left(0,\sigma_{\varepsilon}^{2}\right)$ under the null hypothesis of no serial correlation; (ii) second-order autocorrelation of residuals which is *i.i.d.* $N\left(0,\sigma_{\varepsilon}^{2}\right)$ under the null hypothesis of no serial correlation; (iii) Wald test 1 which is a test of joint significance of the estimated coefficients. It is asymptotically distributed as a χ^2 under the null hypothesis of no relationship; (iv) Wald test 2 which is a test of joint significance of the time dummies; (v) Sargan test of overidentifying restrictions which is asymptotically distributed as a χ^2 under the null hypothesis of instrument validity; and (vi) the difference Sargan test on the additional set of restrictions of the system estimator which is asymptotically distributed as a χ^2 under the null-hypothesis of validity of the additional instruments.

As can be seen from columns (1) and (2), there is strong evidence

TABLE 3
Dynamic Capital Structure Estimates

Dependent Variable: Y_{it}					
Independent Variables	(1) OLS-Level	(2) Within-Groups	(3) GMM-Level	(4) GMM-Difference	(5) GMM-System
Constant	-0.342***	-	-0.514***	0.0035	-0.425***
	(-3.87)		(-3.17)	(1.32)	(-6.77)
	[0.000]		[0.002]	[0.189]	[0.000]
LEVERAGE (-1)	0.702***	0.152**	0.475***	0.2852***	0.600***
	(14.00)	(2.12)	(2.99)	(6.48)	(12.9)
	[0.000]	[0.036]	[0.003]	[0.000]	[0.000]
SIZE	0.0282***	0.0324	0.0450***	0.0409***	0.0365***
	(4.84)	(0.904)	(3.56)	(3.58)	(8.39)
	[0.000]	[0.368]	[0.001]	[0.001]	[0.000]
TANG	0.0397	0.577***	0.0245	0.8200***	0.0447**
	(1.05)	(5.30)	(0.565)	(20.5)	(2.35)
	[0.296]	[0.000]	[0.573]	[0.000]	[0.020]
GROWTH	-0.0283	-0.105***	-0.0515	-0.2390***	-0.094***
	(-0.916)	(-3.04)	(-1.06)	(21.0)	(-3.94)
	[0.361]	[0.003]	[0.001]	[0.000]	[0.000]
PROF	-0.329***	-0.0221	-0.444***	-0.1357**	-0.494***
	(-3.338)	(-1.139)	(-3.40)	(-2.15)	(-9.62)
	[0.001]	[0.890]	[0.001]	[0.024]	[0.000]
VOL	-0.0003	-0.00087	-0.0010*	-0.0004**	-0.0001
	(-0.342)	(-0.969)	(-1.70)	(-2.43)	(-0.665)
	[0.733]	[0.334]	[0.092]	[0.017]	[0.507]

TABLE 3 (continued)

Dependent Variable: Y_{it}	(1) OLS-Level	(2) Within-Groups	(3) GMM-Level	(4) GMM-Difference	(5) GMM-System
1st Order Serial Correlation LM (1)	0.042**	0.000***	0.018**	0.195	0.013**
2nd Order Serial Correlation LM (1)	0.018**	0.049**	0.005***	0.263	0.190
Wald Test 1	0.000***	0.000***	0.000***	0.000***	0.000***
Wald Test 2	0.000***	-	0.002***	0.003***	0.000***
Sargan Test	-	-	0.006***	0.996	0.1390
Difference-Sargan Test	-	-	-	-	0.000***
Adjusted R^2	0.780	0.2529	-	-	-

Notes: $LEVERAGE = \varphi_0 + \gamma_0 LEVERAGE_{it-1} + \gamma_1 SIZE_{it} + \gamma_1 TANG + \gamma_3 GROWTH_{it} + \gamma_4 PROF_{it} + \gamma_5 VOL_{it} + \eta_i + \eta_t + u_{it}$ where η_i is an unobserved firm-specific effect and η_t captures any common period-specific effects. u_{it} is the error term, which represents measurement errors in the independent variable, and other explanatory variables that have been omitted. It is assumed to be independently identical normally distributed with zero mean and constant variance, $u_{it} \approx i.i.d.\ N(0,\sigma_\varepsilon^2)$. *LEVERAGE, SIZE, TANG, GROWTH, PROF,* and *VOL* are as defined in Table 1. Numbers in parentheses are White's (1980) heteroskedasticity-constant *t*-statistics. The numbers in brackets are *p*-values. All models are estimated using the *DPD* program written in *OX*. ***, ** and * indicate the coefficient is significance at the 1%, 5% and 10% levels, respectively.

that the OLS level and within-group specifications are inappropriate to estimate our model. First, the evidence shows that there is a significant unobserved firm-specific effect in these regressions, since the serial correlation tests reveal that the assumption of serially uncorrelated errors is violated (see Arellano and Bond, 1991). Second, there is strong evidence of an upward bias in the coefficient of the lagged dependent variable in the OLS level specification and a downward bias in the within-group specification. The estimated coefficient of the lagged dependent variable under the OLS is 0.70 compared to 0.15 under the within-group specification. This is not surprising since the lagged dependent variable is expected to be biased due to the correlation with the unobservable fixed effects. Indeed, when firm-specific effects exist and are unobservable, the OLS estimation in levels leads to an upward-biased estimate of the coefficient on the lagged dependent variable, whilst the within-group estimate leads to a downward-biased estimate of this coefficient (Blundell and Bond, 1999). Third, the OLS and within-group results may also suffer from the endogeneity problem.

Therefore, we estimate our model in levels using the GMM techniques (see column 3). Again, the GMM-level estimation is not the preferred one, since the test statistics show evidence of misspecification. More specifically, we find significant unobserved firm-specific effects, as indicated by the tests of the first- and second-serial correlations in the residuals. Furthermore, the Sargan test reveals that the instruments used in this estimation may not be valid. The null hypothesis of instruments validity is rejected at the 1 percent level of significance which indicates that there is a strong endogeneity problem. Therefore, we conclude that it is inappropriate to treat firm-specific characteristics as exogenous.

Since the GMM-level estimation gives persistent strong serial correlation in the residuals, it is necessary to control for potential unobserved firm-specific effects as well as the endogeneity problem by employing an instrumental variable estimation technique, more specifically, GMM in first differences. Column (4) reports the first-difference GMM estimates, where all variables are treated as endogenous. As can be seen, this estimation is better as shown by the tests of the first- and second-order serial correlations, the Wald test and the Sargan test for over-identifying instruments. More specifically, the tests for the serial correlations in residuals indicate the absence of first- and second-order serial correlations. The Sargan test indicates that the instruments used in this estimation are valid and this implies that the instruments are not correlated with the error term (e.g., absence of strong unobserved firm-specific effects). Furthermore, the Wald test for the joint significance of the regressors is satisfied. Time dummies are also jointly significant, suggesting that the aggregate factors (e.g., economic shock) exert a significant influence on the financing decisions of Jordanian firms. For example, economic shock and the associated uncertainty may create a scarcity of long-term debt, forcing reliance on equity. Studies by Jovanovic (1982) and Hopenhayn (1992) provide models showing that shocks affect the dynamics of firms' financial decisions.

To overcome the statistical problems of the difference-GMM estimation, we have also used the GMM-system estimator. The use of this technique results in an improvement only if the instruments used are uncorrelated with unobserved firm-specific effects. As can be seen from column (5), the results of the GMM-system estimates are similar to those generated by the model specified in levels (column 3). The first serial correlation test and the difference Sargan test for the validity of use of the additional instruments do not support the use of the GMM-system estimator. These results imply that differences in the right-hand side variables are correlated with the unobserved firm-specific effects, so we cannot assume that the additional moment restrictions used in the system estimation hold. The system estimates thus support the argument that the GMM-difference estimates do not suffer from endogeniety problems or strong unobserved firm-specific effects. Thereby, we can conclude that the GMM-difference specification is the more appropriate one to estimate our dynamic model. Therefore, we rely on the results of this estimate in the analysis of the coefficients for our dynamic model.

Turning to the GMM-difference estimates of the coefficients, the estimated coefficients are significant and have the expected signs and they are remarkably consistent with those reported by empirical studies in this field. The coefficient of lagged leverage is significant and is greater than zero. This result clearly indicates that Jordanian firms always under-adjust in the sense that they fall short of the adjustment required to attain the target leverage levels. The magnitude of the adjustment coefficient λ, which is equal to $1-\gamma_0$, is relatively large (greater than 0.70)[13] possibly providing evidence that Jordanian firms adjust relatively quickly towards the target by altering their dividend policy. This is consistent with the fact that time dimension contracts are very important in explaining the evolution of firms' debt ratios in Jordan. Another possible explanation for this adjustment speed could be that in Jordan, the cost of being off target is relatively high compared to the cost of adjusting the debt ratio.

The size of the firm (as proxied by the logarithm of total sales) is positively correlated to the leverage ratio.[14] This result implies that the borrowing capacity of Jordanian firms is significantly limited by their bankruptcy risk and that the optimal leverage ratio of the firms with lower bankruptcy risk is high. This result is consistent with the evidence reported by Rajan and Zingales (1995)[15] and other empirical studies.

Larger firms might be more diversified and fail less often, so the reciprocal of the firm size may serve as an indicator for the probability of bankruptcy. This is because larger firms can diversify their investment projects on a broader basis and limit their risk to cyclical fluctuations in any one particular line of production. To the extent that this is the case, this positive relation implies that the cost of financial distress is one of the main determinants of the leverage ratio. This argument seems highly relevant in Jordan where the bankruptcy code is not conducive to reorganization of firms, i.e., firms entering bankruptcy are usually liquidated and the liquidation process is costly and lengthy.

The results support the hypothesis of the role of the tangibility of assets in relations to lending decisions. The coefficient estimate of tangibility, measured by the ratio of fixed assets to total assets, is significant and relatively large in magnitude. This result is consistent with the view that there are various costs (agency costs and expected bankruptcy or financial distress costs) associated with the use of debt funds and these costs may be moderated by collateral. Firms with high quality collateral can obtain debt at a lower premium because of the greater security for creditors. This result is also consistent with the evidence reported by Titman and Wessels (1988), Rajan and Zingales (1995), and Bevan and Danbolt (2000) but the relationship is much stronger. The importance of collateral for loans in Jordan is partly due to institutional factors. For example, savings banks are generally subject to limits on the amounts of uncollateralized loans they may make. Furthermore, the nonexistence of a corporate bond market in Jordan combined with the conservative approach of a highly concentrated commercial banking system strongly support this result. An alternative explanation for this result is that the Jordanian bankruptcy laws do not favor the rehabilitation of firms and hence increase the need to recover loan by selling tangible assets.

The growth opportunity (provided by the percentage change in total assets) is significantly and negatively related to the leverage ratio.[16] The inverse relationship between these two variables is consistent with our expectations and the findings reported by Titman and Wessels (1988) and Rajan and Zingales (1995). The inverse relationship supports the view that the cost of financial distress of high growth firms is relatively high and the agency cost of debt is considerable. Because of the high cost of debt (lenders' demand for higher rate of interest when the information asymmetry is higher) managers would be reluctant to raise debt capital causing the lower leverage ratio. Baker and Wurgler (2002) argue that firms are low- (high-) levered because they raise funds when their growth opportunities are high (low). In this case, high growth opportunities may reduce managers' motivation to issue debt and internal equity remains preferable to both managers and shareholders. The relatively large magnitude of the growth coefficient in Jordan is mainly due to the opportunity for managers to pursue their own objectives at the expense of shareholders, since most Jordanian firms have small number of shareholders with weak incentives to monitor the managers. This, in turn, suggests the importance of the agency cost of debt financing for the Jordanian firms. The relatively large magnitude of the growth coefficient may also suggest the higher degree of information asymmetry in Jordan which restricts the corporate managers in raising external debt capital as it would be expensive.

The variable profits over total assets which is used as a proxy for a firm's profitability is negatively and significantly related to leverage. A relatively large negative coefficient of profitability in Jordan may suggest that Jordanian firms, whose managers are said to have a strategic advantage over the information by creditors, use a possessed hierarchy of alternative financial strategies, due to the information asymmetry in line with the pecking order theory. These firms retain a relatively larger proportion of earnings and hence the need for external finance is reduced. Alternatively, this could be due to the relatively weaker protection of investors and creditors in Jordan, implying difficulty in raising external capital and forcing firms to rely on internal equity.

Finally, inconsistent with Titman and Wessels (1988) findings, the results show that the earnings volatility of firms exerts a negative influence on firms' ability to obtain debt. The estimated coefficient is significant at the 1 percent level. The negative sign of volatility is consistent with the financial distress theory that firms with high earnings volatility have a greater chance of being unable to meet their debt commitments, thereby incurring costs of financial distress (Bradley, Jarrell and Kim, 1984).

6. A SUMMARY AND CONCLUSIONS

In this paper, we have examined the determinants of the target capital structure of Jordanian firms and the adjustment process toward this target. The study extends the empirical work on capital structure in three ways. First, this study represents one of the limited number of studies that attempts to examine empirically the capital structure choice using data from an emerging market. Second, the study uses a dynamic model which allows us to shed light on the nature of the dynamic capital structure adjustment process of firms. Finally, the study employs a panel data analysis and GMM estimation techniques which allow us to control for unobserved firm-specific effects and the endogeneity problem.

The findings of this paper suggest that Jordanian firms have target leverage ratios and they adjust to these ratios relatively fast. This indicates that the cost of being away from their optimal leverage ratios and the costs of adjustments are both important for Jordanian firms. Consistent with the predictions of the capital structure theories and the empirical studies, the results of this paper show that firms with high levels of tangibility have relatively high debt ratios. This suggests that the tangibility of assets is important in bank borrowing. The results also suggest that larger firms tend to use significantly more debt than smaller firms. This is consistent with the view that firm size is an inverse proxy for bankruptcy. Furthermore, the results of this paper support the view that debt ratios are affected by profitability, growth opportunity, and earnings volatility. More specifically, firms with high profits, high earnings volatility and more growth opportunities tend to have relatively less debt in their capital structures.

In summary, this paper finds that the variables that are relevant for explaining capital structure in the U.S. and other developed countries are also relevant in the case of Jordan, despite the profound differences in institutional factors.

ENDNOTES

1. Masulis (1983) estimates the impact of a change in a firm's capital structure on its value and finds that both stock prices and value of a firm are positively related to changes in debt level and leverage. Opler and Titman (1994) find that sales growth is lower for firms in the three highest deciles of leverage, but especially so within distressed industries. Lang, Ofek and Stulz (1996) examine the relationship between leverage and real capital expenditure, employment, and net investment growth and find strong negative association. Bernstein and Nadiri (1993) have provided evidence to suggest that financial decisions greatly affect the profit and productivity growth of U.S firms. In addition, Fazzari, Hubbard and Petersen (1988), Peyer and Shivdasani (2001), Hayash and Inoue (1991), Blundell et al., (1992), Cho (1995), and Lensink and Sterken (2000) find evidence from the US, Japan, UK, Korea and the Czech Republic, indicating that investment spending is greatly affected by financial policies. Hanka (1998) finds that firms with higher debt reduce their workforce more often, employ more part-time and seasonal employees, and pay lower wages. Finally, Sharpe (1994) finds that there is a strong relationship between a firm's financial leverage and the cyclicality of its labour force. He points out that, "employment growth at more highly-leveraged firms is more sensitive to demand and financial-market conditions over the business cycle" (p.1060).

2. A complete survey of capital structure theories is contained in Harris and Raviv (1991).

3. For more detailed discussion on using panel data see, for example, Hsiao (1985, 1986), Appelbe et al. (1992), Ahn and Schmidt (1999), and Baltagi (2000).

4. Most empirical studies have employed a single set of firms' data by averaging the number of years of data into a single value.

5. Marc Nerlove provides this model in 1958 (Gujarati, 1995). Nowadays, this model is commonly used in empirical studies. For example, Sharpe (1994) uses this model to investigate the effect of firms' financial policy on the cyclicality of their labor force. Bhattacharya and Bloch (2000) use this model to test for industrial concentration in the Australian manufacturing sector.

6. However, we address this problem in our empirical analysis by using GMM dynamic panel estimators.

7. Without tangible assets, the cost of borrowing may be prohibitively high since creditors may demand very high discounts or high interest payments as a prerequisite to making the loan.

8. For a full theoretical and empirical explanation about the Generalised Method of Moments (GMM) estimation see Matyas (1999).

9. When the explanatory variables are predetermined but not strictly exogenous, only the lagged values of these variables are valid instruments. However, if these variables are strictly exogenous, the current and lagged values are valid instruments.

10. Two-step GMM estimation, which uses one-step residuals to construct an asymptotically optimal weighting matrix, are more efficient than one-step estimation if the disturbances are expected to show heteroscedasticity in large sample data with a relatively long time span. See Arellano and Bond (1991), and Blundell and Bond (1998a, b) for further discussion.

11. See Sargan (1958) and the development of the GMM in Hansen (1982).

12. All estimations are carried out using the *DPD* program written in *OX* (Doornik, Avellano and Bond, 1999).

13. We also carried out the GMM-difference estimation with alternative definitions of leverage (the ratio of total debt to sum of the book value of debt and equity, the ratio of long-term debt to total assets, and the ratio of long-term debt to sum of the book value of debt and equity). We find the results (not reported) are very similar to those reported above.

14. We also use the logarithm of total assets as an alternative proxy for size attribute. We find the results (not reported) very similar to those reported above.

15. Except for Germany where a negative and significant coefficient for size has been reported.

16. We also employ the ratio of firm market value to book market value as an alternative proxy for growth opportunities. We find the results (not reported) very similar to those reported above.

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