Corporate Financial Leverage in Canadian Manufacturing: Consequences for Employment and Inventories

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Abstract
This paper investigates the link between financial structure and employment growth and the link between financial structure and inventory growth, among incorporated Canadian manufacturers over the period 1988 to 1997. It finds that financially vulnerable firms—smaller firms and those with higher leverage—tend to shed more labour than healthier firms for an equal sized drop in product demand. When a demand shock occurs, a firm with high leverage sheds nearly 10% more employment for than a firm with average leverage. The influence was larger during the recession of 1990-1992 and more significant in sectors that were hit hardest by the recession. This is as one would expect given that credit constraints become more binding during recessions. The influence was also larger in sectors that experienced larger cyclical fluctuations. On average, firms with high leverage also tend to cut inventories more (+5%) when a shock in demand occurs.

Résumé
Cette étude porte sur le lien entre la structure financière et la croissance de l'emploi et des inventaires des fabricants canadiens constitués en société au cours de la période allant de 1988 à 1997. On observe que pour une certaine baisse dans la demande de produits, les entreprises financièrement vulnérables—c'est-à-dire celles qui sont de petite taille ou qui ont un ratio de levier financier élevé—ont tendance à réduire davantage leurs effectifs que les entreprises en meilleure santé financière. Lorsqu'un choc à la baisse survient dans la demande de produits, les coupures d'emploi sont près de 10 % plus élevées dans les entreprises avec un ratio de levier financier élevé, en comparaison avec les entreprises dont le ratio se situe dans la moyenne. Cette influence était plus marquée durant la récession de 1990 à 1992, et était plus significative dans les industries qui ont été plus durement touchées par la récession. Ce résultat n'est pas surprenant dans la mesure où les conditions de crédit sont plus contraignantes en période de récession. Enfin, les entreprises avec un ratio de levier financier élevé tendent à réduire davantage leurs inventaires (dans une proportion de 5 %) lorsque survient un choc de la demande.

During recent decades, Canadian businesses increasingly financed themselves by raising their level of debt with respect to assets, commonly referred to as leverage. Between 1961 and 1996, the share of Canadian firms' capital held in debt increased by nearly 50%.[1] In the 1990s, the level of aggregate corporate leverage tended to fall slightly, but still remained high by historical standards. Does this increase in leverage matter? Capital structure theory beginning with Modigliani and Miller (1958) argues that the choice of capital structure does not matter to the net value of the firm or the cost of available capital. Divergences from this theorem, described by Donaldson (1963), Jensen and Meckling (1976), Myers (1977, 1984), Myers and Majluf (1984), and Fama and French (2002) emphasize the role of informational asymmetries and agency costs which differentiate the cost of external and internal finance, making capital structure choice important for the firm's value and for the cost of capital available to the firm. This has implications for the real side activity of the firm, including employment and investment in inventories.

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In this paper we examine the relationship between firm leverage and stability in employment and inventories using Canadian data for the manufacturing sector. Recent empirical studies focusing on the U.S. manufacturing sector have shown that highly leveraged firms have more volatile inventory and employment patterns. In the event of a negative demand shock, firms must find new funds to finance variable inputs. A firm with a healthy balance sheet position may have the cash on hand, or easy access to external finance, to smooth production by building up inventories (Blinder & Maccini, 1991) and avoid the large adjustment costs associated with the firing (and hiring when demand picks up later) of employees (Nickell, 1986; Oi, 1962). On the other hand, if a firm has difficulty obtaining outside finance, its employment and inventories should be more sensitive to the availability of internal funds. Cash flows at highly leveraged firms tend to be committed to principal and interest payments, and lenders may see the firm as having reached its maximum debt capacity. Hence, the cost of additional debt to a financially distressed firm is likely to be high. As a result, leveraged firms will tend to lay off workers (Sharpe, 1994) and allow inventories to decline (Carpenter, Fazzari, & Petersen, 1994; Kashyap, Lamont, & Stein, 1994). Alternatively, firm owners may prefer higher debt to force firm managers to respond quickly to changes in the economic environment (Jensen, 1986, 1988). In either case, employment and inventory instability is the outcome.

Similar arguments have been put forth regarding small firms. Small firms also face capital market constraints since they often do not have access to equity markets and often need to finance their operations with more expensive bank loans. Thus, small firms are often also seen as financially constrained and more sensitive to demand shocks than large firms (Gertler & Gilchrist, 1994; Gertler & Hubbard, 1988).

Interestingly, there is reason to believe that the impact of financial vulnerability on employment and inventory may be larger during recessions. A substantial literature has arisen to describe the so-called "financial accelerator", which is summarized in Bernanke, Gertler, and Gilchrist (1996). The basic implications of the financial accelerator can be described as follows. The first is that small firms and firms with unhealthy balance sheets will bear the brunt of deteriorating credit market conditions following a real or monetary shock, because lenders flee from firms that face significant agency costs of borrowing, a phenomenon referred to as the "flight to quality". Agency costs refer to the higher return necessary for external financing compared to internal financing required to compensate for conflicting incentives facing managers and owners, and the costly monitoring of managerial action. Other things being equal, agency costs should be higher when leverage is high and when the firm is small.[2] Reduction in credit available to these firms will exacerbate the problems related to reduced net worth at the firm, causing them to reduce output and investment more than otherwise for a similar demand shock. The second implication is that the reduction in spending and production of credit-constrained firms will spread to other firms, propagating and amplifying the downturn. This suggests a route by which increased debt in the corporate sector may lead to higher macro-economic instability. It is also hypothesized that the influence of financial vulnerability should be greater the deeper the recession (Gertler & Hubbard, 1988; Kashyap et al., 1994).

Bernanke and Gertler (1989) and Calomiris, Orphanides, and Sharpe (1994) describe this same phenomenon in terms of "debt deflation". When a shock provokes an unanticipated fall in the general price level, the ensuing reduction in the collateral value of assets decreases the capacity of the firm to raise external funds, or "debt overhang". Firms tend to run up debt during expansions, and are more vulnerable to the effects of debt overhang at cyclical peaks as a result of their high leverage. The literature also raises the possibility that if the macroeconomic shock was the result of a monetary policy to raise the interest rate, this may have an effect on the cost of a leveraged firms' outstanding debt (Bernanke & Blinder, 1988). Higher interest rates also affect the cost a firm incurs in carrying inventory (Kashyap et al., 1994). Finally, the literature suggests that inflation might be lower than expected during a recession, increasing the real cost of external capital (Bernanke & Campbell, 1988; Bernanke & Gertler, 1989).

In this paper, we investigate the empirical association between sales fluctuations and employment and inventory stability for firms with high and low levels of capital market constraints, distinguished by size and leverage. We show that: (a) financially vulnerable firms (those with high agency costs and high levels of capital constraint), identified as firms with high leverage or smaller size, downsize their labour force more in the face of declining product demand than other firms; (b) highly leveraged firms reduce their workforces more in recessions than expansions for an equal-sized demand shock; and (c) firms in more cyclical sectors of the economy are affected more than other firms. These results are consistent with the idea that credit market constraints are more binding for these firms, that credit market constraints become more binding during recessions, and that the effect is non-linear and worsens the deeper the recession.

In the next section, we discuss some of the recent empirical work linking financial vulnerability to the real

economic activity of firms, which includes employment, inventories, investment, and R&D spending. The literature generally uses U.S. data, although there are some notable Canadian contributions. In the third section we describe our data and model. In the fourth section we describe the empirical relationship between leverage, size, and employment fluctuations over the business cycle and in the fifth section we describe the empirical relationship between leverage, size, and inventory fluctuations. We are careful to describe our results in correlational terms. One important challenge for this research is to identify the extent to which credit constraints cause larger real-side fluctuations. It is equally plausible that firms that are better at downsizing their labour force can attract debt at a more reasonable cost than those that are inefficient at downsizing (in essence, arguing that leveraged firms are not credit constrained). These firms may have better managerial controls and can react more quickly to changes in product markets and thus are safer credit risks. In the final section of this paper, we discuss the implications of our results and to what extent they indicate a causal association between financial vulnerability and increased business cycle fluctuations in employment and inventories.

Background

An extensive review of theoretical and empirical studies connecting financial and real economic activity can be found in Bernanke et al. (1996) or Hubbard (1998). This section reviews research most relevant to the present study, but it is not in any sense an exhaustive review.

Fazzari, Hubbard, and Petersen (1988) investigate the link between cash flow and investment behaviour for two classes of fast growing firms: those with low dividend payouts and those with high dividend payouts. They argue that firms with high dividend payouts are less likely to be financially constrained (or else they would issue lower dividends). Given the theoretical association between financial vulnerability and real-side fluctuations, one would expect to see that fluctuations in cash flow among high dividend payout firms would affect investment less than in low dividend payout firms. The key empirical advancement of this approach was that dividing firms into two classes based a priori on their expected financial vulnerability provides a test of the implications of the theory. Even if cash flow is endogenously related to investment, a larger association between cash flow and investment among financially vulnerable firms illustrates the link between financial variables and real-side outcomes. They find that investment is more sensitive to cash flow fluctuations in firms that were a priori identified as being more financially vulnerable.

Since Fazzari et al. (1988), numerous studies have utilized this classification approach to identify the influence of financial vulnerability. Gertler and Hubbard (1988) and Gertler and Gilchrist (1994) point out that smaller firms may be particularly vulnerable to imperfect capital markets. They suggest that informational frictions that add to the costs of external finance apply proportionately more to small firms because they have relatively limited options available for raising external funds, which is evidenced by their relatively high use of cash flow and bank debt.[3] Other researchers, such as Hoshi, Kashyap, and Scharfstein (1991), Schaller (1993), and Chirinko and Schaller (1995) use firm membership in an industrial group to identify firms with lower informational frictions. These latter two papers are also notable in that they, along with this study and Mentzer (1996), which we discuss below, make up most of the Canadian literature (that we are aware of) on this subject.[4]

While the studies above examined the impact of credit market constraints on investment, the same arguments can be applied to other real-side outcomes. This would include factors that are presumed to be "quasi-fixed" in the long run such as employment (Calomiris et al., 1994; Gertler & Hubbard, 1988; Sharpe, 1994), as well as highly liquid assets such as inventories (Calomiris et al.; Carpenter et al., 1994; Kashyap et al., 1994). Other studies have examined the impact of credit market constraints on R&D (Himmelberg & Petersen, 1994), mark-ups (Chevalier & Scharfstein, 1996), and market share (Opler & Titman, 1994).

Many studies use exogenous changes in the economy that are expected to affect credit market conditions to identify the influence of credit constraints on real side outcomes. Other things being equal, deterioration in credit market conditions will affect credit-constrained firms more than those that are not credit market constrained. Kashyap et al. (1994) and Gertler and Gilchrist (1994) examined inventory investment following periods of tight monetary policy. Zingales (1998) used deregulation in the U.S. trucking industry to identify an exogenous shock in the competitive environment, which worsened the financial position of existing firms. Zingales found that high leverage significantly decreased the probability of survival.

Other studies use fluctuations in the business cycle to identify the influence of financial vulnerability on firm side characteristics (Calomiris et al., 1994; Chevalier & Scharfstein, 1996). According to the financial accelerator theory, smaller firms and firms with weak balance sheets should experience a relative rise in the cost of external finance and reduce output more in the

face of economic downturn. Since recessions are exogenous, so are the resulting shocks to credit markets. Changes in credit markets should affect smaller and more leveraged firms more than other firms, so we should see the employment and inventories of these firms affected more in recession than other firms. A further implication of the financial accelerator is that the effect will be greater the larger the recession. We test this latter implication by examining the influence of financial vulnerability on firms in the durables and non-durables manufacturing sectors separately. Since we know that cycles are larger in the durables sector, we would expect the financial accelerator to be more active in this sector.

A few studies have empirically examined the impact of financial vulnerability on employment in a similar manner to this study. Cantor (1990) investigates the impact of sales and cash flow variations on employment and investment growth rates for the U.S. corporate sector. Both sales and cash flow are included to control for the variability of demand, input costs and interests payments. He finds that investment and employment vary positively with sales and cash flow. Interestingly, he also finds that the outcomes vary more for highly leveraged firms. Leverage acts as an important state variable, which conditions a firm's response to demand shocks.

Sharpe (1994) introduced a different model because he argued that the Cantor model did not consider the endogenous aspect of cash flow (cash flow is related to leverage by definition). Sharpe used firm level data and a model that employs the business cycles as an instrument for demand and financial conditions to find a significant relationship between a firm's financial leverage and the cyclicality of its labour force. His results also show that employment growth over the business cycle is more sensitive to demand and financial market imperfections at highly leveraged firms, and that the costs of maintaining a firm's labour force over cyclical fluctuations are better borne by larger corporations. Similar conclusions come from Calomiris et al. (1994), who test if the responsiveness in employment, investment, and inventory to exogenous changes in sales depend on the leverage of the firm. The results show that leverage and firm size both play an important role in determining the firm's outcomes and that the size and significance of leverage conditioning effects are larger during recessions.

On this side of the border, Mentzer (1996) provides an example of the effects of sales and net income on employment growth using a small sample of Canadian firms, but fails to find any consistent relationship between past profit and the propensity to downsize. He also tests the effect of leverage but similarly could not find a significant relationship, although the size of his sample (from 82 to 122 observations) may have made identification of a significant effect difficult. Other Canadian research from Schaller (1993) and Ng and Schaller (1996) examines the influence of credit constraints on firm investment using a small sample of Canadian firms. The present study is the first Canadian study to examine the implications of financial structure for employment and inventory fluctuations with a large dataset, and is the first Canadian study to examine the cyclical implications of credit constrained firms.

Data and Method

We want to know how firms respond to changes in product demand, and whether financially healthy firms respond differently than firms that are financially vulnerable. To do so, we have selected a method already used on several occasions to investigate the impact of leverage in the U.S. manufacturing sector (Calomiris et al., 1994; Cantor, 1990; Sharpe, 1994). We briefly explain this method and our data in this section.

The central assumption of this method is that variations in employment (or inventory) growth rate depend on variations in sales growth and that variations will be larger for firms which we identify a priori as more credit constrained, or financially vulnerable to changes in credit market conditions. Thus, we focus on the elasticity of employment (or inventory) growth with respect to variations in sales for firms classified by their level of leverage and size. Leverage and size, therefore, are introduced into the model as state variables that affect the size of the sales to employment elasticity. (The elasticity is a statistical relationship between two variables that shows to what extent one variable changes when another variable changes.) Employment responses to changes in product demand are estimated using a regression methodology:

$$\begin{aligned} GEMP_0 = {} & ß_0 + ß_1 GEMP_{-1} + ß_2 GSAL_{0,-1} + \\ & ß_3 LEV_{-2} + ß_4 SIZE_{-2} + \\ & ß_5 \{LEV_{-2} * GSAL_{0,-1}\} + \\ & ß_6 \{SIZE_{-2} * GSAL_{0,-1}\} \end{aligned} \quad (1)$$

The dependent variable ($GEMP_0$) is the employment percentage change within the firm over one year and $GSAL_{0,-1}$ is the average percentage change in sales over the last two years.

The two other important variables are the conditioning influence of leverage on employment elasticity ($LEV_{-2}*GSAL_{0,-1}$) and the conditioning influence of size on employment elasticity ($SIZE_{-2}*GSAL_{0,-1}$). The firm leverage variable and the firm size variable are interact-

ed with the firm sales growth variable to produce variation in elasticities for firms having different sizes and leverage ratios. Thus, the estimators related to these two covariates show by how much the elasticity of employment (or inventory) to sales of the firm should be affected if the firm is above (or under) the average leverage or the average size, all other things being equal. Our central hypothesis argues that this elasticity will be larger for small and highly leveraged firms. Leverage and size are included in twice lagged form to reduce endogeneity associated with simultaneous movements of sales and leverage or size. That is, since leverage and size are measured before the change in sales and employment, then it is less likely that there is a large problem with reverse causality, whereby changes in sales or employment are affecting leverage.

Following Calomiris et al. (1994), we set leverage values above one to be equal to one to reduce the impact of outliers. Other approaches for dealing with outliers gave substantially similar results. Before estimating the equation, we standardize the leverage and size variables to mean = 0 and standard deviation = 1. Thus, $ß_2$ is the elasticity of employment with respect to sales for a "typical" firm with average leverage and average size, $ß_2 + ß_5$ is the elasticity of employment with respect to sales for a firm with average size and leverage one standard deviation above the mean, and so on.

The model also controls for direct effects of leverage (LEV_{-2}) because firms borrow in order to grow, and size ($SIZE_{-2}$) because small firms traditionally grow faster than larger ones. Independent variables also include past employment growth rates ($GEMP_{-1}$), to control for the fact that firms that grew or declined in past periods may also be likely to do so in the current period. The same model can be applied to estimate fluctuations in inventories—all explanatory variables remain the same, except that $GEMP_{-1}$ is replaced by inventory growth in year t-1.

As we suggested earlier, the firm's employment (or inventory) response to a change in product demand may be different during periods of economic growth and periods of economic decline due to a reduction in credit available. We follow the lead of several other papers in this literature and use the business cycle to indicate an exogenous change in credit market conditions. If smaller and leveraged firms are more credit constrained, then, in the face of recession, smaller and more leveraged firms should see the cost of finance increase more than their less leveraged counterparts, resulting in a larger decline in output. This hypothesis yields a strategy for identifying the influence of financial vulnerability on employment outcomes, using the recession of 1990-92 as an exogenous change in credit market conditions. We use a close variant of Model 1:

$$\begin{aligned} GEMP_0 = {} & ß_0 + ß_1 GEMP_{-1} + ß_2 PGSAL_{0,-1} + \\ & ß_3 NGSAL_{0,-1} + ß_4 LEV_{-2} + ß_5 SIZE_{-2} + \\ & ß_6 P\{LEV_{-2} * GSAL_{0,-1}\} + \\ & ß_7 N\{LEV_{-2} * GSAL_{0,-1}\} + \\ & ß_8 P\{SIZE_{-2} * GSAL_{0,-1}\} + \\ & ß_9 N\{SIZE_{-2} * GSAL_{0,-1}\} \end{aligned} \quad (2)$$

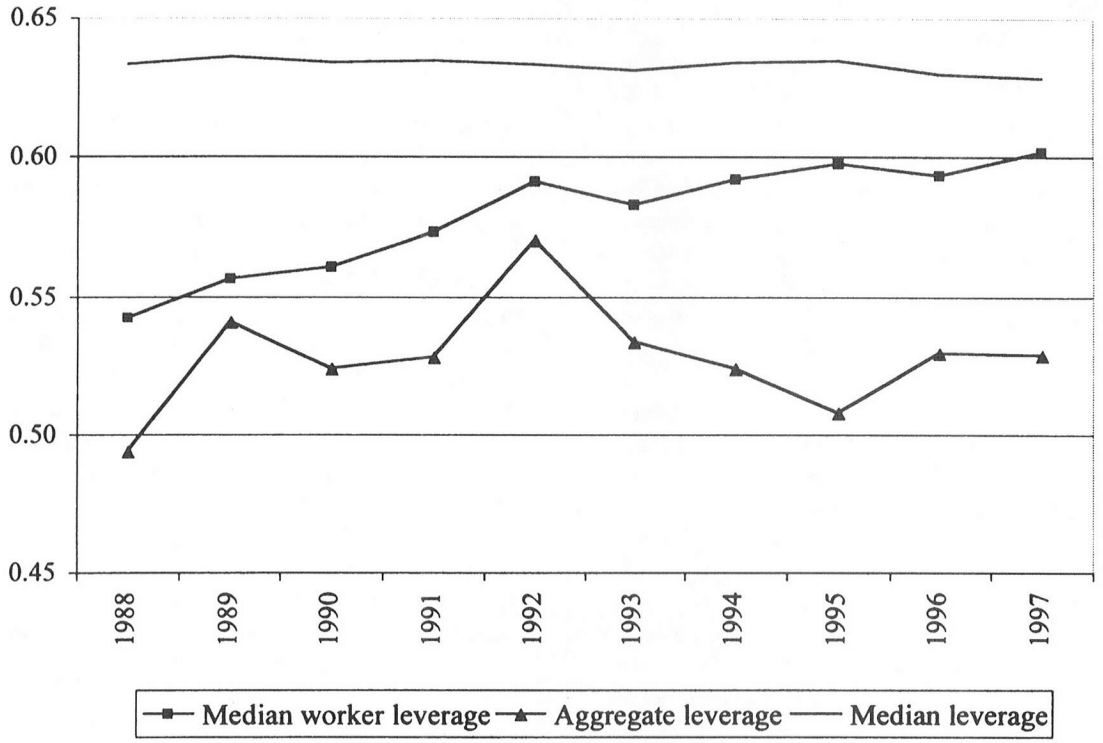
In this variant, P = 1 and N = 0 during periods of growth and P = 0 and N = 1 during periods of decline. Thus, Model 2 allows sales elasticity and the conditioning impact of leverage and size to vary with the state of the economy and will be particularly useful to test the assumption that the relation between financial conditions and employment elasticity is stronger during recessions. Unfortunately, Model 2 could not be applied to model fluctuations in inventory because inventory data for two recession years are missing (1991 and 1992). Both models have been estimated by using the ordinary least squares method (detailed results are shown in the Appendix).

The models outlined in Models 1 and 2 represent our first attempt at identifying the influence of financial conditions on employment stability. Using OLS to estimate these models opens the results to the criticism that the results are correlational and not indicative of a causal influence, despite the a priori sorting of firms into those we expect to have larger informational frictions and those with less. In future work, we plan to investigate the possibility of identifying the causal influence of financial vulnerability on employment stability.

Our dataset is constructed from T2 corporate tax records of Canadian firms, linked to Statistics Canada's "Longitudinal Employment Analysis Program" (LEAP) at the individual firm level for the years 1984 to 1998. The T2/LEAP includes all incorporated public and private businesses operating in all sectors of the economy. It excludes own-account self-employed but not self-employed owners of incorporated businesses, who are employees of the corporation.[5] Variables examined include annual values of assets, equity, sales, inventory, and employment for each firm. Assets and equity are measured at book value, sales are measured on a per-year basis, and each of these variables is deflated using the industrial price index. The measure of leverage we employ in this study is one minus equity/assets, which yields the equivalent of liabilities over assets.[6]

The annual measure of employment is an approximation of the labour activity of the firm and is referred to as "average labour units" (ALU). These units of labour are computed by taking the total payroll of the enterprise for the year, divided by the average annual income of workers in the corresponding province, size class, and industry (3 digit SIC-level). Therefore, these units must be understood in terms of "standardized

Figure 1
Selected Indebtedness Measures



labour units" rather than "full-time equivalent workers". However, annual changes in the number of ALUs are similar to annual changes in the number of paid workers estimated by the Labour Force Survey, and can be interpreted as a reliable source of information about labour market activity.[7]

Our sample includes all manufacturing firms that reported at least 50 employees in at least one year between 1984 and 1998. We focus on manufacturing firms in order to produce results that are comparable to other work such as Calomiris et al. (1994) and Sharpe (1994). We have also run experiments based on firms which had 25 or more employees in at least one year and found that our conclusions were largely unaffected, although coefficients and standard errors tended to be slightly larger. This would reflect measurement error in estimating employment introduced by the process described above, which is likely to be more important in small firms. One weakness in related work on this subject, for example Calomiris et al. (1994) and Sharpe (1994), is that their results apply only to very large publicly traded manufacturing companies.

In addition, we have excluded firms that do not have positive counts of ALUs for at least three consecutive years because some of the variables of the model are measured in twice-lagged form. We consider the year of entry as the first full calendar year of the firm. Similarly, the last year of operation is the most recent calendar year entirely completed by the firm. This method excludes firms in the birth and death years. In the end, we have available nearly 60,000 observations over 10 years for the employment experiment. Firm entry and exit dictates that our sample size varies from year to year, but this gives an average of about 6,000 firms per year.

To compute employment for each firm, we employed the method suggested in Brander, Hendricks, Amit, and Whistler (1998), in which E refers to the number of employed individuals on a yearly basis:

$$G_t = (E_t - E_{t-1}) / E^*_t \qquad (3)$$

where $E^*_t = (E_t + E_{t-1}) / 2$ and t refers to time. This rate, referred to as the "arc growth rate", measures growth relative to the average size of the firm during the current and the immediate precedent period. Hence, the value of G_t lies in the interval]-2,2[. This method has the advan-

Table 1
The impact of leverage and size on employment elasticity

	Elasticity of employment to sales for firms with...		
	Average leverage, Average size	High leverage, Average size	Average leverage, Smaller firms
All firms (1988-97)	0.392 (0.004)	0.428* [+9.2%] (0.005)	0.479* [+22.2%] (0.006)

Percentage difference from average leverage and size is indicated in square brackets.
Standard errors are in parenthesis.
*significantly different from average leverage and average size at 5%.
~significantly different from average leverage and average size at 10%.

tage of reducing the undesired impact of outliers; for firms with moderate growth, this method yields similar growth rates to the more standard approach of using the initial year size as the base for calculating a growth rate.[8] Sales and inventory growth are derived in a similar manner. All financial variables were converted to real terms by dividing through the Industrial Price Index.

The sample used for the inventory experiment does not include data for the years 1991-1992. Like the employment sample, we included firms with at least three consecutive years of positive counts of inventories. Thus, the inventory sample includes approximately 30,000 observations.

Firm Leverage over the 1980s and 1990s

Figure 1 shows leverage evaluated in three different ways. Aggregate leverage (the sum of total firm liabilities divided by total firm assets) rose slightly during the recession years of 1990-1992 but declined sharply afterwards. This is consistent with aggregate results showing that Canadian firms reduced debt in the years following the 1990s recession (Statistics Canada, 2000; Zyblock, 1997). Nevertheless, other measures of leverage followed different paths. Leverage at the median firm remained relatively constant between 1988 and 1997, at 0.63. More interestingly, the median leverage of workers (where the workers' leverage is that of their employer) increased from 0.54 to 0.60 over the same period. This suggests that more workers are employed in highly leveraged firms, and that results of the impact of leverage on employment apply to a non-declining group of workers.

The Relationship between Leverage, Size, and Employment

Leverage, Size and Employment: All Firms, All Years

What is the relationship between leverage and size and the elasticity of employment to sales? To answer this, we estimate Model 1. Coefficients are presented in Table A-1 of the Appendix, but for the purposes of this discussion it is useful to display the results in terms of elasticities. We examine how employment responds to changes in sales under three different situations: (a) the typical firm (average leverage and size); (b) the high-leveraged firm (average size and high leverage); and (c) the small firm (average leverage and small size). High leverage corresponds to a firm located one standard deviation above the average leverage, and a small firm is equivalent to a firm located one standard deviation under the average size. The measure of firm size corresponds to the firm's number of workers.

We first examine the impact of leverage and size on employment growth. Table 1 shows the elasticity of employment for the three types of firms. For a firm with average leverage and average size, the elasticity of employment to sales is 0.392, indicating that such a firm would respond to a 10% drop in sales by cutting employment by 3.92%. Do firms with more leverage and smaller firms downsize more in the face of declining product demand? Firms with high leverage have an elasticity of 0.428, indicating that such firms would drop 4.28% of their workforce in the face of a 10% decline in product demand. This elasticity was 9.2% larger than that of an average firm, indicating a considerable impact of leverage on the responses of firms to demand shocks. Smaller firms have an even higher employment elasticity of

Figure 2
The cyclical path of average and high-leveraged firms

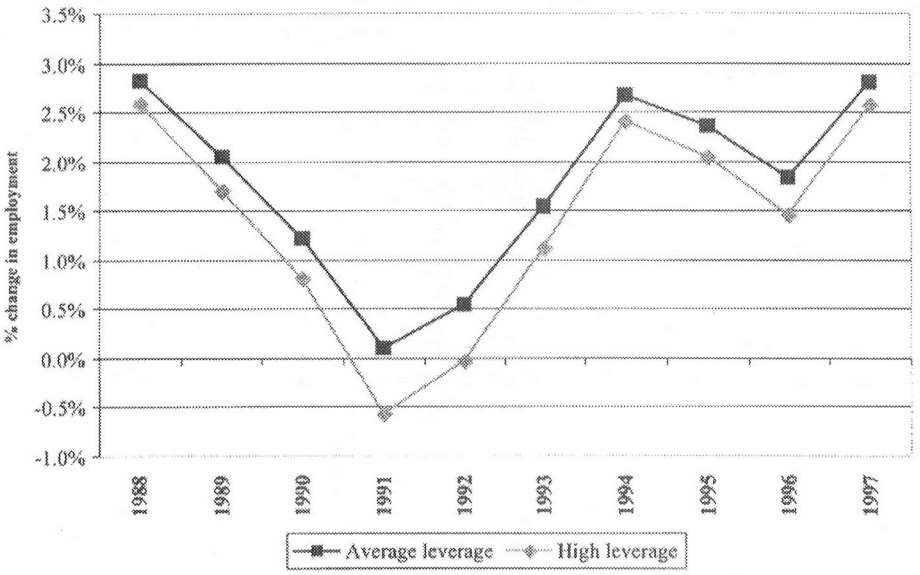


Table 2
The Impact of leverage and size on employment elasticity over the business cycle

	Elasticity of employment to sales for firms with…		
	Average leverage, Average size	High leverage, Average size	Average leverage, Smaller firms
Expansion (1988-89, 1993-97)	0.378 (0.005)	0.407* [+7.7%] (0.006)	0.468* [+23.8%] (0.006)
Recession (1990-92)	0.424 (0.008)	0.474* [+11.8%] (0.010)	0.508* [+19.8%] (0.010)

Percentage difference from average leverage and size is indicated in square brackets.
Standard errors are in parenthesis.
*significantly different from average leverage and average size at 5%.
~significantly different from average leverage and average size at 10%.

0.479, which is 22.2% higher than a firm with average size.[9]

Leverage, Size, and Employment over the Business Cycle

Above we suggested that the relationship between financial vulnerability and employment growth and decline should also be larger in recession than recoveries because credit constraints become more binding in recession. To examine this question, we estimate Model 2 and report the results in terms of elasticities in the manner described above (complete results for Model 2 are presented in Table A-2 of the Appendix).

These results are introduced in Table 2 and show that the impact of leverage is not the same across the business cycles. During years of expansion and recovery, leverage raises the elasticity of sales on employment growth by 7.7%, but the same effect surges to 11.8% during periods of economic downturns, meaning that

Table 3
The impact of leverage and size on employment elasticity over the business cycle, durables and non-durables

	Elasticity of employment to sales for firms with...		
	Average leverage, Average size	High leverage, Average size	Average leverage, Smaller firms
Durables			
All firms (1988-97)	0.411	0.427 [+3.9%]	0.503* [+22.4%]
	(0.007)	(0.008)	(0.009)
Expansion (1988-89, 1993-97)	0.395	0.403 [+2.0%]	0.492* [+24.6%]
	(0.008)	(0.010)	(0.010)
Recession (1990-92)	0.447	0.484* [+8.3%]	0.529* [+18.3%]
	(0.012)	(0.015)	(0.015)
Non-durables			
All firms (1988-97)	0.377	0.427* [+13.3%]	0.460* [+22.0%]
	(0.006)	(0.007)	(0.007)
Expansion (1988-89, 1993-97)	0.363	0.409* [+12.7%]	0.445* [+22.6%]
	(0.007)	(0.009)	(0.009)
Recession (1990-92)	0.408	0.468* [+14.7%]	0.494* [+21.1%]
	(0.010)	(0.013)	(0.013)

Percentage difference from average leverage and size is indicated in square brackets.
Standard errors are in parenthesis.
*significantly different from average leverage and average size at 5%.
~significantly different from average leverage and average size at 10%.

highly leveraged firms reduce employment more in response to a shock in sales during recession than expansion. Employment growth responds more to changes in sales in small firms (+23.8% in expansion and 19.8% in recovery), which suggests that larger firms dampen fluctuations in employment relative to demand more effectively than smaller firms. However, the size factor does not vary significantly along with changing economic conditions. The 23.8% increase in the expansion and the 19.8% increase in the recovery are not statistically different from one another. These findings are consistent with the financial accelerator theory described above. Firms which we have a priori identified as having restricted access to external markets—in this case highly leveraged firms—see their sales elasticity rise in recession relative to those which were not a priori identified as being financially constrained. We did not find that the sales elasticity rose proportionately more in smaller firms, which we also expect to be financially constrained during recession, but this may reflect the fact that firms in our sample are still, at 50 or more employees, relatively large.

Figure 2 provides a graphic illustration of the changing impact of leverage over the business cycle. From the results obtained with our estimation method, we can generate the predicted employment growth of a typical firm (with average leverage, average size, and annual sales growth set at the average for all manufacturers in our sample) over the years 1988 to 1997 (top curve). We also generate predicted employment growth for firms above the average leverage (bottom curve).[10] From 1988 to 1991, a period corresponding to declining employment growth rates, the average firm experienced a drop in employment growth from 2.8% to 0.1% (down 2.7%), whereas highly leveraged firms experienced a larger drop, from 2.6% to –0.6% (down 3.2%). At first glance, such numbers might appear small. However, in this example, a highly leveraged firm reduced employment by about 15% more than the average firm, which is a significant difference.

Leverage, Size, and Employment in Durables and Non-Durables Industries

Table 3 shows results for two sub-divisions of the manufacturing sector: firms producing durable goods,

Table 4
The impact of leverage and size on inventory elasticity

	Elasticity of inventory to sales for firms with...		
	Average leverage, Average size	High leverage, Average size	Average leverage, Smaller firms
All firms	0.997 (0.012)	1.045~ [+4.8%] (0.015)	0.963 [-3.5%] (0.016)

Percentage difference from average leverage and size is indicated in square brackets.
Standard errors are in parenthesis.
~significantly different from average leverage and average size at 10%.

and firms producing non-durable goods. The rationale of doing so is that the impact of financial constraints may be felt differently across various industrial groups because the magnitude of cyclical fluctuations is not the same across all industries. The financial accelerator theory suggests that the influence of credit market constraints will be felt more the deeper the recession. Since we know that recessions are deeper in the durables sector of manufacturing, we can classify firms according to whether they are in the sector we expect to be more credit constrained in the event of a downturn and examine the differential impact on employment. In fact, the elasticity of employment to sales of a typical firm in both sectors is also relatively different, from 0.411 for durables to 0.377 for non-durables (see Tables A-1 and A-2 of the Appendix for detailed regression results). Another reason for examining industry sectors is that what matters might be your financial vulnerability relative to others in your industry (Campello, 2003).

It appears that the impact of high leverage on employment elasticity differs across the two sectors: at 13.3%, the overall impact of leverage on employment elasticity is stronger for non- durables than for durables (+3.9%). However, the results obtained for durables demonstrate that leverage has a significantly greater conditioning impact on employment growth during recessions (+8.3%), because the link between employment growth and leverage is not significant during expansions (+2.0%). This is not the case for firms producing non-durables, in which the effect of leverage does not differ significantly across the business cycle. As indicated above, cycles are larger in the durables sector, which may result in more strongly binding constraints during recessions than those in the non-durables sector.

In both sectors, the effect of firm size is still significant but does not vary significantly across the industrial sectors and across the economic cycles. Smaller firms have higher employment fluctuations by 18% to 25%, depending on the economic context or the sector in which the firm operates; however, these differences were not statistically significant from one another. In other words, being large strongly enhances the capacity of the firm to dampen employment fluctuations in the two broadest industrial categories, and the impact of size has no specific business cycle effects.

The Relationship between Leverage, Size, and Inventories

Leverage, Size, and Inventories: All Firms, All Years

In this section, we examine the impact of leverage on inventory fluctuations. As mentioned earlier, the inventory sample contains data for only the periods 1988-1990 and 1993-1997, which does not allow a complete analysis of the effects of leverage and size over the business cycle. Therefore, we discuss only the results of Model 1. Results of Model 1 for inventories are available in Table A-3 of the Appendix.

According to Table 4, the elasticity of inventory to sales is 0.997 for firms with average leverage and average size, which suggests that fluctuations in sales and inventory move almost perfectly with each other. The results also demonstrate that inventories are much more responsive than employment to fluctuations in sales, as expected.

Interestingly, leverage also has a small but significant impact on the close relationship between sales and inventory changes. Firms that are one standard deviation above the standard leverage increase their elasticity of inventory to sales by 4.8%, which suggest that firms with heavier debt loads rely more on short-term assets to

Table 5
The impact of leverage and size on inventory elasticity, durables and non-durables

	Elasticity of inventory to sales for firms with…		
	Average leverage, Average size	High leverage, Average size	Average leverage, Smaller firms
Durables	0.947 (0.019)	0.952 [+0.5%] (0.023)	0.897 [-5.3%] (0.024)
Non-durables	1.041 (0.016)	1.124* [+8.0%] (0.020)	1.019 [-2.1%] (0.021)

Percentage difference from average leverage and size is indicated in square brackets.
Standard errors are in parenthesis.
*significantly different from average leverage and average size at 5%..

finance themselves. Firm size has no significant impact on inventory changes, which shows that size matters much more for employment volatility than for inventory fluctuations.

Leverage and Inventory, Durables and Non-durables Industries

According to Table 5, the elasticities of inventory to sales are 0.947 and 1.041 for durables and non-durables respectively. Interestingly, the conditional impact of leverage is estimated at 8.0% in the non-durables sector, but has almost no impact in durables industries, possibly because inventories are generally easier to liquidate in non-durables industries. Our results also suggest that inventory changes of durable and nondurable industries may not be influenced by size.

Discussion

In the preceding two sections, we examined the relationship between sales and employment for firms that we a priori identify as being financially constrained and not financially constrained. We find, in accordance with the theory, that the elasticity of employment with respect to sales is larger for those firms that we expect to have higher agency costs, specifically, smaller (+22.2%) and highly leveraged firms (+9.2%). The same theory suggests that agency costs rise more for financially constrained firms during recession, for which we also find evidence. Employment elasticities at highly leveraged firms were found to increase by 11.8% with the onset of recession, compared to 7.7% during expansion. Finally, theory suggests that the deeper the recession, the larger the influence of financial vulnerability. We find, in accordance with this theory, that the employment elasticity of financially constrained durables manufacturers (a more cyclical industry sector) rose more than four times faster during recession than expansion, compared to the non-durables sector which rose only slightly faster in recession. This confirms most of the major predictions of the financial accelerator model, suggesting that increased leverage in the corporate sector has affected employment stability. Our results appear more binding in the case of leverage than firm size, which might be because our sample includes only firms with more than 50 employees.

We cannot be definitive about this result, since there remains a potential that our results could be generated by reverse causality. It could be that our main instrument for financial instability, corporate leverage, may be in fact the result of employment instability. That is, unstable employment causes firms to have a higher leverage position. This could occur if lenders see firms that quickly shed labour in the event of a shock to product demand as being more credit worthy. This explanation also implies that highly leveraged firms are not credit constrained. However, under this assumption, it is not easy to explain why such firms would downsize their employment faster in recession. If such firms were not credit constrained, then in the event of a recession they would not face a relative reduction in credit and would not need to lay off even more workers for an equal sized sales shock. Hence, our results describing increased elasticities in recession for such firms are consistent with the financial

accelerator hypothesis, but not the alternative hypothesis described above. Furthermore, it does not help us explain why the employment to sales elasticity rose more in the sector that took a larger downturn in the 1990s recession. If these firms were not credit constrained, as argued by the alternative hypothesis, then one would not have expected to see these firms downsize more during a recession than during an expansion for an equal sized demand shock.[11]

The main implication of these results is that increased financial instability, related to more corporate leverage, may have increased employment instability by an important margin. While we do not know why corporate leverage increased so much in Canada over past decades, theory suggests that this may have raised the financial vulnerability of the corporate sector in Canada, which has in turn affected the stability of employment. As noted in the introduction, Jensen (1986, 1988) has argued that firm owners may prefer higher debt in their capital structure in order to cash constrain their managers, and force them to react quickly in the face of changing economic conditions. If our results can be interpreted causally, then the increased financial instability in firms may have resulted in shifting some of the risk of business from the owners of firms to the employees.

There are also important potential macroeconomic consequences to increased debt. Researchers have argued that the recession of the 1990s was deeper and longer than previous recessions in part because of the high level of debt held by firms (Calomiris et al., 1994). This high debt severely limited the options available to firms that, in order to survive, may have had to downsize more than otherwise. This paper finds empirical evidence that high levels of corporate debt were in fact related to increased levels of job destruction, and that this was particularly evident during the 1990 to 1992 period. This interpretation is also supported by the fact that higher debt levels were associated with more volatile inventory changes.

Notes

1 Zyblock (1997) argues that in Canada this increase in the use of debt to finance expansion was due to two factors: (a) expansion in Western Canada, especially in the energy sector; and (b) a low (in some years negative) real cost of debt, especially in the 1970s. In addition, corporate tax policy had a positive impact on leverage, since interest expenses were deductible from taxable income (Shum, 1996).

2 This discussion should distinguish between informed (bank) and uninformed debt (Diamond, 1991; Rajan, 1992). Banks can reduce the agency costs associated with lending to small and medium sized firms in a variety of ways, such as screening prospective clients, and provide information to other lenders about the quality of the investment. As noted by Bernanke et al. (1996), the flight to quality predominantly affects the market for uninformed debt, although they cite some evidence that bank loans also are affected. Our data do not distinguish between informed and uniformed debt, preventing us from examining this issue more fully. Firms with equal sized total debt may face different agency costs depending on the mix of informed and uninformed debt. This implies some measurement error in our use of leverage to indicate the presence of capital constraints. The likely effect of this will be to reduce the size of our estimated coefficients associated with firm leverage.

3 Some research that studied the relationship between financial status and investment has demonstrated that the sensitivity of investment to cash flow was not necessarily stronger for more financially constrained firms when other approaches are used to classify firms according to their financial status (Cleary, 1999; Kaplan & Zingales, 1997). A thorough discussion of the issue is found in Hubbard (1998).

4 Whited (1992) and Hubbard, Khashyap, and Whited (1995) are two examples where the relationship between finance and investment are structurally modelled.

5 This dataset includes Canadian controlled corporations, plus branches of foreign firms. It may be that the leverage of foreign controlled firms does not accurately reflect their true leverage, implying some measurement error in our use of leverage to indicate the presence of capital constraints. As mentioned earlier, the likely effect of this measurement error will be to reduce the size of our estimated coefficients associated with firm leverage.

6 Only book values of balance sheet values are available in this dataset. The increase in the leverage ratio in Canada may be more muted when analyzing the market value of debt. For example, Furstenberg and Malkiel (1977) illustrate that the increased reliance on external funds observed in the U.S. after 1965 was more muted when examining the market value of debt. For a detailed discussion on this topic refer also to Taggart (1985).

7 One possibility is that production and non-production workers will have different sensitivities to a demand shock. In the event of a demand shock it may be easier to cut consultants, accountants, or research and development, rather that production workers. Unfortunately, the data do not distinguish between production and non-production workers, preventing us from examining this question more fully.

8 However, the results obtained with conventional growth rates do not yield substantially different results.

9 Following Booth and Gordon (1981), one could argue that financial constraints or financial subsidies might have a

different impact on firms with different capital-labour ratios. We test this possibility by splitting our sample into those with an asset to employment ratio above one, and those with this ratio below one. We find that the conditional impact of leverage on the relationship between sales and employment in firms with high capital-labour ratios did not differ significantly from the conditional impact of leverage in firms with low capital-labour ratios.

10 Firms above the average leverage in Figure 2 are the equivalent of a firm surpassing the average leverage by two times the standard deviation.

11 An argument for reverse causality could also be made in the case of inventories. Firms with high levels of inventories may be able to borrow more when faced with a more significant downturn than expected. This would make firm leverage endogenous with respect to inventories. Because we do not have observations on inventories across the whole business cycle, we cannot test whether inventories fall more for highly leveraged firms during recessions, or whether they fall more in industries with larger cyclical fluctuations.

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Appendix

A-1: Regression Results for Model (1) – Leverage and Employment

Model	All Firms	Durables	Non durables
Constant	0.006*	0.008*	0.005*
	(0.001)	(0.002)	(0.001)
Lag employment growth rate	-0.123*	-0.133*	-0.114*
	(0.004)	(0.006)	(0.005)
2nd lag of leverage	-0.003*	-0.004*	-0.003
	(0.001)	(0.002)	(0.001)
2nd lag of firm size	-0.035*	-0.036*	-0.033*
	(0.001)	(0.002)	(0.001)
Current and lagged sales growth	0.392*	0.411*	0.377*
	(0.004)	(0.007)	(0.006)
Current and lagged sales growth * 2nd lag of leverage	0.036*	0.016*	0.050*
	(0.003)	(0.005)	(0.004)
Current and lagged sales growth * 2nd lag of firm size	-0.087*	-0.092*	-0.083*
	(0.003)	(0.005)	(0.005)
Number of observations	59,370	24,910	34,460
R-square	15.3	16.8	14.1

* significant at the 5% level

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Appendix

A-2: Regression Results for Model (2) – Leverage and Employment

Model	All Firms	Durables	Non durables
Constant	0.007*	0.008*	0.005*
	(0.001)	(0.002)	(0.001)
Lag employment growth rate	-0.123*	-0.134*	-0.114*
	(0.004)	(0.006)	(0.005)
2nd lag of leverage	-0.003*	-0.003*	-0.003
	(0.001)	(0.002)	(0.001)
2nd lag of firm size	-0.034*	-0.036*	-0.033*
	(0.001)	(0.002)	(0.001)
Current and lagged sales growth: expansion	0.378*	0.395*	0.363*
	(0.005)	(0.008)	(0.007)
Current and lagged sales growth: recession	0.424*	0.447*	0.408*
	(0.008)	(0.012)	(0.010)
Current and lagged sales growth * 2nd lag of leverage: expansion	0.029*	0.008	0.046*
	(0.004)	(0.006)	(0.005)
Current and lagged sales growth * 2nd lag of leverage: recession	0.050*	0.037*	0.060*
	(0.006)	(0.010)	(0.008)
Current and lagged sales growth * 2nd lag of firm size: expansion	-0.090*	-0.097*	-0.082*
	(0.004)	(0.006)	(0.005)
Current and lagged sales growth * 2nd lag of firm size: recession	-0.084*	-0.082*	-0.086*
	(0.006)	(0.009)	(0.007)
Number of observations	59,370	24,910	34,460
R-square	15.3	16.8	14.2

* significant at the 5% level

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Appendix

A-3: Regression Results for Model (1) – Leverage and Inventory

Model	All Firms	Durables	Non durables
Constant	0.007*	0.007	-0.007
	(0.003)	(0.005)	(0.004)
Lag inventory growth rate	-0.392*	-0.386*	-0.399*
	(0.005)	(0.008)	(0.007)
2nd lag of leverage	-0.013*	-0.014*	-0.012*
	(0.003)	(0.005)	(0.004)
2nd lag of firm size	-0.017*	-0.025*	-0.011*
	(0.003)	(0.005)	(0.004)
Current and lagged sales growth	0.997*	0.947*	1.041*
	(0.012)	(0.019)	(0.016)
Current and lagged sales growth * 2nd lag of leverage	0.048*	0.005	0.083*
	(0.009)	(0.015)	(0.012)
Current and lagged sales growth * 2nd lag of firm size	0.034*	0.050*	0.022
	(0.009)	(0.014)	(0.012)
Number of observations	29,508	12,348	17,160
R-square	23.1	22.2	24.0

* significant at the 5% level

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Appendix

*A-4: Classification of manufacturing industries**

SIC-E	Classification	Observations	% of sample
10: Food	Non-durables	6,015	10.1
11: Beverage	Non-durables	503	0.8
12: Tobacco products	Non-durables	55	0.1
15: Rubber products	Non-durables	478	0.8
16: Plastic products	Non-durables	2,631	4.4
17: Leather and allied products	Non-durables	598	1.0
18: Primary textile	Non-durables	478	0.8
19: Textile products	Non-durables	1,518	2.6
24: Clothing	Non-durables	5,553	9.4
25: Wood	Non-durables	5,231	8.8
26: Furniture and fixture	Non-durables	2,737	4.6
27: Paper and allied products	Non-durables	1,595	2.7
28: Printing, publishing and allied industries	Non-durables	4,676	7.9
29: Primary metal	Durables	1,283	2.2
30: Fabricated metal products	Durables	8,249	13.9
31: Machinery	Durables	4,171	7.0
32: Transportation equipment	Durables	3,315	5.6
33: Electrical and electronic products	Durables	2,952	5.0
35: Non-metallic mineral products	Durables	1,769	3.0
36: Refined petroleum and coal products	Non-durables	201	0.3
37: Chemical and chemical products	Non-durables	2,191	3.7
39: Other manufacturing	Durables	3,171	5.3
All industries	—	59,370	100.0

*Source: Standards Division, Statistics Canada.