

# A Theoretical And Empirical Investigation Of The Impact Of Labor Flexibility On Risk And The Cost Of Equity Capital

Carolyn M. Callahan, University of Memphis, USA  
Martin Stuebs, Baylor University, USA

## ABSTRACT

*This paper analytically and empirically investigates the linkage between labor costs and a firm's income volatility, equity risk, and cost of capital. While the relationship between labor costs and the firm's cost of capital under uncertainty conditions is important, there has been little research examining this issue. While we control for fixed labor costs, we focus on labor flexibility effects as the U.S. temporary staffing sales for 2005 totaled \$69.5 billion, 8.5% more than in the previous year (American Staffing Association, 2007). Within the Capital Asset Pricing Model (CAPM) framework, we demonstrate analytically and empirically that labor flexibility reduces income volatility, equity risk and cost of capital in the service industry. However, we find that labor leverage has no impact on income volatility, and increases equity risk and cost of equity capital. These results suggest that managers can structure labor costs to minimize the firm's risk and maximize shareholder value.*

**Keywords:** labor, labor leverage, labor flexibility, volatility, risk, cost of capital

## 1. INTRODUCTION

Within the context of the standard capital asset pricing model (CAPM), the primary purpose of this paper is to demonstrate the theoretical linkage between labor costs and a firm's income volatility, equity risk, and cost of equity capital. The relationship between equity risk and factors in a firm's uncertain economic environment is a subject of contemporary concern especially in these current turbulent economic times. How can firms better cope with economic uncertainty? Many articles have appeared in the literature that attempt to link equity risk to elements of the product and factor markets faced by the firm, in the framework of the Sharpe (1964), Lintner (1965) and Mossin (1966) CAPM. The most relevant to the analytical analyses of the present study are Conine (1982), Subrahmanyam and Thomadakis (1980), Callahan and Mohr (1989), Lord and Beranek (1999), Rosett (2001; 2003), and more recently Hong and Sarkar (2007). While little academic research has been conducted on the relation between labor costs and equity risk, Rosett (2001; 2003) are notable exceptions. In contrast to Rosett's work, which focuses on fixed labor stock, in this study we analytically and empirically investigate the linkage between labor costs and a firm's income volatility, equity risk, and cost of equity capital. Our analytical and empirical results demonstrate that labor flexibility reduces income volatility, equity risk and cost of capital in the service industry noted for the high propensity of labor costs. However, we find that labor leverage has no impact on income volatility, and increases equity risk and cost of equity capital in the service industry.

Labor costs are a significant fundamental production input cost (Freeland et al., 1979).<sup>1</sup> Understanding the effects of this primary production cost, labor, on a firm's risk structure and cost of equity capital is important. We focus our work on the concept of labor flexibility. Labor economists generally define labor flexibility as the ease or difficulty with which firms can modify the size and composition of their workforce in response to the changing economic environment. The practice of labor flexibility includes all aspects of contingent labor, such as temporary layoffs, greater reliance on casual, contractual, temporary or part-time workers, and contracting out employment.

The popular press reports many examples of firms using flexible labor to manage risk and uncertainty. For example, currently, 15 to 20 percent of the workforce in most large companies—including Sun Microsystems, Hewlett Packard, Cisco Systems, and other technology firms—comes from contingent labor sources (Sims, 2000). U.S. contractors in the construction industry use contingent labor to respond to changes in demand (Phillips, 2003). AT&T uses Resource Link, an internal labor pool that supplies AT&T's business units with labor on an as-needed basis, to meet uncertainty and reduce risk (Meadows, 1994).

On the academic side, there have been few studies investigating the linkage between labor costs and the cost of capital. Studies in the management science literature show that utilizing one concept of labor flexibility, specifically, the degree of variable compensation, reduces demand uncertainty, labor supply uncertainty, and equity risk (Bloom and Milkovich, 1998; Clinton, 1997; Milner and Pinker, 2001; Pinker and Larson, 2003; Stroh et al., 1996). More specifically, Milner and Pinker (2001) and Pinker and Larson (2003) develop mathematical optimization models of the interaction between firms and labor supply agencies when demand and supply are uncertain and study how each affects the contingent labor supply or the nature of the contracts formed. In departure from these studies, and more closely related to the current research, Rosett (2001; 2003) empirically demonstrates that labor leverage, a proxy for the present value of obligated future labor costs, is positively associated with a firm's equity risk.

We extend Rosett (2001; 2003) by incorporating labor flexibility, an additional labor cost variable that measures the degree of variable labor costs. While Rosett focuses on the linkage between labor leverage and equity risk, we build a more complete model of the effects of labor costs on the firm's cost of equity capital by linking our labor flexibility analysis to income volatility and the firm's cost of equity capital. In our analytical analyses, we use an income statement decomposition approach to link labor flexibility and labor leverage to the operating and financing risk of the firm. That is, within the context of the standard CAPM of Sharpe (1964), Lintner (1965) and Mossin (1966) and following the seminal analytical efforts of Hamada (1972), Rubinstein (1973), Lev (1974) and Conine (1982), we directly link labor costs to equity risk.

To test the validity of our analytical models, we use the service industry for our empirical analysis. In the present study, the selection of service industries was motivated by a desire to obtain high variance in labor cost conditions. This variation is germane to understanding fully the impact of labor costs on our measures of equity risk. Services lie at the hub of economic activity in the United States. Service jobs account for almost 80 percent of total U.S. employment. As such, we say that the U.S. has a service economy. We suggest that the service industry represents a unique setting for our tests as service is the result of applying human labor or mechanical efforts to people or objects. Services are intangible products involving a performance, or an effort that cannot be physically possessed. Schmenner (1986; 1995) provides a framework for understanding services and utilizing them strategically, by specifically considering labor intensity and labor costs. Throughout the economy, especially in services, firms rely more and more upon external contract workers to fill key positions that were once considered the exclusive purview of full-time permanent workers (Milner and Pinker 2001).

Hence, labor costs and labor flexibility in the service industry are economically important in the firm's cost structure.

In the service industry, our empirical analyses are consistent with our analytical results. That is, our study finds a differential analytical financial market effect for labor flexibility and labor leverage. Although not previously examined in the literature, we find that labor flexibility reduces income volatility, equity risk and cost of equity capital, while labor leverage increases equity risk and cost of capital. These results have useful implications for managers who wish to use labor flexibility to manage the firm's risk and maximize shareholder value. For investors, knowledge of these labor effects will improve the prediction of ex ante risk and investment decisions.

The paper is organized as follows. Section II presents the analytical models and theoretical observations. Section III presents the empirical analysis and results. The conclusions are discussed in Section IV.

## 2. THEORETICAL MODEL

Studying the linkage between labor markets and financial markets can enhance our understanding (Lindenberg and Ross, 1981). In studying the underlying causes of systematic risk in the financial markets, Campbell et al. (2009) conclude that underlying cash flow fundamentals have a dominant influence on systematic risk. Labor costs represent a fundamental production input cost impacting cash flows and hence should impact systematic risk.

While there are many different types of labor costs or employee compensation,<sup>2</sup> in general, an employee's compensation consists of two primary labor cost components: (1) fixed salary, and (2) at-risk (variable) compensation (associated with variable compensation plans (VCP)), (Abdel-khalik, 2003; Gaynor and Anderson, 1995). This dichotomization is useful for examining the effects of labor costs on income volatility, equity risk, and cost of capital.

In the following analysis, labor leverage and labor flexibility measure these two primary labor components. Recall that labor leverage measures fixed labor stock, the present value of obligated *future* labor compensation costs (Rosett, 2001; 2003), while labor flexibility, measures an employers' ability to vary quantities of labor and compensation in the current period. Labor flexibility is an important issue as America's staffing companies employed an average of 2.96 million temporary and contract workers per day in 2006—more than in any other year—according to the American Staffing Association quarterly employment and sales survey (2007), yet we know little about the effects of labor flexibility on the value of the firm. To address this important economic issue, we begin our investigation by formulating an analytical model.

The theoretically derived model presented in this section develops clear relationships between (1) labor flexibility, income volatility, equity risk and the cost of capital and (2) labor leverage, equity risk, and the cost of capital. We analytically show that labor flexibility reduces income volatility, equity risk and cost of capital. However, we demonstrate that labor leverage has no impact on income volatility, and increases equity risk and cost of equity capital.

### Relationship between Labor Flexibility, Labor Leverage and Income Volatility

Graham et al. (2005) find that an overwhelming majority of CFOs (97%) prefer to report non-volatile (smooth) earnings, holding cash flows constant. The main reasons offered by survey participants for their preference for smooth earnings are the investors' perception of lower risk, and the lower cost of equity and debt. However, prior research has not reached a consensus on whether income volatility garbles information for equity market participants with a resultant impact on market metrics such as risk and the cost of capital. While some researchers (e.g., Sankar and Subramanyam (2001), and Demski (1998)) argue that dampening income volatility is informative, other studies, regulators, and anecdotal evidence (e.g., Leuz et al., 2003; Levitt, 1998; Lang et al., 2003; and Bhattacharya et al., 2003), suggest that income volatility is non-informative and should not impact the perception of equity risk in the capital market. We begin our analysis and approach to this issue by linking income volatility to labor flexibility and labor leverage, the subject of this paper.

Rubinstein (1973) and Lev (1974)<sup>3</sup> both developed theoretical models of systematic risk allowing for stochastic demand and we follow this seminal approach. We begin by defining a firm's before-tax earnings ( $X$ ) for a single period as:

$$X = R - VC - FC \quad (1)$$

Where:

$X$  = before tax earnings

$R$  = total revenues (sales)

$VC$  = total variable costs, which are a function of the number of units sold ( $q$ ).

$FC$  = total fixed costs, which are unaffected by volume changes.

We make two changes to the before-tax earnings equation to isolate variable (*VCL*) and fixed (*FCL*) labor costs since this study focuses on labor costs. First, we decompose total variable cost (*VC*) into all variable costs except variable labor costs (*VC<sub>-VCL</sub>*) and variable labor costs (*VCL*). Second, we divide total fixed cost (*FC*) into all fixed costs except fixed labor (*FC<sub>-FCL</sub>*) and fixed salaries (*FCL*).

$$X = R - VC_{-VCL} - VCL - FC_{-FCL} - FCL \tag{2}$$

Consistent with Lev (1974) and others, we consider the effect of demand (*q*) fluctuations on income volatility. The effect of demand fluctuations on earnings can be examined by rewriting Equation (2) as:

$$X = SP_u q - VC_{u-VCL} q - VCL_u q - FC_{-FCL} - FCL \tag{3}$$

Where:

- SP<sub>u</sub>* = sales price per unit
- VC<sub>u-VCL</sub>* = variable costs per unit excluding variable labor costs per unit
- VCL<sub>u</sub>* = variable labor cost per unit
- q* = quantity (total units produced and sold)

Equation (3) is then differentiated with respect to *q*. Because fixed costs are independent of changes in demand, they do not appear in the differentiated equation. Differentiating Equation (3) with respect to *q* assumes that demand uncertainty is the only factor affecting income volatility. In other words, prices do not change independent of changes in quantity. Similar to Lev (1974), if perfectly competitive output ( $[dSP_u/dq] = 0$ ) and input ( $[dVC_{u-VCL}/dq] = 0$ ;  $[dVCL_u/dq] = 0$ ) markets are assumed, the differentiation of Equation (3) with respect to *q* becomes:

$$dX = [(SP_u - VCL_u - VC_{u-VCL})] dq \tag{4}$$

Equation (4) demonstrates that variable labor costs per unit (*VCL<sub>u</sub>*) reduce the effect of demand fluctuations (*dq*) on income volatility (*dX*). Ceteris paribus, an increase in variable labor costs per unit, i.e., labor flexibility, decreases income volatility.

Next, the assumption of a perfectly competitive variable labor input market ( $[dVCL_u/dq] = 0$ ) is relaxed. An increase in the demand for variable labor causes a rightward shift of the demand curve resulting in an increase in equilibrium quantity and an increase in equilibrium price ( $[dVCL_u/dq] > 0$ ) if the firm is facing an upward sloping variable labor supply curve. Modifying Equation (4) yields:

$$dX = \left[ (SP_u - VC_{u-VCL}) + \left( -VCL_u - \frac{dVCL_u}{dq} q \right) \right] dq \tag{5}$$

Equation (5) shows that variable labor costs buffer changes in earnings from changes in demand in two ways. First, the variable cost of labor per unit (*VCL<sub>u</sub>*) reduces the effect of demand uncertainty (*dq*) on income volatility (*dX*). Second, assuming a firm faces an upward sloping variable labor supply curve (a tenable economic assumption) ( $[dVCL_u/dq] > 0$ ), changes in the variable cost of labor per unit with respect to changes in quantity will also reduce the effect of demand fluctuations on income volatility.

There are two key implications that may be drawn from Equation (5). First, Equation (5) shows that variable labor costs (*VCL<sub>u</sub>*) reduce income volatility (*dX*) due to demand uncertainty (*dq*). Second, fixed compensation (*FCL*) is unaffected by changes in quantity and has no effect on income volatility due to demand uncertainty. Therefore, fixed compensation (*FCL*) cannot be used to buffer income volatility from the effects of demand uncertainty.

**Relationship between Labor Flexibility, Labor Leverage and Equity Risk**

Given the established income volatility effects, we next examine the impact of labor costs on equity risk to make the linkage to the firm’s cost of capital. By assuming a direct relationship between accounting net income and security returns Lev (1974) derives Equation (6):

$$R_U = \frac{cg_U + d_U}{MVE_U} = \frac{[X_U(1-\tau) + \Delta g_U]}{MVE_U} \tag{6}$$

Where:

- $R_U$  = unlevered firm returns
- $cg_U$  = capital gains
- $d_U$  = dividends
- $X_U$  = before tax earnings
- $\tau$  = corporate tax rate
- $MVE_U$  = market value of equity for an unlevered firm
- $\Delta g_U$  = change in the capitalized growth rate

We can define the relationship between firm returns ( $R_L$ ) and unlevered firm returns ( $R_U$ ) using a similar approach to Hamada (1972).

$$R_L = R_U \left( 1 + \frac{D_L}{MVE_L} \right) \tag{7}$$

Where:

- $R_L$  = return of a levered firm
- $R_U$  = return of an unlevered firm
- $D_L$  = market value of debt for a levered firm
- $MVE_L$  = market value of equity for a levered firm

Substituting Equation (6) into Equation (7) for unlevered firm returns ( $R_U$ ) yields Equation (8):

$$R_L = \left( \frac{[X_U(1-\tau) + \Delta g_U]}{MVE_U} \right) \left( 1 + \frac{D_L}{MVE_L} \right) \tag{8}$$

Two modifications are made to Equation (8) to investigate the relationship between labor flexibility, labor leverage and equity risk. First, total liabilities ( $D_L$ ) are decomposed into debt excluding labor leverage ( $D_{L-LL}$ ) and an off-balance sheet labor leverage liability ( $LL$ ) consistent with Rosett (2001; 2003). Labor leverage risk is analogous to financial leverage risk.

$$D_L = D_{L-LL} + LL \tag{9}$$

Where:

- $D_L$  = total debt of a levered firm
- $D_{L-LL}$  = total debt of a levered firm excluding labor leverage
- $LL$  = labor leverage

Equation (9) is substituted for  $D_L$  in Equation (8). Second, assuming a direct relation between net income and security returns,<sup>4</sup> the decomposition of before-tax earnings ( $X$ ) in Equation (3) is substituted for the before-tax earnings of an unlevered firm ( $X_U$ ) in Equation (8). Incorporating these two changes into Equation (8) results in Equation (10).

$$R_L = \left( \frac{[(SP_u q - VC_{u-VCL} q - VCL_u q - FC_{-FCL} - FCL)(1 - \tau) + \Delta g_U]}{MVE_U} \right) \left( 1 + \frac{D_{L-LL}}{MVE_L} + \frac{LL}{MVE_L} \right) \quad (10)$$

Equation (10) is then differentiated with respect to  $q$ . In addition to assuming perfectly competitive output ( $[dSP_u/dq] = 0$ ) and input ( $[dVC_{u-VCL}/dq] = 0$ ;  $[dVCL_u/dq] = 0$ ) markets, we use the assumptions of a constant tax rate ( $d\tau/dq = 0$ ) and constant change in growth rate ( $d\Delta g_U/dq = 0$ ) to simplify the resulting derivative. Because initial invested resources are unchanged by changes in quantity ( $[dMVE_U/dq] = 0$ ;  $[dMVE_L/dq] = 0$ ;  $[dD_{L-LL}/dq] = 0$ ;  $[dLL/dq] = 0$ ), the differentiation of Equation (10) with respect to  $q$  becomes:

$$dR_L = \left( \frac{[(SP_u - VC_{u-VCL} - VCL_u)_U(1 - \tau)]}{MVE_U} \right) \left( 1 + \frac{D_{L-LL}}{MVE_L} + \frac{LL}{MVE_L} \right) dq \quad (11)$$

Equation (11) demonstrates that variable labor costs per unit ( $VCL_u$ ) reduce the effect of demand fluctuations ( $dq$ ) on return volatility ( $dR_L$ ). Ceteris paribus, an increase in variable labor costs per unit, i.e., labor flexibility, decreases return volatility. However, labor leverage ( $LL$ ) increases the effect of demand fluctuations ( $dq$ ) on return volatility ( $dR_L$ ). The equity risk results for labor leverage and labor flexibility also extend to a firm's systematic risk.

Analytical studies demonstrating that financial risk directly influences systematic risk began with Hamada (1972) and have been extended by several analytical papers.<sup>5</sup> Equation (12) presents a Hamada (1972)-Lev (1974) beta decomposition. Appendix A contains details of this beta decomposition.

$$\beta_L = \left( \frac{\text{cov}((X_U(1 - \tau))/MVE_U, R_M)}{\sigma_{R_M}^2} + \frac{\text{cov}((\Delta g_U)/MVE_U, R_M)}{\sigma_{R_M}^2} \right) \left( 1 + \frac{D_L}{MVE_L} \right) \quad (12)$$

We can draw two key conclusions from Equation (12).<sup>6</sup> First, income volatility (measured by the covariance of after-tax income deflated by equity with market returns) increases equity risk. Second, financial leverage (measured by the debt-to-equity ratio) increases equity risk. This provides a good foundation for an analytical investigation of the effects of labor leverage and labor flexibility on equity risk.

Similar to the equity risk decomposition, two modifications are made to Equation (12) to investigate the relationship between labor flexibility, labor leverage and equity risk. First, we substitute the decomposition of total liabilities ( $D_{L-LL} + LL$ ) in Equation (9) for  $D_L$  in Equation (12). Second, the decomposition of before-tax earnings ( $X$ ) in Equation (2) is modified by incorporating total contribution margin before variable labor costs ( $CM_{-VCL} = R - VC_{-VCL}$ ).

$$X = CM_{-VCL} - VCL - FC_{-FCL} - FCL \quad (13)$$

Assuming a direct relation between net income and security returns,<sup>7</sup> Equation (13) is then substituted for the before-tax earnings of an unlevered firm ( $X_U$ ) in Equation (12). Incorporating these two changes into Equation (12) results in Equation (14).

$$\beta_L = \left( \frac{\text{cov}(((CM_{-VCL})_U(1-\tau))/MVE_U, R_M)}{\sigma_{R_M}^2} - \frac{\text{cov}(((VCL)_U(1-\tau))/MVE_U, R_M)}{\sigma_{R_M}^2} + \frac{\text{cov}((\Delta g_U)/MVE_U, R_M)}{\sigma_{R_M}^2} \right) \left( 1 + \frac{D_{L-LL}}{MVE_L} + \frac{LL}{MVE_L} \right) \tag{14}$$

We draw two key conclusions from Equation (14). First, *ceteris paribus*,<sup>8</sup> labor flexibility (*VCL*) is inversely related to equity risk ( $\beta_L$ ). The middle covariance term, the covariance between after-tax variable labor costs deflated by equity and the market return, reduces systematic risk. An increase in the level (expected value) of variable labor costs increases the covariance with the market return and reduces systematic risk. Second, labor leverage (*LL*) is positively associated with equity risk. Increases in labor leverage increase a firm’s total liabilities and financial risk (the last term in Equation (14)).<sup>9</sup> This increases a firm’s systematic risk.<sup>10</sup> These risk effects of labor leverage and labor flexibility should extend to a firm’s cost of capital.

Work started by Rubinstein (1973) and extended by Callahan (1985), Callahan and Mohr (1989), and Lord and Beranek (1999) decomposed operating risk (the first right-hand side term in Equation (14)) into four factors: 1) unit operating margin, 2) the value of equity, 3) the complement of the firm’s average income tax rate, and 4) demand beta (the covariance of firm unit output with returns on the market portfolio). Our work decomposes operating risk into three components: operating margin before labor costs, labor costs, and a change in capitalized growth rate. In addition, our work adds to the work of Lee et al. (1990) and Peyser (1994). They examine the risk effects of the capital intensity (capital-labor ratio) in a firm’s production function. Our work examines the risk effects of labor characteristics not just the risk effects of the labor amount relative to capital.

**Relationship between Equity Risk and the Cost of Equity Capital**

Systematic risk as we have modeled in the analytics is the market risk or the risk that cannot be diversified away, as opposed to “idiosyncratic risk,” which is specific to individual stocks. Even if we have a perfectly diversified portfolio there is some risk that we cannot avoid and this is widely accepted as systematic risk. There is a large body of finance and accounting research showing a positive relation between systematic or equity risk and a firm’s cost of capital beginning with the well-known Sharpe-Lintner CAPM that demonstrates that a firm’s cost of equity capital is a positive function of its systematic risk (Lintner, 1965; Sharpe, 1964). Our analytical results show that labor flexibility and labor leverage affect systematic risk, and therefore will also affect the firm’s ex ante cost of capital. By deduction, labor flexibility is inversely related to the cost of capital. And labor leverage is directly related to the cost of capital.

In sum, the overall conclusion of our analytical analysis is that labor costs affect a firm’s operating characteristics, equity risk and cost of capital. We have shown analytically that variable labor costs or labor flexibility reduces income volatility due to demand uncertainty effects. Second, fixed labor costs or labor leverage is unaffected by changes in demand and has no effect on income volatility. To make our linkage to the cost of equity clear, our analytical analyses show that labor flexibility is inversely related to equity risk, while labor leverage is positively associated with equity risk. Finally, given the equity risk effects, the impact of labor leverage and labor flexibility extend to a firm’s cost of capital. Our analyses of labor costs advance our understanding of the risk-generating process operating in capital markets.<sup>11</sup>

**3. EMPIRICAL ANALYSIS**

**Methodology**

To empirically test the validity of our analytical models, we use the service industry<sup>12</sup> over the sample period from 1960 – 2004. In the present study, the selection of service industries was motivated by a desire to use an industry sector where labor costs are economically important. The services sector offers several advantages for our investigation. The services sector is labor intensive. In addition, the services sector has no inventory to buffer production and production input costs like labor from demand volatility.

Sample data are collected from three sources: COMPUSTAT (financial information to calculate labor flexibility, labor leverage, the income volatility measure, and other financial data), CRSP (stock return information to calculate the standard deviation of returns and beta), and I/B/E/S (analysts’ earnings forecast information to calculate the cost of capital estimate). All monetary values are denominated in millions. Employee data are denominated in thousands. The sample period runs from 1960 – 2004. We begin with 22,038 initial COMPUSTAT service sector observations (observations with labor and employee data). These were matched with CRSP-supplied standard deviation of returns data leaving 7,259 observations. We further restrict the sample by retaining only observations with all information required for the primary regressions. This leaves 698 useable observations. Next, we truncate all major variables to remove the extreme 1% tails of the distributions. This minimizes the effect of any errors that might create extreme outliers in regressions. The final services sector sample contains 561 observations.

Table 1 presents selected descriptive statistics of this study’s main variables.

**Table 1---Descriptive Statistics**

<b>Variable</b>	<b>Description</b>	<b>Mean</b>	<b>Standard Deviation</b>
<i>SD(E<sub>t-4,t</sub>)</i>	Standard Deviation of Earnings	70.427	186.851
<i>SD(r<sub>CRSP</sub>)</i>	Standard Deviation of CRSP Returns	0.029	0.016
<i>E(r)</i>	Cost of Capital	0.109	0.031
<i>Labor</i>	Labor Leverage	0.028	0.042
<i>LaborFlex</i>	Labor Flexibility	0.581	0.339
<i>MV</i>	Log market value	5.765	2.008
<i>Leverage</i>	Debt/(Market Value + Debt)	0.423	0.229
<i>IOS</i>	Investment Opportunity Set	0.693	0.262
<i>Sales</i>	Log sales	5.886	1.726
<i>E/V</i>	Financing Policy	0.577	0.229
<i>B</i>	Beta	0.749	0.527
<i>BtM</i>	Book-to-Market ratio	0.544	0.418

*Notes:* The lowest and highest 1% of the distribution was removed from each continuous variable in this study. Only December fiscal year-end firms are included in the analysis. All dollar-valued items are deflated to year 2000 prices using the GDP deflator. The standard deviation of earnings (*SD(E<sub>t-4,t</sub>)*) is the standard deviation of earnings before interest and taxes (*C170 + C15*) using five annual earnings observations for years *t-4* through *t*. The standard deviation of returns (*SD(r<sub>CRSP</sub>)*) is calculated by CRSP for calendar years using daily raw returns. CRSP requires trades on at least 80% of trading days to calculate a *SD(r<sub>CRSP</sub>)*. The cost of capital (*E(r)*) is calculated using the Easton (2004) model. The cost of capital is a function of current period price (*P<sub>0</sub>*) and one-year and two-year earnings forecasts (*eps<sub>1</sub>*, *eps<sub>2</sub>*):

$$E(r) = \sqrt{\frac{E_0(eps_1) - E_0(eps_2)}{P_0}}$$

Labor Leverage is defined as *Total Employment/MVE*, or Compustat items *C29/[C25\*C199]*. Labor Flexibility follows a similar cost structure decomposition process used by Lev (1974). It is based on firm-by-firm estimates of  $\alpha_1$  from time-series regressions of  $Labor = \alpha_0 + \alpha_1 * EBITL + \varepsilon$  using the current and four lagged annual observations. In this context, we define  $EBITL = C170 + C15 + C42$  and  $Labor = C42$ . Log market value is the natural log of the market value (*C25\*C199*) at the end of the fiscal year. Leverage (*Leverage*) is the book value of debt (*C6 - C60*) divided by debt plus the market value of equity (*C6 - C60 + C25\*C199*) both at the end of the fiscal year. The Investment Opportunity Set follows the definition of Smith and Watts (1992). They use the ratio of book value of assets to firm value, or  $[Book\ Value\ of\ Assets]/[Market\ Value\ of\ Equity + Total\ Assets - Book\ Value\ of\ Equity]$ . This is measured using Compustat items  $C6/[(C25*C199)+C6-C60]$ . Log Sales follows the definition of Smith and Watts (1992). This is measured as  $\ln(C12)$  where *C12* is valued using year 2000 prices. Financing policy (*E/V*) follows the definition of Smith and Watts (1992). They use the ratio of market value of equity to firm value, or  $[Market\ Value\ of\ Equity]/[Market\ Value\ of\ Equity + Total\ Assets - Book\ Value\ of\ Equity]$  or Compustat items  $[C25*C199/(C25*C199+C6-C60)]$ . Beta ( $\beta$ ) is calculated by CRSP for calendar years using daily raw returns. CRSP requires trades on at least 50% of trading days to calculate  $\beta$ . The book-to-market ratio is the book value of equity (*C60*) divided by the market value of equity (*C25\*C199*).

We use three dependent firm performance variables. Similar to Kothari et al. (2002), the standard deviation of realized earnings for five years proxies for income volatility. Similar to Rosett (2003), the standard deviation of returns taken from CRSP serves as a market-based equity risk measure.<sup>13</sup> Finally, we use the Easton (2004) model to calculate an implied cost of capital estimate.



We use two independent labor variables of interest in our tests. Consistent with Rosett (2003), labor leverage is defined as employees divided by market value of equity  $(C29 / [C25 * C199])^{14}$  and is used as a proxy for labor stock. Labor flexibility is the regression coefficient from regressing total labor costs on earnings before interest, taxes and labor costs (*EBITL*).<sup>15</sup> Regression analysis is a popular cost estimation technique. However, like any cost estimation technique, it is based on assumptions. The two key assumptions in the regression equation below are: 1) the labor costs only depend on one activity, i.e., EBITL dollars, and 2) the relation between labor costs and EBITL is linear.

$$Labor_{it} = \alpha_i + LF_{it}EBITL_{it} + \varepsilon_{it} \tag{15}$$

Where:

*Labor<sub>it</sub>* = total labor compensation for firm *i* in year *t* (*C42*),

*EBITL<sub>it</sub>* = earnings before interest, taxes and labor costs (*C170 + C15 + C42*) for firm *i* in year *t*.

*LF<sub>it</sub>* = Proxy for the flexibility in a firm’s labor costs calculated as the regression coefficient from regressing total labor costs (*C42*) on EBITL (*C170 + C15 + C42*) using the current year (*t*) and four prior years (to *t-4*) (five total years) of data for firm *i*.

Other control variables used in our expanded models include the following:

Log market value is the natural log of the market value (*C25\*C199*) at the end of the fiscal year.

Leverage is the book value of debt (*C6 – C60*) divided by debt plus the market value of equity (*C6 – C60 + C25\*C199*) both at the end of the fiscal year.

The Investment Opportunity Set follows the definition of Smith and Watts (1992). They use the ratio of book value of assets to firm value (*C6/[(C25\*C199)+C6-C60]*).

Log sales follows the definition of Smith and Watts (1992). This is measured as the natural log of sales (*C12*).

Financing policy (*E/V*) follows the definition of Smith and Watts (1992). They use the ratio of market value of equity to firm value (*C25\*C199/(C25\*C199+C6-C60)*).

Beta ( $\beta$ ) is calculated by CRSP for calendar years using daily raw returns. CRSP requires trades on at least 50% of trading days to calculate  $\beta$ .

The book-to-market ratio is the book value of equity (*C60*) divided by the market value of equity (*C25\*C199*).

## **Results**

Income volatility, equity risk, and cost of capital variables are regressed on labor flexibility and labor leverage to test the analytical hypotheses. Two models are used for each market measure and income volatility: 1) a base model containing labor flexibility and labor leverage as independent variables, and 2) an expanded model containing labor flexibility, labor leverage and control variables. We report pooled regression results, standardized coefficient responses, and *t*-statistics based on White (1980) corrected standard errors similar to Rosett (2003).

Table 2 presents the income volatility model results. Labor flexibility is the only labor proxy used in the income volatility models since there was no hypothesized analytical relationship between labor leverage and income volatility. Panel A contains the base model results; Panel B provides the expanded model results.

Table 2---Income Volatility Pooled Regression Results

Regressions of income volatility measure, the standard deviation of earnings, on labor flexibility, a labor-based proxy. Other controls include: the natural log of market value which serves as a proxy for risk and a control for size; leverage which controls for financial leverage. Reported coefficients, except for the intercept, are standardized responses. *t*-statistics are calculated using robust standard errors (White, 1980).

**Panel A: Income Volatility Base Model**

$$\text{Model: } SD(E_{t-4,t}) = \alpha + \beta_1 \text{LaborFlex} + \text{error}_{t-4,t}$$

Variable	Description	Coefficient	t-statistic
Intercept	Intercept	137.899	6.05
LaborFlex	Labor Flexibility	-0.211	-3.93
Adjusted R <sup>2</sup>		4.27%	
<i>n</i>		561	

**Panel B: Income Volatility Expanded Model**

$$\text{Model: } SD(E_{t+1,t+5}) = \alpha + \beta_1 \text{LaborFlex} + \beta_2 \text{MV} + \beta_3 \text{Leverage} + \text{error}_{t-4,t}$$

Variable	Description	Coefficient	t-statistic
Intercept	Intercept	-210.759	-6.80
LaborFlex	Labor Flexibility	-0.277	-5.74
MV	Log market value	0.560	8.93
Leverage	Debt/(Market Value + Debt)	0.201	5.15
Adjusted R <sup>2</sup>		33.48%	
<i>n</i>		561	

Notes: The lowest and highest 1% of the distribution was removed from each continuous variable in this study. Only December fiscal year-end firms are included in the analysis. All dollar-valued items are deflated to year 2000 prices using the GDP deflator. The standard deviation of earnings ( $SD(E_{t-4,t})$ ) is the standard deviation of earnings before interest and taxes ( $C170 + C15$ ) using five annual earnings observations for years  $t-4$  through  $t$ . Labor Flexibility follows a similar cost structure decomposition process used by Lev (1974). It is based on firm-by-firm estimates of  $\alpha_1$  from time-series regressions of  $Labor = \alpha_0 + \alpha_1 * EBITL + \varepsilon$  using the current and four lagged annual observations. In this context, we define  $EBITL = C170 + C15 + C42$  and  $Labor = C42$ . Log market value is the natural log of the market value ( $C25 * C199$ ) at the end of the fiscal year. Leverage (*Leverage*) is the book value of debt ( $C6 - C60$ ) divided by debt plus the market value of equity ( $C6 - C60 + C25 * C199$ ) both at the end of the fiscal year.

Labor flexibility is strongly negatively associated with the standard deviation of earnings in both the base and expanded models. The expanded model includes size and leverage variables, common control variables used in other income volatility models (Kothari et al., 2002). Taken as a whole, the empirical results support the analytical conclusion that labor flexibility reduces income volatility.

Table 3 presents the equity risk model results. Panel A contains the base model results; Panel B provides the expanded model results.

**Table 3: Market-based Risk Measure Pooled Regression Results**

Regressions of market-based equity risk measure, the standard deviation of returns, on labor leverage, a labor-based risk proxy, and labor flexibility, a labor-based proxy. Other controls include: a financing policy proxy; the natural log of sales which serves as a proxy for risk and a control for size; and an investment opportunity set proxy. Reported coefficients, except for the intercept, are standardized responses. *t*-statistics are calculated using robust standard errors (White, 1980).

**Panel A: Market-based Risk Measure Base Model**

$$\text{Model: } SD(r_{CRSP}) = \gamma_0 + \gamma_1 \text{Labor} + \gamma_2 \text{LaborFlex} + \varepsilon$$

Variable	Description	Coefficient	t-statistic
Intercept	Intercept	0.034	21.69
Labor	Labor Leverage	0.214	4.14
LaborFlex	Labor Flexibility	-0.269	-5.22
Adjusted R <sup>2</sup>		8.61%	
<i>n</i>		561	

**Panel B: Market-based Risk Measure Expanded Model**

$$\text{Model: } SD(r_{CRSP}) = \gamma_0 + \gamma_1 \text{Labor} + \gamma_2 \text{LaborFlex} + \gamma_3 \frac{E}{V} + \gamma_4 \text{Sales} + \gamma_5 \text{IOS} + \varepsilon$$

Variable	Description	Coefficient	t-statistic
Intercept	Intercept	0.059	7.67
Labor	Labor Leverage	0.154	3.00
LaborFlex	Labor Flexibility	-0.207	-4.51
<i>E/V</i>	Financing Policy	-0.154	-1.90
Sales	Log sales	-0.313	-6.88
IOS	Investment Opportunity Set	-0.069	-0.83
Adjusted R <sup>2</sup>		16.95%	
<i>n</i>		561	

Notes: The lowest and highest 1% of the distribution was removed from each continuous variable in this study. Only December fiscal year-end firms are included in the analysis. All dollar-valued items are deflated to year 2000 prices using the GDP deflator. The standard deviation of returns ( $SD(r_{CRSP})$ ) is calculated by CRSP for calendar years using daily raw returns. CRSP requires trades on at least 80% of trading days to calculate a  $SD(r_{CRSP})$ . Labor Leverage is defined as *Total Employment/MVE*, or Compustat items  $C29/[C25*C199]$  and is in year 2000 prices. Labor Flexibility follows a similar cost structure decomposition process used by Lev (1974). It is based on firm-by-firm estimates of  $\alpha_1$  from time-series regressions of  $Labor = \alpha_0 + \alpha_1*EBITL + \varepsilon$  using the current and four lagged annual observations. In this context, we define  $EBITL = C170 + C15 + C42$  and  $Labor = C42$ . Financing policy (*E/V*) follows the definition of Smith and Watts (1992). They use the ratio of market value of equity to firm value, or  $[Market Value of Equity]/[Market Value of Equity + Total Assets - Book Value of Equity]$  or Compustat items  $[C25*C199/(C25*C199+C6-C60)]$ . Log Sales follows the definition of Smith and Watts (1992). This is measured as  $\ln(C12)$  where *C12* is valued using year 2000 prices. The Investment Opportunity Set follows the definition of Smith and Watts (1992). They use the ratio of book value of assets to firm value, or  $[Book Value of Assets]/[Market Value of Equity + Total Assets - Book Value of Equity]$ . This is measured using Compustat items  $C6/[(C25*C199)+C6-C60]$ .

Labor leverage is strongly positively associated with the standard deviation of returns in both the base and expanded models. Labor flexibility, on the other hand, is strongly negatively associated with the standard deviation of returns in both the base and expanded models. The base model has an  $R^2$  of 8.61%. The expanded model adds controls for size, financing policy, and investment opportunities (Rosett, 2003) resulting in an increased  $R^2$  of 16.95%. The equity risk model empirical results support the analytical conclusions that while labor leverage increases equity risk, labor flexibility reduces equity risk.

Table 4 presents the cost of capital model results. Panel A contains the base model results; Panel B provides the expanded model results.

Table 4: Cost of Capital Pooled Regression Results

Regressions of estimated cost of capital measure on labor flexibility, a labor-based proxy. Other controls include: beta; the natural log of market value which serves as a proxy for risk and a control for size; and the book-to-market ratio. Reported coefficients, except for the intercept, are standardized responses. *t*-statistics are calculated using robust standard errors (White, 1980).

**Panel A: Cost of Capital Base Model**

Model:  $E(r) = \alpha_1 + \alpha_2 Labor + \alpha_3 LaborFlex + \alpha_4 \beta + \alpha_5 MV + \alpha_6 BtM + \varepsilon$

Variable	Description	Coefficient	t-statistic
<i>Intercept</i>	Intercept	0.123	20.78
<i>Labor</i>	Labor Leverage	0.344	4.12
<i>LaborFlex</i>	Labor Flexibility	-0.291	-3.75
<i>Adjusted R<sup>2</sup></i>		13.93%	
<i>n</i>		212	

**Panel B: Cost of Capital Expanded Model**

Model:  $E(r) = \alpha_1 + \alpha_2 Labor + \alpha_3 LaborFlex + \alpha_4 \beta + \alpha_5 MV + \alpha_6 BtM + \varepsilon$

Variable	Description	Coefficient	t-statistic
<i>Intercept</i>	Intercept	0.169	13.12
<i>Labor</i>	Labor Leverage	0.167	1.97
<i>LaborFlex</i>	Labor Flexibility	-0.258	-3.95
<i>β</i>	Beta	0.159	2.94
<i>MV</i>	Log market value	-0.400	-5.25
<i>BtM</i>	Book-to-Market ratio	0.086	0.84
<i>Adjusted R<sup>2</sup></i>		29.45%	
<i>n</i>		212	

Notes: The lowest and highest 1% of the distribution was removed from each continuous variable in this study. Only December fiscal year-end firms are included in the analysis. All dollar-valued items are deflated to year 2000 prices using the GDP deflator. The cost of capital ( $E(r)$ ) is calculated using the Easton (2004) model. The cost of capital is a function of current period price ( $P_0$ ) and one-year and two-year earnings forecasts ( $eps_1, eps_2$ ):

$$E(r) = \sqrt{\frac{E_0(eps_1) - E_0(eps_2)}{P_0}}$$

Labor Leverage is defined as *Total Employment/MVE*, or Compustat items  $C29/[C25*C199]$  and is in year 2000 prices. Labor Flexibility follows a similar cost structure decomposition process used by Lev (1974). It is based on firm-by-firm estimates of  $\alpha_1$  from time-series regressions of  $Labor = \alpha_0 + \alpha_1*EBITL + \varepsilon$  using the current and four lagged annual observations. In this context, we define  $EBITL = C170 + C15 + C42$  and  $Labor = C42$ . Beta ( $\beta$ ) is calculated by CRSP for calendar years using daily raw returns. CRSP requires trades on at least 50% of trading days to calculate  $\beta$ . Log market value is the natural log of the market value ( $C25*C199$ ) at the end of the fiscal year. The book-to-market ratio is the book value of equity ( $C60$ ) divided by the market value of equity ( $C25*C199$ ).

Labor leverage is strongly positively associated with the implied cost of capital in both the base and expanded models. Labor flexibility, on the other hand, is strongly negatively associated with the implied cost of capital in both the base and expanded models. The base model has an  $R^2$  of 13.93%. The expanded model adds controls for size, systematic risk, and the book-to-market ratio resulting in an increased  $R^2$  of 29.45%. The equity risk model empirical results support the analytical conclusions that while labor leverage increases the cost of capital, labor flexibility reduces the cost of capital.

**4. CONCLUSION**

This paper analytically and empirically investigates the linkage between labor costs and a firm's income volatility, equity risk, and cost of capital. The contribution of this work is an explicit consideration of labor costs in

the decomposition of equity risk. While we consider labor leverage (fixed labor cost), we add to the literature by considering labor flexibility which measures the relative level of variable compensation in a firm's labor cost structure. To test the validity of our analytical models, we use the service industry over the sample period from 1960 – 2004 for our empirical tests. We find that our empirical analyses are consistent with our analytical results. That is, our study finds a differential analytical capital market effect for labor flexibility and labor leverage. We find that labor flexibility reduces income volatility, equity risk and cost of equity capital, while labor leverage increases equity risk and cost of capital.

Understanding the linkage between labor flexibility costs and the firm's income volatility, equity risk, and cost of equity capital is important. The U.S. staffing industry in America's work force is changing. Many people are looking for flexibility in their employment arrangements, yet we know little about the impact of this phenomenon on firm value. This paper has provided some evidence that there is a linkage between labor flexibility and the cost of equity capital and hence, firm value; however other research studies are needed. Future research can extend the work in this study in two ways. First, the analytical conclusions developed here can be rigorously tested empirically in other aspects of the firm's operating and financing environment. Second, future work can begin to examine the integration between productivity effects and risk effects of labor costs.

#### **AUTHOR INFORMATION**

**Carolyn M. Callahan**, KPMG Distinguished Professor of Accounting and Director of the School of Accountancy at the University of Memphis, earned a Ph.D. from Michigan State University. Her research interests focus on analytical and empirical examination of models that link accounting information to equilibrium prices in aggregate markets. She has published research in the *Accounting Review*, *Journal of Accounting Research*, *Contemporary Accounting Research*, *Accounting Horizons*, *Review of Quantitative Finance and Accounting* and the *Journal of Accounting Literature*.

**Martin T. Stuebs, Jr.** is an Assistant Professor of Accounting at Baylor University in Waco, Texas. He received his doctoral degree from the University of Arkansas. He has published articles in several journals including the *Journal of Accounting and Public Policy*, *Accounting & the Public Interest*, the *CPA Journal* and *Issues in Accounting Education*.

#### **REFERENCES**

1. Abdel-khalik, A. R. (2003). Self-sorting, incentive compensation and human-capital assets. *European Accounting Review*, 12(4), 661-697.
2. Alberts, W. W., & Hite, G. L. (1983). The Modigliani-Miller leverage equation considered in a product market context. *Journal of Financial and Quantitative Analysis*, 18(4), 425-437.
3. American Staffing Association. (2007). Quarterly staffing survey 2007. American Staffing Association. Alexandria, VA. Available at: <http://www.americanstaffing.net/statistics/economic.cfm>
4. Banker, R. D., Lee, S., Potter, G., & Srinivasan, D. (2000). An empirical analysis of continuing improvements following the implementation of a performance-based compensation plan. *Journal of Accounting & Economics*, 30(3), 315-350.
5. Barth, M. E., Beaver, W., & Landsman, W. R. (1998). Relative valuation roles of equity book value and net income as a function of financial health. *Journal of Accounting & Economics*, 25(1), 1-34.
6. Bhattacharya, U., Daouk, H., & Welker, M. (2003). The world price of earnings opacity. *The Accounting Review*, 78, 641-678.
7. Blinder, A. J., ed. (1990). *Paying for productivity. A look at the evidence*. Washington, DC: The Brookings Institution.
8. Bloom, M., & Milkovich, G. T. (1998). Relationships among risk, incentive pay and organizational performance. *Academy of Management Journal*, 41(3), 283-297.
9. Bonner, S. E., & Sprinkle, G. B. (2002). The effects of monetary incentives on effort and task performance: Theories, evidence, and a framework for research. *Accounting, Organizations & Society*, 27(4/5), 303-345.
10. Callahan, C. M., & Mohr, R. M. (1989). The determinants of systematic risk. *Financial Review*, 24, 157-181.

11. Callahan, C. M. (1985). The theoretical and empirical examinations of the determinants of systematic risk. Unpublished Dissertation, Michigan State University.
12. Campbell, J. Y., Polk, C., & Vuolteenaho, T. (2009). Growth or glamour? Fundamentals and systematic risk in stock returns. *The Review of Financial Studies*, 1-40.
13. Casey, B., Metcalf, H. & Millward, N. (1997). *Employers' use of Flexible Labor*, London: Policy Studies Institute.
14. Christie, A. A. (2000). Equity risk, the opportunity set, production costs and debt. Working paper, Louisiana State University.
15. Chung, K. H., & Charoenwong, C. (1991). Investment options, assets in place, and the risk of stocks. *Financial Management*, 20(3), 21-33.
16. Clinton, A. (1997). Flexible labor: Restructuring the American work force. *Monthly Labor Review*, 120(8), 3-27.
17. Conine Jr., T. E. (1983). On the theoretical relationship between systematic risk and price elasticity of demand. *Journal of Business Finance & Accounting*, 10(2), 173-182.
18. Conine Jr., T. E. (1982). On the theoretical relationship between business risk and systematic risk. *Journal of Business Finance & Accounting*, 9(2), 199-205.
19. Conine, T. E. (1980a) Debt capacity and the capital budgeting decision: A comment. *Financial Management*, 9(1), 20-22.
20. Conine, T. E. (1980b) Corporate debt and corporate taxes: An extension. *Journal of Finance*, 35(4), 1033-1037.
21. Demski, J. (1998) Performance measure manipulation. *Contemporary Accounting Research*, 15, 261-285.
22. Easton, P. D. (2004). PE ratios, PEG ratios, and estimating the implied expected rate of return on equity capital. *Accounting Review*, 79(1), 73-95.
23. Ehrhardt, M. C., & Shrieves, R. E. (1995). The impact of warrants and convertible securities on the systematic risk of common equity. *Financial Review*, 30(4), 843-856.
24. Fama, E. F., & French, K. R. (1997). Industry costs of equity. *Journal of Financial Economics*, 43(2), 153-193.
25. Freeland, M. S., Anderson, G. F., & Schendler, C. (1979). National input price index. *Health Care Financing Review*, 1(1), 37-61.
26. Gaynor, M., & Anderson, G. F. (1995). Uncertain demand, the structure of hospital costs, and the costs of empty hospital beds. *Journal of Health Economics*, 14(3), 291-317.
27. Graham, J., Harvey, C., & Rajgopal, S. (2005). The economic implications of corporate financial reporting. *Journal of Accounting & Economics*, 40, 3-73.
28. Hamada, R. S. (1972). The effect of the firm's capital structure on the systematic risk of common stock. *Journal of Finance*, 27(2), 435-458.
29. Hite, G. L. (1977). Leverage, output effects, and the M -- M theorems. *Journal of Financial Economics*, 4(2), 177-202.
30. Hong, G., and Sarkar, S. (2007). Equity systematic risk (beta) and its determinants. *Contemporary Accounting Research*, 24(2), 423-466.
31. Kothari, S. P., Laguerre, T. E., & Leone, A. J. (2002). Capitalization versus expensing: Evidence on the uncertainty of future earnings from capital expenditures versus R&D outlays. *Review of Accounting Studies*, 7, 355-382.
32. Lally, M. (2002). Time varying market leverage, the market risk premium and the cost of capital. *Journal of Business Finance & Accounting*, 29(9/10), 1301-1318.
33. Lally, M. (2004). The Fama-French model, leverage, and the Modigliani-Miller propositions. *Journal of Financial Research*, 27(3), 341-349.
34. Lang, M., Raedy, J., & Yetman, M. (2003). How representative are firms that are cross-listed in the United States? An analysis of accounting quality. *Journal of Accounting Research*, 41, 363-386.
35. Lee, C., Liaw, K. T., & Rahman, S. (1990). Impacts of market power and capital-labor ratio on systematic risk: A Cobb-Douglas approach. *Journal of Economics and Business*, 42(3), 237-241.
36. Leuz, C., Nanda, D. & Wysocki, P. (2003). Earnings management and investor protection: An international comparison. *Journal of Financial Economics*, 69, 505-527.
37. Lev, B. (1974). On the association between operating leverage and risk. *Journal of Financial & Quantitative Analysis*, 9(4), 627-641.

38. Levitt, A. (1998). *The Numbers Game*. NYU Center for Law and Business, New York, NY.
39. Lindenberg, E. B., & Ross, S. A. (1981). Tobin's q ratio and industrial organization. *Journal of Business*, 54(1), 1-32.
40. Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *Review of Economics & Statistics*, 47(1), 13-37.
41. Lord, R. A., & Beranek, W. (1999). Operating characteristics and operating risk: Additional empirical evidence. *Quarterly Journal of Business & Economics*, 38(3), 41-50.
42. Mandelker, G. N., & Rhee, S. G. (1984). The impact of the degrees of operating and financial leverage on systematic risk of common stock. *Journal of Financial & Quantitative Analysis*, 19(1), 45-57.
43. Meadows, J. L. (1994). AT&T workers form an internal contingent labor pool. *Personnel Journal*, 73(12), 90.
44. Milner, J. M., & Pinker, E. J. (2001). Contingent labor contracting under demand and supply uncertainty. *Management Science*, 47(8), 1046-1062.
45. Modigliani, F., & Miller, M. H. (1963). Corporate income taxes and the cost of capital: A correction. *American Economic Review*, 53(3), 433-443.
46. Modigliani, F., & Miller, M. H. (1958). The cost of capital, corporation finance and the theory of investment. *American Economic Review*, 48(3), 261-297.
47. Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica*, 34(4), 768-783.
48. Nayar, N., & Willinger, G. L. (2001). Financial implications of the decision to increase reliance on contingent labor. *Decision Sciences*, 32(4), 661-681.
49. Peyser, P. S. (1994). Wage risk and the lee, liaw, and rahman model. *Journal of Economics and Business*, 46(5), 421-427.
50. Phillips, N. (2003). Leased labor. *Construction*, 70(13), 11.
51. Pinker, E. J., & Larson, R. C. (2003). Optimizing the use of contingent labor when demand is uncertain. *European Journal of Operational Research*, 144(1), 39-55.
52. Rhee, S. G. (1986). Stochastic demand and a decomposition of systematic risk. *Research in Finance*, 6, 197-216.
53. Rosett, J. (2003). Labour leverage, equity risk and corporate policy choice. *European Accounting Review*, 12(4), 699-732.
54. Rosett, J. G. (2001). Equity risk and the labor stock: The case of union contracts. *Journal of Accounting Research*, 39(2), 337-364.
55. Rubinstein, M. E. (1973). A mean-variance synthesis of corporate financial theory. *Journal of Finance*, 28(1), 167-181.
56. Sankar, M. R., & Subramanyam, K. R. (2001). Reporting discretion and private information communication through earnings. *Journal of Accounting Research*, 39, 365-386.
57. Schmenner, R. W. (1995). *Service Operations Management*. Englewood Cliffs, NJ: Prentice Hall, Inc.
58. Schmenner, R. W. (1986). How can service businesses survive and prosper? *Sloan Management Review*, 27(3), 21-32.
59. Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *Journal of Finance*, 19(3), 425-442.
60. Sims, S. (2000). Flex force. *Los Gatos Weekly Times*.
61. Smith Jr., C. W., & Watts, R. L. (1992). The investment opportunity set and corporate financing, dividend, and compensation policies. *Journal of Financial Economics*, 32(3), 263-292.
62. Stroh, L. K., Brett, J. M., Baumann, J. P., & Reilly, A. H. (1996). Agency theory and variable pay compensation strategies. *Academy of Management Journal*, 39(3), 751-767.
63. Subrahmanyam, M. G., & Thomadakis, S. B. (1980). Systematic risk and the theory of the firm. *Quarterly Journal of Economics*, 94(3), 437-451.
64. White, H. (1980). A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica*, 48(4), 817-838.

**APPENDIX A**

**Relationship between Financial Risk, Income and Equity Risk**

Integrating Hamada (1972) and Lev (1974) analytically shows that beta, a measure of a firm’s systematic risk, is a function of income volatility and financial risk.<sup>16</sup>

Hamada (1972) shows that a firm’s systematic equity risk ( $\beta_L$ ) is a function of a firm’s operating risk ( $\beta_U$ ) and financing risk ( $D_L / MVE_L$ ).  $\beta_U$  represents an estimate of the firm’s operating (business) risk while the debt-to-equity ratio approximates financial risk. Hamada (1972) demonstrates that as a firm’s financial risk increases (debt-to-equity ratio increases), the firm’s levered beta also increases.

$$\beta_L = \beta_U \left( 1 + \frac{D_L}{MVE_L} \right) \tag{A1}$$

Where:

- $\beta_L$  = beta of a levered firm
- $\beta_U$  = beta of an unlevered firm
- $D_L$  = market value of debt for a levered firm
- $MVE_L$  = market value of equity for a levered firm

Incorporating Lev (1974) into Equation (A1) establishes the relationship between systematic risk and income volatility. Lev (1974) decomposes unlevered beta by combining equations (A2) and (A3). First, based on the CAPM, unlevered systematic risk is defined as follows:

$$\beta_U = \frac{\text{cov}(R_U, R_M)}{\sigma_{R_M}^2} \tag{A2}$$

Where:

- $R_U$  = unlevered firm returns
- $R_M$  = market returns

Next, by assuming a direct relationship between accounting net income and security returns, Lev (1974) obtains Equation (A3):<sup>17</sup>

$$R_U = \frac{cg_U + d_U}{MVE_U} = \frac{[X_U(1 - \tau) + \Delta g_U]}{MVE_U} \tag{A3}$$

Where:

- $R_U$  = unlevered firm returns
- $cg_U$  = capital gains
- $d_U$  = dividends
- $X_U$  = before tax earnings
- $\tau$  = corporate tax rate
- $MVE_U$  = market value of equity for an unlevered firm
- $\Delta g_U$  = change in the capitalized growth rate



Equation (A3) is substituted for  $R_U$  in Equation (A2). After this substitution, the newly modified Equation (A2) is then substituted into Equation (A1) for  $\beta_U$ . The result of these substitutions is Equation (A4):

$$\beta_L = \left( \frac{\text{cov}((X_U(1-\tau) + \Delta g_U) / MVE_U, R_M)}{\sigma_{R_M}^2} \right) \left( 1 + \frac{D_L}{MVE_L} \right) \tag{A4}$$

Equation (A5) decomposes the covariance of firm returns with the market return into two parts: 1) the covariance of after-tax income deflated by market value of equity with the market return and 2) the covariance of the change in the capitalized growth rate deflated by market value of equity with the market return.

$$\beta_L = \left( \frac{\text{cov}((X_U(1-\tau)) / MVE_U, R_M)}{\sigma_{R_M}^2} + \frac{\text{cov}((\Delta g_U) / MVE_U, R_M)}{\sigma_{R_M}^2} \right) \left( 1 + \frac{D_L}{MVE_L} \right) \tag{A5}$$

Where:

- $\beta_L$  = beta of a levered firm
- $R_M$  = market returns
- $X_U$  = before tax earnings
- $\tau$  = corporate tax rate
- $MVE_U$  = market value of equity for an unlevered firm
- $\Delta g_U$  = change in the capitalized growth rate
- $D_L$  = market value of debt for a levered firm
- $MVE_L$  = market value of equity for a levered firm

The systematic risk effect of income volatility is now isolated in the first term on the right-hand side of Equation (A5).

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**ENDNOTES:**

<sup>1</sup> For example, Blinder estimates that labor accounts for at least 70% of total costs in his book on labor practices in the U.S., *Paying for Productivity* (1990).

<sup>2</sup> For example, in addition to salaried employees, there are several flexible employment arrangements like part-time employees, temporary employees, temporary agency workers, employees whose hours vary from week to week, employees on annual hours contracts, and flextime employees (Casey et al., 1997).

<sup>3</sup> As we do, a number of studies use Lev (1974) as a starting point to build on and extend his initial work. For example, Chung and Charoenwong (1991) find that growth opportunities increase uncertainty and systematic risk extending the literature examining the risk effects of firm operating characteristics. Whereas Lev (1974) assumes that only quantity is stochastic, Conine (1982) derives a beta decomposition that allows both price and quantity to be stochastic and mutually dependent. In addition, Conine (1983) demonstrates the relationship between beta and the constant price elasticity of demand. Building on the work examining the effects of stochastic prices on beta, Subrahmanyam and Thomadakis (1980) show that factor mix and price affect systematic risk. They also find that beta is a decreasing function of operating leverage—a result that contradicts Lev (1974).

<sup>4</sup> Note that this assumption is consistent with the assumptions in Lev (1974) and was also used in to derive Equation (6).

<sup>5</sup> A number of studies have extended Hamada’s initial work. Conine (1980a; 1980b) extend Hamada (1972) by investigating the effects of risky debt and risky preferred stock on systematic risk. Ehrhardt and Shrieves (1995) consider the effects of warrants and convertible securities. Hite (1977), Alberts and Hite (1983), and Lally (2002) use the Modigliani and Miller (1958; 1963) model to investigate the effects of financial leverage on systematic risk, firm profits, and the market risk premium. Lally (2004) incorporates Hamada (1972) into the Fama and French

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(1997) model to relate the Fama and French sensitivity coefficients to a firm's leverage. This study adds to this body of literature by examining how labor costs and labor leverage in particular affects financing risk.

<sup>6</sup> Note that Equation (12) assumes that operating risk and financial risk are independent of each other. Therefore Equation (12) shows only the direct effects of operating risk and financing risk on beta and does not show indirect off-setting effects of operating risk and financial risk (Hite, 1977).

<sup>7</sup> Note that this assumption is consistent with the assumptions in Lev (1974) and was also used to derive Equation (6) and in Appendix A to derive Equation (A3).

<sup>8</sup> Note that this ceteris paribus assumption means, among other things, that the change in capitalized growth is unaffected by differences in the mix of fixed and variable labor costs.

<sup>9</sup> This analytical result is also consistent with the operationalizations of labor leverage in Rosett (2003). Rosett (2003) uses labor cost and number of employees to proxy for the present value of future labor costs and then deflates these values by the market value of equity to calculate labor cost leverage and labor leverage respectively. These operationalizations are similar to our analytical results.

<sup>10</sup> Rosett (2003) presents analytical equations that demonstrate the positive relationship between labor leverage and systematic risk. While our conclusions are the same, our analytical equations differ.

<sup>11</sup> An extensive body of research investigates the performance and productivity effects of various flexible forms of compensation: 1) forms of variable incentive compensation (Banker et al., 2000; Bonner and Sprinkle, 2002), and 2) forms of contingent or temporary labor (Nayar and Willinger, 2001). However, little work has considered the effects of labor flexibility on equity risk.

<sup>12</sup> We use Barth et al.'s (1998) services sector classification. Barth et al. (1998) classify the following SIC codes in the services sector: 7000-7369 and 7380-8999.

<sup>13</sup> Although  $\beta$  is a noisier measure of firm risk due to estimation inefficiencies noted by Christie (2000) and others, our results are qualitatively similar when  $\beta$  is used as a market-based risk proxy.

<sup>14</sup> *C* represents the COMPUSTAT data item number.

<sup>15</sup> Note that this approach of regressing total labor costs on *EBITL* (a proxy for the quantity of production) is similar to the approach that Lev (1974) used by regressing total costs on sales to estimate a firm's total variable costs.

<sup>16</sup> Several studies build on the early work of Hamada (1972) and Lev (1974) and integrate the effects of operating and financing risk. For example, Mandelker and Rhee (1984) examine the joint impact of operating and financial leverage and find that operating and financial leverage magnify the intrinsic business risk of common stock. Rhee (1986) decomposes beta into a business risk component, an operating risk component and a financing risk component. Rhee (1986) uses this decomposition to reconcile Subrahanyam and Thomadakis (1980) with Lev (1974). Rhee (1986) also decomposes the cost of capital into a business risk premium, operating risk premium, and financial risk premium.

<sup>17</sup> Note that Equation (A3) is identical to Equation (6) in the body of the paper where it was also used in the equity risk decomposition.