

Full Length Research Paper

Operating leverage and systematic risk

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Accepted 25 October, 2011

The aim of this paper is to study the effect of operating leverage in the systematic risk of listed companies in Tehran Stock Exchange. In this study, operating leverage (OL) as independent variable and systematic risk (β) as the dependent variable are considered. $SIG \leq 0.05$ means H_0 hypothesis is rejected; otherwise there is no adequate reason for rejecting H_0 . For testing the hypothesis of this study, linear regression technique has been used. According to the results obtained, H_0 is confirmed because $SIG = 0.20 > 0.05$. Thus, operating leverage has no effect on the systematic risk of listed companies in Tehran Stock Exchange.

Key words: Operating leverage, capital structure, systematic risk, financial leverage, earnings before interest and taxes (EBIT).

INTRODUCTION

Risk is the potential that a chosen action or activity (including the choice of inaction) will lead to a loss (an undesirable outcome). The notion implies that a choice has an influence on the existing outcome (or existed). Potential losses themselves may also be called "risks". Almost any human endeavour carries some risk, but some are much more risky than others. Return on equity, free cash flow (FCF) and price-to-earnings ratios are a few of the common methods used for gauging a company's well-being and risk level. One measure that does not get enough attention is operating leverage, which captures the relationship between a company's fixed and variable costs. In good times, operating leverage can supercharge profit growth; in bad times, it can crush profits. Even a rough idea of a firm's operating leverage can tell you a lot about a company's prospects. In this article, we will give you a detailed guide to understanding operating leverage (Aquino, 2003).

Essentially, operating leverage boils down to an analysis of fixed costs and variable costs. Operating leverage is highest in companies that have a high proportion of fixed operating costs in relation to variable operating costs. This kind of company uses more fixed assets in the operation of the company. Conversely, operating leverage is lowest in companies that have a low proportion of fixed operating costs in relation to variable operating costs.

Total risk can be divided into two parts: business risk,

and financial risk. Operating leverage is an index of business risk. Business risk refers to the stability of a company's assets if it uses no debt or preferred stock financing. Business risk stems from the unpredictable nature of doing business, that is, the unpredictability of consumers' demand for products and services. Works that relate accounting numbers to market measures of systematic equity risk was largely undertaken (Ryan, 1997). A major contribution of the Mandelker and Rhee (1984) model over Hamada and Rubinstein type models, is that it utilizes leverage values based on accounting flow numbers (degree of operating and financial leverage) rather than market stock numbers (level of operating and financial leverage). More recent proposals on changes in accounting disclosure of risk mean that a theoretically sound model of the relationship between accounting measures and market measures of risk is timely (Scholes, 1996). Identification of this relationship is helpful on a number of fronts. Firstly, the instability of market betas over time means that ex-post measures of market risk are not good predictors of future risk. Identification of an appropriate relationship between accounting variables and market risk could lead to improved predictive models of future market risk. Secondly, financial models of risk (for example, CAPM) do not identify the operational factors and environmental contingencies which influence risk. An accounting model gets closer to the identification of economic fundamentals

which drive such relationships. Finally, interest in this relationship is further fuelled by being of practical use in situations where market estimates of risk are unavailable. Theoretical models that generate a value premium generally rely on the "operating leverage hypothesis," introduced to the real options literature by Carlson et al. (2004). This hypothesis states that variable (for example, flow) production costs play much the same role as debt servicing in levering the exposure of a firm's assets to underlying economic risks. Models that generate a value premium are because absent of operating leverage growth options are riskier than deployed capital. While operating leverage plays a critical role in these theories, there exists little supporting empirical evidence (Sagi et al., 2005).

Operational risk is emerging as the third leg of an enterprise-wide risk strategy for financial institutions. All firms are susceptible to the risk of a loss in value from events such as competitive actions, economic changes and management decisions. However, financial institutions belong to a category of firms that are particularly susceptible to risks from events that occur in the normal business operations. Since financial institutions deal in a valuable commodity (money), there is a significant risk of loss in their day-to-day transaction processing activities. Industries such as nuclear processing and gold mining also have significant operational risk.

Economic risks can be manifested in lower incomes or higher expenditures than expected. The causes are many; for instance, the hike in the price for raw materials, the lapsing of deadlines for construction of a new operating facility, disruptions in a production process, emergence of a serious competitor on the market, the loss of key personnel, the change of a political regime, or natural disasters. Reference class forecasting was developed to eliminate or reduce economic risk. In business, means of assessing risk vary widely between professions. Indeed, they may define these professions; for example, a doctor manages medical risk, while a civil engineer manages risk of structural failure. A professional code of ethics is usually focused on risk assessment and mitigation (by the professional on behalf of client, public, society or life in general).

In the workplace, incidental and inherent risks exist. Incidental risks are those that occur naturally in the business but are not part of the core of the business. Inherent risks have a negative effect on the operating profit of the business.

The aim of this study is the effect of operating leverage in the systematic risk of listed companies in Tehran Stock Exchange.

MATERIALS AND METHODS

Systematic risk per share, by establishing linear relationship between the market portfolio returns as independent variables and share returns as the dependent variable, is derived. Systematic risk and operating leverage of 58 companies (2006 to 2009) from

Tehran Stock Exchange is calculated within a 12-month financial period by using the statistic software programs of SPSS and Excel. In this study, operating leverage (OL) is considered as an independent variable, and systematic risk (β) is considered as a dependent variable.

Research hypotheses are as follows:

H₀: Operating leverage has no effect on the systematic risk of listed companies in Tehran Stock Exchange.

H₁: Operating leverage has effect on the systematic risk of listed companies in Tehran Stock Exchange.

SIG \leq 0.05 means H₀ hypothesis is rejected. Otherwise, there is no adequate reason for rejecting H₀ hypothesis.

RESULTS, DISCUSSION AND CONCLUSION

A number of papers have demonstrated capital structure relevance, thus refuting the Modigliani-Miller capital structure irrelevance theorem. Harris and Raviv (1991), on summarizing theories of capital structure put forth until then, point to several articles associating leverage with different endogenous factors, such as: firm value, default probability, extent of managerial equity ownership, target premium, probability of successful takeover, and interest coverage ratio and the probability of reorganization following default. They likewise reviewed other empirical evidences not directly related to any theoretical result, such as the result that leverage decreases with return volatility. Concretely, Bradley et al. (1984) found that firm leverage ratios are negatively related to the volatility of firm earnings (³/₄) measured by the standard deviation of the first difference in annual earnings, scaled by the average value of total assets (³/₄) if the costs of financial distress are non-trivial. They do this via both simulations and cross-sectional studies.

Heinkel (1982) developed a separating equilibrium in an asymmetrically informed capital market where investor expectations about individual firms are shown to depend on the capital structures of the firms. His model assumes that all debts are risky and shows that the present value of a given debt repayment promise does depend on the characteristics of the issuing firm.

Several previous studies have analyzed the association between a firm's operating and financial leverages and its beta. Recently, Mandelker and Rhee (1984) examined, using a correlation-based analysis, the effect of a firm's degree of operating leverage (DOL) and degree of financial leverage (DFL) on its beta and concluded that the impacts of DOL and DFL on beta are positive and statistically significant. Their theoretical model and its empirical testing implicitly assume that DOL and DFL are independent of each other, and strictly multiplicative. Such traditional assumption of independence, however, has been questioned by Huffman (1983) and others who argues that a firm's capacity decision may lead to important interactions between its DOL and DFL.

Operating leverage occurs when a company has fixed costs that must be met regardless of sales volume. When

the firm has fixed costs, the percentage change in profits due to changes in sales volume is greater than the percentage change in sales. With positive (that is, greater than zero) fixed operating costs, a change of 1% in sales produces a change of greater than 1% in operating profit. A measure of this leverage effect is referred to as the degree of operating leverage (DOL), which shows the extent to which operating profits change as sales volume changes. This indicates the expected response in profits if sales volumes change. Specifically, DOL is the percentage change in income (usually taken as earnings before interest and tax, or EBIT) divided by the percentage change in the level of sales output.

$$DOL = \frac{Q(P - V)}{Q(P - V) - FC}, \quad EBIT = Q(P - V) - FC$$

Q = Quantity produced or sold

V = Variable cost per unit

P = Sales price

FC = Fixed operating costs

Investors can come up with a rough estimate of DOL by dividing the change in a company's operating profit by the change in its sales revenue.

$$DOL = \frac{\Delta EBIT}{\Delta SR}$$

SR = sales revenue

Studies by Hamada (1972); Rubenstein (1973); and Mandelker and Rhee (1984) test the impact of operating and/or financial leverages on beta based on some theoretical priors. After decomposing the systematic risk into the firm's operating and financing risk, Hamada (1972) and Rubenstein (1973) compare the betas between levered and unlevered firms and report that financial leverage explains approximately 20% of the systematic risk. Lev first develops a theoretical model that establishes a positive association between a firm's operating leverage and its systematic risk (and total risk). Barth et al. (2007) show that firms with higher financial statement transparency, as measured by the covariance between earnings and returns, have lower expected returns and systematic risk Barth et al. (2007).

In finance, the term leverage arises often. Both investors and companies employ leverage to generate greater returns on their assets. However, using leverage does not guarantee success, and the possibility of excessive losses is greatly enhanced in highly leveraged positions. For companies, there are two types of leverage that can be used: operating leverage and financial leverage. Operating leverage relates to the result of different combinations of fixed costs and variable costs.

Specifically, the ratio of fixed and variable costs that a company uses determines the amount of operating

leverage employed. A company with a greater ratio of fixed to variable costs is said to be using more operating leverage. If a company's variable costs are higher than its fixed costs, the company is said to be using less operating leverage. The way that a business makes sales is also a factor in how much leverage it employs. A firm with few sales and high margins is said to be highly leveraged. On the other hand, a firm with a high volume of sales and lower margins is said to be less leveraged (Kaplan and Peterson, 1998).

Financial leverage arises when a firm decides to finance a majority of its assets by taking on debt. Firms do this when they are unable to raise enough capital by issuing shares in the market to meet their business needs. When a firm takes on debt, it becomes a liability on which it must pay interest. A company will only take on significant amounts of debt when it believes that return on assets (ROA) will be higher than the interest on the loan. A firm that operates with both high operating and financial leverage makes for a risky investment. A high operating leverage means that a firm is making few sales but with high margins. This can pose significant risks if a firm incorrectly forecasts future sales. If a future sales forecast is slightly higher than what actually occurs, this could lead to a huge difference between actual and budgeted cash flow, which will greatly affect a firm's future operating ability. The biggest risk that arises from high financial leverage occurs when a company's ROA does not exceed the interest on the loan, which greatly diminishes a company's return on equity and profitability (Lev, 1974).

The benefits of high operating leverage can be immense. Companies with high operating leverage can make more money from each additional sale if they do not have to increase costs to produce more sales. The minute business picks up, fixed assets such as property, plant and equipment (PP&E), as well as existing workers, can do a whole lot more without adding additional costs. Profit margins expand and earnings soar faster than revenues (Mandelker and Rhee, 1984).

The best way to explain operating leverage is by way of examples. Take, for example, a software maker such as Microsoft. The bulk of this company's cost structure is fixed and limited to upfront development and marketing costs. Whether it sells one copy or 10 million copies of its latest Windows software, Microsoft's costs remain basically unchanged. So, once the company has sold enough copies to cover its fixed costs, every additional dollar of sales revenue drops into the bottom line. In other words, Microsoft possesses remarkably high operating leverage (Reilly and Brown, 2003). By contrast, a retailer, such as Wal-Mart demonstrates relatively low operating leverage. The company has fairly low levels of fixed costs, while its variable costs are large. Merchandise inventory represents Wal-Mart's biggest cost. For each product sale that Wal-Mart rings in, the company has to pay for the supply of that product. As a result, Wal-Mart's cost of goods sold

Table 1. Regression results

Variable	Coefficient	Std. error	T-stat	Sig.
C	1.014	0.475	2.146	0.036
OL	-0.361	0.280	-1.291	0.201

(COGS) continues to rise as sales revenues rise.

Operating leverage can tell investors a lot about a company's risk profile and although high operating leverage can often benefit companies, companies with high operating leverage are also vulnerable to sharp economic and business cycle swings (Rubinstein, 1973). As stated earlier, in good times, high operating leverage can supercharge profit. But companies with a lot of costs tied up in machinery, plants, real estate and distribution networks cannot easily cut expenses to adjust to a change in demand. So, if there is a downturn in the economy, earnings do not just fall, they can plummet. In other words, the company has close to zero cost of goods sold. After its fixed development costs were recovered, each additional sale was almost pure profit (Ryan, 1997).

Accounting measures of firm-level risk have predictive power for firm's betas with market-wide cash flows, and this predictive power arises from the behavior of firm's cash flows. The systematic risks of stocks with similar accounting characteristics are primarily driven by the systematic risks of their fundamentals Campbell et al. (2007).

Asset pricing theory suggests that the former should have a higher price of risk; thus beta, like cholesterol, comes in 'bad and good' varieties. Empirically, we find that value stocks and small stocks have considerably higher cash-flow betas than growth stocks and large stocks, and this can explain their higher average returns. The poor performance of the CAPM since 1963 is explained by the fact that growth stocks and high-past-beta stocks have predominantly good betas with low risk prices Campbell et al. (2004).

The formula for the beta of an asset within a portfolio is

$$\beta_a = \frac{Cov(r_a, r_p)}{Var(r_p)}$$

where r_a measures the rate of return of the asset, r_p measures the rate of return of the portfolio, and $Cov(r_a, r_p)$ is the covariance between the rates of return. The portfolio of interest in the CAPM formulation is the market portfolio that contains all risky assets, and so the r_p terms in the formula are replaced by r_m , the rate of return of the market.

Few investors really know whether a company can expand sales volume past a certain level without, say, sub-contracting to third-parties or further capital investment, which would increase fixed costs and alter

operational leverage. At the same time, a company's prices, product mix and cost of inventory and raw materials are all subject to change. Without a good understanding of the company's inner workings, it is difficult to get a truly accurate measure of the DOL.

Nevertheless, it worth getting even a rough idea of a company's operating leverage. Even if it is not 100% accurate, knowledge of a company's DOL can help us assess the level of risk it offers to investors.

Be very careful using either of these approaches. They can be misleading if applied indiscriminately. They do not consider a company's capacity for growing sales. Few investors really know whether a company can expand sales volume past a certain level without, say, sub-contracting to third-parties or further capital investment, which would increase fixed costs and alter operational leverage. At the same time, a company's prices, product mix and cost of inventory and raw materials are all subject to change. Without a good understanding of the company's inner workings, it is difficult to get a truly accurate measure of the DOL. Nevertheless, it worth getting even a rough idea of a company's operating leverage. Even if it is not 100% accurate, knowledge of a company's DOL can help us assess the level of risk it offers to investors. Although you need to be careful when looking at operating leverage, it can tell you a lot about a company and its future profitability. Investors can get a rough sense of the company's outlook and risk in the face of changing market conditions. While operating leverage does not tell the whole story, it certainly can help.

Although, you need to be careful when looking at operating leverage, it can tell you a lot about a company and its future profitability. Investors can get a rough sense of the company's outlook and risk in the face of changing market conditions. While operating leverage does not tell the whole story, it certainly can help. For testing the hypothesis of this study from linear regression technique has been used and the results of regression are shown in Table 1.

$$\beta = 1.01 - 0.36 OL$$

LS // dependent variable is beta, SMPL range: 1 to 58; number of observations: 58.

According to the results in Table 1, H_0 is confirmed because $SIG = 0.20 > 0.05$. Thus, operating leverage has no effect on the systematic risk of listed companies in Tehran Stock Exchange.

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