

# Impact of Financial distress on the Debt Service Coverage in Ethiopia: A Case of Manufacturing Firms

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## Abstract

It is not uncommon to see manufacturing firms struggling to turnaround from their financial distress. Debt Service Coverage ratio is presumed to play a role in addressing this problem. With this in mind, the main objective of the study is to determine the relationship between financial distress and Debt service coverage of manufacturing firms in Ethiopia for the period from 1999 to 2005. Due to data heterogeneity, non-continuity and because the Hausman test favors it over the Random Effect technique, the panel data General Least Square (GLS) regression method is used. The result proves that liquidity, profitability, and efficiency have positive and significant influence on debt service coverage. On contrary, leverage has negative and significant influence on Debt Service coverage. FD have a negative impact on DSC and leading firms to bankruptcy and liquidation and can cause economic, social and political impact on manufacturing firms and contribute to the CEO resignation, employee's layoff or loss of jobs, dividend reduction, plant closing and related consequential health and moral distress.

**Keywords:** Financial Distress, Debt Service Coverage, Ethiopia

## 1. Introduction

Financial distress is a famous topic of corporate finance under studies worldwide, especially in developed countries. It affects the debt service coverage of the firms in every industry. It results for instance, in loss of firms, resignation of CEO, reduction of dividends, plant closing, layoffs, and plummeting stock prices.

Financial distress is a situation where a firm's operating cash flows are insufficient to cover current debt and the firm is forced to take corrective action.

The Financial distress in the firm adversely affects the performance of the firm and results in lower debt service ratio. It can be said that the impact of financial distress on debt service coverage is negative and the early stage of financial distress could be revenue reduction. The profitability of the firm is decreasing and the liquidity ratio of the firms decline due to high leverage of the firm.

For that matter, one can even question the role of FD on DSC. FD may have a negative effect on the DSC of a firm if they give rise to high leverage, low liquidity, low efficiency and low profitability. FD affects firm's liquidity position which is measured by CA to CL. As long as liquidity is not maintained, many highly leveraged firms are not able to renegotiate their debt agreement if they are breached contract; rather they go for reorganization, acquisition, merger or liquidation.

After all, one may ask, why are we concerned about the debt service coverage? The liquidity, profitability, efficiency and leverage are an important indicator of any firm's performance of DSC and it plays several roles in financial policy decision. First, its significance stems from the fact that the DSC components, reflecting the income-debt ratio, are closely related to the status of the capital structure and financial decision which are key factors of financial stability. Second, a firm's DSC includes the manipulation of its liquidity, profitability, efficiency and leverage, reflecting the totality of EBIDA to total debt with in the firm. Third, since the DSC ratio determines a firm's solvency.

## 2. Background of the study

Now, let's see the nature of debt service coverage and its components in the case of manufacturing companies to the rest of the industries. Debt service coverage is the firm's ability of covering current obligations of fixed charge such as interest, dividend and other fixed charges payable currently. The components of debt service coverage are liquidity, profitability, leverage, efficiency and firm size discounted by fixed charges.

The firm's FD is the early stage of business failure and the symptoms of FD are the firm is desperately short of cash, the firm's suppliers are pushing for faster payments but the borrowings are at or close to the maximum and the firm's monthly accounts, show that the business is losing money consistently (Brealey et al, 2000).

DSC is presumed to play a significant role through minimizing the occurrence of FD. One of the mechanisms is through its effect on leverage, liquidity, profitability, and efficiency. As can be seen from Figure 1 DSC to liquidity, profitability and efficiency is positive and DSC to leverage is negative. For that matter if the firm has higher DSC the prevalence of FD is minimal. For possible reasons cited in the literature review, FD may contribute to the decrease of these rests of three factors and increase of leverage.

Two questions are imminent in relation to the relationship among these variables; to what extent does FD affect liquidity, leverage, profitability and efficiency of firms? And what is the net effect of FD on the DSC of those firms?

With this in mind, this study tries to see the effect of FD on DSC of Ethiopian manufacturing firms using econometric methods. Regression techniques are employed to see the effect of FD on liquidity, leverage, profitability, efficiency and finally DSC. The paper is organized as follow; the next section deals with literature review on the interplay of the four financial variables. The third section covers the econometric analysis. Results are interpreted in the fourth section and finally, conclusions are drawn and recommendations are forwarded in the last chapter.

### **3. Literature review**

#### **3.1. Previous studies**

Numerous studies have been conducted on the issue of factors determining debt service coverage, both taking itself as a subject of study or by breaking down to its components, namely liquidity, leverage, profitability, firm size, efficiency and macroeconomic factors.

A related literature investigates the relation of debt service coverage and FD in the context of financial decision issues. Based on the conceptual framework developed by Pranow (2010), formulated a comprehensive theory describing linkages between Debt service Coverage and financial distress enables studying determinants of financial distress. Pranow argues that a decrease in debt service coverage occurs as a result of high leverage and low liquidity, which, in turn, is facilitated by FD.

Different empirical researches have come up with similar conclusions on the relationship of FD and DSC. To the best knowledge of the author, there is hardly any panel study on FD-DSC nexus for manufacturing firms in Ethiopia. There are studies on other countries and blocks of countries in this regard. For instance, Denis and Denis (1995) find support for the widely held belief that increased levels of FD negatively affect profitability (pre-operating income or net income) of firms.

The other studies conducted by Koes Pranowo et al. (2010) too indicated that FD actually has a negative effect on profitability, efficiency and liquidity of manufacturing firms. Using a panel data least square method, fixed effect model set for 200 non-financial companies listed in Indonesian stock exchange for period from 2004-2008 finds that inward FD has a negative effect on Debt service coverage.

A study that identified factors affecting leverage (Opler and Titman 1994; Andrade and Kaplan 1998) indicates that FD has statistically significant impact on leverage as proxy for FD although its coefficient has negative sign.

The hypothesis of the FD and DSC is studied by previous studies. There is a positive relationship between liquidity and DSC. The higher the firm's liquid assets, the higher the ability of the firms to cover its fixed charges and the lower the probability of the firm to go for financial distress (Outecheva 2007). There is a negative relationship between leverage and firm's debt service coverage. The more the firm's debt, the more the probability of the firm's FD (Altman & Hotchkiss 2005). There is a positive relationship between profitability and firm's DSC. The profitability of the firm increases, the FD decreases. On the other hand the more unprofitable company, the higher probability of failing (Pranowo et al, 2010). There is a positive relationship between efficiency and firm's DSC. If the firm has higher efficiency, they have higher ability of debt service coverage (Altman 1963).

#### **3.2. Theoretical framework**

##### **3.2.1. Liquidity and Financial distress**

FD and DSC are not only increasingly complementary and mutually supportive, but also increasingly inseparable as two sides of the process of financial strain (Gestel et al. 2006).

Furthermore, FD may stimulate liquidity problem on domestic firms through failure as a result of chronic losses which cause a disproportionate increase in liabilities accompanied by shrinkage in the asset value. FD is expected to affect liquidity causes short term insolvency effect, especially through non-meeting of current obligation or making difficulty in paying off financial obligation to creditors. This effect creates increase fixed costs, illiquid assets or low revenue that promotes economic turndowns (Gestel et al. 2006).

FD leads to inability to fulfill current obligation to third parties and increases non performing loans in commercial banks (Andrade and Kaplan 1998). FD contributes to likelihood of bankruptcy through affecting the level of liquid assets (Hendel 1996).

FD may reduce firm's existence ability that further reduces performance of firms. Others may argue that DSC leads to increase in firm's performance that further enhances to prevent FD. Liquidity contributes to firm's growth by enhancing working capital adequacy and ideal cash investment.

Furthermore, the increase in liquidity resulting from increase in current asset to current liability ratio reduces the firm's insolvency, thus increasing DSC. In addition to these effects, high CA to CL ratio also provide

a firm with low probability of FD, which is often confirmed in the early stages of firm growth, enabling a firm to better DSC ratio.

Thus, for a variety of reasons, FD decreases firm's liquidity. The reverse causation from FD to liquidity is also intuitively straightforward. DSC increment improves a firm's liquidity and hence FD Probability would be minimal.

### **3.2.2. Leverage and Financial distress**

The impact of leverage on FD is significant. Leverage effects FD has two sides of the process of financial strain influence, either operating side which causes operating risk or financial side which causes financial risk (Shim and Siegel (1998).

Furthermore, high leverage may facilitate FD on firms through inability to pay its debt and increasing insolvency and promoting bankruptcy. High leverage contributes to firm's FD by facilitating inability to meet the current obligation and deterioration of cash flow. Ogawa (2003) argues that corporate debt can affect investment by creating debt overhang. Firm's leverage is a main factor that negatively impacts the level of FD (Andrade and Kaplan 1998). Leverage increases the degree of firm's FD (Lee et al. 2010; Outecheva 2007). FD is seen as an intermediate state between solvency and insolvency. A firm is distressed when it misses interest payments or violates debt covenants (Purnanandam 2005).

The firm can capitalize on advantages from increasing its leverage through tax benefits. However, as firm's leverage above a certain point, the firm's degree of FD increase and costs associated with leverage overshadow benefits (Opler and Titman 1994).

Furthermore, the increase in leverage resulting from increase in total debt to total asset ratio increases the firm's insolvency, thus decreasing DSC. In addition to these effects, high TD to TA ratio also provide a firm with high probability of FD, which is often confirmed in the each stages of FD will happen.

Thus, for a variety of reasons, leverage leads firms for FD. The reverse causation from FD to leverage is also intuitively straightforward. DSC increment improves a firm's leverage and hence financial distress probability would be minimal.

### **3.2.3. Profitability and Financial distress**

Studies on effect of FD on profitability are scant. FD in each stage can influence the firm's profitability. FD plays a significant role in a firm's operation and profitability through the influence of cost implications, such as administrative and legal costs associated with the bankruptcy process ( both direct & indirect FD costs) (Betker 1997; Beaver 1966).

FD leads firms to low level of profitability and shortage of cash. A firm is considered to be financially distressed if one of the following events occurs: it experiences several years of negative net operating income or the suspension of dividend payments, financial restructuring or massive layoffs (Platt and Platt 2002). FD should not be analyzed by financial ratios at balance sheet only, but also by analyzing profit and loss and cash flow of the companies (Pranowo et al, 2010).

Furthermore, FD may stimulate profitability problem on firms through cash flow deterioration and deterioration of revenue or operating income perpetually. FD is expected to affect operating income causes short term insolvency effect, reduces the firm's ability by constraining working capital and increasing indebtedness.

Furthermore, the increase in profitability resulting from increase in Gross profit to total sales ratio increases the firm's solvency, thus increasing DSC. In addition to these effects, low GP to TS ratio also provide a firm with low probability of FD, which is indicates firms in the track of FD.

Thus, for a variety of reasons, FD decreases firm's profitability. DSC increment improves a firm's profitability and hence the occurrence of FD is low.

### **3.2.4. Efficiency and Financial distress**

Studies on effect of FD on efficiency are very important because firm's efficiency or turnover ratios measure how productively the firm is using its assets and FD affects the productive capacity significantly (Brealey et al, 2000). The firm efficiency is measured in terms of its EBITD/TA (Altman 1983). This parameter indicates the firm's viability and speed of turning over its assets within the year, which determines the firm's FD.

The capital intensity of firm determines FD through alleviating the degree of distress, because higher capital intensity implies a higher degree of fixed assets that could be used as collateral in case a firm experiences a FD condition (Charalambakis, Espenlaub & Garrett 2008).

Furthermore, FD can affect the firm's efficiency. FD acting a momentous function in a firm's efficiency through the influence of reducing the productive capacity of assets. The more unproductive assets in the firm's imply the less return on asset and the lower EBITD/TA ratio leads for FD. FD leads firms to low performance of its productive asset and low efficiency.

Furthermore, the increase in efficiency resulting from increase in EBITD/TA ratio increases the firm's productivity, thus increasing DSC. In addition to these effects, low EBITD/TA ratios also grant a firm with near to the ground the probability of FD, which is designate firms in the track of FD.

Thus, for a multiplicity of rationales, FD dwindles firm's efficiency. DSC augmentation perk up a

firm's efficiency and hence the incidence of FD is very negligible.

### 3.2.5. Debt service coverage and Financial distress

FD is determined by DSC ratio, because the firm is classified as distressed if in any of two consecutive years its EBITDA is lower than eighty percent of the firm's interest expense. This marker incorporates the fact that a firm facing FD usually experiences a decline in profitability, is over leveraged or has insufficient cash flows to cover current obligations (Asquith et al. 1994).

FD may facilitate problem of liquidity, profitability, leverage and efficiency on firms through failure and insolvency as a result of unremitting losses.

Furthermore, FD may impact on DSC, because FD causes the cessation of operation, nonpayment of current obligations due to cash flow problems, the firm's total liabilities are in excess of total assets, and the formal declaration of bankruptcy (Altman 1983).

Thus, for a assortment of reasons, FD decreases firm's DSC. DSC increment improves a firm's profitability, liquidity, leverage, efficiency and hence FD effect on firm is very minimal.

## 4. Methods of data collection and Analysis

In finance debt service coverage are assumed to be a function of: (i) profitability in the of the firm; (ii) the liquidity of the firm relative to the current obligation of the firm, and (iii) other factors such as efficiency, firm size, firm age, operational viability and so on.

This study examines the relationship between DSC performance and FD occurrence in Ethiopian manufacturing firms for the period from 1999 through 2005. CA to CL ratio, TD to TA ratio, GP to TS ratio, EBITD/TA and logTA and then EBIDA to TD ratio of those countries are modeled as a function of DSC and other explanatory variables.

A dynamic model type is formulated:

$$FD = \beta_0 + \beta_1 LEV_{it} + \beta_2 LIQ_{it} + \beta_3 PROFS_{it} + \beta_4 EFF_{it} + \beta_5 FSIZE_{it} + \epsilon_{it} \dots \dots \dots (1)$$

LIQ<sub>it</sub> = the firm's holding of liquid assets to cover short term debts;

PROFS<sub>it</sub> = the profitability of the firm;

SIZE<sub>it</sub> = the natural logarithm of the firm size measured in terms of volume of assets;

EFF<sub>it</sub> = efficiency of the firm;

LEV<sub>it</sub> = the level of the firm leverage

In line with (Pranow et al, 2010)

$$DSC = (EBIDA) / (TD) \dots \dots \dots (2)$$

EBIDA = (EAT + (DEPR + AMORT) + (INTEREST) - Tax)

TD = principal plus interest or coupon

The firm with the DSC of below 1.00 is financially distressed, firms with DSC below 0.5 are fully distressed and DSC of above 1.00 is financially viable.

Data used for this study are collected from individual manufacturing firms, beverage and metal manufacturing firms of Ethiopia. Annual data from manufacturing firms is collected for the period between 1999 and 2005. Study subject selection is dictated solely by data availability among manufacturing firms. For descriptive statistics of the raw data you may refer to Table 1. The liquidity, leverage, profitability, and efficiency amount as determinants (DSC) is used for this analysis as the ratio takes care of the differences.

Generalized Least Square techniques (GLS) and Random Effect Methods (REM) are preferred to infer the better relationship between the variables under the situation. Hausman test is performed to choose from the two and Random Effect (RE) model is found to give superior result than the random effect. In addition to that, the objective of the study is to determine the effect of the factors under consideration on manufacturing firms, not to explain the inter-firm difference. This makes RE more desirable than the RE. Following the works of (reference-model) Random panel effect (RE-GLS) regression method is applied to determine the significance of the effect of the explanatory variables on the dependent variables.

## 5. Empirical Results

### 5.1. Liquidity Determinant

All the variables, as can be seen on Table 2, show their expected sign. It is well known that the decrease of the current assets in the firm relative to current obligation (CA/CL) reduces liquidity (Turetsky & McEwen 2001) hence, a negative link between the decrease of CA to CL and liquidity is expected. In other words appreciation of CA to CL ratio increases the liquidity of the firms.

The positive coefficient of CA to CL for the regression output implies that the increase of the current assets positively affects the firm's liquidity. Converse, the decrease of CA to CL helps the liquidity of firms.

This is in line with both theoretical reasoning in corporate finance and findings of previous empirical studies (Pranow et al, 2010). A one point increase in CA to CL results in a 0.0623445 percent increase in liquidity. Though the coefficient is small, the effect is statistically significant at 90 percent confidence interval. This

implies CA to CL that targeting may help the liquidity subsector of the firm.

### 5.2. Leverage Determinant

It is well known that the appreciation of the total debt in the firm relative to total asset (TD/TA) increases leverage (Altman 1983) hence, a positive link between the increases of TD to TA and leverage is expected. In other words appreciation of TD to TA ratio increases the leverage of the firms.

The negative coefficient of TD to TA for the regression output implies that the increase of the total debt relative to total asset affects the firm's leverage. Converse, the decrease of TD to TA helps the solvency of firms.

This is in line with both theoretical reasoning in corporate finance and findings of previous empirical studies (Pranow et al, 2010). A one point increase in TD to TA results in a -0.4762632 percent increase in leverage. Though the coefficient is small, the effect is statistically significant at 90 percent confidence interval. This implies TD to TA that targeting may help the solvency subsector of the firm.

### 5.3. Profitability Determinant

It is well known that the appreciation of the gross profit in the firm relative to total sales (GP/TS) increases profitability (Altman 1983) hence, a positive link between the increases of GP to TS and profitability is expected. In other words appreciation of GP to TS ratio increases the profitability of the firms.

The positive coefficient of GP to TS for the regression output implies that the increase of the gross profit to total sales affects the firm's profitability. Converse, the increase of GP to TS helps the profitability of firms.

This is in line with both theoretical reasoning in corporate finance and findings of previous empirical studies (Pranow et al, 2010). A one point increase in GP to TS results in a 0.7778155percent increase in Profitability. Though the coefficient is small, the effect is statistically significant at 90 percent confidence interval. This implies GP to TS that targeting may help the profitability subsector of the firm.

### 5.4. Efficiency Determinant

It is well known that the appreciation of the Earning Before Interest Tax and Depreciation to total asset (EBITD/TA) increases efficiency (Altman 1983) hence, a positive link between the increases of EBITD to TA and efficiency is expected. In other words appreciation of EBITD to TA ratio increases the efficiency of the firms.

The positive coefficient of EBITD to TA for the regression output implies that the increase of the Earning before Interest Tax and Depreciation to total asset affects the firm's efficiency. Converse, the increase of EBITD to TA helps the efficiency of firms.

This is in line with both theoretical reasoning in corporate finance and findings of previous empirical studies (Pranow et al, 2010). A one point increase in EBITD to TA results in a 0.7198798 percent increase in efficiency. Though the coefficient is small, the effect is statistically significant at 90 percent confidence interval. This implies EBITD to TA that targeting may help the efficiency subsector of the firm.

### 5.5. Debt service coverage Determinants

All the variables, as can be seen on Table 2, show their expected sign. This is in line with both theoretical reasoning in corporate finance and findings of previous empirical studies (Pranow et al, 2010). A one point increase in CA to CL results in a 0.0623445 percent increase in liquidity of firms and increase DSC. The p-value 0.0000 and coefficient 0.0623445 percent indicates statistically significant at 90 percent confidence interval.

The leverage of the firm has impact on DSC. A one point increase in TD/TA results in a -0.4762632 percent increase in leverage of firms and decrease DSC. The p-value 0.0000 and coefficient -0.4762632 percent indicates statistically significant at 90 percent confidence interval. The profitability impact on DSC. A one point increase in GP/TS results in a 0.7778155percent increase in profitability of firms and increase DSC. The p-value 0.0000 and coefficient 0.7778155percent indicates statistically significant at 90 percent confidence interval. The firm efficiency impact on DSC. A one point increase in EBITD to TA results in a 0.7198798 percent increase in efficiency of firms and increase DSC. The p-value 0.0002 and coefficient 0.7198798 percent indicates statistically significant at 90 percent confidence interval.

## 6. Conclusions and Recommendations

In recent period manufacturing firm's liquidity, efficiency and profitability turndown and leverage is growing fast. Several factors appear to have contributed to this phenomenon including FD. However, to date there has not been that much attempt to investigate the role of FD on DSC. Using Panel data for the Period of 1999-2005 for 11 Ethiopian manufacturing firms, this issue is investigated.

CA to CL ratio has positive and significant effects on both liquidity and DSC. It means that when the CA to CL ratio increases, both liquidity and DSC will increase. The direct relationship between liquidity and

DSC is in line with both theory and empirical works and that of DSC and CA to CL is sensitive. This can be explained by the nature of DSC ratio. Manufacturing firms DSC ratio of “liquidity dependent” nature for payment of fixed charge of interest, dividends, bank loans and others that are currently unrequited in nature.

TD to TA ratio has negative and significant effects on DSC but inversely on leverage. It means that when the TD to TA ratio increases, leverage and DSC will decrease. GP to TS ratio has positive and significant effects on both profitability and DSC. It means that when the GP to TS ratio increases, both profitability and DSC will increase.

EBITD to TA ratio has positive and significant effects on both efficiency and DSC. It means that when the EBITD to TA ratio increases, both efficiency and DSC will increase.

The negative and significant FD of firm implies that FD has significant negative contribution to the DSC of the firms. FD in the firm will have a negative effect on liquidity, profitability and efficiency increment and subsequently to the DSC. One good reason could be manufacturing firms in Ethiopia are importing chemicals and other inputs for their productions and they are getting highly leveraged due to the bank loans. Equity financing and possible import substitution matters for booming Ethiopian manufacturing industry sector. Ethiopian Manufacturing firms lag behind in terms of human capital development and technological progress.

The necessities of reliance on DSC of manufacturing firms increased from time to time. FD impacts liquidity, leverage, profitability and efficiency of firm’s asset to turnover.

When we see the overall effect of FD on DSC, if a factor has Negative effect on liquidity, efficiency and profitability, the net effect on DSC is found to be in the direction of effect on the liquidity. This is due to the very high share of liquidity on the DSC of those firms. Firms in the early stage of financial distress, like most manufacturing firms in other countries, would loss more from liquidity than profitability as the firm would probably fall short of liquid assets (funds) to pay their obligation. Hence, in this regard, financing policy instruments should be in place to assure that financing (both debt and equity) in areas of equity promotions and debt substitutions are encouraged.

The size of firm the under investigation is not a significant factor affecting both DSC and FD. The insignificant effect may imply that DSC and FD are unresponsive to the level of increase in asset of the firm.

In general, policy makers in Ethiopia have the opportunity to influence the financing policy of the firms in the promotion of equity financing Manufacturing firms and manage infant manufacturing firms high leverage by controlling equity financed manufacturing firms and devising reorganization of their debts. Banks have upper hand to supervise the liquidity, solvency, profitability and efficiency of firms through application of CAMEL techniques during granting loans. The appropriate executors should consider improving efficiency of firms through retrenchment of assets and replacing, improving liquidity through improving cash collection and asset restructuring, improving profitability through replace or drop departments, products or lines of the business.

FD having a negative effect on DSC and leading firms bankruptcy and liquidation; putting economic, social and political impact on manufacturing firms that contribute to the CEO resignation, employee’s layoff/loss of jobs, dividend reduction, plant closing and related consequential health and moral distress.

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## Appendix : Regression results

**Table 1.** Panel Data Regression Random Effect Model Result

Random-effects GLS regression	Number of obs	=	<b>76</b>
Group variable: <b>firms</b>	Number of groups	=	<b>11</b>
R-sq: within = <b>0.7630</b>	obs per group: min	=	<b>6</b>
between = <b>0.9413</b>	avg	=	<b>6.9</b>
overall = <b>0.9013</b>	max	=	<b>7</b>
Random effects u_i ~ <b>Gaussian</b>	wald chi2(7)	=	<b>316.52</b>
corr(u_i, X) = <b>0</b> (assumed)	Prob > chi2	=	<b>0.0000</b>

dsc	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
profit	.7778155	.2222335	3.50	0.000	.3422458	1.213385
eff	.7198798	.229787	3.13	0.002	.2695056	1.170254
liquid	.0623445	.010382	6.01	0.000	.0419961	.0826928
leve	-.4762632	.0771539	-6.17	0.000	-.6274821	-.3250443
fsize	.0558841	.0287628	1.94	0.052	-.00049	.1122583
opervi	.0192333	.0118305	1.63	0.104	-.003954	.0424207
gcg	-.0026728	.0069413	-0.39	0.700	-.0162775	.010932
_cons	-1.132389	.4616602	-2.45	0.014	-2.037226	-.2275517
sigma_u	.06476254					
sigma_e	.07073068					
rho	.45603781	(fraction of variance due to u_i)				

Source: regression result of panel data.

**Table 2.** Hausman specification test for model fitness final

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. hausman fixed
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	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fixed	(B) .		
profit	.7256655	.7778155	-.0521501	.1282198
eff	.5719943	.7198798	-.1478855	.1418454
liquid	.0668977	.0623445	.0045533	.0063746
leve	-.5033271	-.4762632	-.0270639	.0296322
fsize	.0859889	.0558841	.0301047	.0330301
opervi	.0219268	.0192333	.0026934	.0051822

b = consistent under Ho and Ha; obtained from xtreg  
 B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(6) = (b-B)' [(V\_b-V\_B)^(-1)] (b-B)  
 = **9.83**  
 Prob>chi2 = **0.1318**

**Table 3. BREUSCH AND PAGAN LAGRANGIAN MULTIPLIER TEST FOR HETROSKEDASTICITY**

Breusch and Pagan Lagrangian multiplier test for random effects

$$dsc[firms,t] = \beta x + u[firms] + e[firms,t]$$

Estimated results:

	Var	sd = sqrt(Var)
dsc	.0774336	.2782689
e	.0050028	.0707307
u	.0041942	.0647625

Test:  $\text{Var}(u) = 0$   
 $\chi^2(1) = 9.84$   
Prob >  $\chi^2 = 0.0017$

**Table 4. Tests for multicollinearity problem using correlation matrix**

	dsc	profit	eff	liquid	leve	fsize	opervi	gcg
dsc	1.0000							
profit	0.6747	1.0000						
eff	0.5707	0.8477	1.0000					
liquid	0.5759	0.0254	-0.1526	1.0000				
leve	-0.6523	-0.1069	0.0625	-0.7149	1.0000			
fsize	0.0502	-0.4927	-0.4103	0.1856	-0.1202	1.0000		
opervi	0.4917	0.4280	0.5637	0.0719	-0.0697	0.2666	1.0000	
gcg	-0.1072	-0.0001	-0.0685	0.0506	0.2245	0.0644	-0.0011	1.0000

Autocorrelation Tests based on Durban Watson (DW)

Cross-sectional time-series FGLS regression

Coefficients: **generalized least squares**  
Panels: **homoskedastic**  
Correlation: **no autocorrelation**

Estimated covariances	=	1	Number of obs	=	76
Estimated autocorrelations	=	0	Number of groups	=	11
Estimated coefficients	=	8	Obs per group: min	=	6
			avg	=	6.909091
			max	=	7
			wald $\chi^2(7)$	=	777.76
			Prob > $\chi^2$	=	0.0000

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
profit	.9177531	.1723939	5.32	0.000	.5798674	1.255639
eff	.8445023	.1778558	4.75	0.000	.4959113	1.193093
liquid	.0529561	.0086854	6.10	0.000	.035933	.0699793
leve	-.4800109	.0693894	-6.92	0.000	-.6160115	-.3440103
fsize	.0692916	.0183235	3.78	0.000	.0333781	.105205
opervi	.0002053	.0111451	0.02	0.985	-.0216387	.0220493
gcg	-.0022535	.0032756	-0.69	0.491	-.0086736	.0041667
_cons	-1.116937	.2810325	-3.97	0.000	-1.667751	-.5661236

. sum

Variable	Obs	Mean	Std. Dev.	Min	Max
firms	77	6	3.183014	1	11
year	77	2002	2.013115	1999	2005
dsc	77	.3785697	.2846163	.0137864	1.142032
profit	76	.2419149	.1207847	.0211472	.4633958
equity	77	.4861284	.2224185	.1729034	.9391285
eff	77	.1869522	.1262358	.0109197	.4085041
liquid	77	2.135935	1.72031	.4903508	9.23599
leve	77	.5085471	.2202952	.0611014	.8269072
fsize	77	18.39809	.8091785	16.96834	20.65224
opervi	77	15.93089	1.398243	9.401043	18.23706
age_in_year	77	38.09091	28.83765	1	85
gcg	77	15	3.183014	10	20
d1	77	.4935065	.5032363	0	1
_est_fixed	77	.987013	.1139606	0	1